UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
UNION ELECTRIC COMPANY	)	Docket No. STN 50-483-OL
	)	
(Callaway Plant, Unit 1)	)	

JOINT INTERVENORS' ANSWER TO APPLICANT'S AND STAFF'S MOTIONS FOR SUMMARY DISPOSITION

I. INTRODUCTION

Applicant has moved, in three separate motions, for summary disposition of three portions of Joint Intervenors' Contention One (part I.B (concrete cracks), part I.D (Concrete Cover) and part II.A.1 (SA-358 Piping)). The NRC Staff has moved, in four separate motions, for summary disposition of the same three portions of Contention One, plus a fourth portion, part I.A (Embedded Plates). Joint Intervenors oppose all seven motions.

This Answer is Joint Intervenors' opposition to all seven motions for summary disposition. The general and legal arguments apply to all seven motions. Due to limited resources, however, Joint Intervenors are able to respond to the specific factual statements and arguments of Applicant and Staff only with respect to part II.A.1, SA-358 Piping and part I.A, Embedded Plates.

Joint Intervenor's Answer contains the following sections, after this Introduction:

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II. GENERAL AND LEGAL ARGUMENT

Joint Intervenors contend that the Applicant and the Staff have improperly divided Contention One into separate parts. Contention One is titled "FAILURE OF THE QUALITY ASSURANCE PROGRAM" and alleges:

> Surveillance and inspection functions of Applicant Union Electric Company, and others, including Bechtel Power Corp. (lead architect/engineer), Daniel International Corp. (construction contractor) and Code Authorized Nuclear Inspectors, failed to ensure the quality of safety-related material, structures, systems and components through all phases of their fabrication, construction, testing and inspection contrary to the quality assurance criteria of 10 CFR Part 50 Appendix B. Many vendor-supplied components were on the construction site and were approved for installation before code-defined deficiencies and nonconformances were identified. During construction deficiencies and nonconformances were accepted against code requirements. Without effective surveillance and inspection by the Applicant, and others, of material suppliers, component vendors, and construction contractors, all safety-related material, structures, systems, and components must be considered of questionable integrity. Because effective surveillance and inspection were not performed, the safe operation of the Callaway Plant is in jeopardy and should not be licensed.

Contention One then cites several "[d]eficiencies and nonconformances which evidence the failure of the quality assurance program," including the four items upon which Applicant's and Staff's motions are based.

Joint Intervenors' Contention One alleges that collectively, the deficiencies and nonconformances add up to a failure of the quality assurance program. Each of the deficiencies and nonconformances cited in Contention One raises a question as to overall safety. The broader issue is the adequacy of the Applicant's quality assurance program.

The health and safety of the public is one of the foremost considerations in the issuance of an operating license. This Board must determine, inter alia,

> Whether there is reasonable assurance: (i) that the activities to be authorized by the operating license can be conducted without endangering the health and safety of the public . . .

10 C.F.R. §2.104(c)(3). To ensure this, quality assurance criteria were promulgated by the NRC, to be followed during the plant's construction, "to provide adequate confidence that a structure, system, or component will perform satisfactorily in service." 10 C.F.R. Part 50, Appendix B, Introduction. Joint Intervenors argue that there is not that adequate assurance here. Even if in isolation, each part of Contention One may not seem to present significant danger to public health and safety, together the parts of Contention One raise a greater, overall question relating to the adequacy of the Applicant's quality assurance program. As the Atomic Safety and Licensing Board stated in Virginia Electric and Power Co. (North Anna Nuclear Power Station, Units 1 and 2) LBP-77-68, 6 N.R.C. 1127, 1159 (1977), in discussing the staff's investigation of alleged deficiencies in construction:

> [T]he Staff concluded that the substantial allegations, when considered alone, were of minor significance, but, collectively, they indicated the need for improvements.

This is precisely Joint Intervenors' point. Numerous substantiated failures, or even questions, as to the adequacy of the Applicant's quality assurance program, serve to illuminate the inadequacy of the Applicant's program as a whole, a program intended to assure adequate confidence of satisfactory performance but failing to sustain even that fairly low standard. The possible result here - endangering the public health and the public safety - is a high risk to take.

Joint Intervenors in this case are not alone in their concerns. In Houston Lighting and Power Company (South Texas Project, Units 1 and 2) CLI-80-32, 12 N.R.C.

281 (1980), the Commissioners addressed certain concerns of intervenors regarding safety-related construction activities. In Houston, there had been a finding of numerous (twenty-eight) items of noncompliance illustrated by approximately fifty incidents. The Company identified six "root causes" for the items of noncompliance, promising to remedy them. An observation made by the Commissioners in that proceeding is extremely pertinent to the matter in controversy here. In responding to the Company's six "root causes," the Commissioners stated:

> While identification of these "root causes" may be helpful to an analysis of the problems at the South Texas Project, they might also be said to raise a question of overriding significance: are these problems symptoms of some other and more basic deficiencies?

12 N.R.C. at 285, n. 2 (emphasis added). Here, Joint Intervenors assert that their contentions are merely "symptoms" identifying the basic deficiency - Applicant's inadequate and ailing quality assurance program.

The Nuclear Regulatory Commission's provision for summary disposition as to matters involved in NRC proceedings is available when the moving party can show that there is no genuine issue to be heard on any matter. 10 C.F.R. §2.749. This provision is similar to the Federal Rules of Civil Procedure Rule 56, providing for summary judgment. Decisions interpreting Rule 56 can aid in the interpretation of the standards in evaluating a motion for summary disposition. Alabama Power Co. (Joseph M. Farley Nuclear Plant Units 1 and 2), ALAB 182, 7 A.E.C. 210, 217 (1974). Decisions interpreting Rule 56 help, but the NRC rule specifically governs. The pertinent statutory language requires the presiding officer to examine six different types of documents, as a whole, in order to reach a decision.

The presiding officer shall render the decision sought if the filings in the proceedings, depositions, answers to interrogatories, and admissions on file, together with the statements of the parties and the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to the decision as a matter of law. 10 C.F.R §2.749(d).

Case law has established some basic guidelines regarding the NRC rule and Rule 56. Summary judgment is only authorized where it is quite clear what the truth is and where no genuine issue remains for trial. Public Serice Company of New Hampshire (Seabrook Station, Units 1 and 2) LBP-74-36, 7 A.E.C. 877, 878 (1974). The record is to be viewed in the light most favorable to the party opposing the motion, and it is not necessary that the opposing party show that it would prevail on the disputed factual issues, but only that there exist such issues to be tried. Id. The burden is clearly on the moving party. Adickes v. Kress and Co., 398 U.S. 144, 157 (1970). This is the general rule of the NRC 10 C.F.R. §2.732. The party opposing a motion for summary disposition cannot "rest upon the mere allegations or denials of his answer," 10 C.F.R. §2.749(b), but this does not mean that it is necessary for the opposing party to provide supporting evidentiary material.

> These provisions [10 C.F.R. §2.749(b) and Rule 56(e)], without more, could lead one to believe that, if a motion for summary judgment is supported by evidentiary material on the relevant issues and the opponent of the motion does not respond with evidentiary material to the contrary, the motion must be granted. This thesis was advanced by respondent in Adickes v. Kress and Co., [398 U.S. 144, 159]. The Supreme Court dealt with it in the following way: (footnote omitted)
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> > This argument does not withstand scrutiny, however, if both the commentary on and the background of the 1963 amendment conclusively show that it was not intended to modify the burden of the moving party under Rule 56(c) to show initially the absence of a genuine issue concerning any material fact. The Advisory Committee . . ., in a comment directed specifically to a contention like respondent's . . ., stated that "[w]here the evidentiary matter in support of the motion does not establish the absence of a genuine issue, summary judgment must be denied even if no opposing evidentiary matter is presented. (Emphasis in original.)

Cleveland Electric Illuminating Company (Perry Nuclear Power Plant, Units 1 and 2), ALAB-443, 6 N.R.C. 741, 753-754 (1977). The burden on the party moving for summary disposition is great. Joint Intervenors contend that Applicant and Staff have not sustained that heavy burden.

III. SA-358 PIPING

A. Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping

Both the Applicant and Staff seek summary disposition on Contention One, Failure of the Quality Assurance Program; Part II, Substandard Piping, paragraph A, Material Manufacturing Deficiencies; subparagraph (1), which concerns "a substandard piece of ASME Class II SA-358 piping which has been installed in the emergency core cooling system."

Contention One states, "Surveillance and inspection functions of Applicant Union Electric, and others . . . failed to ensure the quality of safety-related material . . . contrary to the quality assurance criteria of 10 CFR Part 50 Appendix B."

Neither the Applicant nor the Staff address any of the quality assurance criteria of Appendix B. For that reason alone, their motions must be denied.

The specific Appendix B criteria, related to Part II.A.1 with which the Applicant has failed to comply are listed below along with the facts to substantiate noncompliance.

1. Contrary to Criterion IX, radiographic indications of rejectable weld defects were judged acceptable and not repaired. Facts in support of this part of the contention are quoted directly from a Notice of Violation, addressed to Union Electric Company, dated 6/25/81, and signed by James G. Keppler (Director, NRC Region III) (Exhibit 1)[1]:

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[1] Documents identified as "Exhibits" are being submitted with this Answer.

10 CFR Part 50, Appendix B, Criterion IX, states, "Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

Pipe piece No. 5P, part of the accumulator discharge line from accumulator TEPOIA, was manufactured to material specification ASME SA-358. Specification SA-358 requires "Radiographic Examination in Accordance with . . . ASME . . ." Section I, Paragraph PW-51.

ASME Code, Section I, Paragraph PW-51 states "Sections of weld that are shown by radiography to have any of the following types of imperfections shall be judged unacceptable and shall be repaired . . ."

> 51.3.1 Any type of crack, or zone of incomplete fusion or penetration.

Contrary to the above, on March 6, 1981, the inspector determined from review of radiographs of the seam weld on pipe piece No. 5P at film location markers 13-14 that the film indicated apparent incomplete fusion and excess reinforcement and yet the pipe piece had not been judged unacceptable or repaired.

2. Contrary to Criterion IX the longitudinal seam weld for pipe piece No. 5P, cited above, was not accomplished according to the qualified procedure or the applicable code. The welding procedure used to manufacture the pipe and the ASME material specification require a double welded joint, which is defined as a weld made from both sides. The evidence indicates that in some portions of the pipe all of the weld metal in the finished weld was deposited or formed from only the outside of the pipe, making those portions of the weld a single welded joint, which is defined as a weld made from only one side.

10 CFR Part 50, Appendix B, Criterion IX, states, "measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

The subject pipe piece was manufactured in accordance with the ASME material specification SA-358, Class 1, which states in paragraph 1.3.1, "Class 1 - Pipe shall be double welded. . ." (Exhibit 2).

The welding procedure used in manufacturing the pipe is described in NRC IE Report No. 50-483/81-04 (submitted by NRC Staff with its motion) as follows:

> The original pipe piece was manufactured (plate bent and seam welded) at ARMCO Steel Corporation, Advanced Materials Division, during late 1977. Stainless steel type 304 in the form of ASTM specification SA-240 plate and Weld Procedure No.. 5, Revision 1, were utilize . Weld Procedure No. 5 is a submerged arc welding (SAW), double-weld, full automatic weld procedure. In this procedure, the inner pipe diameter weld is made first, consisting of one pass, the seam is then backgouged, examined, and welded with one or more weld passes.

The evidence indicates that contrary to the above procedure a pass from the outside of the pipe melted through the single pass made on the inside. A portion of the melt-thru sagged down into the pipe causing excessive reinforcement. Documented evidence of this is as follows:

The affidavit of William Key, submitted with the NRC Staff motion for summary disposition on this issue states, "I reviewed the shop radiographs of the seam weld. In one location, I identified some drop through in the root." Drop through in the root could only have occurred by a pass from the outside of the pipe melting through and consuming the single, back gouged pass, made on the inside of the pipe.

An experienced weldor and an eye witness of the defect in the pipe piece describes the weld in Exhibit II attached to IE Report 50-483/81-04 in the following manner, "The weld appeared to be a single welded butt joint in which the root pass had fallen through. By fall through I mean that the internal weld bead drooped down or protruded into the pipe an excessive amount and did not fuse uniformly into the plate surface."

NRC IE Report No. 50-483/80-10 accepts "fall through" to the extent that it uses the term parenthetically when referring to excess reinforcement (See pages 2 and 6).

The Applicant seeks to refute these facts with the following statement in the Affidavit of Michael F. Stuchfield:

> Burn-through during the process of welding from the outside could not have caused this overlap condition. Burn-through is a condition where a total passage of molten material occurs through the root of the weld, causing slag and weld metal to adhere to the inside surface in a totally unacceptable condition, from both a visual and radiographic point of view.

The American Welding Society publication titled "Welding Terms and Definitions," ASW A3.0, defines burn-through as, "A term erroneously used to denote excessive melt-thru or a hole." (Exhibit 12).

Mr. Stuchfield, in using an erroneous term, does not account for melt-thru in which a hole does not exist. In a condition only involving melt-thru slag could not pass from the top of the weld to the bottom. In using the term "burn-through" Mr. Stuchfield is apparently speaking of a condition involving a hole and is not addressing the "drop through" identified in the William Key afffidavit or the "fall through" identified by an experienced weldor.

The Affidavit of Joseph V. Laux, submitted by Applicant, paragraph 5, states, "An excess weld reinforcement height of 3/16 inch was measured. The length of weld involved was approximately 6 inches, with a width of approximately 2 inches. The total weld surface area affected is 12 square inches."

The weld described by Mr. Laux is supposed to be a single pass that could not be 2 inches wide as he claims. By comparing the height of the weld with the width in photographs anyone can see that the weld is not much over 1/2 inch in width. NRC IE Report No. 50-483/81-04 (page 4) states, "Review of vendor radiographs indicated that one approximately four inch area of the pipe piece . . ." contained excess weld reinforcement not 12 inches. Mr.. Laux's statement indicates that he did not see the inside of the we.d in question and did not understand the welding procedure.

3. Contrary to Criterion XV a nonconformance involving a minimum wall violation (Nonconformance Report No. 2SN-0496-P (Exhibit 3)) was not dispositioned in accordance with documented procedures when the cause of the nonconformance was identified by an inspector rather than the Project Discipline Engineer.

Criterion XV states, "Nonconforming items shall be reviewed and accepted, rejected, repaired or reworked in accordance with documented precedures." Construction Procedure AP-VII-02, Exhibit A, page 3 (Exhibit 4), in paragraph 10, states, "Cause of Nonconformance and Action to Prevent Recurrence - The Project Discipline Engineer shall identify the cause of the nonconformance . . ." (exphasis in original). NRC IE Report 50-483/81-04, page 16, paragraph 17.b. states, "In the 'Cause of Nonconformance and Action to Prevent Recurrence' on the NCR, the QC inspector stated (in part) 'ovality in pipe not recognized by vendor prior to machining counter bore.' This was the inspector's conclusion . . ." (emphasis added).

4. Contrary to Criterion XV Deficiency Report No. 2SD-0699-P (Exhibit 5) does not define the cause of the nonconformance as required by documented procedure.

Criterion XV states, "Nonconforming items shall be reviewed and accepted, rejected, repaired or reworked in accordance with documented procedures." Construction Procedure AP-VII-02, paragraph 4.4, page 12, (Exhibit 6) under the heading PROJECT DISCIPLINE ENGINEER, states, "Define the cause of the deficiency . . ." Deficiency Report No. 2SD-0699-P (Exhibit 5) gives no indication or statement to indicate the cause of the deficiency.

5. The nonconformances of overlap and excess reinforcement cited in Nonconformance Report No. 2SN-0501-P (Exhibit 7) were errantly dispositioned contrary to documented procedures when Bechtel returned the report without disposition and the report was superceded by Deficiency Report No. 2SD-0699-P.

Criterion XV states, "Nonconforming items shall be reviewed and accepted, rejected, repaird or reworked in accordance with documented procedures." Construction Procedure AP-VII-02, page 2 (Exhibit 8) differentiates NCR's and DR's in paragraphs 3.4 and 3.5 as follows:

> 3.4 - Nonconformance Reports (NCR's) shall be used to document material nonconformances which are dispositioned "USE-AS-IS" or "REPAIR." All NCR's required Lead A/E approval or, if NSSS equipment is involved, approval by the NSSS A/E.
>
> 3.5 - Deficiency Reports (DR's) shall be used to document material deficiencies (including procedural violations or quality-related prblems) that are dispositioned "REWORK" or "REJECT FOR THIS USE". DR's do not require Lead A/E approval and are considered approved when all required Daniel signatures are obtained.
>
> 1. The Deficiency Report may also be used to initiate correction of either suspected or actual deficiencies in supplier materials or equipment in accordance with the provisions of Reference 2.11.

The Glossary to AP-VII-02, Appendix I, page 1 (Exhibit 9) defines "repair" and "rework" as follows:

> Repair - A disposition which is imposed when it can be established that a nonconforming characteristic can be restored to a condition such that the capability of the item to function reliably and safely is unimpaired even though that item still may not conform to the original requirement.
>
> Rework - A disposition which is imposed when it can be established that a nonconforming item or activity can be made to fully conform to a prior specified requirement. Nonconforming items (materials) shall be dispositioned as "Rework" when conditions 1 and 2, condition 3 below are satisfied.
>
> 1. Correction of the nonconforming item can be accomplished by using the same or equivalent processes specified in the drawing and specification requirements.
>
> 2. The end condition of the item will be unchanged from that specified in the drawing and specification requirements; particularly, regarding physical or chemical properties, and especially stress/strain properties.

3. When provided for in the applicable specification, correction of the nonconforming item can be accomplished using a procedure which has been approved by the responsible design organization.

Both repair and rework require that specific conditions "can be established." When NCR 2SN-0501-P was superceded by DR 2SD-0699-P the onus of responsibility to establish the conditions for a DR rework disposition was placed by Daniel International Corp. onto Bechtel. The NCR states under the heading "Statement of Corrected Action," "This NCR is superceded by DR #2SD-0699-P per Bechtel disposition (See attach B) which states this is not a NCR category item."

Bechtel's disposition and letter to support it do not establish that the items are not NCR category items or that they are DR items, contrary to AP-' .

NRC IE Report 50-483/81-04 states, on page 9, as follows:

> The Nonconformance Report (NCR 2SN-0501-P) documenting overlap and excessive reinforcement was also sent to Bechtel for disposition. By letter dated June 1, 1979, the report was returned by Bechtel to the Callaway site without disposition. The reason for this action was a conclusion that the observed conditions did not "fall under NCR category." It should be noted that to return a Nonconformance Report without disposition is not equivalent to a disposition to "use-as-is." Such a response can indicate that (1) the NCR is in error, or (2) disposition by other means such as a Deficiency Report is more proper.
>
> The June 1, 1979, Bechtel letter addresses both observed nonconforming conditions, excessive weld reinforcement and overlap (See Exhibit B of Investigation Report No. 50-483/80-10). The paragraph regarding reinforcement height requirements appears to be incorrect in that it references sections of ASME III, whereas Paragraph 5.2.3 of material specification ASME SA-358 should have been identified as the applicable specification for a vendor weld, allowing 1/8 inch of reinforcement.
>
> The paragraph in the June 1, 1979, Bechtel letter regarding overlap contains an incorrect observation that material specification ASME SA-358 references ASME Section VIII, Paragraph UW-51(b). SA-358 references ASME Section I, Paragraph PW-51. The reference to ASME Section VIII is likewise in error as Section VIII does not pertain to the piping covered by Section III. However, the wording of both Sections is virtually identical (the Code often duplicates Sections) and neither refers to "overlap" as a rejectable condition for radiography. This error is not considered significant. What was significant was the apparent acceptance of overlap as a weld condition.

and

> [I]t is of concern that the Architect-Engineer's failure to disposition the Nonconformance Report reflected a misinterpretation of Code requirements.

From these facts we conclude that the condition required by AP-VII-02 to establish a DR disposition was not met and that the nonconformances involved were not repaired or reworked in accordance with documented procedures as required by Criterion XV.

6. Weld defects identified through photographs of the weld as fissures or cracks were not identified as a nonconformance contrary to Quality Control Procedure No QCP-508, Appendix I, and 10 CFR Part 50, Appendix B, Criteria IX.

Criterion IX states, "Measures shall be established to assure that special processes, including welding, heat treating, and non-destructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

Quality Control Procedure No. QCP-508, Appendix I, Visual Inspection - Acceptance Criteria for ASME Section III, page 6, Criterion 8 states, "No cracks."

IE Report No. 50-4[illegible]/81-04 states on page 4, "Three photographs of the internal weld condition prior to grinding were still available in a QC inspector's file. These three photographs clearly show excessive weld reinforcement and overlap, with two fissures or cracks in the excess reinforcement (Exhibit X)."

None of the nonconformances or deficiency reports related to this pipe piece cite cracks or fissures as a defect, contrary to Quality Control Procedure QCP-508 and Appendix B, Criterion IX.

7. Melt-thru is a condition adverse to quality when it exposes a weld puddle to the atmosphere, yet contrary to Criterion XVI no measures are established to assure identification of this deficiency.

Criterion XVI states, in part, "Measures shall be established to assure that conditions adverse to quality, such as . . . deficiencies, deviations, defective material . . . and nonconformances are promptly identified . . ."

Section 2, above presents evidence that melt-thru did occur in the pipe piece in question.

The Union Electric answer to the Joint Intervenors' Interrogatory No. 26(d), second set, states, "Exposure of the weld puddle to the atmosphere could affect the mechanical properties." If the mechanical properties were adversely affected by exposing the weld puddle to the atmosphere there are no specific criteria for identifying such a condition within the Construction Procedures, contrary to Criterion XVI,

B. Response to Applicant's Statement of Material Facts on Part II.A.1 (SA-358 Piping)

1. Disagree. The Applicant has misstated the contention for which it seeks a summary disposition by omitting the first portion of the contention. The full title of the contention in question is Contention Number 1, Failure of the Quality Assurance Program; Part II, Substandard Piping; paragraph A, Material Manufacturing Deficiencies; subparagraph (1), which concerns "a substandard piece of ASME Class II, SA-358 piping which has been installed in the emergency core cooling system."

Contention Number 1 states, "Surveillance and inspection functions of Applicant Union Electric, and others, including Bechtel Power Corp. (lead architect/engineer), Daniel International Corp. (construction contractor) and Code Authorized Nuclear Inspectors, failed to ensure the quality of safety-related material . . . contary to the quality assurance criteria of 10 CFR Part 50 Appendix B." The specific Appendix B criteria, related to Contention Number 1, Part II.A.1, with which the Applicant and its designees have failed to comply are lsited above in the Statemen of Material Facts and Argument in Support of Part II.A.1 (Sa-358 Piping).

2. Agree.

3. Agree.

4. Agree.

5. Agree.

6. Agree.

7. Disagree. The actual ovality has not been determined. Ovality is determined by subtracting the minimum diameter from the maximum outside diameter. The only accurate measurements of the pipe diameter were taken in four unspecified planes in one location on the pipe. (NRC IE Report No. 50-483/81-04, para. 16; submitted by NRC Staff with its motion). The maximum and mimimum diameters may have been located in an unmeasured plane. The pipe was judged acceptable by 0.14% or 0.0155 inches, the approximate thickness of five sheets of typing paper. The unmeasured planes in this ten-inch pipe could easily be 0.0155 inches longer or shorter than the maximum or minimum diameters measured in four planes.

