

SACRIFICIAL SHIELD WALL

- ANALYSIS, DESIGN, CONSTRUCTION OF SSW

- o BWR MARK II
- o 1100 MW PLANT

Docket # 50-397
Control # 8007310013
Date 7-11-80 of Document:
REGULATORY DOCKET FILE

Approved: _____
Special Agent in Charge

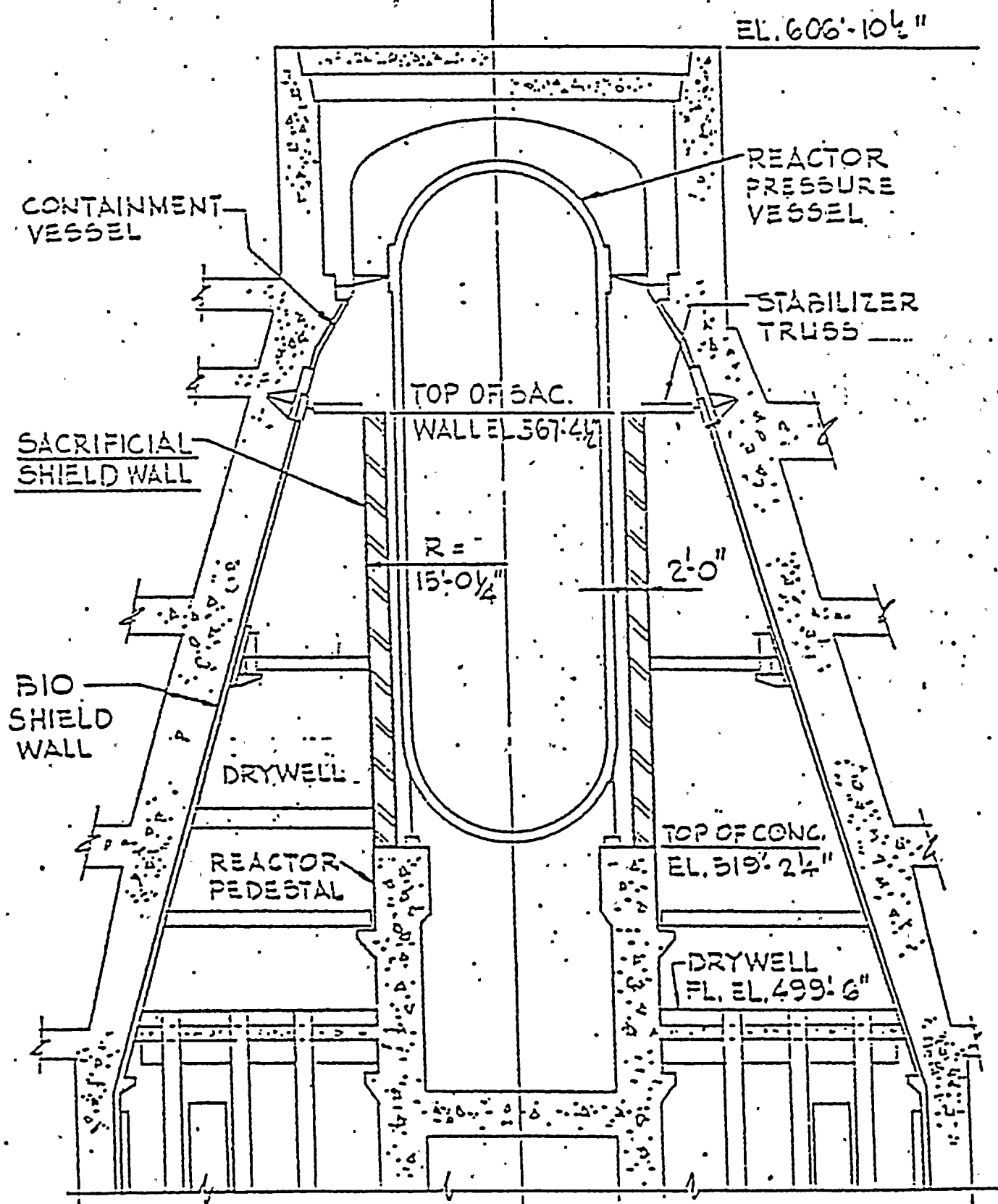
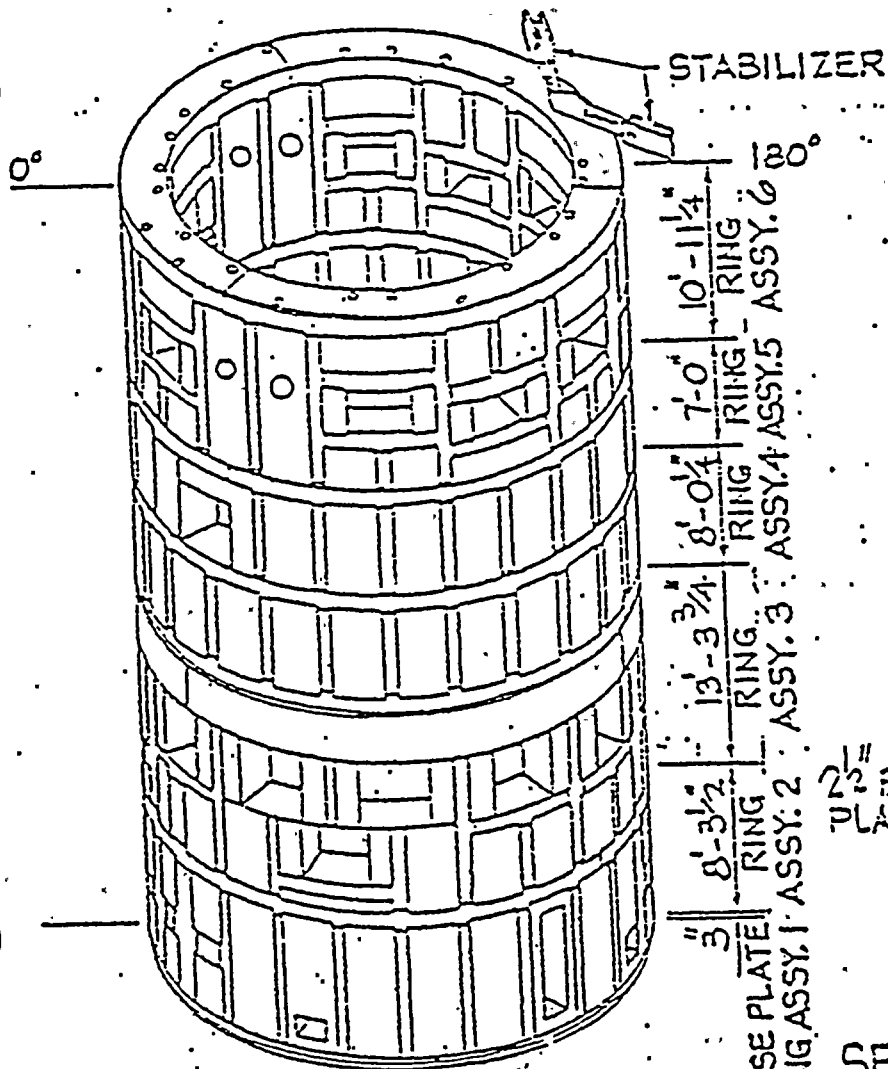