8. Agree.

9. Disagree. Joint Intervenors disagree with the statement that, "It would not have been significant, however, if the excess reinforcement had not later been removed . . ." This statement is in contradiction to NRC IE Report No. 50-483/81-04 which states on page nine, "the weld reinforcement defects, if uncorrected would have been an unacceptable condition."

10. Disagree. The Daniel NCR No. 2SN-0501-P (Exhibit 7) on the pipe in question was returned by Bechtel without disposition because Bechtel erroneously judged the defects "not an NCR category item." Because of Bechtel's action, Daniel issued a superseding deficiency report (DR) (Exhibit 5) which identified the "overlap" as "poor fusion." The Daniel DR was the documentation for the actual rework done on the weld and should be referred to concerning the identification of the defect. The "overlap" described on the NCR should also be referred to as "poor fusion," as identified on the DR.

In an attempt to probe the quality assurance and quality control procedures used by Bechtel to disposition NCR's such as NCR No. 2SN-0501-P here referred to by the Applicant, Joint Intervenors requested a copy of the N certificate holder's Quality Assurance Manual (Document Request No. 55, second set). Bechtel is the N certificate holder for the Callaway plant. The Joint Intervenors were informed by the Applicant that the Applicant did not have "possession, custody or control" of Bechtel's Quality Assurance Manual (in response to the document request). Without access to this document neither the Joint Intervenors nor the Applicant nor this Board can fully evaluate Bechtel's disposition of NCR No. 2SN-0501-P.

Joint Intervenors also disagree with the statement, "The overlap apparently was excess weld material which had rolled over onto the surface of the pipe material." This statement is in contradiction to the affidavit of William Key submitted with the NRC Staff's motion for summary disposition, which described the overlap/poor fusion condition as "drop through."

12. Disagree. This type of weld imperfection (overlap/poor fusion) is correctly called "incomplete fusion" when it is identified on radiographic film and is contrary to ASME Section I, para. PW-51, which is applicable to radiographed SA-358 material. (See Notice of Violation addressed to Union Electric Company dated June 25, 1981, and signed by James G. Keppler; Exhibit 1.)

13. Disagree. "Burn-through" is defined in the American Welding Society publication, "Terms and Definitions — ASW A3.0," as "An erroneous term to describe melt-through or hole." (Exhibit 12). This evidence is presented in the Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping), supra, paragraph 2.

14. Disagree. Joint Intervenors disagree with the statement, "A slight or momentary variation in any of these parameters would cause the overlap condition." While a general overlap condition may be caused by a variation in parameters, the

particular overlap-poor fusion in this instance was accompanied by excess reinforcement and fissures or cracks. The total condition of the weld indicated melt-thru which would be caused by a slight or momentary variation of welding parameters. See Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping), supra, paragraph 2.

15. Disagree. The presence of melt-thru would expose the weld puddle to the air. Such an exposure would affect the structural integrity of the weld joint. The evidence of melt-through is contained in the Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping), supra, paragraph 2.

That exposure to air would affect the structural integrity of the weld joint is confirmed in the Applicant's response to Joint Intervenors' interrogatory no. 26d, second set.

16. Disagree. The overlap/poor fusion and excess reinforcement were not repaired by Daniel. The Daniel DR states that the weld defects were "reworked," not "repaired."

The simple removal of excess material by localized grinding did not change all of the weld metal affected by exposure to air. (See Item 15 above.)

17. Disagree. The inspections and tests made did not evaluate the mechanical properties of weld metal affected by exposure to air. The inspections and tests made are therefore insufficient grounds for saying that there are no defects in the reworked weld.

18. Disagree. Hydrostatic testing does not nullify previous 10 CFR 50 Appendix B and ASME Code-required assurances of quality and structural integrity. If the pipe piece was not welded in accordance with a qualified procedure and nonconformances were not dispositioned according to documented procedure, as evidence indicates, then the pipe's integrity is clouded irrespective of hydrostatic test results. See Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping).

C. Response to NRC Staff's Statement of Material Facts on Part II.A.1 (SA-358 Piping)

1. Disagree. The NRC Staff has misstated the contention for which it seeks a summary disposition by omitting the first portion of the contention. The full title of the contention in question is - Contention Number 1, Failure of the Quality Assurance Program; Part II, Substandard Piping; paragraph A, Material Manufacturing Deficiencies; subparagraph (1), which concerns "a substandard piece of ASME Class II, SA-358 piping which has been installed in the emergency core cooling system."

Contention Number 1 states, "Surveillance and inspection functions of Applicant Union Electric, and others, including Bechtel Power Corp. (lead architect/engineer), Daniel International Corp. (construction contractor) and Code Authorized Nuclear Inspectors, failed to ensure the quality of safety-related material . . . contrary to the quality assurance criteria of 10 CFR Part 50 Appendix B." The specific Appendix B criteria, related to Contention Number 1, Part II.A.1, with which the Applicant and its designees have failed to comply are listed above in the Statement of Material Facts and Argument in Support of Part II.A.1 (SA-358 Piping).

2. Agree.

3. Agree.

4. Agree.

5. Agree.

6. Disagree. Section III of the American Society of Mechanical Engineers Code, paragraph NC-2561 states, "inspection . . . shall be in accordance with the material specification." (Exhibit 10). The material specification is also part of the ASME Code and is found in Section II. Specification SA-358, paragraph 15.1 reads as follows, "Permissible Variations - The dimensions at any point in length of pipe shall not exceed the following:" and "15.1.2 Out-of-roundness - Difference between major and minor outside diameters, 1 percent." (Exhibit 11). Conformance to the material

specification is established as a requirement for Class II piping in ASME Section III and the actual material specification is found in ASME Section II.

7. Agree.

8. Disagree. The actual measured ovality has not been determined. The only accurate measurements of the pipe's diameter were taken in four unspecified planes, at one location on the pipe (50-483/81-04, para. 16). If these measurements were equally spaced around the pipe, they would be approximately 4 inches apart. The maximum and mi[illegible] neters may have been located in the unmeasured area. The pipe was judged acceptable by .14% or .0155 inches, the approximate thickness of 5 sheets of typing paper. An unmeasured plane in this 10 inch pipe could easily be 0.0155 inches longer or shorter than the maximum or minimum diameters measured in four planes.

9. Disagree. Without accurate determination of out-of-roundness this is an unfounded statement.

10. Agree.

11. Agree.

12. Agree.

13. Agree.

14. Agree.

15. Agree.

16. Agree.

17. Agree.

18. Disagree. There is reason to believe that the quality and structural integrity of the subject SA-358 piping is questionable. A preponderance of evidence indicates melt-thru as the cause of the initial weld defects. (See Statement of Material Facts and Argument in Support of Part II.A.1, para. 2, supra.) A melt-thru event would have exposed the weld puddle to the air, and such an exposure would affect the

structural integrity of the weld joint. The Applicant's answer to Joint Intervenors' Interrogatory no. 26(d), Second Set, states, "Exposure of the weld puddle to the atmosphere could affect the mechanical properties." An evaluation of the effects of melt-thru on SA-358 piping has not been made. Until such an evaluation is made the assurance of quality and structural integrity of SA-358 piping containing melt-thru is clouded.

IV. EMBEDDED PLATES

A. Statement of Material Facts and Argument in Opposition to Summary Disposition on Part I.A (Embedded Plates)

Introduction

Embedded plates, or 'embeds,' are critical to the structural integrity of Callaway Plant because they support steel floor beams, which in turn support whole floor systems. They are also used to support piping for radioactive water, vibrating machines, and other critical components of the nuclear power plant. An embed is a steel plate with studs welded to one face, like the bristles of a brush. The embed is embedded in a concrete wall or floor, with the surface of the plate flush with the surface of the wall or floor. (See Affidavit of Eugene Gallagher, para. 4, submitted by NRC Staff).

On June 9, 1977, after 691 embedded plates fabricated by Cives had been embedded in Seismic Class I structures and systems at the plant (UE answers to Interrogatory nos. 4(b) and 6(c), first set), an NRC inspector discovered that some of the welds attaching the studs to some of the plates being installed were defective (Gallagher, para. 6). The defects were numerous enough and serious enough to cause Union Electric to stop the installation of any additional plates until all embeds on site would be inspected (Gallagher, para. 7; NRC answer to Interrogatory no. 1, first set). The results of the inspection were serious enough to cause Union Electric to order that a large number of studs be repaired on site and that others be sent back to the fabricator. The initial inspection surveillance reports resulted in the issuance of a 610-page nonconformance report (NCR-2-0831-C-B) containing evidence of approximately 786 plates with defective welds. Of those, approximately 575 plates showed evidence of more than one defective stud weld — in many cases, all or a majority.[2] The data of the numerous ensuing inspections have been progressively reinterpreted in an effort to diminish the significance of the inspections, while the safety problems remain unaddressed. The reinterpretations have included relaxations of the ASW code.

Inspections by the contractor, Daniel International, over the weeks and months following discovery of the problem, found extensive evidence of poor workmanship in embed fabrication, based on inspections of uninstalled embeds. Over the next three years, Union Electric and Bechtel Corporation, the architect/engineer responsible for procuring the embeds, along with Cives Corporation, the fabricator, worked to demonstrate that the plates not yet installed had a negligible number of defects. By trying to prove that the plates not yet installed were of acceptable quality, Union Electric and the Bechtel Corporation sought to demonstrate that the 691 plates installed before June 9, 1977 were also acceptable. The NRC Staff agreed with their findings. Joint Intervenors do not.

Joint Intervenors oppose the NRC Staff's motion for summary disposition. Joint Intervenors' Contention I.A presents genuine issues as to material facts related to the safety of equipment installed in the Callaway Plant. Therefore, NRC Staff's request for summary disposition should be denied.

Joint Intervenors shall outline in four sections the genuine issues of material fact which exist in the case and which the NRC Staff has inadequately addressed or

---

[2]NCR-2-0831-C-B is the Nonconformance Report containing 610 pages of inspection and surveillance reports pertaining to defective embeds. Due to its size the 610 page attachment is not being submitted herewith but can be obtained from the Applicant or from Joint Intervenors upon request. Joint Intervenors will produce this document at the hearing.

failed to address in its motion. The documented evidence relating to each issue is also discussed below. These matters are central to the issue of the unsafe operating condition of the plant. Joint Intervenors will address these matters as follows:

Section 1: The inspection and reinspection programs of the embeds provide no evidence that the embeds installed before June 9, 1977, are safe.

Section 2: The number of plates with defective stud welds is greater than that presently alluded to by the companies responsible and by the NRC Staff.

Section 3: The fabricator of the embeds practiced substandard quality control.

Section 4: The deviations from the American Welding Society Code (D1.1-75) allowed for the embeds at the Callaway Plant were implemented shortly after the welding defects were discovered and have not been demonstrated to provide adequate assurance of safety.

1. <u>The inspection and reinspection programs of the embeds provide no evidence that the embeds installed before June 9, 1977, are safe.</u>

Because there is little known about the quality of the embeds installed before June of 1977, the Applicant has been forced to project the probability of the installed embeds' safety from an assortment of tests, inspections and analyses.

Daniel and Bechtel both admit that there are installed embeds which are identical in type to those that were inspected after June, 1977 and found to be defective. For example, a status report on the embed problem from Bechtel to SNUPPS, <u>BLSE 4589</u> states: "It has been determined that a number of studs on embedded plates, frames and pipe sleeves already received at the site and installed in forms are deficient." (July 6, 1977, Enclosure Cives — Shear Stud Evaluation; Exhibit 13) In addition, an Inter-Office Communication voiding a Nonconformance Report, <u>PQWP-220, 2/1/78 (Exhibit 14)</u> indicates that of 4 plates (Type EP 1) received on site, one was embedded in concrete on May 18, 1977. The other three were later reinspected and found to be in need of repair.

Furthermore, the location of the potentially faulty embeds that have been installed cannot be determined: NCR 2-2386-C-A, Attachment C, p. 1, dated June 12, 1978 (Exhibit 15) states: "However, no documentation can be found which substantiates that the embedments were repaired, reinspected and accepted. Further, the embedments cannot be located at the site. If they are installed within the plant structures, specific identification of the embeds is not possible because there is no unique identifier that is traceable on the face of the plates." The NRC Staff suggested that UE identify the location of each installed plate, determine what loads each plate must bear and determine the consequences of plate failure upon the safe operation of the plant. This was not done by UE. See UE letters to NRC: ULNRC-349, April 24, 1980, paragraph 17 and ULNRC-354, May 23, 1980, paragraph 17, both contained in NRC Report No. 50-483/80-14 (supplied by NRC Staff with its motion; Attachment 1).

2. The number of plates with defective stud welds is greater than that presently alluded to by the companies responsible and by the NRC Staff.

The only number or percentage of defective embeds referred to in the NRC Staff's motion comes from the following source: NRC Report #80-14, p. 7; "The reinspection of 7543 plates which contained 81,643 machine welded head studs, of which 66 studs (0.08%) were identified as not meeting AWS bend test requirements."

However, other evidence indicates a far greater problem. NRC Report #80-14 also states at p. 7: "During the months of July and August 1977, Cives Steel Corporation reinspected over 400 manually welded plates of which 80 did not meet the specification requirements of C-131, Revision 9." This statement acknowledges a defect rate of 20 percent. An even more outrageous reject rate appears in DLUC 1788-Attachment, p. 43, August 18, 1977, (Exhibit 16) to wit:

b) Manual Welded Embed Plates

Approximate Number Inspected	280
Approximate Reject Rate	90% (weld criteria only)

Audit base to substantiate reject rate:

Sample size = 15

Number rejects = 15 (weld criteria only)

Reject rate = 100%

Other documents indicate the following:

DLUC 2142, November 14, 1977 (Exhibit 17), p.1:

Manually Welded Studs Inspected	6103
Number of Studs Rejected	2729
Reject Rate	44.72%

Bechtel Supplier Deviation Disposition Request No. 4, dated July 11, 1977, (Exhibit 18): Of 19 plates delivered, 12 needed to have 1/16" added to their vertical leg: EP211-A2, A17, A47; EP511-A20, A45, A46, A48; EP611-A3, A24, B24, D24, A40.

SLU-6-41, November 1, 1976 (Exhibit 19):

> A recent examination of Bechtel inspection activities indicates a number of reports of misfabricated and discrepant materials produced by the Miscellaneous Steel Supplier, Cives Corp. Discrepancies identified to date include . . . undercut welds. . . The above data raises questions in regard to the acceptability of those materials delivered to the site which have been released for shipment without benefit of Bechtel and item inspection.

DLUC 2399, November 19, 1978, page 2 (Exhibit 20): "Data Package Prepared to provide information for use in an Engineering valuation" lists 312 rejected manually welded embeds.

Other documents indicated an inconsistency between the number of plates with multiple welding defects. In one document, Donald F. Schnell, then Union Electric Manager of Nuclear Engineering, wrote to Eugene Gallagher of the NRC that, "There is evidence of mutiple defects per embed; ten plates in this category and they are shown in Attachment 'B'." (ULNRC-354 dated May 23, 1980, p. 3 included in NRC Report #80-14, supplied by NRC Staff with its motion; Attachment 1). An additional seven embeds (five sleeves and two door frames) are listed in Attachment "B" as having two or three defective stud welds.

However, in a second document, Nonconformance Report No. 2-0831-C-B, Joint Intervenors find drawings of approximately 575 embeds with two or more defective stud welds. On 466 of those embeds, at least half of the stud welds are defective.

3. <u>The fabricator of the embeds practiced substandard quality control.</u>

Bechtel and SNUPPS realized that the embeds produced by Cives were defective long before the NRC first inspected them in June of 1977. On December 30, 1975 the Bechtel Surveillance Inspection Report (Enclosure B to BLUE-700 (Exhibit 21)) stated: "Twelve studs were welded to each of the two plates . . . . One stud on each plate did not have a fillet extending quite 360 degrees around the perimeter. Both parted from the plate when bent with a hammer in accordance with the AWS Bend Test requirement."

On November 5, 1976 SNUPPS wrote to Bechtel about the embeds:

> Examination of Bechtel Surveillance Inspection Reports over the past few months indicates the nonconformances have been and are continuing to be identified involving fabricated steel produced by Cives Corp. Specifically, Bechtel inspection activities which are based on a sampling level of 20-25 percent have identified nonconformances involving more than 300 pieces of misfabricated steel. These include discrepancies such as mislocated studs; weld undercut; oversize embed holes and painting defects. Discussion with the Bechtel Inspection Supervisor indicates other nonconformances have been identified in addition to those listed in the Bechtel Inspection Reports. Additionally, nonconforming material has recently been detected at Callaway Site (see: NCR No. 2-0017-C-A dtd. 10/12/76) raising further questions with respect to the suppliers performance. (SLBM: 6-514, SNUPPS to Bechtel, November 5, 1976 (Exhibit 22)).

Four days prior to the November 5th letter, SNUPPS had written to Union Electric with the same concern:

> A recent examination of Bechtel procurement inspection activities indicates a number of reports of misfabricated and discrepent (sic) materials produced by the Miscellaneous Steel Supplier, Cives Corp. Discrepencies identified to date include items such as mislocated studs; oversize holes in embedded frames; undercut welds; oversize pipe sleeves; door frames out of square and painting defects. (SLU: 6-41, SNUPPS to Union Electric, November 1, 1976) (Exhibit 19)).

A Bechtel Inter-Office Memo, dated June 29, 1977, (Exhibit 23) describes the Bechtel quality control surveillance at the supplier's fabrication shop as "unacceptable, because it is not providing 100% inspection," yet the first "final" report issued by Bechtel eleven days later states that the supplier's "inspection procedures were acceptable." (Exhibit 24). The Bechtel Inter-Office Memo of June 29, 1977, stated:

> During a visit on June 29, 1977 [or June 28], it was observed how you were performing the inspection on the automatic welded studs. Observing them when the plates were banded back to back, then stacked. The stack was about 12 plates (12 feet) long, 5 or 6 (5 feet) high and 2 (9-10 feet) deep. In the opinion of B.L.Meyers (Engineering), S.J. Seiken (SNUPPS Client) and myself [E.J. Simanek, Procurement, Bechtel at Gaithersburg], this is unacceptable as it is not providing 100% inspection of the subject welds as requested, therefore, you are directed to change your inspection technique to provide the Project with the degree of inspection. (Exhibit 23).

After finding the QC surveillance method unacceptable, eleven days later, the Bechtel "Final Report - Investigation of Welded Studs," dated August 10, 1977, p. 5, listed among the corrective actions required:

> "1. Mechanically Welded Studs
>
> The rejection rate and the probability of failure indicate that the materials as received at the jobsite are acceptable. However, to further insure that future fabrication of these type studs are, and will continue to be acceptable, the following additional actions were taken:
>
> a. An investigation of the supplier's shop was performed on 6/28/77 by technical, supplier quality and SNUPPS personnel. The result of this investigation indicated that the supplier's fabrication and <u>inspection procedures were acceptable.</u>" (Emphasis added) (Exhibit 24).

Furthermore, prior to the discovery of the embed problem in June 1977, Bechtel did not require Cives to perform inspections and tests according to AWS requirements. See Bechtel letter to SNUPPS dated November 2, 1977, BLSE 5195 (Exhibit 25).

Evidence indicates that quality control problems at the fabricator, Cives, were not corrected in 1977, but still existed as recently as 1980. See Bechtel letter to UE dated July 22, 1980, BLUE 712 (Exhibit 26).

4. The deviations from the American Welding Society Code (D1.1-75) allowed for the embeds at the Callaway Plant were implemented shortly after the welding defects were discovered and have not been demonstrated to provide adequate assurance of safety.

The four deviations from the AWS Code were proposed by Bechtel in a letter to SNUPPS dated July 20, 1977 (Exhibit 27), six weeks after the NRC inspection of embeds which resulted in the stop work orders.

Bechtel's justification for the deviations, "[T]hese rules do not address specific cases such as circular manual stud welding in clusters on embedded plates," (Exhibit 27, page 5) and Eugene Gallagher's statement in his affidavit, para. 14, that the deviations from the AWS code "are minor in nature and do not affect the basic weld design or the capacity of the connection" are inconsistent with the position taken by the NRC, as reflected below:

> NRC takes exception to statement in J.K. Bryan cover letter,
>
> > P. 1: 'As noted in the Bechtel specification for these embeds, even AWS requirements limiting undersize, profile and other weld characteristics cannot be applied to manually-welded embeds and are unnecessary to assure their ability to carry design loads.'
>
> Mr. Gallagher has talked to Moss Davis of AWS plus NRR and I & E HQ people expert in AWS requirements. He posed this question: 'Are AWS weld profile, undercut, etc. requirements applicable to manually-welded studs?' The answer from these people is "YES." (ULNRC-349, a letter from Donald Schnell of UE to Eugene

Gallagher of the NRC dated April 24, 1980; p. 1 contained in NRC Report No. 80-14, submitted by NRC Staff).

B. Response to NRC Staff's Statement of Material facts on Part I.A (Embedded Plates)

1. Agree.

2. Disagree. On June 9, 1977, an NRC inspector identified embedded plates with machine-welded studs which did not contain a full 360 degree weld, but there is no evidence that the inspector knew at that time whether the stud welds had been bend tested as required by AWS code.

3. Disagree. On or before June 9, 1977, 691 plates (459 machine-welded and 232 manually-welded) fabricated by Cives had been embedded in Seismic Class I structures and systems at the site. (Applicant's Answers to Interrogatories numbers 4(b) and 6(c), first set). The record does not indicate how many plates had been embedded by this time in non-Seismic Class I structures and systems such as in the Radioactive Waste Building and the Turbine Building.

4. Disagree. The Applicant initiated a 100% inspection program of all the uninstalled plates after June 9, 1977. As part of this program, an effort was made to have every manual and machine weld visually examined, though the record does not indicate whether the inspectors were directed to examine the entire circumference of each weld or to inspect for and record the presence of undercut, porosity, incomplete fusion, overlap and other weld defects. Furthermore, the welds were not bend-tested as required by Section 4.30 of the AWS Structural Welding Code D1.1-75 (Exhibit 28, page 42).

5. Disagree. A variety of visual inspections and reinspections at the plant site starting after June 9, 1977, and extending into September 1980 resulted in reports on a range of defective and failed machine-welded studs and plates. (See Statement of Material Facts and Argument in Support of Part I.A (Embedded Plates), section 2, supra.) One such reinspection performed by the procuring agent for the embeds, Bechtel,

and the vendor, Cives Steel Corporation, indicated that 31,643 machine-welded studs were visually inspected. Of that number, 457 studs were found to have less that 360 degree welds, and 66 of those studs failed. There is no documentation to support the statement that the 66 failures were caused by the required AWS bend test, as stated in the affidavit of Eugene Gallagher. The inspection that resulted in the claim that only 66 stud welds failed was reported by Bechtel on page one of its "Final Report: Investigation of Welded Studs," enclosed in BLSM-5977 dated August 10, 1977. (Exhibit 24). Mr. Gallagher's affidavit indicates he was assigned to the Callaway Plant beginning in December 1977, so he cannot have personal knowledge of the alleged bend testing. Therefore, documentation is required. Furthermore, Joint Intervenors know of no documentation indicating that "the failed studs were repaired."

Furthermore, records have not been provided which demonstrate the number of machine-welded plates repaired at the Callaway plant site after June 9, 1977, in spite of repeated requests for such information starting with the first round of discovery (Interrogatory no. 8; and see letter dated August 26, 1981 from Thomas A. Baxter to Kenneth M. Chackes, pp. 2-3). Only conflicting records have been produced regarding the number of plates shipped back to the vendor for repair or replacement. (Applicant's answer to Joint Intervenors' interrogatory no. 6, second set.)

6. Disagree. A variety of visual inspections and reinspections starting after June 9, 1977, resulted in reports of a range of defective and failed manually-welded studs and plates. (See Statement of Material Facts and Argument in Support of Part I.A (Embedded Plates), section 2, supra.) The Applicant has not produced records indicating the total number of manually-welded plates which were repaired or replaced on site or by the vendor, in spite of Joint Intervenors' requests for such information starting with the first round of discovery (See paragraph 5, supra).

7. Disagree. Joint Intervenors agree that the Applicant tested twelve manually-welded studs with visual defects at Lehigh University but note that the Lehigh

"bend" or "tension" tests as described in Bechtel's "Detailed Procedure for Test Program to Evaluate Welds of Anchor Rods and Studs to Embedded Plates," Revision 2, dated August 5, 1980, are not the inspection procedures for stud welds described by the AWS Code D1.1-75, Section 4.30 (Exhibit 28; Bechtel's "Detailed Procedure" is attached to NRC Report #80-14 submitted by NRC Staff with its motion). The record does not indicate whether any of the twelve stud welds would have failed if it would have been struck with a hammer and bent to an angle of 15 degrees from its original axis, as per Section 4.30 of the governing AWS Code.

Also, the record does not indicate the date that each of the twelve plates was fabricated or delivered to the site and, therefore, the relevance of the studs tested at Lehigh to the manually-welded plates located on site on or before June 9, 1977 is unknown. Furthermore, the record does not include the technical specifications and other documents necessary to make an analysis of whether the tests of the manually welded studs indicated failure, or not.

8. Disagree. Joint Intervenors agree that six plates with machine-welded studs which had been embedded in concrete at the Callaway Plant prior to June 9, 1977, were tested in the walls. Joint Intervenors disagree that the plates were randomly selected. Test procedures called for selecting four EP-512 plates and two EP-912 plates "based upon accessibility to the plates and feasibility of mounting a test rig for the plates." ("Detailed Procedure for Test Program," Revision 2, p. 5; attached to NRC Report #80-14 submitted by NRC Staff with its motion).

The record does not contain the technical specifications or other documents concerning the plates that would be needed to determine whether the plates were tension-tested at the design load conditions (plus a design load tolerance of a maximum of 15%). ("Detailed Procedure," Revision 2, p. 5). There is no discussion of dead (static) loads or of dynamic (live) loads in Bechtel's "Detailed Procedure for Test Program."

The record does not indicate whether the machine-welded plates were tension-tested, load-tested, or what. The tests of August 14, 1980, of the embedded plates at Callaway were described alternately as "pull tests" ("Detailed Procedure," Revision 2, August 5, 1980, Appendix A), "tension tests," ("Interim Test Report," August 27, 1980, p. 1, and Appendix A, test result data sheets and graphs), "proof load tests," ("Report on Testing," September 15, 1980, p. 5, Exhibit 29), and "field tests - Load vs. Plate Deflection," ("Report on Testing," September 15, 1980, Table of Contents and Figures 3 and 4, Exhibit 29). The final reading for the reported deflection of each plate was taken only two minutes after the maximum load was recorded. The record does not indicate whether the plates performed acceptably.

9. Disagree. See Statement of Material Facts and Argument in Support of Part I.A (Embedded Plates), supra.

10. Disagree. The record does not indicate if or when the NRC Staff "granted" the Applicant authority to diverge from the original Licensee commitment in the PSAR, Section 3.8.1.6.6.2 to following the AWS D1.1-72 and D1.1, Revision 73, Structural Welding Code for welding structural steel. Furthermore, questions of fact exist regarding the nature and affect of the exceptions. See Statement of Material Facts and Argument in Support of Part I.A, Section 4, supra.

V. CONCLUSION

For the reasons stated above Joint Intervenors contend that all seven motions for summary disposition should be denied. In the alternative, the motions directed to the SA-358 Piping and Embedded Plates issues should be denied as it clearly has been shown herein that numerous issues of material fact exist with respect to those portions of Contention One.

Respectfully submitted,
CHACKES AND HOARE

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
UNION ELECTRIC COMPANY	)	Docket No. STN 50-483-OL
	)	
(Callaway Plant, Unit 1)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of Joint Intervenors' Answer to Applicant's and Staff's Motions for Summary Disposition have been served on the following by deposit in the United States mail this 30th day of October, 1981 (by Express Mail to those indicated by asterisk).

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EXHIBITS FOR JOINT INTERVENORS' ANSWERS TO APPLICANT'S AND STAFF'S MOTIONS FOR SUMMARY DISPOSITION

DOCKET NO. STN 50-483-OL

Appendix A

NOTICE OF VIOLATION

Union Electric Company | Docket No. 50-483

As a result of the investigation conducted on February 20, March 3-6, 23-27, 1981, and in accordance with the Interim Enforcement Policy, 45 FR 66754 (October 7, 1980), the following violation was identified.

10 CFR Part 50, Appendix B, Criterion IX, states, "Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements."

Pipe piece No. 5P, part of the accumulator discharge line from accumulator TEPOIA, was manufactured to material specification ASME SA-358. Specification SA-358 requires "Radiographic Examination in Accordance with ... ASME .." Section I, Paragraph PW-51.

ASME Code, Section I, Paragraph PW-51 states "Sections of weld that are shown by radiography to have any of the following types of imperfections shall be judged unacceptable and shall be repaired..."

51.3.1 Any type of crack, or zone of incomplete fusion or penetration.

Contrary to the above, on March 6, 1981, the inspector determined from a review of radiographs of the seam weld on pipe piece No. 5P at film location markers 13-14 that the film indicated apparent incomplete fusion and excess reinforcement and yet the pipe piece had not been judged unacceptable or repaired.

This is a Severity Level V violation (Supplement II).

Pursuant to the provisions of 10 CFR 2.201, you are required to submit to this office within twenty-five days of the date of this Notice a written statement or explanation in reply. Since the investigation indicated action had been taken to correct the identified noncompliance, your reply need only address actions to be taken to avoid further noncompliance. Under the authority of Section 182 of the Atomic Energy Act of 1954, as amended, this response shall be submitted under oath or affirmation.

Dated 6/25/81

James G. Keppler
James G. Keppler
Director

Exhibit 1

SPECIFICATION FOR ELECTRIC-FUSION-WELDED AUSTENITIC CHROMIUM-NICKEL ALLOY STEEL PIPE FOR HIGH-TEMPERATURE SERVICE

SA-358

(Identical with ASTM Specification A 358-75 except that S5 has been changed and the following additional requirements apply)

1. Scope

1.1 This specification covers electric-fusion-welded austenitic chromium-nickel alloy steel pipe suitable for corrosive or high-temperature service, or both. (Although no restrictions are placed on the sizes of pipe which may be furnished under this specification, commercial practice is commonly limited to sizes not less than 8-in. nominal diameter.)

1.2 This specification covers eleven grades of alloy steel as indicated in Table 1. The selection of the proper alloy and requirements for heat treatment shall be at the discretion of the purchaser, dependent on the service conditions to be encountered.

1.3 Four classes of pipe are covered as follows:

1.3.1 *Class 1*—Pipe shall be double welded by processes employing filler metal in all passes and shall be completely radiographed.

1.3.2 *Class 2*—Pipe shall be double welded by processes employing filler metal in all passes. No radiography is required.

1.3.3 *Class 3*—Pipe shall be single welded by processes employing filler metal in all passes and shall be completely radiographed.

1.3.4 *Class 4*—Same as Class 3 except that the weld pass exposed to the inside pipe surface may be made without the addition of filler metal (see 5.2.2.1 and 5.2.2.2).

1.4 Supplementary requirements S1, S2, S3, S4 are included as options to be specified when so desired. These supplementary requirements cover provisions ranging from additional testing, to formalized procedures for manufacturing practice.

NOTE 1—The values stated in U.S. customary units are to be regarded as the standard.

2. Applicable Documents

2.1 *ASTM Standards:*

A 240, Specification for Stainless and Heat-Resisting Chromium and Chromium-Nickel Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels

A 530, Specification for General Requirements for Specialized Carbon Steel and Alloy Steel Pipe

E 30, Chemical Analysis of Steel Cast Iron, Open-Hearth Iron, and Wrought Iron

2.2 *American Society for Mechanical Engineers:*

ASME Boiler and Pressure Vessel Code, Section I

ASME Boiler and Pressure Vessel Code, Section IX

2.3 *American Welding Society Specifications:*

A 5.4 Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes

A 5.9 Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes

3. General Requirements

3.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A 530 unless otherwise provided herein.

3.2 The following sections only of Specification A 530 apply: 1, 2, 3, 5, 16, 17, 18, 19, 20, 21, and 22.

4. Basis of Purchase

4.1 Orders for material under this specification shall include the following, as required, to describe the desired material adequately:

4.1.1 Quantity (feet, centimeters, or number of lengths).

4.1.2 Name of material (electric-fusion-welded pipe),

4.1.3 Grade (Table 1

4.1.4 Class (see 1.3),

Exhibit 2

HA1.C

Form CP-6P (Rev. 10-78)
NONCONFORMANCE REPORT (NCR)

Project Name/Number	Action Rqd By:	Hold Tag	Q	N	NCR Number
CALLAWAY/7186	5/17/79	1 of 1	X		2SN-0496-F

System ID - EP

Identification of Area and Item

Reactor Building, SNUPPS Unit #2
Spool No. 2-EP-01-S002

FS-M-DM-
Traveler No.-03EP01(Q)L

Controlling Documents

Bechtel Specification 10466-M-201A (Q), Revision 11
Bechtel Specification 10466-MS-6 (Q), Revision 5

Description of Nonconformance

Counterbored end of spool 2-EP-01-S002 at Weld No. 2-EP-01-F004 under minimum wall requirements per MS-6. See attached U.T. Report ATTACHMENT "A"

"TESTING"

WQCS 4-27-
LWQCI 4/27

Originator / Title / Date

Recommended Disposition & Basis for Recommendation:

Use as is - Bechtel to determine that min. wall of 0.814" will meet design criterias and function of system will be maintained.

- [ ] Rework
- [ ] Repair
- [x] Use As Is
- [ ] Reject

05-01-79
AUTHORIZED NUCLEAR INSPEC

Cause of Nonconformance and Action to Prevent Recurrence:

Ovality in pipe not recognized by vendor prior to machining counterbore, thereby resulting in min wall violation. Vendor to be notified by Bechtel to prevent recurrence. No DIC action required.

Action Taken to Control Nonconformance:

Attach Q.C. Hold Tag.

POTENTIAL 50.55(e)/PART 21
YES ☐ NO ☒

Piping Engr. 4-30-79 | QRS 5-1-79

Route to:
For Corrective Action C. Plows

Site Approval / Title / Date

Statement of Completed Action:

Disposition "use as is". Hold tag removed and destroyed

QWQCE 5-31-79
WQCS 5-31-

LWQCI 5/31/79
Action Completed / Title / Date / Action Verified

Exhibit 3

Distribution: J. L. Turdera, R. L. Powers, D. F. Schnell, W. H. Weber, N. A. Petrick, F. D. Field

EXHIBIT

INSTRUCTIONS FOR COMPLETING
NONCONFORMANCE REPORT (NCR)

1. Identification of Area and Item - The Originator shall provide identification of the area and item which is affected by the nonconforming condition; e.g., serial number, lot number, purchase order number, concrete pour number, equipment number, system number, traveler number and any other pertinent information on the NCR.

2. Controlling Documents - The Originator shall enter controlling documents; e.g., specification number, drawing number, procedure number, etc.; Revision number is to be included in the referenced number.

3. Description of Nonconformance - The Originator shall provide a clear, concise description of the nonconformance and method of inspection used if other than visual, e.g., testing. Reference any attachments required to clarify the description of the nonconformance.

4. "Q" - The Originator shall identify the nonconformance by marking and "X" in the area under "Q" if Safety Related.

5. Originator/Title/Date - The Originator shall sign, enter his title and date of NCR initiation.

6. Control Method - The Project Discipline QC Engineer shall enter number of Hold Tags used to control item(s) or indicate other means used.

7. The Project Discipline QC Engineer shall sign and date signifying satisfactory review and concurrence and obtain NCR number from QC Manager to be assigned as described in the procedure i.e., SNUPPS Unit, sequence and discipline.

8. Recommended Disposition and Bases for Recommendation - The Project Discipline Engineer shall provide a recommendation as to a Daniel desired resolution to the nonconformance, check the appropriate standard disposition box and enter justification for the recommended disposition. NOTE: "Review Design" disposition shall be used as a Daniel Engineering option when A/E assessment or design change is required for NCR's.

9. Action Required by - The Project Discipline Engineer shall enter the latest date on which Daniel requests that NCR disposition review/approval be received.

10. Cause of Nonconformance and Action to Prevent Recurrence - The Project Discipline Engineer shall identify the cause of the nonconformance (if known) and provide a statement as to what action(s) when appropriate, shall be taken to prevent and minimize recurrence. The Responsible Manager shall initial and date beside the Action to Prevent Recurrence indicating concurrence and initiation of the "Cause of Nonconformance and Action to Prevent Recurrence".

11. Action taken to Control Nonconformance - The Project Discipline Engineer shall indicate concurrence with the control method by entering the number of hold tags placed by Quality Control Personnel and describe any additional action taken to control the nonconforming item or area (when appropriate).

Written as a result of the NCR — P.H.

Form CP-477 (10-78)

DEFICIENCY REPORT

Page 1 of 1

No. 2SD-0699-P

DWG/ISO FSMD-M03-EP01

SPEC/Proc ASME Sec. II, Part C, Spec. SA-358

Date 09-06-79

S [X] NS [ ] Reactor Building

PURCHASE ORDER/TRAVELER NO. 2-EP01

DESCRIPTION: The reinforcement of the vendor's longitudinal weld on Spool #2-EP-01-S002 at Weld #2-EP-01-F004 is not fused uniformly (See Attachment A NCR 2-SN-0501-P) into the plate surface as required by Material Spec. SA-358, Para. 5.2.3. Also, the inside reinforcement is 3/16" (1/8" is the maximum allowed per the above para.) "VISUAL" & Testing

Action Taken to Control Deficiency

Hold Tags 1 of 1 attached. This DR supersedes NCR #2SN-0501-P

ORIGINATOR [signature] DATE 9/6/79 QCE [signature] PWQCS DATE 9-6-79

DISPOSITION & JUSTIFICATION

Remove excessive reinforcement of & area of poor fusion by grinding (Remove 1/16" from reinforcement & blend area of poor fusion into surrounding area). QC perform visual inspection.

REWORK [X]

REJECT [ ]

Cause of Deficiency and Action to Prevent Recurrence

Pipe was received on site with referenced defects, by copy of this DR Bechtel to notify vendor of deficiency.

E Steininger PWQCE 9-28-79

PROJECT DISCIPLINE ENGINEER [signature]

POTENTIAL 50-55e/PART 21 Yes [ ] No [X]

SITE APPROVAL TITLE DATE

AUTHORIZED INSPECTOR [signature] DATE [illegible]

ROUTE TO (FOR CORRECTIVE ACTION): [illegible]

ACTION TAKEN:

See Attach. "B"

HOLD TAG REMOVED AND DESTROYED.

Work Completed Per Disposition

RESPONSIBLE SUPERVISOR [signature] DATE 11-15-79

REINSPECTION

REWORK SATISFACTORY [X] REWORK UNSAT. [ ] REJECT [ ]

SNV N/A DATE N/A

Q.C. INSPECTOR W D Damron PWQCI DATE 11-15-79

DISCIPLINE Q.C. ENGINEER E Steininger DATE 11-19-79

Exhibit 5

DISTRIBUTION: [illegible]

4.0 PROCEDURE - Cont.

4.3 Continued

RESPONSIBLE POSITION — ACTION

PROJECT DISCIPLINE QC ENGINEER

9. Make required entry on Hold Tag(s) and promptly attach Hold Tag(s) as necessary (Exhibit A of Reference 2.7) and place material in segregated storage area, when practical, or exercise other control measures in order to control the deficient material.

4.4 Processing of Deficiency Report (DR)

RESPONSIBLE POSITION — ACTION

PROJECT DISCIPLINE ENGINEER

1. Review appropriate drawings/specifications for disposition. Provide additional information, inspection, and document requirements (when applicable) on the DR (Exhibit B).

   NOTE: Should the Project Discipline Engineer determine that the disposition will be either "USE AS IS" or "REPAIR" he shall close the DR in accordance with Appendix II of this procedure, return the closed DR to the Project QC Manager and initiate a Nonconformance Report.

2. Define the cause of the deficiency and assess for appropriate corrective action. If it is determined that corrective action is applicable, document the recommended corrective actions to prevent similar recurrences on the DR and promptly contact the responsible manager for concurrence and initiation of the "Cause of Deficiency and Action to Prevent Recurrence".

   NOTE: If the cause of the deficiency is indeterminate, the section shall be marked "indeterminate".

RESPONSIBLE MANAGER

3. Indicate concurrence with "Cause of Deficiency and Action to Prevent Recurrence".
   Initiate recommended corrective actions to prevent recurrence of similar deficiencies when required.

Exhibit 6

NONCONFORMANCE REPORT (NCR)

Project Name/Number		Hold Tag			NCR Number
CALLAWAY/7136	5/17/79	Hold Tag 1 of 1	X		2SM-0501-P

Reactor Building, SNUPPS Unit #2 'PIPING'.
Spool No. 2-EP-01-S002

FS-M-DM-
Traveler No.- 03EP01 (

Controlling Documents

ASME Section II, Winter '74 Edition (SA358)
Bechtel Specification 10466-M-201A, Revision 11

Description of Nonconformance

Visual Inspection of vendor longitudinal weld on spool #2-EP-01-S0 at weld number 2-EP-01-F00+ indicates rejectable defects (overlap) of the inside surface. Also, inside reinforcement is 3/16" (1/8" maximum required by ASME Section II).

"VISUAL"

Recommended Disposition & Basis for Recommendation:

~~USE AS IS - BECHTEL TO PROVIDE BASIS FOR RECOMMENDATION.~~
~~Bechtel to provide disposition and basis for recommendation~~ REMOVE EXCESSIVE OVERLAP (SEE ATTACHMENT "A") BY GRINDING. RECOMMEND USING REINFORCEMENT AS IS.

☐ Rework
☑ Repair
☐ Use As Is
☐ Reject

See * AUTHORIZED NUCLEAR INSPEC

Cause of Nonconformance and Action to Prevent Recurrence:

BECHTEL TO PROVIDE CAUSE OF NON-CONFORMANCE & ACTION TO PREVENT RECURRENCE.

* Prior to implementation of Bechtel Disposition, route NCR to ANI for written concurrence of disposition.

Action Taken to Control Nonconformance:

Q.C. HOLD TAG ATTACHED

POTENTIAL 50.55(e)/PART 21 YES ☐ NO ☑

Route to:
For Corrective Action C. Plows

Statement of Completed Action: See Attachment A w 6/11/79
This NCR is superseded by DR # 2SD-0699-P per Bechtel disposition (see attach. B) which states ... NCR ...

E. Steinmeyer 9-6-79

| | LWQCE | 9-6-79 |

Distribution: J. L. Turdera D. F. Schnell N. A. Petrick

Exhibit 7

3.0 GENERAL - Cont.

3.2 Revisions to an appendix of this procedure, with the exception of Appendix I, will require site approval only by the Project QC Manager and the Construction Engineering Manager, and Client approval when the revision involves Client requirements.

3.3 A glossary of terms and definitions for this procedure is contained in Appendix I.

3.4 Nonconformance Reports (NCR's) shall be used to document material nonconformances which are dispositioned "USE-AS-IS" or "REPAIR". All NCR's require Lead A/E approval or, if NSSS equipment is involved, approval by the NSSS A/E.

3.5 Deficiency Reports (DR's) shall be used to document material deficiencies (including procedural violations or quality-related problems) that are dispositioned "REWORK" or "REJECT FOR THIS USE". DR's do not require Lead A/E approval and are considered approved when all required Daniel signatures are obtained.

1. The Deficiency Report may also be used to initiate correction of either suspected or actual deficiencies in supplier materials or equipment in accordance with the provisions of Reference 2.11.

3.6 Nonconforming items shall be dispositioned as "REWORK" when the applicable specification provides for correction of the nonconforming item using a procedure which has been approved by the cognizant design organization. However, based on additional information, reviews, or evaluations, the original disposition may be changed.

3.7 Major program breakdowns, repetitive nonconforming conditions, and any serious quality problem shall be controlled in accordance with the provisions of Reference 2.2.

3.8 Nonconformance Reports which cannot be dispositioned by Construction Engineering that require A/E assessment or design change shall be identified by checking the "Review Design" block.

3.9 Nonconforming items involving NSSS furnished materials and equipment shall be processed per the provisions of Section 4.1 and 4.2 of this procedure. Nonconformance shall be documented on an NSSS Nonconformance Form (Exhibit C), regardless of the proposed disposition. NSSS NCR's shall be transmitted to the "Westinghouse Site Liaison Representative".

Exhibit 8

GLOSSARY OF TERMS AND DEFINITIONS

NONCONFORMING ITEM - Any material, part or component that does not conform to the requirements of applicable drawings, codes, standards, specifications, or other documents.

NONCONFORMANCE REPORT (NCR) - A report utilized to document material nonconformances, disposition, action to prevent recurrence, verification of completed disposition and formal close-out. (The NCR is also used to document nonconformances with "Review Design" recommended disposition).

DEFICIENCY REPORT (DR) - A report utilized to document procedural and material deficiencies, disposition, action to prevent recurrence, verification of completed disposition and formal close-out.

MATERIAL NONCONFORMANCE - Nonconforming items which are dispositioned "Used As Is" or "Repair"

MATERIAL DEFICIENCY - Nonconforming items , are dispositioned "Rework or "Reject for this use".

USE AS IS - A disposition which is imposed when it can be established that the nonconformance will not result in any adverse conditions and that the itme will continue to meet the engineering functional requirements including performance, maintainability, fit and safety.

REWORK - A disposition which is imposed when it can be established that a nonconforming item or activity can be made to fully conform to a prior specified requirement. Nonconforming items (materials) shall be dispositioned as "Rework" when conditions 1 and 2, condition 3 below are satisfied.

1. Correction of the nonconforming item can be accomplished by using the same or equivalent processes specified in the drawing and specification requirements.

2. The end condition of the item will be unchanged from that specified in the drawing and specification requirements; particularly, regarding physical or chemical properties, and especially stress/strain properties.

3. When provided for in the applicable specification, correction of the nonconforming item can be accomplished using a proceudre which has been approved by the responsible design organization.

REPAIR - A disposition which is imposed when it can be established that a nonconforming characteristic can be restored to a condition such that the capability of the item to function reliably and safely is unimpaired even though that item still may not conform to the original requirement.

REJECT FOR THIS USE - A disposition which is imposed when it is determined that nonconforming items cannot be used and must be disposed of in accordance with project requirements.

NC-2559 Repair by Welding

The requirements for repair by welding shall be the same as stated in NC-2539.

NC-2560 EXAMINATION AND REPAIR OF TUBULAR PRODUCTS AND FITTINGS WELDED WITH FILLER METAL

NC-2561 Required Examination

Welded (with filler metal) tubular products, such as pipe made in accordance with SA-155, SA-358, and SA-409 and fittings made in accordance with the WPW grades of SA-234, SA-403, and SA-420, shall be treated as material; however, inspection by an Inspector and stamping with a NPT symbol shall be in accordance with the material specification. In addition to the NPT symbol, a numeral 2 shall be stamped below and outside the official Code symbol. All welds shall be examined by radiography. The radiographic methods shall be in accordance with the requirements of the material specification. When radiographic examination of welds is not specified in the material specifications, the radiography shall be in accordance with NC-5110. Tubular products and fittings which have been radiographed shall be marked to indicate that radiography has been performed. The radiographic film and a radiographic report showing film locations shall be provided with the Certified Materials Test Report. The Authorized Inspector shall certify by signing the Partial Data Report Form NM-1 in accordance with NA-5290. Nameplates are not required for material.

NC-2567 Time of Examination

Radiographic acceptance examinations of welds, including those for repair welds, may be performed prior to any required heat treatment.

NC-2568 Elimination of Surface Defects

Unacceptable surface defects shall be removed by grinding or machining, provided that the requirements of (a) through (c) below are met.

(a) The remaining thickness of the section shall not be reduced below the minimum required.

(b) The depression, after defect elimination, shall be blended uniformly into the surrounding surface.

(c) If the elimination of the defect reduces the thickness of the section below the minimum required by the design, the material shall be repaired in accordance with NC-2539.

NC-2569 Repair by Welding

Repair welding of base material defects shall be in accordance with NC-2539. Repair welding of weld seam defects shall be in accordance with NC-4450.

NC-2570 EXAMINATION AND REPAIR OF STATICALLY AND CENTRIFUGALLY CAST PRODUCTS

NC-2571 Required Examinations

(a) Cast pressure retaining material shall be examined by either radiographic or ultrasonic methods or a combination of the two methods except for pumps and valves with inlet piping connections 4 in. nominal pipe size and less. Castings or sections of castings, which have coarse grains or configurations which do not yield meaningful results by ultrasonic examination, shall be examined by radiographic methods.

(b) For cast pumps and valves with inlet piping connections over 2 in. (51 mm) up to and including 4 in. nominal pipe size, magnetic particle or liquid penetrant examination shall be performed, and the weld ends for a minimum distance of t (where t is the design section thickness of the weld) from the final welding end shall be radiographed.

(c) As an alternative to performing the examinations required in (b) above, it is permissible to use cast pumps and valves with inlet piping connections over 2 in. (51 mm) up to and including 4 in. nominal pipe size by applying a quality factor of 0.70 to the pressure rating of the valves and to the allowable stress values used in the design of the pumps.

(d) Cast pumps and valves with inlet piping connections 2 in. nominal pipe size and smaller shall be examined and repaired in accordance with the requirements of the material specification.

NC-2572 Ultrasonic Examination of Ferritic Steel Castings

The requirements for ultrasonic examination of statically and centrifugally cast products are given in the following subparagraphs.

NC-2572.1 Straight Beam Method. When ferritic castings are to be examined ultrasonically, all sections, regardless of thickness, shall be examined in accordance with SA-609, Specification for Longitudinal Beam Ultrasonic Inspection of Carbon and Low

Exhibit 10

12.3 *Hydrostatic Test*—Each length of pipe shall be subjected to a hydrostatic test in accordance with Specification A 530, unless specifically exempted under the provision of 12.4. Pressure shall be held for a sufficient time to permit the inspector to examine the entire length of the welded seam.

12.4 The purchaser, with the agreement of the manufacturer, may complete the hydrostatic test requirement with the system pressure test, which may be lower or higher than the specification test pressure, but in no case shall the test pressure be lower than the system design pressure. Each length of pipe furnished without the completed manufacturer's hydrostatic test shall include with the mandatory marking the letters *NH*.

13. Radiographic Examination

13.1 For Classes 1, 3, and 4 pipe, all welded joints shall be completely examined by radiography.

13.2 Radiographic examination shall be in accordance with the requirements of the *ASME Boiler and Pressure Vessel Code*, Section I, latest edition, Paragraph PW51.

13.3 Radiographic examination may be performed prior to heat treatment.

14. Thickness and Weight

14.1 The wall thickness and weight for welded pipe furnished under this specification shall be governed by the requirements of the specification to which the manufacturer ordered the plate.

15. Permissible Variations in Dimensions

15.1 *Permissible Variations*—The dimensions at any point in a length of pipe shall not exceed the following:

15.1.1 *Outside Diameter*—Based on circumferential measurement, ±0.5 percent of the specified outside diameter.

15.1.2 *Out-of-Roundness*—Difference between major and minor outside diameters, 1 percent.

15.1.3 *Alignment*—Using a 10-ft (305 cm) straightedge placed so that both ends are in contact with the pipe, ⅛ in. (3.2 mm).

15.1.4 *Thickness*—The minimum wall thickness at any point in the pipe shall not be more than 0.01 in. (0.3 mm) under the nominal thickness.

16. Lengths

16.1 Circumferentially welded joints of the same quality as the longitudinal joints shall be permitted by agreement between the manufacturer and the purchaser.

17. Finish

17.1 The finished pipe shall be free from injurious defects, and shall have a workmanlike finish.

17.2 *Repair of Plate Defects by Machining or Grinding*—Pipe showing moderate slivers may be machined or ground inside or outside to a depth which shall ensure the removal of all included scale and slivers, providing the wall thickness is not reduced below the specified minimum wall thickness. Machining or grinding shall follow inspection of the pipe as rolled, and shall be followed by supplementary visual inspection.

17.3 *Repair of Plate Defects by Welding*—Repair of injurious defects shall be permitted only subject to the approval of the purchaser. Defects shall be thoroughly chipped out before welding. The repairs shall be radiographed and if the pipe itself has already been heat treated, it shall then be heat treated again except in the case of small welds that, in the estimation of the purchaser's inspector, do not require heat treatment. Each length of repaired pipe shall be subjected to the hydrostatic test.

17.4 When required by the purchaser in the contract or order, the inside surface of the pipe shall be sandblasted or pickled and then passivated.

18. Marking

18.1 In addition to the marking prescribed in Specification A 530, the markings on each length of pipe shall include the plate material designations as shown in Table 1, the marking requirements of 5.3 and 12.3, and Class 1, 2, 3, or 4, as appropriate (see 1.3).

Exhibit 11

Welding Handbook

Seventh Edition, Volume 1

Fundamentals of Welding

Charlotte Weisman, Editor

AMERICAN WELDING SOCIETY
2501 Northwest 7th Street
Miami, Florida 33125

Exhibit 12

Appendix

A

Terms and Definitions

Extracted from Welding Terms and Definitions, AWS A3.0, prepared by the AWS Committee on Definitions, Symbols and Metric Practice.

using a filler metal, having a liquidus above 450 °C (840 °F) and below the solidus of the base materials. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction.

brazement. An assembly whose component parts are joined by brazing.

brazer. One who performs a manual or semiautomatic brazing operation.

braze welding. A method of welding by using a filler metal, having a liquidus above 450 °C (840 °F) and below the solidus of the base metals. Unlike brazing, in braze welding, the filler metal is *not* distributed in the joint by capillary attraction.

brazing (B). A group of welding processes which produces coalescence of materials by heating them to a suitable temperature and by using a filler metal, having a liquidus above 450 °C (840 °F) and below the solidus of the base materials. The filler metal is distributed between the closely fitted surfaces of the joint by capillary attraction.

brazing alloy. See preferred term **brazing filler metal.**

brazing filler metal. The metal which fills the capillary gap and has a liquidus above 450 °C (840 °F) but below the solidus of the base materials.

brazing operator. One who operates machine or automatic brazing equipment.

brazing procedure. The detailed methods and practices including all joint brazing procedures involved in the production of a brazement. See **joint brazing procedure.**

brazing sheet. Brazing filler metal in sheet form.

brazing technique. The details of a brazing operation which, within the limitations of the prescribed brazing procedure, are controlled by the brazer or the brazing operator.

brazing temperature. The temperature to which the base materials are heated to enable the filler metal to wet the base materials and form a brazed joint.

brazing temperature range. The temperature range within which brazing can be conducted.

bridge size (eye protection). The distance between lenses on the nose side of each eye, expressed in millimetres.

bronze welding. A term erroneously used to denote braze welding. See **braze welding.**

buildup sequence. See **joint buildup sequence.**

burner. See preferred term **oxygen cutter.**

burning. See preferred term **oxygen cutting.**

burning in. See preferred term **flow welding.**

burnoff rate. See preferred term **melting rate.**

burn-thru. A term erroneously used to denote excessive melt-thru or a hole. See **melt-thru.**

burn-thru weld. A term erroneously used to denote a seam weld or [illegible] weld.

buttering. A form of surfacing in which one or more layers of weld metal are deposited on the groove face of one member (for example, a high alloy weld deposit on steel base metal which is to be welded to a dissimilar base metal). The buttering provides a suitable transition weld deposit for subsequent completion of the butt weld.

butt joint. A joint between two members relief heat treatment of a specific portion of a structure.

locked-up stress. See preferred term **residual stress.**

longitudinal resistance seam welding. The making of a resistance seam weld in a direction essentially parallel to the throat depth of a resistance welding machine.

longitudinal sequence. The order in which the increments of a continuous weld are deposited with respect to its length. See **backstep sequence, block sequence,** etc.

low frequency cycle (resistance welding). One positive and one negative pulse of current within the same weld or heat time at a frequency lower than the power supply frequency from which it is obtained.

M

machine brazing. Brazing with equipment which performs the brazing operation under the constant observation and control of a brazing operator. The equipment may or may not perform the loading and unloading of the work. See **automatic brazing.**

machine oxygen cutting. Oxygen cutting with equipment which performs the cutting operation under the constant observation and control of an oxygen cutting operator. The equipment may or may not perform the loading and unloading of the work. See **automatic oxygen cutting.**

machine welding. Welding with equipment which performs the welding operation under the constant observation and control of a welding operator. The equipment may or may not perform the loading and unloading of the work. See **automatic welding.**

manifold. A multiple header for interconnection of gas or fluid sources with distribution points.

manual brazing. A brazing operation performed and controlled completely by hand. See **automatic brazing** and **machine brazing.**

manual oxygen cutting. A cutting operation performed and controlled completely by hand. See **automatic oxygen cutting** and **machine oxygen cutting.**

manual welding. A welding operation performed and controlled completely by hand. See **automatic welding, machine welding,** and **semiautomatic welding.**

mash resistance seam weld. A resistance seam weld made in a lap joint in which the thickness at the lap is reduced plastically to approximately the thickness of one of the lapped parts.

mask (thermal spraying). A device for protecting a surface from the effects of blasting or coating adherence or coalescence with the substrate. Masks are generally of two types: reusable or disposable.

matrix (thermal spraying). The major continuous substance of a thermal sprayed coating as opposed to inclusions or particles of materials having dissimilar characteristics.

mechanical bond (thermal spraying). The adherence of a thermal sprayed deposit to a roughened surface by the mechanism of particle interlocking.

melting range. The temperature range between solidus and liquidus.

melting rate. The weight or length of electrode melted in a unit of time.

melt-thru. Complete joint penetration for a joint welded from one side. Visible root reinforcement is produced.

Cives - Shear Stud Evaluation

It has been determined that a number of studs on embedded plates, frames and pipe sleeves already received at the site and installed in forms are deficient. The deficiency is generally a machine weld that is not 360 degrees.

This situation poses three immediate problems:

1. What should be done with material already in forms and other material at site.
2. What can be done about studs already in concrete (i.e., does a similar condition exist - incomplete welds).
3. What can be done about future work.

The following suggested plan of action has been partially implemented:

1. All deficient material in forms should be rejected and replaced where replacement plates exist; or repaired to the level of shear connectors. Material is considered deficient if it does not satisfy the inspection criteria for shear connector AWS D1.1-75. All other material at the site is being 100% reinspected by Cives to the level of shear connectors. Bechtel is performing a spot check of the Cives inspector in order to validate the reported deficiencies and reports that Cives is inspecting according to code. All deficient studs are being documented and bend tested. All bend testing results are being documented. Studs that do not pass the bend test should be repaired to the inspection level required for shear connectors.

   In addition to the work being performed in the field, Bechtel has insituted a 100% inspection at the Cives shop, and the Bechtel regional supervisor will visit Cives in order to determine the origin of the problem at Cives.

2. The condition of studs already in concrete can be evaluated based on the results of the inspection cited above. If the data gathered in 1 above indicates that most of the deficient welds pass the bend test and are, therefore, acceptable according to AWS D1.1-75, it can be inferred that a similar population exists for the studs already cast in concrete. If, however, a significant number of the studs fail the bend test then the probable number of unacceptable studs per plate will be evaluated from the inspection data and the questionable plates, etc. in concrete will be analyzed with the appropriate number of deficient studs. The analysis should attempt to determine the probability of failure of critical plates. Assumption other than the number of deficient studs will have to be made (i.e. reasonable strength of a deficient stud).

3. Before it can be determined what should be done about future work Cives must evaluate the causes of the present situation. They are in the process of performing such an evaluation and will transmit the results by June 30.

4. A representative of Bechtel Engineering will visit the Cives shop on June 28, 1977, to review inspection and fabrication procedures and to discuss the general problem of stud welding with Cives management.

Exhibit 13

A29 [illegible]

INTER-OFFICE COMMUNICATION

[illegible] H. Smith (35) DATE: February 1, 1978

P. E. Johnson (27) PQWP-220

NCR 2-1942-C

[illegible] void NCR 2-1942-C. As of 1/31/78, only four (4) EP1
[illegible] plates have been received on site. All four have been
[illegible]. One plate was embedded in concrete on May 18, 1977 in
[illegible]-004, and thereby could not have possibly been rejected
[illegible] 22, 1977, and furthermore, would not have been part of
[illegible] inspection program of 10466-C-131 material. The remaining
[illegible] EP1's have been reinspected and repaired. Therefore,
[illegible] rejected on 6/22/77 and given the Daniel Plate Number
[illegible] removed from Fab Shop and placed in a Hold Area. This
[illegible] reinspected and repaired by the Cives unique

[illegible] Welding QC Surveillance Reports for the remaining
[illegible] indicating satisfactory condition after repair.

P. E. Johnson 2-1-78

P. E. Johnson
Project Welding QC Engineer

CONCURRENCE: [illegible] 2-2-78

[illegible]
Project Civil Engineer

Exhibit 14

A29.04

NONCONFORMANCE REPORT (NCR)

Project Name/Number	Action Req'd By		NCR Number
Coffey / 7186		NO HOLD TAGS *	2-1942-C

Identification of Area and Item — System ID: n/a

Location unknown (see description of Nonconformance)
EP-1-1000 (Embedment for Turbine Building)

* Embedment installed in Turbine Pedestal, exact location unknown, therefore hold tag not applied.

Controlling Documents:
Bechtel P.O. 10466-C131 Rev. 10
Bechtel Spec. 10466-C131 Rev. 8
Bechtel Drawing C-0C4904 Rev. 2

Description of Nonconformance:

SEE PAGE 2

Originator — Title: QCE — Date: 1-16-78

Recommended Disposition & Basis for Recommendation: ☐ Rework ☐ Repair ☐ Use As Is ☐ Reject

Cause of Nonconformance and Action to Prevent Recurrence:

Action taken to Control Nonconformance:

Site Approval — Title — Date

Disposition: Inspect Statement Included ☐ Yes ☐ No ☐ Approved as Recommended

☐ Disposition Revised as Follows:

Documents to be Revised:

A/E Approval — Title — Date — SNUPPS or Utility Approval — Title — Date

Statement of Completed Action:

Void per PQWP-220 dated 2-1-78 NCR NO. 2-1942-C
No new number issued

PAGE 2 OF 6

Title — Date — Action Verified — Title — Date

[illegible]	M.A. PETRICK	W.H. WEBER
[illegible]	[illegible]	[illegible]

[illegible] 7/11/78

NONCONFORMANCE REPORT (NCR) — Form CP-QA-1 (4-78) — Continuation Sheet

[illegible]	Action Rqd By	NO HOLD TAGS	Q	N	NCR Number
[illegible]		*		X	[illegible]2-C

DESCRIPTION OF NONCONFORMANCE: EP 1-1000 inspected and documented on NCR 2-0831-C-B for defective stud welds, is installed in Turbine Pedestal. No documentation is on file to substantiate that the embedment was repaired, reinspected and accepted prior to installation.

NOTE: EP-1-1000 is transferred from NCR 2-0831-C-B to this NCR for close out.

2	1
4	3
6	5
8	7
10	9

1. US, UC, SP, LP
2. US, UC, SP, LP
3. US, UC, SP, LP
4. US, UC, SP, LP
5. US, UC, SP, LP
6. US, UC, SP, LP
7. US, UC, SP, LP
8. US, UC, SP, LP
9. US, UC, SP, LP
10. US, UC, SP, LP

NOTE: Studs 1 - 10 undersize due to concavity

LEGEND

US = UNDERSIZE

UC = UNDERCUT

SP = WELD SPATTER

LP = LINEAR POROSITY

NOTE: EP-1-1000 originally rejected 6/22/77. Original report on file in M11.02.

NCR NO. 2-1742-C
PAGE 3 OF 6

JUN 13 1978

June 12, 1978

Nuclear Constr.

Attachment C
[illegible] 1 of 2

[illegible] ACCEPTABILITY OF [illegible] PLATES [illegible]:

NCR 2-1941-C-A
NCR 2-2369-C-A
NCR 2-2[illegible]-C-A
NCR 2-2386-C-A

The subject Nonconformance Reports cover embedded plates which were originally described under NCR 2-0831-C-B. All of the plates involved were inspected by Daniel QC and were rejected because of perceived weld deficiencies. However, no documentation can be found which substantiates that the embedments were repaired, reinspected and accepted. Further, the embedments cannot be located at the site. If they are installed within the plant structures, specific identification of the embeds is not possible because there is no unique identifier that is traceable on the face of the plates.

The subject NCR's were forwarded to Bechtel for disposition, with a Daniel recommendation to "use as is". Bechtel returned the NCR's with BLUE-5[illegible], dated April 21, 1978, without disposition. Their rationale for withholding disposition was that all such embeds with suspected weld deficiencies were covered in their Final Report - Investigation and Documentation Supporting NCR 2-0831-C-B, transmitted with [illegible], dated January 16, 1978. Since this report concluded that the embedments covered by NCR 2-0831-C-B were capable of supporting design loads, Bechtel believes that the subject NCR's are unnecessary.

Nuclear Engineering is in agreement with Bechtel's position regarding these NCR's. Reference is also made to Union Electric's conclusion regarding embeds covered on NCR 2-0831-C-B, embodied in a report dated March 10, 1978, transmitted to the Nuclear Regulatory Commission via ULNRC-238.

Notwithstanding our conclusion that the embedded plates covered by the subject NCR's are acceptable and capable of supporting design loads, it is recognized that Daniel requires a mechanism for closing out potential questions regarding these plates. Based on the analysis made in Union Electric's report of March 10, 1978, Nuclear Engineering in this specific situation accepts responsibility for Daniel's recommendation to disposition the subject NCR's "use as is". Because the Design Organization, Bechtel Power Corporation, does not regard the plates as nonconforming (lacking specific documentation regarding their present condition), in order to close out Daniel's records, the NCR's are herewith accepted by UE Nuclear Engineering.

2386-C-A

13 [illegible] 15

Exhibit 15

DANIEL INTERNATIONAL CORPORATION

CALLAWAY PLANT
P. O. BOX 108
FULTON, MISSOURI 65251
(314) 676-3111

RLP will prepare response for WHW & DIC FDF

August 18, 1977

DLUC 1788

DFS/FDF agreed on 8/26/77 to:
1. Maintain 100% inspection of all welds of embeds (machine or manual).
2. Reduce dimensional checks to 10% level. FDF

Union Electric Company
P.O. Box 149
St. Louis, Missouri 63166

Attention: W. H. Weber
Manager, Nuclear Construction

Subject: Revision to MCR applicable to P/O #10466-C-131-2

Reference: ULD 822

Dear Walt:

The referenced ULD which imposes 100% receipt inspection on Bechtel procurred safety related materials, provides provisions for reducing this inspection level when a satisfactory confidence level can be determined. To this end a review of inspection data accumulated since 7/15/77 on Cives embeds has been performed. In order to isolate problem areas the embeds have been catagorized as follows:

a) Machine Welded Embed Plates
b) Manual Welded Embed Plates
c) Machine Welded Embed Sleeves
d) Manual Welded Embed Frames

Based upon this catagorization the following recommendations are submitted for your approval:

a) Reduce 100% inspection requirement on machine welded embed plates to a normal 10% receipt inspection level.

b) Maintain 100% inspection on manual welded embed plates for weld criteria only, reduce remaining inspection elements to a normal 10% receipt inspection level.

c) Reduce 100% inspection requirement on machine welded embed sleeves to a normal 10% receipt inspection level.

TO	MAIL	COPIES LTR	COPIES ENCL	FOR FILE	FOR	FOR	ANS.
D610	C131	1	1	3456			
DFS		1	1		✓		
DWC		1	1		✓		
WHW		1	1		✓		
RPW	1-2	1	1		✓	✓	
RLP		1	1		✓	–	

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AUG 24 1977
F. D. FIELD

Exhibit 16

d) Maintain 100% inspection of manual welded embed frames for weld criteria only, reduce remaining inspection element to a normal 10% receipt inspection level.

The data to support the above recommendations is contained in an attachment to this correspondence. If further clarification is required please contact the writer. Your early response to these recommentations would be greatly appreciated.

Very truly yours,

H. J. Starr
Project Manager

HJS/JC/b

cc: R. Powers UE-QA
W. van der Zalm Daniel QA
F. Field UE-QA
D. Schnell UE

Attachment

Inspection Data Cives Embeds

The approximate totals shown below were supplied by QC inspection personnel who have been performing the required inspection functions. The sample data was obtained by a review of accumulated inspection reports retained in the QC office. These reports are available for any further indepth review as may be deemed necessary.

a) Machine Welded Embed Plates

Approximate number inspected 5,220
Approximate reject rate less than 1%
Audit base to substantiate reject rate:
Sample size = 266
Number rejects = 0
Reject rate = 0%

b) Manual Welded Embed Plates

Approximate number inspected 280
Approximate reject rate 90% (Weld criteria only)
Audit base to substantiate reject rate:
Sample size = 15
Number rejects = 15 (Weld criteria only)
Reject rate = 100%

c) Machine Welded Embed Sleeves

Approximate number inspected 700
Approximate reject rate, less than 1%
Audit base to substantiate reject rate
Sample size = 70
Number rejects = 0
Reject rate = 0%

d) Manual Welded Embed Frames

Approximate number inspected 200
Approximate reject rate 20% (Weld criteria only)
Audit base to substantiate reject rate:
Sample size = 80
Number rejects = 17 (Weld criteria only)
Reject rate = 21.25%

	LTR	ENC	FILE			
DWC	1		✓	—		
WHZ	1		✓	—		
RPW	1		✓			
DFS	1		✓			
N.Date	1					
0610-C131	1	—	3456			

RETURN COMMENTS TO W. H. ZVANUT · CODE 480

DANIEL INTERNATIONAL CORPORATION
CALLAWAY PLANT
P. O. BOX 108
FULTON, MISSOURI 65251
(314) 676-3111

Nuclear Constr.
A 420

November 14, 1977

DLUC - 2142
Response Requested By 11/24/77

A42C dw 11/18/77

152A-LA 1015

TO					
	C641	1	—	✓	
RLP	C641	1	—		✓
DFS	470	1	—		✓
AAK	C641	1	—		* ✓ 12
0257	470	1	—	3456	
WHW	C641	1	—		✓
Route:	"	1	—		
MID	↓				✓
F0610 C131				✓	

* TASK FORCE FOR ACTION KWN 11/

Union Electric Company
P. O. Box 149
St. Louis, Missouri 63166

Attention: W. H. Weber
Manager, Nuclear Construction

Subject: Summary of the Daniel Inspection of Cives Embedded Material

Dear Walt:

As per Union Electric's request, Daniel has completed the study of Cives Embedded Material with the following results:

Embedded Frames (Automatically Welded)

Total No. Studs inspected	5341
Number Rejected	95
Reject Rate	1.78%

Embedded Sleeves (Automatically Welded)

Total No. Studs inspected	8316
Total Rejected	201
Reject Rate	2.42%

Embedded Plates

Automatically Welded Studs Inspected	96472
Rejected Studs	106
Reject Rate	0.11%
Manually Welded Studs Inspected	6103
Number of Studs Rejected	2729
Reject Rate	44.72%

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NOV 22 1977
D. F. SCHNELL

RECEIVED
NOV 17 1977
DANIEL DOCUMENT CONTROL

Exhibit 17

Total number Automatically Welded Studs Inspected	110129
Number Rejected	402
Reject Rate	0.365%
Total Number Studs Inspected	116232
Total Number Rejected	3131
Overall Reject Rate	2.69%

This data was collected from information contained in Surveillance Reports on file in file number N11.02.

It should be pointed out that automatically welded studs which were repaired by manual welding, and which were rejected because of weld inspection are included in the data for automatically welded studs.

Based on the extremely low rejection rate for automatically welded studs versus manually welded studs, Daniel requests approval to reduce the inspection rate on automatically welded studs to a sampling plan as proposed by Daniel. For manually welded studs, Daniel proposes to continue the present inspection rate of 100% until a competence level can be obtained.

If you should have any questions concerning the data contained in this letter, please contact Mr. P. E. Johnson, the Project Welding QC Engineer, or the undersigned.

Your prompt attention in response to the request for reducing inspection on automatically welded studs furnished by the Cives Corporation will be appreciated.

Very truly yours,

H. J. Starr
Project Manager

HJS/WGW/clm

cc E. D. McFarland (6)
J. A. Holland (10)
W. G. Westhoff (4)
P. E. Johnson (27)
M. A. McDaniel (1)

Supplier Deviation Disposition Request

Job 10466

NOTE: The reverse side of this form contains the instructions for its preparation and use. Items marked * with an asterisk (*) are for Bechtel entries only.

FOR SUPPLIER USE		FOR BECHTEL USE	
Supplier SDDR No.	Date Submitted	*Bechtel SDDR No.	*Date Received
4	7/8/77	C131-1-1	7/11/77

Supplier Name: CIVES STEEL COMPANY Northern Division — Address: 8 Church St. — City & State: Gouverneur New York — Zip 13642

Supplier's Order No.	3. Supplier's Part No.	4. Supplier's Part Name	5. Date Deviation Determined	Previous SDDR (No. & Date)
0466-C-1310	See Attached	Embedded Plates	6/23/77	3 6/28/77
Buyer's P.O. No.	8. Buyer's Part No.	9. Buyer's Part Name	10. Bechtel Inspector Notified	11. Bechtel Eng. Notified
0466-C-131-1	See Attached List		6/23/77	6/22/77

Qty or Serial No. — 13. Deviation Description (Attach extra sheets, photographs, sketches, etc. as necessary)

Welds are indicated to be undersize on the vertical leg by 0 to 1/16". Data enclosed indicates that the joint in question is controlled by the stress value in the anchor base material rather than in the fillet welds. The yield strength of the anchor base material supplied is sufficiently higher than the minimum specified to cause the supplied joint to equal the strength of the specified joint. Therefore, it is recommended that the subject items be accepted as is.

14. Supplier's Disposition Classification: XX Accept As Is ☐ Repair ☐ Modify Buyer's Requirement

15. Proposed Disposition and Technical Justification:

See Attachment

Reference list of plates enclosed

Reference letter dated June 30, 1977

16. Associated Supplier Document Change(s):

17. Supplier Authorized Representative
Signature: Original signed by Dean W. Parshley — Title: General Manager
Name: Dean W. Parshley — Date: 7/8/77

*18. Bechtel Engrg. Action: See Below — ☐ Accepted ☐ Rejected ☐ Rejected-Resubmit

Engrg. Follow-up: ☐ Dwg Change ☐ Other ☐ Spec/Req. Change ☐ Discipline or Suppliers Affected

*19. Bechtel Disposition Statement (Includes Justification) (Attach extra sheets, sketches, etc. as necessary)

Accept as is: A22, A18, A44, A19, A4, A43, A12.
Repair: Add 1/16" weld to vertical leg: A2, A17, A47, A20, A45, A46, A4[illegible], A3, A24, B24, D24, A40.

NOTE: Weld is acceptable as long as effective throat size is obtained regardless of the profile and convexity of the weld.

Accepted plates have full rated load capacity with 1/16" reduction in vertical leg weld even at minimum specified yield strength of anchor base material.

*20. Bechtel Engineering Approval: [signatures] — Date: 7-11-77, 7/12/77

Verification Signatures — 21. Supplier — Date

Exhibit 18

Attachment:

Plates with threaded rods.
Snupps 10466-C-131

Hand Welded Plates (P.O.1)

EP1 A22

EP211 A2, A17, A47

EP311 A18, A44

EP411 A19

EP511 A20, A45, A46, A48

EP611 A3, A24, B24, D24, A40

EP711 A4, A43

EP811 A12

Listing to be incorporated into Supplier Deviation Disposition Request number 4, July 8, 1977.

(Rebert telecopy)

SNUPPS
Standardized Nuclear Unit
Power Plant System

5 Choke Cherry Road
Rockville, Maryland 20850
(301) 869-8010

November 1, 1976
SLU: 6 - 41 File: C-131
SUBJ: Miscellaneous Steel:
Specification C-131

Mr. D. F. Schnell
Union Electric Company
P. O. Box 149
St. Louis, Missouri 63166

Dear Mr. Schnell:

A recent examination of Bechtel procurement inspection activities indicates a number of reports of misfabricated and discrepent materials produced by the Miscellaneous Steel Supplier, Cives Corp. Discrepencies identified to date include items such as mislocated studs; oversize holes in embedded frames; undercut welds; oversize pipe sleeves; door frames out of square and painting defects. These discrepencies are being identified by Bechtel inspection on the basis of a sampling inspection program involving approximately 20-25 percent of the materials to date. In each instance, the material discrepencies have been corrected and the item satisfactorily reinspected prior to release for shipment.

The above data raises questions in regard to the acceptability of those materials delivered to the site which have been released for shipment without benefit of Bechtel end item inspection. To resolve any uncertainty that may exist in regard to the acceptability of miscellaneous steel previously delivered by Cives, it is suggested that Daniel Quality Control establish and implement plans for dimensional and visual inspection of selected shipments of materials previously delivered to the Callaway site. As discussed with Daniel (Van der Zalm) on October 28, 1976, it is understood that Daniel is in agreement with the desirability of performing these inspections and will proceed to develop and implement a program of on-site

Exhibit 19

inspections in early November. The results of these inspections should be reported to SNUPPS in order to determine whether follow-up actions should be initiated with Bechtel and Cives Corporation.

Daniel's assistance in this matter is appreciated.

Very truly yours,

S. J. Seiken
QA Manager

SJS/jh
cc: W. H. Weber UE
F. D. Field UE
M. R. Hamby Daniel
W. Van der Zalm Daniel

TO	MAIL	COPIES LTR	ENC	FILE	INFO	COM	ACT.	ANS. DUE
[illegible]		1	A,B		✓			
[illegible] *		1	A,B,C		✓			
[illegible]		1	AE		✓			
		1	A					
610 C131		1	ABC [illegible]					
[illegible]		1	AB [illegible]					
212		1	AB [illegible]					

RETURN COMMENTS TO W. H. ZVANUT - CODE 450

CALLAWAY PLANT
P. O. BOX 100
FULTON MISSOURI 65251
(314) 676-3111

*Received Advance Copy 1/22/77

January 19, 1978

DLUC-2399

RETURN COMMENTS TO:

Union Electric Company
P. O. Box 149
St. Louis, Missouri 63166

ATTENTION: W. H. Weber
Manager, Nuclear Construction

SUBJECT: Data Package Prepared to provide information for use in an Engineering Evaluation

Dear Walt:

Attached is the Data Package from Daniel's QA Record File N11.02 listing rejected Cives manually welded embedded items for your evaluation. This package consists of the following:

1. Attachment A - Flow chart for documents contained in this package and proposed close-out of NCR 2-0831-C-B.

2. Attachment B - This attachment describes the method used by Daniel in determining those items/entries which were not applicable or did not provide sufficient information to be used in performing an Engineering evaluation. This attachment consists of three (3) pages sequentially numbered.

See [illegible] NCR 0831

3. Attachment C - This attachment consists of copies of the actual Surveillance Reports and the supporting sketches from Daniel File N11.02 which have been annotated as described in Attachment B. This attachment consists of 610 pages sequentially numbered.

RECEIVED
JAN 23 1978
D. F. SCHNELL

Received
JAN 20 1978
Nuclear Constr.

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JAN 20 1978
DANIEL DOCUMENT CONTROL
PROJECT 7155

Exhibit 20

Following is a summary of the number of rejected items by specific type:

Plate Type	No. Rejected
EP-1	3
EP-111	1
EP-211	23
EP-212	1
EP-311	47
EP-312	3
EP-411	30
EP-412	5
EP-511	39
EP-611	66
EP-711	92
EP-811	2
Total No. Plates Rejected	312

It should be pointed out that the rejected items contained in this Data Package are listed on NCR 2-0831-C-B and NCR 2-1835-C-B. Since these are Category "B" NCR's dispositioned REWORK by Daniel, or return to Cives for rework, it was not necessary to make specific entries as to amount of, or percent of the total weld, which was rejectable. Therefore inspectors' entries reflected the greatest amount of undersize measured on each stud, and that undersize varied from 5% to 100% of the total weld circumference. This fact has been verified by interviews conducted with the personnel who performed the inspections. Because of the manner in which weld deficiencies were reported, an engineering evaluation which assumes the maximum undersized condition around the complete weld circumference will not represent a true image of the actual conditions.

It should be pointed out that some Surveillance Reports would seem to reflect a much higher percentage of rejection both in number, and amount undersize, than the norm. In most instances these reports were generated to document embeds previously rejected by inspection or craft personnel in the Power Block by generic number which were moved to a "hold area" in the laydown yard for reinspection and rework at a later date. In general, these were embeds that would require a greater degree of rework to gain acceptance. In these instances it was felt that it would be more expeditious for construction purposes to replace rather than rework these items.

In an effort to be responsive to previous urgent requests for information pertinent to NCR 2-0831-C-B, Daniel has provided a copy of the actual NCR accompanied by relative data from QA File N11.02. It must, therefore, be recognized that previous packages supplied to the NRC, UE and Bechtel have contained not only records with entries relative to NCR 2-0831-C-B, but also all inspection results pertaining to the reinspection of Cives material. Each sheet contained in the previous packages contained at least one (1) entry relating to the NCR and therefore had to be included. It should be clear that the attached package is in no way intended as an explanation for NCR 2-0831-C-B, but is provided for the purpose of providing information for use in an engineering evaluation. Daniel is presently in the process of preparing a separate package for the purpose of closing NCR 2-0831-C-B.

H. J. Starr 1/12/78
Project Manager

HJS/PEJ/WGW/ap

cc: H. J. Starr (1)
W. G. Westhoff (4)
W. H. Weber (UE)
D. F. Schnell (UE) 2
R. L. Powers (UE)

SURVEILLANCE INSPECTION REPORT
BPI-221

INSPECTION ASSIGNMENT NO. 10466-C-131
P.O. NO. M/R 10466-C-131(Q) REV. 2
MAT'L ON ORDER Miscellaneous Steel
PRIME SUPPLIER Cives Corporation
SUPPLIER Same
LOCATION Gouverneur, NY

REPORT NO. 2 "Q" List
DATES INSPECTION PERFORMED Dec. 30, 1975
PAGE 1 OF 2
REF. NO. None
S.O. NO. 5900

1. SUPPLIER CONTACTS

NAME	TITLE
Mr. Dean Parshley	Project Manager
Mr. Alex Teed	Q. A. Manager

2. STATUS OF SUPPLIER DRAWINGS, PROCEDURES, AND DATA SHEETS THAT REQUIRE BECHTEL ENGINEERING APPROVAL USED DURING THIS REPORT PERIOD

Paint procedure - level 3; drawings and weld procedures - level 1.

3. MATERIAL RELEASED FOR SHIPMENT DURING THIS REPORT PERIOD

None.

4. STATUS OF PREVIOUSLY REPORTED UNCORRECTED NONCONFORMANCES

N/A.

5. DESCRIPTION OF UNCORRECTED NONCONFORMANCES DISCOVERED DURING THIS REPORT PERIOD

N/A.

6. DRAWINGS AND SPECIFICATIONS USED FOR INSPECTION PURPOSES

Exhibit 21

DRAWING NO.	REV.	SPECIFICATION NO.	REV.
		10466-C-131(Q)	4
2	A	75-243	0 - Weld Procedure
102	A	75-244	0 - Weld Procedure
		CZ-11-1	1 - Paint Procedure

7. SUMMARY OF WITNESS POINTS, HOLD POINTS AND OTHER INSPECTIONS PERFORMED DURING THIS REPORT PERIOD

Visited the supplier's plant for two witness points established during the initial visit as follows:

1. Fit-up and welding on a first time basis for each weld process.
   a) Shielded metal arc weld of anchor bolts to plates to dwg. #2 Rev. A, tack welding procedure 75-244, fillet welding to procedure 75-243 unrevised. Qualification records for the welding, C. Patchin, are in order. Results of inspection were satisfactory for workmanship and dimensions.

   b) Nelson studs were welded to plates in accordance with AWS D1.1-75 and dwg. #102 Rev. A. Twelve studs were welded to each of the two plates. The layout was dimensionally checked and found to be satisfactory. One stud on each plate did not have a fillet extending quite 360° around the perimeter. Both parted from the plate when bent with a hammer in accordance with the AWS requirement. Several of the visually satisfactory welds were tested in the

Continued

DISTRIBUTION
Original to: E. J. Simanek
Copies to: J. L. Turdera S. J. Saiken

PREPARED BY Henry E. Quinn
INSPECTOR

Bechtel Power Corporation

Interoffice Memorandum

To H. Quinn

Subject SNUPPS Project
Bechtel Job 10466
10466-C-131
Inspection of Stud
Anchors - Miscellaneous Steel

Copies R. H. Stone
J. E. Malone
D. E. Trapold
J. L. Turdera
P. H. Divjak
A. M. Vuksan

Date June 29, 1977

From E. J. Simanek

Of Procurement

At Gaithersburg

This is to confirm our conversation on June 29, 1977 regarding 100% inspection of the studs welded to the embeded plates.

On June 15, 1977, you were verbally requested to initiate the 100% inspection of the welds made by the automatic stud welding process and the SMAW welding process.

During a visit on June 29, 1977, it was observed how you were performing the inspection on the automatic welded studs. Observing them when the plates were banded back to back, then stacked. The stack was about 12 plates (12 feet) long, 5 or 6 (5 feet) high and 2 (9-10 feet) deep.

In the opinion of B. L. Meyers (Engineering), S. J. Seiken (SNUPPS Client) and myself, this is unacceptable as it is not providing 100% inspection of the subject welds as requested, therefore, you are directed to change your inspection technique to provide the Project with the degree of inspection. If it means more visits (time), then it is expected that this will be worked out with your Regional Supervisor.

We cannot indicate at this time how long a period the 100% inspection of the subject welds will continue. This is dependent on what is found at the Jobsites (Union and Kansas), results of your inspections and Project review of the results plus Client concurrence.

This is also to reiterate that we have been requested to 100% inspect the "Q" list sleeves and the missile door frames.

If you have any further questions, please contact us.

E. J. Simanek

EJS:vgn

Exhibit 23

Bechtel Power Corporation

Telephone call

Copy ~~Route~~ H Quinn
T I Gillespie
P Dinjak
File

By E J Simanek Of

To Hank Quinn Of

Date June 15 1977 Time

Subject C-131 Civies Job No. 10466

Hank was requested to initiate 100% inspection of all welds to the embeded plates. This is at Client request. He was also requested to keep detailed records to indicate Pc Mk - No. Studs - Studs inspected - disposition ok - bend OK manual weld in order to preclude having to go back and recount -

In addition he was requested to ~~tack~~ 100% inspect ~~[illegible]~~ the "Q" list Sleeves - and Missile door Frames ~~[illegible]~~

Bechtel Power Corporation

Post Office Box 607
15740 Shady Grove Road
Gaithersburg, Maryland 20760
301-948-2700

RETURN COMMENTS TO R. P. WENDLING - CODE 450

August 10, 1977

Mr. N. A. Petrick
Executive Director, SNUPPS
5 Choke Cherry Road
Rockville, MD 20850

Dear Mr. Petrick:

0500

BLSM - 5977 File 0499.4/C-131
SNUPPS Project - Job No. 10466
NRC Inspection at Callaway Jobsite
on June 7-9, 1977

RECEIVED

AUG 1 9 1977

NUCLEAR ENGR.

Ref: 1. SLBM 7-302, S. J. Seiken to R. H. Stone dated July 27, 1977
2. BLSM - 5959, R. H. Stone to N. A. Petrick dated August 8, 1977

Encl: Final Report: Investigation of Welded Studs

Reference 1 requested Bechtel to provide for SNUPPS consideration a detailed report with emphasis on the following:

1. Corrective actions taken in response to the NRC inspection findings and the results achieved to date.

2. Corrective actions to be taken to avoid further noncompliance in the area cited and

3. The date when full compliance will be achieved.

Enclosed please find the detailed report requested. A response to the findings were transmitted via separate letter on August 8, 1977 (Reference 2). The responses address the corrective actions taken by all responsible parties as requested in item 1 of the reference 1 letter. Item 2 and 3 of the reference letter will not be addressed as no actions are deemed necessary.

Exhibit 24

N. A. Petrick
[illegible]
B/SM 5977

August 10, 1977

The 100% reinspection of machine welded studs at the Callaway site is summarized in the enclosed report. A partial reinspection was also performed at the Wolf Creek site (approximately 30% of the plates at the site were included). Out of 10,000 studs inspected, two were damaged in transit, 3 had less than 360° welds, and 1 did not pass the bend test. The reinspection at Kansas was terminated because of the extremely low rejection rate (1/10,000).

The data gathered for machine welded studs (see report) indicates that the percentage of defective welds (0.56%) is far below the industry average of 3-5%, and that the percentage of rejectable studs is also extremely low (.03%). It is, therefore, recommended that the 100% final inspection at the Cives shop being performed by Bechtel be terminated.

In addition to a review of the machine welded studs, hand welded studs were also examined. As indicated the acceptance criteria for manually welded anchor bolts has been modified and clarified. This change will necessitate that the material already fabricated be reinspected. Cives will perform such a reinspection in the near future.

Very truly yours,

R. H. Stone
Project Manager

PD:RHS:CJF

cc: S. J. Seiken, w/1
F. D. Field, w/1
R. P. White, w/1
[redacted]

FINAL REPORT
INVESTIGATION OF WELDED STUDS

Bechtel Power Corporation

Prepared By: K. Parikh
D. L. Meyers

Table of Contents

Statement of Problem

During a recent visit to the Callaway site representatives of the NRC discovered some mechanically welded studs with less than 360° welds on embedded pl..s. As a result of this, a 100% reinspection of all mechanically welded plates was initiated. In addition manually welded plates were also reinspected.

The results of these reinspections are as follows:

1. Mechanically Welded Studs:

No. of Plates	No. of Studs	No. of Defects (less than 360° weld)	No. of Failures	% Defects	% Failures
7543	81,673	457	66	0.56	0.08

2. Manually Welded Studs:

   A majority of the studs were found unacceptable based upon AWS D1.1 requirements. In general the defects are as follows:

   a. The vertical leg of the weld is undersized by up to 1/16".

   b. The horizontal weld is oversized by up to 1/8".

   c. The profile and convexity of the welds are unacceptable according to AWS D1.1.

   d. Some undercut in excess of that allowed by AWS D1.1 exists.

Investigation

Preliminary investigation of both problems indicated the following:

1. The number of defects for machine welded studs is below industry averages for the equipment and techniques used in the fabrication of embedded plates. However, Cives (supplier) was asked to determine the reason for the defective material reaching the jobsite and to determine the possibility of tracing the defective materials to factors such as specific time period, shift, location, etc.

2. The required weld detail according to AWS D1.1-75 for manually welded studs is almost impossible to produce using normal production materials and techniques. It should be noted that this detail (embedded plates) is peculiar to power plants and the requirements of the sections of AWS D1.1 not being met were developed for linear welds and not for the type of weld in question.

In both cases three conditions must be investigated:

a. Material already in concrete.
b. Material already fabricated.
c. Future fabrication.

These conditions were investigated by the program outlined below:

A. For Machine Welded Studs:

A probability analysis was performed to evaluate performance of plates which are already in concrete. For this purpose, the Bechtel liaison group at the Callaway site furnished information regarding concrete placed prior to June 9, 1977. A listing of all plates embedded in concrete (placed by June 9, 1977) was prepared. Next each plate was identified by its location and the imposed load. Using this information a tabulation showing the actual service load and the capacity of plate under normal service conditions was prepared (see Table 1, Appendix B).

For plate design it is assumed that the applied loads are close to the center of the plate. However, to facilitate installation in field, a tolerance of 6" for the application of the load is allowed. Thus, for a given plate the load applied at a stud which has failed represents the worst case. Other points of load application may be anywhere within the plate resulting in cases which are not as severe as the one mentioned above.

In order to evaluate the effect of loading the plate in areas other than the critical area, the plates were divided in nine(9) zones (see sketch 1a and 1b, Appendix B). The load carrying capacities of plates, with the load applied in each zone were calculated and the number of potential failures were determined (see Table 2, Appendix B). The probability of such failures taking place was determined and is described under "Results".

B. For Manually Welded Studs:

A listing of plates with manually welded studs was prepared based upon field information on concrete placed prior to June 9, 1977. For each plate actual applied loads were determined.

Reduced capacities of plates were then calculated by assuming the welds between studs and plates to be 1/8" and 1/16" undersized, respectively. In addition reduced capacities of the plates were established by assuming 1/16" undercut in studs. These reduced capacities were compared with the actual applied loads on each plate (see Table 3, Appendix B).

From field reinspection reports it was verified that in no case did the undersize weld or the undercut in the stud exceed the maximum assumed values (i.e. 1/8" undersize and 1/16" undercut).

Results

1. Mechanically Welded Studs

The results of Cives investigation into the causes of the deficient material along with the statistics attached in Appendix A indicate that over 80% of the defective material occurred during a four month period shortly after fabrication started. It was during this period that the particular shop layout, fabrication procedures and inspection procedures developed for the SNUPPS project were initiated. Since that time the defective material has been drastically reduced. Our survey indicates that the percentage of welds less than 360° is less than 0.10%.

In addition the probability of failure resulting from a defective stud, for plates already in place, was investigated as follows:

Probability Analysis:

Let P = Probability of an embedded plate failure

P_1 = Probability of a defective stud (obtained from field reinspection reports of similar plates not yet installed)

P_2 = Probability of load which is applied to embedded plate being the reaction to a "Q" list system. This was established by review of load application on all plates (in place) involved.

P_3 = Probability that the load which is applied to embedded plate exceeds the failure capacity of the plate. This was established based on the tabulation of actual loads developed from available data and can be further broken down as follows:

a. p_3' = Probability that applied load will cause a failure of plate.

b. p_3'' = Probability that the applied load will fall into the zone in which plate failure occurs.

c. p_3''' = Probability that the particular stud in the zone under review will fail.

Numerically,

P_1 (from statement of problem, of 81673 studs, 66 failed) $= \frac{66}{81673} = \frac{1}{1237.5}$

P_2 (from tabulation compiled, of 541 plates 255 "Q" listed) $= \frac{255}{576} = \frac{1}{2.26}$

p_3' (from table compiled, of 541 plates, 39 fails in Zone I) $= \frac{39}{541} = \frac{1}{13.87}$

p_3'' (Since there are 9 zones, probability of load being in Zone I) $= \frac{1}{9}$

{ Probability of load being in corner of a plate should be lower than the probability of load being in the center of the plate. Hence, this is a conservative number.

p_3''' (since there are 4 studs, probability of the given stud failure) $= \frac{4}{4} = 1$

Since there are 4 zones in a plate which qualify as Zone I.

Then, probability of plate failure for load in Zone I is

$$= P = p_1 \times p_2 \times p_3 = p_1 \times p_2 \times (p_3' \times p_3'' \times p_3''')$$

$$= \frac{1}{1237.5} \times \frac{1}{2.26} \times \frac{1}{13.87} \times \frac{1}{9} \times 1$$

$$= 2.865 \times 10^{-6}$$

Similarly probability of plate failure for load in Zone II and VI is:

$$p_3' = \frac{29}{541} = \frac{1}{18.66}$$

$$P = \frac{1}{1237.5} \times \frac{1}{2.26} \times \frac{1}{18.66} \times \frac{1}{9} \times 1$$

$$= 2.12 \times 10^{-6}$$

Probability of load being in Zone II should be lower than the probability of load being in the center of the plate. Hence, this is a conservative number.

and probability of plate failure for load in Zone III is

$$p_3' = \frac{21}{541} = \frac{1}{25.76}$$

$$P = \frac{1}{1237.5} \times \frac{1}{2.26} \times \frac{1}{25.76} \times \frac{1}{9} \times 1 = 1.54 \times 10^{-6}$$

(Note - A load in Zones IV, V, and VII through IX will not cause failure.) Hence, the probability of plate failure $= 2.865 \times 10^{-6} + 2 \times 2.12 \times 10^{-6} + 1.54 \times 10^{-6} = 8.645 \times 10^{-6}$. It should be noted that the above calculations do not include the following factors:

a. Probability that all imposed loads occur at the same time. This should be significantly less than 1 since it is not a normal condition that all loads act at the same time. For example the probability of occurrence of some of the assumed loads are:

1. 10^{-4} for seismic loads

2. Approximately 10^{-1} for pipe movement or rolling loads.

b. Probability of a plate failure inducing system failure is also significantly less than 1.

These factors will further reduce the probability of causing a major safety hazard in the power block due to a defective stud to a probability significantly less than 10^{-11}.

2. Manually Welded Studs

From the study of the compiled data and the calculated reduced capacities of plates due to 1/8" undersize welds or 1/16" undercut of studs it was established that a sufficient design margin existed and that none of the plates embedded prior to June 9, 1977 possess the potential to fail. Thus no corrective action is required for plates which are installed. It was also determined that the as received weld profile is structurally acceptable for the fabricated plates.

Corrective Actions

1. Mechanically Welded Studs

The rejection rate and the probability of failure indicate that the materials as received at the jobsite are acceptable. However, to further insure that future fabrication of these type studs are, and will continue to be acceptable, the following additional actions were taken:

a. An investigation of the supplier's shop was performed on 6-28-77 by technical, supplier quality and SNUPPS personnel. The result of this investigation indicated that the supplier's fabrication and inspection procedures were acceptable.

b. The technical specifications were revised to require that all future mechanically welded studs with less than 360° welds be bend tested prior to shipment to the site.

2. Manually Welded Studs

Since it has been demonstrated that the as received material is structurally adequate the specification (10466-C-131) and the PSAR were changed to clarify and reflect this condition. The PSAR change and justification for the change are included in Appendix C.

Conclusions

The investigations performed concerning welded studs received at the Callaway jobsite have indicated that for mechanically and manually welded studs the fabrication and quality control procedures are satisfactory resulting in a completely acceptable product.

Bechtel Power Corporation

Engineers — Constructors

15740 Shady Grove Road
Gaithersburg, Maryland 20760
301-948-2700

Mr. Nicholas A. Petrick
Executive Director, SNUPPS
5 Choke Cherry Road
Rockville, Maryland 20850

NOV 21 1977

BLSE 5195 File C-131(Q)
Bechtel Job No 10466
SNUPPS Project
Inspection of Machine Welded Studs

Encl: Letter Parshley to Divjak dated 11/18/77

Dear Mr. Petrick:

At the request of Union Electric, we are supplying the enclosure which documents the inspection of machine welded studs performed by CIVES Steel Company.

Since June 15, Bechtel has inspected 100% of the material fabricated at CIVES. The procedure includes inspection of welds for 360° with bend testing according to AWS 4.30.1 as needed. Prior to June 15, Bechtel performed a 10% random inspection which included inspection for a full 360° weld. This was part of our overall quality review.

It should be noted that although inspection to paragraph 4.30.1 of AWS D1.1 did not take place until Rev. 9 of Specification C-131(Q) was issued, the reinspection of all plates at the Callaway site indicate a very small percentage of studs without full 360° welds (.56%).

Very truly yours,

J. L. Turdera
Senior Project Engineer

PHD/BLM/bb

cc: J. M. Evans, w/1
E. D. Tarver, w/3
D. W. Capone, w/3
J. R. Jorgensen, w/3
M. T. Opstad, w/5

152 A

TO	MAIL	COPIES LTR	COPIES ENC	FOR FILE	FOR INFO	FOR COM	FOR ACT.	ANS. DUE
0610	C131	1	1	5456				
DWC		1	1		✓			
WHZ		1	1		✓			
RPW		1	1		✓			
LAY		1	1		✓			
N. Date		1	-					

RETURN COMMENTS TO W. H. ZVANUT - CODE 450

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NOV 28 1977

Exhibit 25

TO	MAIL	COPY LTR	COPY ENC	FOR FILE	FOR INFO	FOR COM	FOR ACT	ANS DUE
DES		1	–		✓			
DNC		1	–		✓			
FDF		1	–			✓		[illegible]
RLP		1	–			✓		[illegible]
WAW		1	–			✓		8-[illegible]
WHE		1	–				✓	8-[illegible]
DIC		1	–			✓		8-[illegible]
N. Dark		1	–					
0610-C131		1	–	3450				

[illegible] COMMENTS TO [illegible] CODE 450

Bechtel Power Corporation

Engineers–Constructors

15740 Shady Grove Road
Gaithersburg, Maryland 20760
301–948-2700

Mr. D. F. Schnell
Manager - Nuclear Engineering
Union Electric Company
Post Office Box 149
St. Louis, MO 63166

JUL 22 1980

BLUE 712 File: C-131
Bechtel Job No. 10884
SNUPPS Project
Undersize Manual Fillet Welds on
Machine Welded Studs

Ref: 1. UTD B-1475 (Cives) dated 6/17/80

Dear Mr. Schnell:

This letter confirms the discussion on June 24, 1980 between Bechtel (L. [illegible]tondo, E. Thomas and K. Parikh) and Union Electric (D. Stecko) regarding the undersize of manual fillet welds found on several embed plates in the field stock. Review of the data in Reference 1 reveals that the worst effective undersize for a given stud is approximately 1/8 inch. Plate EP912D-A127-163 has two studs with an undersize identified as ranging between 1/16 and 3/16 inches on the vertical stud leg around the entire circumference. Verbal confirmation received from the field indicates in one case this results in an average undersize estimated to be slightly greater than 1/8 inch. The other stud has an effective undersize estimated to be slightly less than 1/8 inch. Since the undersize is limited to one leg only, the effective undersize of the welds, measured by the reduction in minimum throat area, is less than 1/8 inch. The field reported that all the studs identified as being undersize were in a bent condition. However, in a few cases the bend was less than the 15° specified in AWS D1.1, Section 4.30.1.

Our analysis reveals that a replacement weld with an effective undersize weld of 1/8 inch or less around the entire circumference is sufficient to transmit the maximum design loads imposed on the stud. The basis for this conclusion is the following: The requirements imposed by AWS D1.1 to use a 5/16 fillet weld when manually welding studs are to ensure that failure of the assembly will not occur at the weldment (i.e., the weldment is stronger than the stud). The minimum safety factor imposed on our structural components is at least 1.67 (or 5/3). The actual

Exhibit 26

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JUL 2[illegible] 1980

safety factor for the stud weldment is obviously greater, since failure will not occur in the weld. Reducing the effective weld size from 5/16 inch to 3/16 inch (a reduction of 3/5) results in a weld which is sufficient to transfer the maximum design load with a safety factor at least greater than 1.0.

The conclusion is that the studs with undersize welds as reported are capable of performing their intended design function.

However, the undersize welds do not conform to the specification requirements. To preserve the intended design safety margins, the nonconforming welds should be repaired.

Very truly yours,

J. H. Smith
Project Engineering Manager

EWT:bg

cc: N. A. Petrick

Bechtel Power Corporation
Engineers — Constructors

Post Office Box 607
15740 Shady Grove Road
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Mr. Nicholas A. Petrick
Executive Director, SNUPPS
5 Choke Cherry Road
Rockville, Maryland 20850

JUL 2 0 1977

BLSE-4662 File 0542
Bechtel Job No. 10466
SNUPPS Project
SAR Change Notice 21-77

Encl: A. SAR Change Notice 21-77

Dear Mr. Petrick:

Enclosed for your review and approval is SAR Change Notice 21-77. This change modifies the commitment to AWS Standards for containment construction.

No changes are required to the Environmental Reports or the Site Addenda due to this change.

The concurrence of Westinghouse is not required.

This Change Notice was telecopied to the SNUPPS Technical Committee on July 18, 1977. Your immediate attention to the approval of this change will be appreciated.

Very truly yours,

J. L. Turdera
Senior Project Engineer

RLS:rm
cc: E. F. Beckett, w/1
J. M. Evans, w/1
D. W. Capone, w/3
J. R. Jorgensen, w/3
E. D. Tarver, w/3
H. T. opstad, w/5
R. G. Schuster (NSP), w/1
L. Yandell (UE), w/1
P. C. Wilkens (RG&E), w/1
G. D. Boyer (KG&E), w/3

bcc: B. K. Kanga
R. L. Ashley
P. H. Divjak
P. Labarta
B. L. Meyers

Exhibit 27

GAITHERSBURG POWER DIVISION JOB NO. 10466

SNUPPS PROJECT

1. SAR CHANGE NOTICE

P [X] F [ ]

3. NO. 21-77

2. DISCIPLINE CIVIL

4. ORIGINATOR B. Parish

5. DATE 7-15-77

6. REFERENCED SECTIONS OF SAR

3.8.1.6.6.2.a

7. DESCRIPTION OF CHANGE

SEE ATTACHMENT

ATTACHMENTS: PSAR p. 3.8-15
Description of Change
Justification for Change

8. REFERENCED SPECIFICATIONS OR DRAWINGS AFFECTED

10466-C131 SPECIFICATION

9. JUSTIFICATION BELOW [ ] ATTACHED [✓]

SEE ATTACHMENT

10. DISTRIBUTION

B. Meyers [signature]

M. Stuchfield [signature]

EWJ 7-15-77	[signature] 7/15	[signature]	[signature]	7/18/77		
11. SUBMITTED/ GRP. SUPVR.	12. REVIEWED/ COGNIZANT PE	13. REVIEWED/ L.E.	14. APPROVED/SR. PROJ. ENGR.	DATE	15. CONCURRENCE BY CLIENT	DATE

17. CLOSEOUT ACTION

— —	—
16. CONCURRENCE BY NSSS	DATE

d. ACI 347-68 - Recommended Practice for Concrete Formwork is used without exception.

e. ACI 305-72 - Recommended Practice for Hot Weather Concreting is used without exception.

f. ACI SP 2-~~72~~ 75 - Manual of Concrete Inspection is used without exception. C/N 10-77

g. ASTM C94-72 - Ready-Mixed Concrete is used without exception.

3.8.1.6.6.2 Steel Construction

a. ~~AWS D1.1-72 and D1.1 - Rev. 1-73 - Structural Welding Code is used without exception for welding of structural steel.~~ P SEE ATTACHM... C/N 21-...

b. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings Sections 1.23 and 1.25, February 1969, including Supplement Nos. 1 ~~and~~, 2, and 3 are used without exception. C/N 10-77

c. AISC - Specification for Structural Joints Using ASTM A 325-72a or A 490-72 Bolts is used without exception.

3.8.1.6.6.3 Liner Plate Erection

Welding procedures and personnel shall be qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX; Welding Qualification.

Vertical and dome liner plates are used as forms and erection precedes the concrete placement.

The liner plate and penetration assemblies are erected to the following tolerances.

a. General liner plate

1. The radial location of any point on the liner plate shall not vary from the design radius by more than ±3 inches. At any given elevation the maximum diameter minus the minimum diameter shall not exceed six inches, with a two inch allowance for local out-of-roundness. Measurements shall be made at 30 degree spacings for each 10-foot height.

C/N 10-77

Description of Change

Revised Para 3.8.1.6.6.2. Steel Construction (item a only)

a. AWS D1.1-75 Structural Welding Code is used for Structural Steel except as noted herein:

The following exceptions are allowed for welding between Anchor Studs and Plates embedded in Concrete.

i Vertical leg of weld may be up to 1/16" smaller than that specified on drawings.

ii Unequal legs are permitted.

iii Weld profile and convexity requirements for these welds need not be imposed.

iv An undercut of up to 1/16" for 10% of weld length may be permitted.

Justification For Change Notice 21-77

Subject: Welds Between Plates Embedded in Concrete and Anchor Studs.

Justification: The welds under discussion occur between anchor studs and plates (see attached sketch for typical detail). These embedded plates are designed to transfer load from attachments such as floor beams to the concrete. The plates which range in thicknesses from 3/4" to 1 1/2" are anchored in concrete by means of studs 1" to 1 1/2" in diameter spaced at 6" to 12" centers. The welding between the plates and studs is done manually.

American Welding society (AWS) D1.1-75 requires structural welds to be of equal legs with limited convexity and 0.01" undercut into the base metal. These requirements are generally necessary for normal linear structural welds. However, these rules do not address specific cases such as circular manual stud welding in clusters on embedded plates. Such plates are peculiar to Nuclear Power Plants.

Due to inaccessibility of the area to be welded, it is not feasible to insert electrodes at an angle so as to obtain the indicated weld configuration. (Normally perpendicular to surface of the Finished weld.) The actual position of the electrodes used in this case results in welds with unequal legs (i.e. Horizontal and vertical legs of weld being unequal), a significantly convex weld profile and some undercut of the stud base metal.

These conditions do not reduce the structural integrity of the weld for the application considered for the following reasons:

i A 1/16 inch short vertical leg does not reduce the capacity of the connection since the interface strength developed is greater than the strength of the stud.

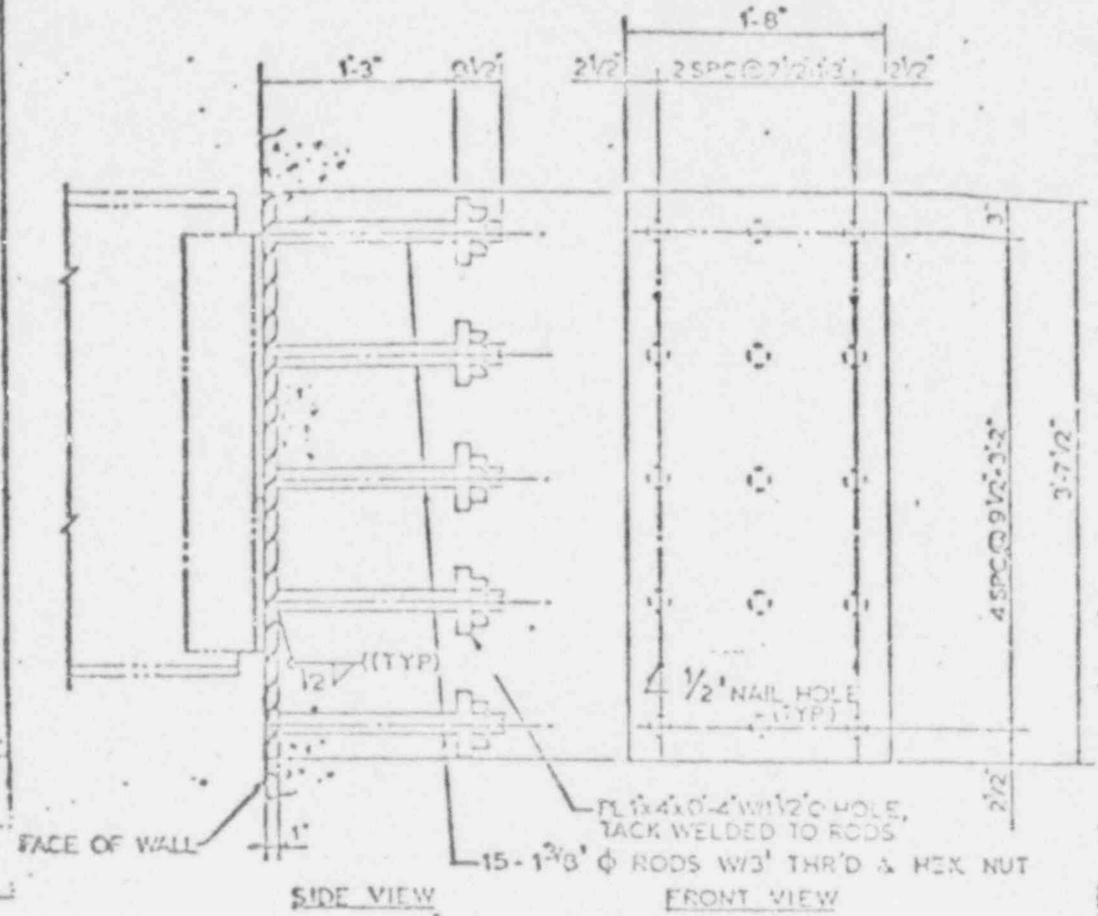
ii Unequal legs are not generally permitted for linear welding since this condition can result in thermal stress in one of the pieces being welded. However, since the stud is free to move under differential thermal strains, no stress can be developed. Any movement that occurs will be small and will not affect stud performance.

iii Weld profile and convexity are also measures of the amount of heat transmitted to the elements being welded and are therefore not critical for the same reasons given in ii above.

iv Since the studs are threaded, the tension capacity is controlled in the threaded area. The net area of stud reduced in diameter due to an undercut of 1/16 inch is greater than net area of stud at the root of threads at which section tensile strength of the stud is computed. Thus, the reduced area of stud due to undercut does not affect the computed strength of the stud.

The abovementioned deviations from AWS D1.1-75 for confined welded areas have historically been accepted industry practice. The AWS code is not intended for this use but rather for structural steel. However, normally it is used because these are structural welds and this is the only code available. In addition, the code does have other aspects required, such as welder qualifications, weld procedures, material control and workmanship.

Summary: It has been shown that the weld profile obtained in practice, results from the configuration of the detail. A perfect weld according to AWS D1.1 would not be obtainable with available production methods and techniques. However, it has also been demonstrated that the weld obtained, with its minor deviations from code, is technically acceptable and has in fact been the industry standard for a number of years.



TYPICAL DETAIL OF
EMBEDDED PLATE

unless the weld is protected by a shelter. This shelter shall be of a material and shape appropriate to reduce wind velocity in the vicinity of the weld surface to a maximum of five miles per hour.

4.24.3 The type and diameter of the electrodes used shall meet the requirements of the procedure specification.

4.24.4 Welds shall be started in such a manner as to permit sufficient heat build-up for complete fusion of the weld metal to the groove face of the joint. Welds stopped at any point in the length of the joint and restarted after a delay of more than one minute shall be examined for full fusion by nondestructive methods and repaired if necessary in accordance with 4.24.6.

4.24.5 Because of the high heat input characteristic of these processes, preheating is not normally required. However, no welding shall be performed when the temperature of the base metal at the point of welding is below 32 °F (0 °C).

4.24.6 Welds having defects prohibited by 8.15 or 9.25 shall be repaired as permitted by 3.7 utilizing a qualified welding process, or the entire weld shall be removed and replaced.

Part F
Stud Welding

4.25 Scope

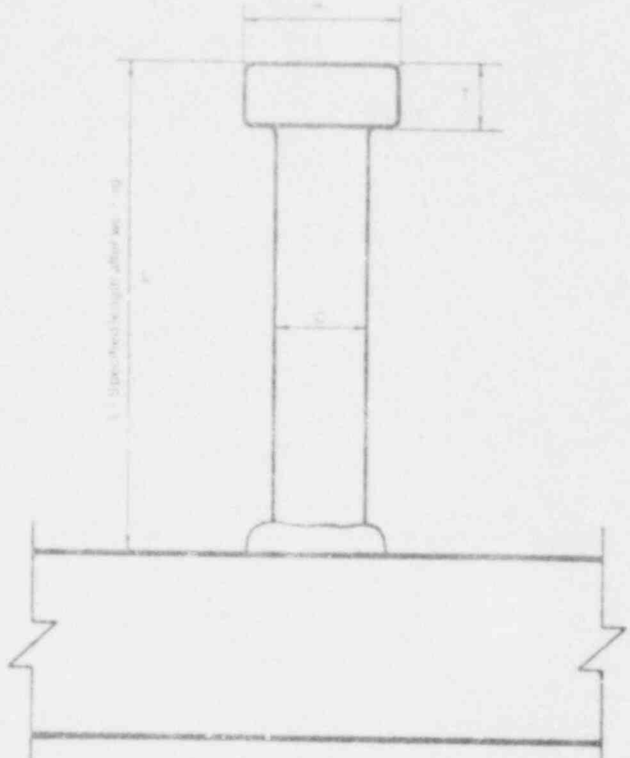
Part F contains provisions for the installation and inspection of steel studs welded to steel, to attach members and connection devices to concrete (as concrete anchors and as shear connectors in composite steel-concrete construction), and to fasten other members and appurtenances.

4.26 General Requirements

4.26.1 The design of studs shall be suitable for arc welding to steel members with automatically timed stud welding equipment. The type, size or diameter, and length of stud shall be as specified by the drawings, specifications, or special provisions as approved by the Engineer. (See Fig. 4.26.1 for dimensions and tolerances of standard type shear connectors).

4.26.2 An arc shield (ferrule) of heat-resistant ceramic or other suitable material shall be furnished with each stud.

4.26.3 A suitable deoxidizing and arc-stabilizing flux for welding shall be furnished with each stud of 5/16 in. (8.0 mm) diameter or larger. Studs less than 5/16 in. in diameter may be furnished with or without flux.



Shank diam C	Length (L) tolerances	Head diam H	Min head height T
Standard dimensions, in.			
1/2 +0.000 −0.010	+1/16 −1/8	1 ± 1/64	9/32
5/8 +0.000 −0.010	+1/16 −1/8	1-1/4 ± 1/64	9/32
3/4 +0.000 −0.015	+1/16 −1/8	1-1/4 ± 1/64	3/8
7/8 +0.000 −0.015	+1/16 −1/8	1-3/8 ± 1/64	3/8
Standard dimensions, mm			
12.7 +0.00 −0.25	+1.6 −3.2	25.4±0.4	7.1
15.9 +0.00 −0.25	+1.6 −3.2	31.7±0.4	7.1
19.0 +0.00 −0.38	+1.6 −3.2	31.7±0.4	9.5
22.1 +0.00 −0.38	+1.6 −3.2	34.9±0.4	9.5

Fig. 4.26.1—Dimensions and tolerances of standard type shear connectors.

From Structural Welding Code D1.1-75

Exhibit 26

4.26.4 Only studs with qualified stud bases shall be used. A stud base, to be qualified, shall have passed the tests prescribed in 4.31. The arc shield used in production shall be the same as used in the qualification tests. Qualification of stud bases in accordance with 4.31 shall be at no expense to the owner.

4.26.5 Finish shall be produced by cold heading, cold rolling, or machining. Finished studs shall be of uniform quality and condition, free of injurious laps, fins, seams, cracks, twists, bends, or other injurious discontinuities. A stud with cracks or bursts deeper than one-half of the distance from the periphery of the head to the shank may be cause for rejection.[9]

4.26.6 Only studs qualified under 4.31 shall be used. When requested by the Engineer, the contractor shall provide the following information:

4.26.6.1 A description of the stud and arc shield.

4.26.6.2 Certification from the manufacturer that the stud base is qualified as specified in 4.26.4. Qualification test data shall be retained in the files of the manufacturer. Copies of the data shall be furnished by the contractor or fabricator on written request of the Engineer.

4.27 Mechanical Requirements

4.27.1 Studs shall be made from cold drawn bar stock conforming to the requirements of Specification for Cold Finished Carbon Steel Bars and Shafting, ASTM A108, Grades 1010 through 1020, either semi- or fully-killed.

4.27.1.1 Tensile requirements of shear connector studs, as determined by tests of bar stock after drawing, or of full diameter finished studs, at the manufacturer's option, shall conform to the following:

Tensile strength, psi min	60 000 (415 MPa)
Elongation in 2 in. (50.8 mm) % min	20
Reduction of area, % min	50

4.27.1.2 Studs other than shear connectors shall have a minimum tensile strength of 55 000 psi (480 MPa) and a minimum elongation of 20 percent in 2 in. (50.8 mm). Tests may be made on bar stock after drawing or on full diameter finished studs, at the manufacturer's option.

4.27.2 Tensile requirements shall be determined in accordance with the applicable sections of ASTM A370, Mechanical Testing of Steel Products. When the tensile requirements of 4.27.1.1 are determined from finished studs, the tension tests may be made on studs welded to test plates of ASTM A36 steel, using a test fixture similar to that shown in Fig. 4.27.2. When the tensile requirements of 4.27.1.2 are determined from finished studs, the ends of the studs may be gripped in the jaws of a tension testing machine. Plates of adequate size may be fillet welded to the unwelded end for studs without heads. If fracture occurs outside the middle half of the gage length, the test shall be repeated.

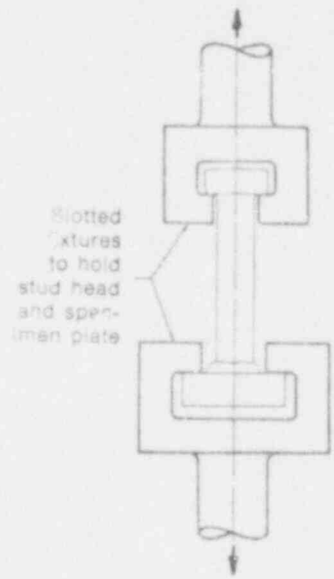


Fig. 4.27.2—Typical tension test fixture.

4.27.3 Upon request by the Engineer, the contractor shall furnish:

(1) The manufacturer's certification that the studs, as delivered, conform to the applicable requirements of 4.26 and 4.27.

(2) Certified copies of the manufacturer's test reports covering the last completed set of in-plant quality control mechanical tests, required by 4.27, for each stock size delivered. These tests shall be made using either finished studs or steel bars for studs of diameters to be furnished under the contract. The quality control tests shall have been made within the six month period before delivery of the studs.

4.27.3.1 When quality control tests are not available, the contractor shall furnish mechanical test reports conforming to the requirements of 4.27. The mechanical tests shall be on either finished studs, or steel bars for studs of diameters to be delivered and selected from material provided by the manufacturer of the studs. The number of tests to be performed shall be specified by the Engineer.

[9]Heads of shear connectors or anchor studs are subject to cracks or bursts, which are names for the same thing. Cracks or bursts designate an abrupt interruption of the periphery of the stud head by radial separation of the metal. Such interruptions do not adversely affect the structural strength, corrosion resistance or other functional requirements of shear connectors or anchor studs.

4.27.4 The Engineer may, at the contractor's expense, select studs of each type and size used under the contract as necessary for checking the requirements of 4.26 and 4.27. These check tests shall be at the owner's expense.

4.28 Workmanship

4.28.1 Studs shall be welded to steel members with automatically timed stud welding equipment connected to a suitable power source.

4.28.2 If two or more stud welding guns are to be operated from the same power source, they shall be interlocked so that only one gun can operate at a time, and so that the power source has fully recovered from making one weld before another weld is started.

4.28.3 While in operation, the welding gun shall be held in position without movement until the weld metal has solidified.

4.28.4 At the time of welding, the studs shall be free from rust, rust pits, scale, oil, or other deleterious matter that would adversely affect the welding operation.

4.28.5 The stud base shall not be painted, galvanized, or cadmium plated prior to welding.

4.28.6 The areas on the member to which the studs are to be welded shall be free of scale, rust, or other injurious material to the extent necessary to obtain satisfactory welds. These areas may be cleaned by wire brushing, peening, prick-punching, or grinding.[19]

4.28.7 Welding shall not be done when the base metal temperature is below 0 °F (−18 °C) or when the surface is wet or exposed to falling rain or snow. When the temperature of the base metal is below 32 °F (0 °C), one stud in each 100 studs welded shall be tested by the methods specified in 4.30.1 and 4.30.2 as applicable in addition to the first two tested as specified in 4.29.1 and 4.29.2.

4.28.8 Longitudinal and lateral spacings of stud shear connectors with respect to each other and to edges of beam or girder flanges may vary a maximum of 1 in. (25.4 mm) from the location shown on the drawings, provided the adjacent studs are not closer than 2-1/2 in. (63.5 mm) center to center. The minimum distance from the edge of a stud base to the edge of a flange shall be the diameter of the stud plus 1/8 in. (3.2 mm) but preferably not less than 1-1/2 in. (38.1 mm). Other types of studs shall be so located as to permit a workmanlike assembly of attachments without alterations or reaming.

4.28.9 After welding, arc shields shall be broken free from shear connectors and anchor studs and, where practicable, from all other studs.

4.28.10 The studs, after welding, shall be free of any discontinuities or substances that would interfere with their intended function. However, nonfusion on the vertical leg of the flash,[21] and small shrink fissures are acceptable.[20A]

4.28.11 At the option of the contractor, studs may be fillet welded by the shielded metal arc process, provided the following requirements are met:

4.28.11.1 The fillet weld size shall be a minimum of 5/16 in. (8.0 mm).

4.28.11.2 Welding shall be done with low hydrogen electrodes 5/32 or 3/16 in. (4.0 or 4.8 mm) in diameter.

4.28.11.3 The stud base shall be prepared so that the outside circumference of the stud fits tightly against the base metal.

4.28.11.4 All rust and mill scale at the location of the stud shall be removed from the base metal by grinding. The end of the stud shall also be clean.

4.28.11.5 The base metal to which studs are welded shall be preheated in accordance with the requirements of Table 4.2.

4.29 Quality Control

4.29.1 Shear Connectors

4.29.1.1 The first two stud shear connectors welded on each member, after being allowed to cool, shall be bent to an angle of 30 deg from their original axes by striking the studs with a hammer. If failure occurs in the weld zone of either stud, the procedure shall be corrected and two more studs shall be welded to the member and tested. If either of the second two studs fail, additional welding shall be continued on separate plates until two consecutive studs are tested and found to be satisfactory. Two consecutive studs shall then be welded to the member, tested, and found to be satisfactory before any more production studs are welded to the member.

4.29.1.2 For members having less than 20 stud shear connectors, the stud welding procedure may be tested at the start of each day's production welding period[20] in lieu of testing in accordance with 4.29.1.1. Before use in production, each welding unit shall be used to weld two stud shear connectors to separate test material in the same general position (flat, vertical, overhead, sloping) and of similar thickness. After being allowed to cool, they shall be bent as described in 4.29.1.1. If failure occurs, the procedure shall be corrected and two consecutive studs shall be welded to the

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[19] Extreme care should be exercised when welding through metal decking.

[20] A new production period begins with the welding of a given size and type stud with a given welding schedule or with the beginning of each day's production.

[21] The fillet weld profiles shown in Fig. 3.6 do not apply to the flash of automatically timed stud welds.

test material, tested and found to be satisfactory before any production studs are welded to the member.

4.29.1.3 The foregoing testing shall be performed after any change in the welding procedure.

4.29.1.4 If failure occurs in the stud shank, an investigation shall be made to ascertain and correct the cause before more studs are welded.

4.29.2 For Applications Other Than Shear Connectors: Before starting the welding operations or at the request of the Engineer, two stud connectors shall be welded to separate material in the same general position (flat, vertical, overhead, sloping) and of similar thickness and material as the member. After being allowed to cool, each stud shall be bent to an angle of 30 deg from its original axis by striking the stud with a hammer. If failure occurs in the weld zone of either stud, the procedure shall be corrected and two successive studs successfully welded and tested before any studs are welded to the member. The foregoing testing shall be performed after any change in the welding procedure. If failure occurs in the stud shank, an investigation shall be made to ascertain and correct the cause before more studs are welded.

4.29.3 Studs on which a full 360 deg flash[21] is not obtained may, at the option of the stud welding contractor, be repaired by adding a 5/16 in. (8.0 mm) minimum fillet weld in place of the missing flash.[21] The shielded metal arc process with low hydrogen electrodes, 5/32 or 3/16 in. (4.0 or 4.8 mm) in diameter, shall be used in accordance with the requirements of this code. The repair weld shall extend at least 3/8 in. (9.5 mm) beyond each end of the discontinuity being repaired.

4.29.3.1 For studs having a shank diameter 7/16 in. (11 mm) or less, the use of smaller diameter electrodes are permissible provided they are low hydrogen type.

4.29.4 If the reduction in the length of studs as they are welded becomes less than normal, i.e., the length of stud is more than 1/16 in. (1.6 mm) greater than specified, welding shall be stopped immediately and not resumed until the condition has been corrected.

4.29.5 If an unacceptable stud has been removed from a component subjected to tensile stresses, then the area from which the stud was removed shall be made smooth and flush. Where in such areas base metal has been pulled out in the course of stud removal, shielded metal arc welding with low hydrogen electrodes in accordance with the requirements of this code shall be used to fill the pockets and the weld surface shall be ground flush. In compression areas of members, if stud failures are confined to shanks or fusion zones of studs, a new stud may be welded adjacent to each unacceptable area in lieu of repair and replacement on the existing weld area (see 4.28.8). If metal is torn from the base metal of such areas, the repair provisions shall be the same as for tension areas except that, when the depth of discontinuity is less than 1/8 in. (3.2 mm) and 7 percent of the base metal thickness, the discontinuity may be faired by grinding in lieu of filling the unacceptable area with weld metal. Where a replacement stud is to be placed in the unacceptable area, the just mentioned repair shall be made prior to welding the replacement stud. Replacement shear connector studs shall be tested by bending to an angle of 15 deg from their original axes. The areas of components exposed to view in completed structures shall be made smooth and flush where a stud has been removed.

4.30 Inspection Requirements

4.30.1 If a visual inspection reveals any stud shear connector that does not show a full 360 deg flash,[21] any stud that has been repaired by welding, or any stud in which the reduction in length due to welding is less than normal, such stud shall be struck with a hammer and bent to an angle of 15 deg from its original axis. For studs showing less than a 360 deg weld fillet, the direction of bending shall be opposite to the missing weld fillet. Studs that crack in the weld, the base metal, or the shank under inspection or subsequent straightening shall be replaced (see 4.30.4).

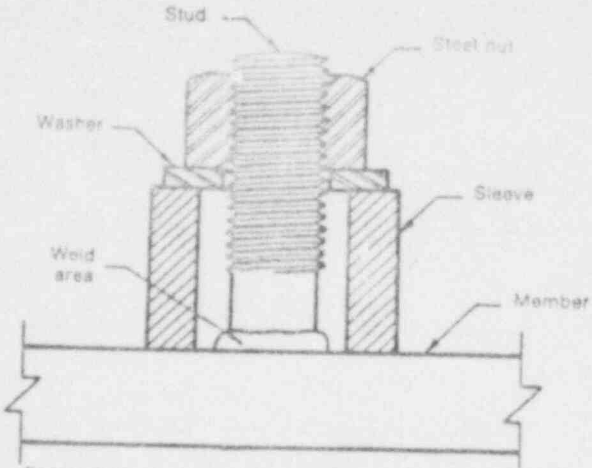
4.30.1.1 Non fusion on the vertical leg of the flash,[21] and small shrink fissures are acceptable.[20a]

4.30.2 For studs other than shear connectors, at least one stud in every 100 shall be bent to an angle of 15 deg from its original axis by striking with a hammer. If threaded, the stud shall be torque tested with a calibrated torque wrench to the value given in Fig. 4.30.2 for the diameter and thread of the stud, in a device similar to that shown in Fig. 4.30.2. If the stud fails, the procedures shall be checked in accordance with 4.29.2, and two more of the existing studs shall be bent or torque tested. If either of these two studs fails, all of the studs represented by the tests shall be torque-tested, bend-tested or rejected. For critical structural connections, the Engineer shall designate the type and extent of additional inspection in the contract.

4.30.2.1 Non fusion on the vertical leg of the flash,[21] and small shrink fissures are acceptable.[20a]

4.30.3 The Engineer's Inspector, where conditions warrant, may select a reasonable number of additional

20a. The expelled metal around the base of the stud is designated as flash in accordance with the definition of flash in AWS A3.0, Terms and Definitions, and Appendix I of this Code. It is not a fillet weld such as formed by conventional arc welding. The expelled metal, which is excess to the weld required for strength, is not detrimental, but on the contrary is essential to provide a good weld. The containment of this excess molten metal around a welded stud by the ferrule (arc shield) assists in securing sound fusion of the entire cross section of the stud base. The stud weld flash may have nonfusion in its vertical leg and overlap on its horizontal leg; and may contain occasional small shrink fissures or discontinuities that usually form at the top of the weld flash with essentially radial and/or longitudinal orientation to the axis of the stud. Such nonfusion on the vertical leg of the flash and small shrink fissures are acceptable.



Dimensions are appropriate to the size of the stud. Threads of the stud shall be clean and free of lubricant other than for the residue of cutting oil.

Required torque for testing threaded studs				
Nominal diameter of studs		Threads per inch and series designated	Testing torque	
in.	mm		ft-lb	J
1/4	6.4	28 UNF	5.0	6.8
1/4		20 UNC	4.2	5.7
5/16	7.9	24 UNF	9.5	12.9
5/16		18 UNC	8.6	11.7
3/8	9.5	24 UNF	17.0	23.0
3/8		16 UNC	15.0	20.3
7/16	11.1	20 UNF	27.0	36.6
7/16		14 UNC	24.0	32.5
1/2	12.7	20 UNF	42.0	57.0
1/2		13 UNC	37.0	[illegible]
9/16	14.3	18 UNF	60.0	81.4
9/16		12 UNC	54.0	73.2
5/8	15.9	18 UNF	84.0	114
5/8		11 UNC	74.0	100
3/4	19.0	16 UNF	147.0	200
3/4		10 UNC	132.0	180
7/8	22.2	14 UNF	234.0	320
7/8		9 UNC	212.0	285
1	25.4	12 UNF	348.0	470
1		8 UNC	318.0	430

Fig. 4.30.2—Torque testing arrangement and table of testing torques.

studs to be subjected to the tests specified in 4.30.1 and 4.30.2.

4.30.4 The bent stud shear connectors and concrete anchors that show no sign of failure shall be acceptable for use and left in the bent position if no portion of the stud is less than 1 in. (25.4 mm) from a proposed concrete surface. All required bending and straightening shall be done, without heating, before completion of the stud welding operation on the job, except as otherwise provided in the contract.

4.30.5 If, during the progress of the work, inspection and testing indicate, in the judgment of the Engineer that the stud welds being produced are not in accordance with this code, the contractor will be required, at his expense, to make the changes (such as welding procedure, welding equipment, and stud base) necessary to secure satisfactory results on studs to be subsequently welded.

4.30.6 At the option and the expense of the owner, the contractor may be required at any time to submit studs of the types used under the contract for check qualification in accordance with the procedures of 4.31.

4.31 Stud Base Qualification Requirements

4.31.1 Purpose. The purpose of these requirements is to prescribe tests for manufacturer's certification of a stud base for welding under shop or field conditions.

4.31.2 Responsibility for Tests. The manufacturer shall be responsible for the performance of the qualification tests. These tests may be performed by a testing agency satisfactory to the Engineer. The agency performing the tests shall submit a certified report to the manufacturer of the stud giving procedures and results for all tests including the information listed under 4.31.10.

4.31.3 Extent of Qualification. Qualification of a stud base shall constitute qualification of stud bases with the same geometry, material, flux, and arc shield, of the same diameter and down to, but not including, 1/8 in. (3.2 mm) and smaller nominal diameters.

4.31.4 Duration of Qualification. A size of stud base with arc shield, once qualified, is considered qualified until the manufacturer makes any change in the stud base geometry, material, flux, or arc shield which affects the welding characteristics.

4.31.5 Preparation of Specimens

4.31.5.1 Test specimens shall be prepared by welding representative studs to suitable specimen plates of ASTM A36 steel. Tests for threaded studs shall be on blanks (studs without threads).

4.31.5.2 Studs shall be welded with power source, welding gun, and automatically controlled equipment as recommended by the manufacturer. Welding voltage, current, and time (see 4.31.6) shall be measured and recorded for each specimen. Lift and plunge shall be at the optimum setting as recommended by the manufacturer.

4.31.6 Number of Test Specimens

4.31.6.1 Thirty test specimens shall be welded consecutively with constant optimum time but with current 10 percent above optimum. Optimum current and time shall be the midpoint of the range normally recommended by the manufacturer for production welding.

4.31.6.2 Thirty test specimens shall be welded con-

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REPORT ON TESTING
TO EVALUATE
WELDS OF ANCHOR RODS AND STUDS
TO EMBEDDED PLATES

BECHTEL POWER CORPORATION

Gaithersburg, Maryland

Prepared by
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September 15, 1980

Exhibit 29

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2.3 Field Tests on Plates with Machine Welded Studs

Six plates with machine welded studs were jointly selected by Union Electric, Daniel International Corp., and Bechtel for insitu testing. Plate locations and types, as well as the location of the attachment by which the load was applied, are described in Appendix C. Four plates, designated as EP512 were subjected to a 15,000 lb. tension load and two other plates designated as EP912 were subjected to a 30,000 lb. tension load. These loads were slightly higher than the design capacity of the plate. Deflection readings for each test plate were taken at the jacking point at load increments of ² kips and 4 kips respectively. The load was applied within a four stud cluster for plates with one or multiple clusters, consistent with the design rationale.

3. Details of Testing and Results

3.1 Laboratory Bend Tests

The six bend test specimens were positioned in the testing machine with the 4 inch square plate clamped to a vertical test fixture. The load was applied hydraulically using a ram inserted in the head of the machine. A dial gage was used to record head travel and the bend angle was initially calculated from head travel measurement. Load was applied to the stud at a point 6 inches from the face of the plate. Photographs in Appendix D sheet 3 show the testing of a bend specimen.

The specimens were positioned for the bend test so that the direction of the bend was as specified by the NRC. The electrical resistance strain gages were placed on the tension side approximately one bar diameter from the edge of the weld or 1-3/8" from the face of the plate.

All specimens yielded by bending of the rod at the strain gage location approximately 1" from the edge of the weld. Figure 1 shows the strain readings plotted against the applied load for all bend tests. Yield strain for the bars was approximately 0.0013 inches per inch representing a yield of 38 ksi which is consistent with the material properties of the ASTM A36 anchor rods used for the embeds. Because of the round cross section of the rod, the yielding exhibited in a bend test produces a rounded curve with no sharp yield point. (see Figure 1) At the strain of 0.040 inches per inch, which is the limit of the curve in Figure 1, the angle is approximately 10 degrees.

Each test was stopped when the angle of bend exceeded 30 degrees. The following angles were measured by a protractor after the test with the load removed.

1. Purpose of the Test Program

The test program was authorized by Union Electric Company to comply with the request by the NRC that a physical demonstration of the strength of the welds between anchor rods and studs to embed plates be conducted in order to supplement Union Electric's report on the Acceptability of Embedded Plates dated March 10, 1978 (ULNRC-238).

The sample selection for testing was done in accordance with the Detailed Procedure in Appendix A. Selection of welds on manually welded rods was based on visual observation of apparent worst cases. Plates with machine welded studs were selected at various locations throughout the plant based on availability and accessibility for testing.

2. Summary of Testing

The anchor rods and plates were selected, designated and tested in accordance with Appendix A - Detailed Procedures, Rev. 2. Tension and Bend Tests on the anchor rods were conducted at Lehigh University. Tests on plates with machine welded studs were conducted at the Callaway jobsite. A brief description of each type of test follows:

2.1 Bend Tests on Anchor Rods

Six anchor rods were selected by the NRC for bend testing in a specified direction. These anchor rods were cut from their parent embed assembly such that a 4" x 4" section of the plate remained attached to the rod without affecting the welds of the rod and plate juncture. The anticipated bend line, established by a test on a sample, was found to be approximately 1 inch above the edge of the weld. Thus, the strain gage for the designated anchor rods was affixed at 1"± above the weld to record the strain in the anchor rod. The load was applied on the rods at a distance of 6" from the face of the plate and the strain readings corresponding to 100 lb. increments of load were recorded. All six rods were bent to a 30 degree angle.

2.2 Tension Tests on Anchor Rods

Six anchor rods selected by Union Electric were cut from their parent embed assembly such that a 4" x 4" plate section with rod attached remained without affecting the welds at the rod and plate juncture. The inspection report dated March 4, 1978 included in Appendix B describes the recorded deficiencies of the welds. The obtained test specimens were placed in a 300,000-lb. capacity Baldwin testing machine. The tension load was applied gradually and readings for changes in the length of the rod were taken as described in Section 3.0.

Specimen	Bend Angle in Degrees
B1	37-1/2
B2	30-1/2
B3	32
B4	30
B5	32
B6	30

The extreme fiber strain at 30 degrees extrapolated from Figure 1 is approximately 17%, which is about one half the value of strain at ultimate load as established by the subsequent tension tests.

All of the welds were strong enough to cause the bar to bend outside the weld. No cracks or other detrimental effects to the welds were observed in the welds following the bend tests.

3.2 Laboratory Tension Tests

The arrangement for the tension tests is shown in photographs on sheet 2 of Appendix D. A dial gage was used to measure head travel. The length of the specimen between the upper grips and the face of the 4" square plate was measured as the gage length. Average strain in the bar was calculated by dividing the head travel by the gage length.

Figure 2 shows a plot of applied load versus average strain. Three of the tension specimens follow a single steep curve to the left and above the other three curves. These were the specimens with long bars (gage lengths of approximately 14 inches). For these tests the bending of the 4" square plate, test fixture deformation, and slip of the grips were very small compared to elongation of the bar. The result is a uniform load versus average strain curve up through yield of the bar. One of these specimens failed by fracture of the weld while the other two failed in the bar.

The three curves to the right in Fig. 2 are affected by bending of the plate, test fixture deformation and grip movement such that each follows a separate curve up to yield. Two of these specimens failed in the welds and one failed in the bar. The specimens with the short gage length are more apt to fail in the weld however, because the grips provide a fixed end causing greater bending stresses in the weld due to sample eccentricity or non-perpendicularity. The slope of the curves therefore do not by themselves reflect a difference in the weld quality when compared with the steeper curves.

Although three of the specimens failed in the welds the strength and ductility of these specimens were comparable to the others which failed in the rod. The design load level is shown by the dotted line in Fig. 2 and is significantly below the ultimate tested capacity.

Yielding of the bars occurred at 29.6, 30.7, 30.1, 29.6, 29.7 and 30.0 kips (minimum specified yield load of 28.2 kips). The yield loads average 2.19 times the design load. This exceeds the load factor of 1.6 used in design. The smallest average strain at failure was 27-1/2% for Specimen T6, which failed in the weld. This result in terms of ductility means that the bar elongated 5 times the yield strain prior to failure. The most ductile specimen was T3 which failed in the bar at 8 times the yield strain.

The ultimate strengths of the tension specimens were 50.0, 50.1, 50.75, 51.5, 51.3 and 46.2 kips compared to the design load of 13.65 kips. The three specimens that failed in the weld had ultimate strengths of 50.1, 51.5 and 46.2 kips. Except for Specimen T6 the ultimate strengths of the weld failures are equal to the ultimate strengths of the specimens which failed in the bars. Specimen T6 had the smallest weld size of the three specimens that failed in the weld. The reduced weld size may be the result of the end of the bar being cut out-of-square and not due to poor welding. The weld on T6 was more than adequate for the design load (i.e the factors of safety for yield and ultimate loads were found to be 2.18 and 3.38 respectively).

3.3 Field Tests of Embedded Plates

The field tests were conducted by setting the load cell instrument for a given load and pumping the hydraulic jack until the load was reached. Photographs showing the test set up are presented on sheets 4 and 5 of Appendix D. Specimens F1, F2, F3 and F5 (EP512 plates) were loaded in increments of 3 kips up to a total load of 15 kips. Specimens F4 and F6 (EP912 plates) were loaded in increments of 4 kips from 2 kips up to 30 kips. Two dial gages attached to the load cell and bearing on the concrete adjacent to the plate were used to read the average deflection of the plate. In the test of Specimen F2 one dial gage was bearing on the plate and one on the concrete because the 1-1/2" diameter stud that was welded to the plate for attachment of the jacking assembly was not centered on the plate, due to positioning of the hold down expansion anchors which had to be positioned to clear reinforcing bars.

Figure 4 shows the results of average deflection versus load for the tests of Specimens F4 and F6 which were loaded to 30 kips. At the maximum load of 30 kips the deflection was 0.0224 inch for Specimen F4 and 0.0108 inch for Specimen F6. Specimen F4 had a very slight increase in deflection under load while Specimen F6 exhibited no increase in deflection while the load was held at 30 kips for 2 minutes. The small amount of increase in deflection of plate F2 is not significant and is attributable to adjustment at the grip of the threaded attachments. After the initial increase in the deflection, no additional increase was observed. The larger deflection at working load for the EP912 plates as compared to the EP512 plates is caused primarily by increased bending of the plate at the higher loads. The deflection of all specimens was much less than the acceptance limit of 0.25 inch.

All six curves for the field tests exhibit essentially a linear performance and a stable deflection at the maximum load. The difference in slope of the curves is not significant and is due primarily to the location and relative perpendicularity of the 1-1/2" diameter stud through which the load was applied. There were no audible sounds or sudden changes of deflection during any of the tests nor was there any indication of yielding of the plate or studs.

4. Exceptions Taken in Procedure

Although the detailed procedures were followed closely during the testing, the following minor deviations were necessary to accommodate the test equipment.

1. In tension testing at Lehigh University, the nut and the 3" x 3" washer plates at the threaded end of the rod were cut off in order to fit the rod in the Baldwin testing machine.

2. Since the 3" x 3" washer plates were removed from the anchor rod, the appropriate red color markings and the plate designations were transferred to the 4" x 4" plate at the other end.

None of the above listed deviations had any impact on the test results.

5. Summary and Conclusions

This testing program included bend and tension tests on single manually welded anchor rods and proof load tests of embedded plates with machine welded studs. The following conclusions have been derived from the test results.

1. Manual welds are sufficient to develop the full bending strength of the bars even though visual inspection of the welds reveals that welds are undersize in some areas of the circumference.

2. Manual welds with undersized welds (believed to represent worst case condition) are sufficient to develop the full yield strength of the anchor rods. Test specimens exhibited satisfactory ductility well beyond the yield limit even though three specimens failed in the weld.

3. Weld failures in the tension tests were not of any significance since the failure loads were approximately the same as the ultimate capacity of the anchor rods.

4. Plates with machine welded studs, tested in place, were sound and exhibited only the expected amount of deflection at the maximum design load.

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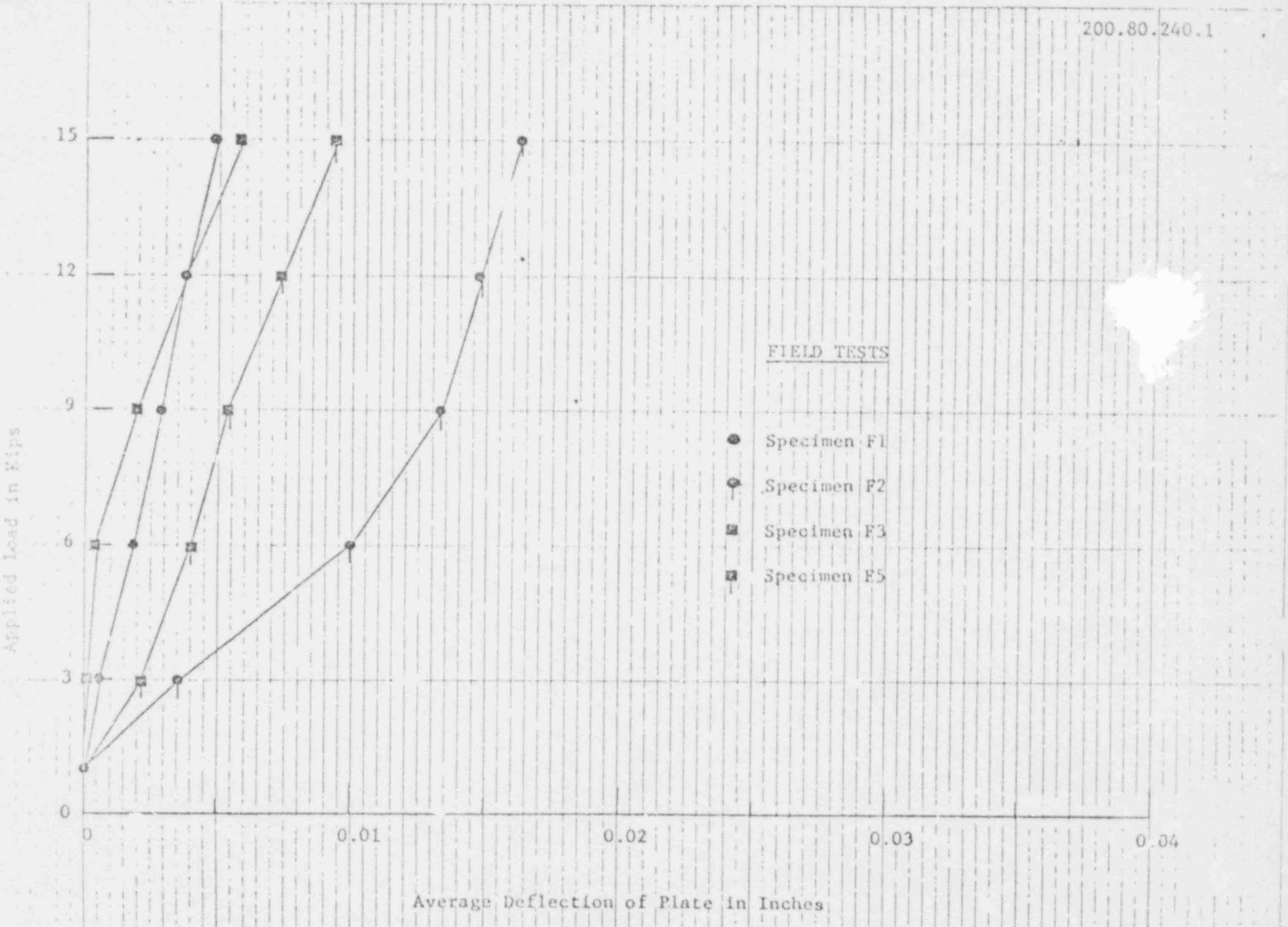
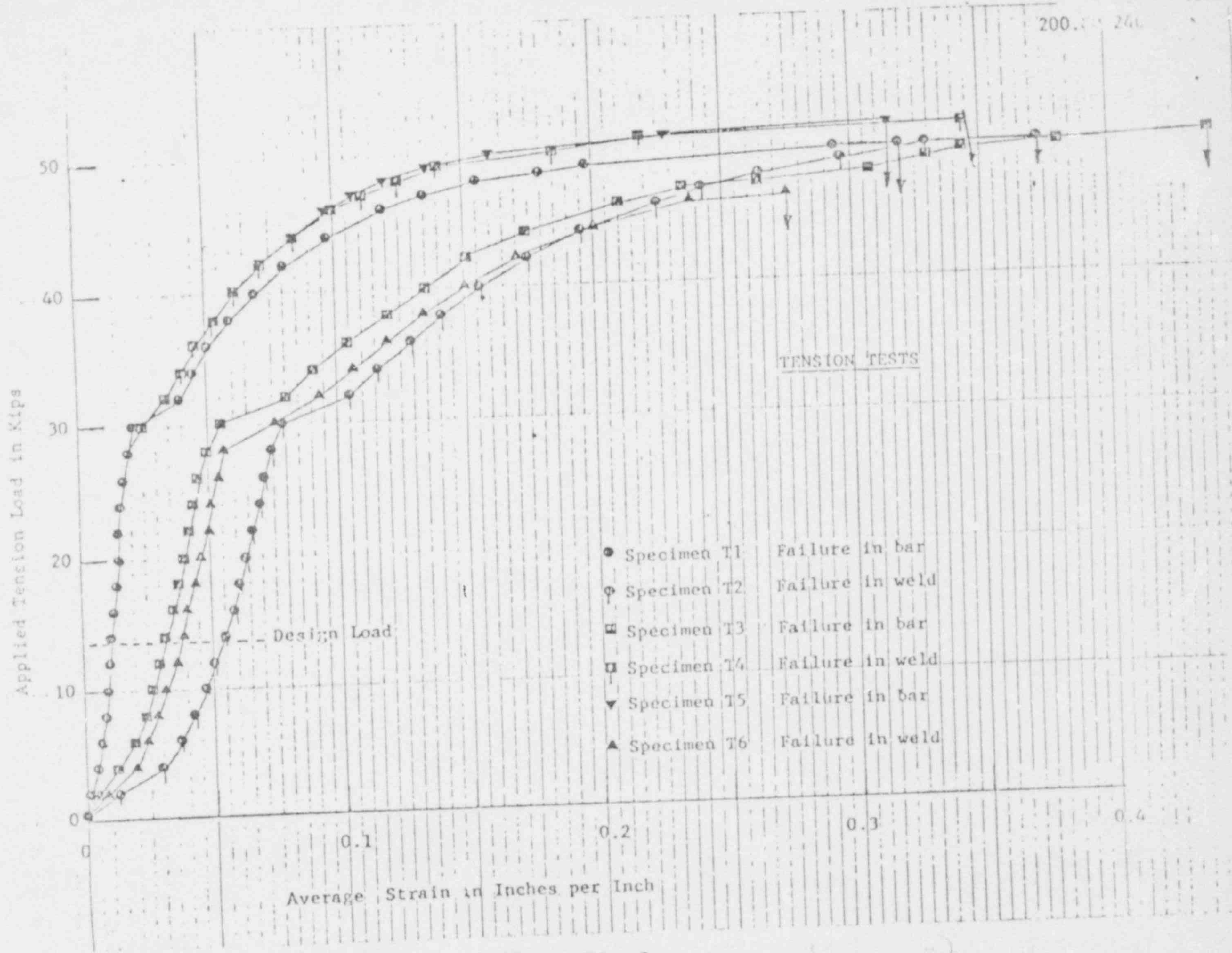
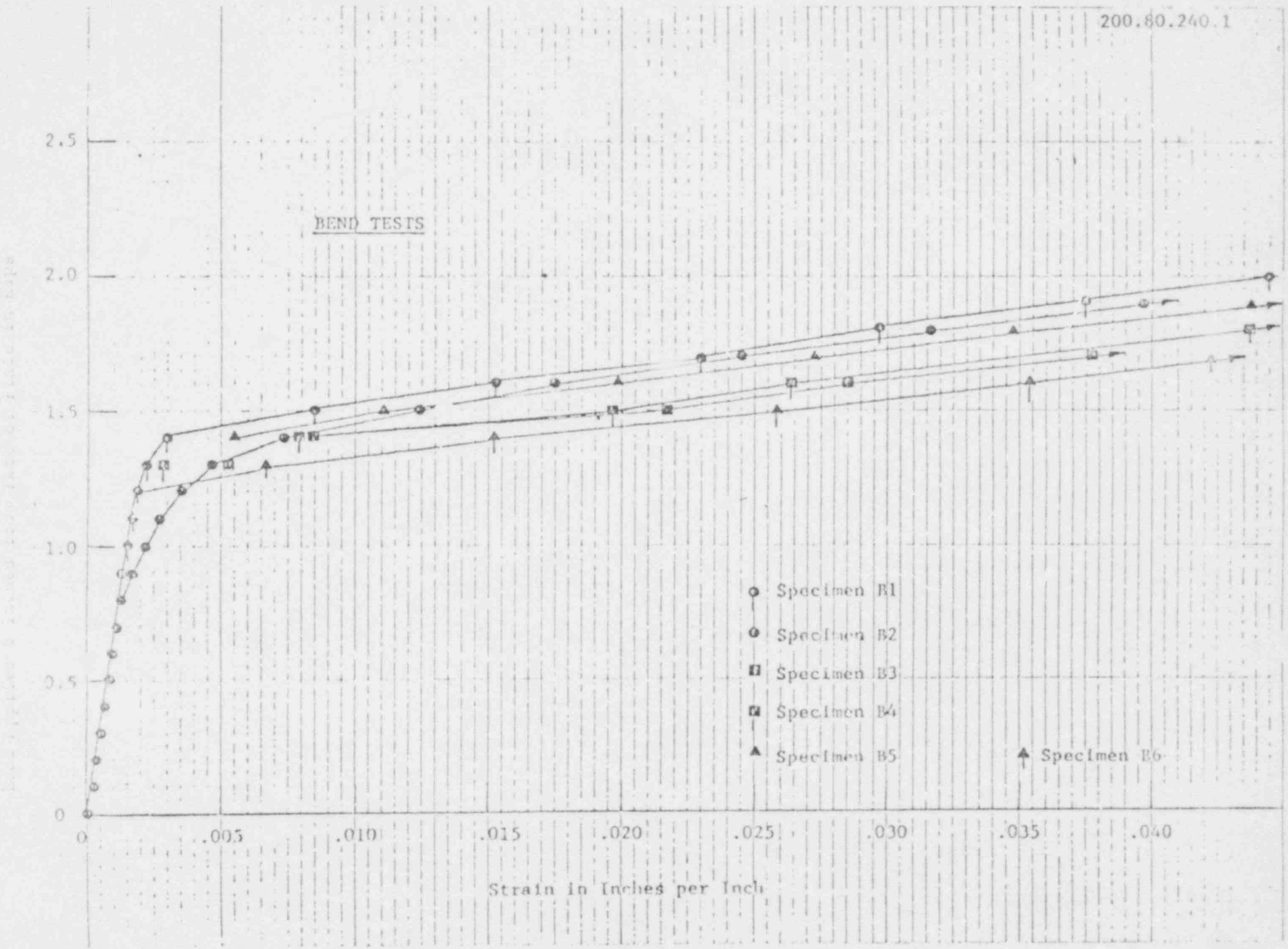


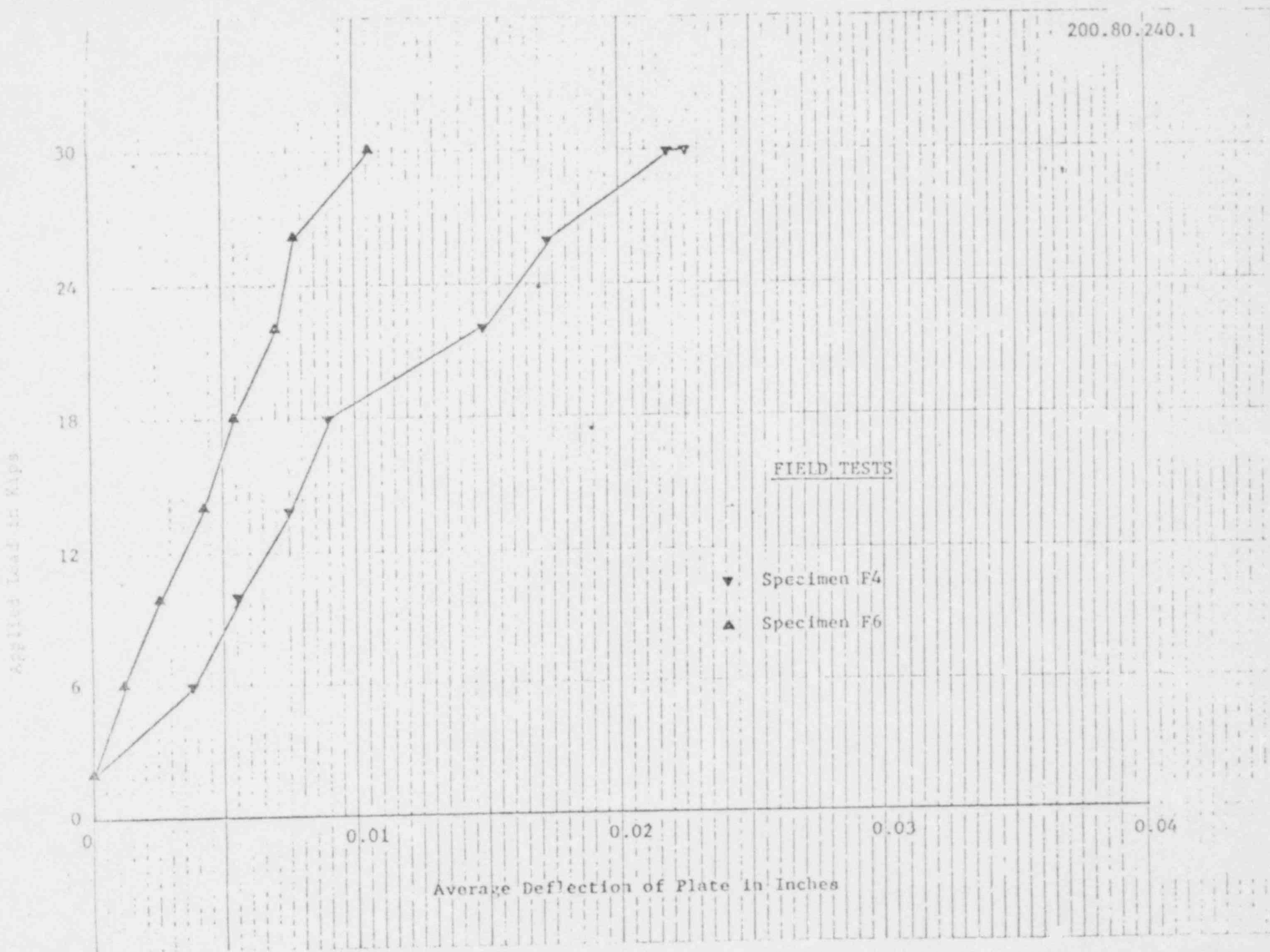
Test Report on Anchor and Stud Welding: Fig. 3



Test Report on Anchor and Stud Welding: Fig. 2



Test Report on Anchor and Stud Welding: Fig. 1



Test Report on Anchor and Stud Welding: Fig. 4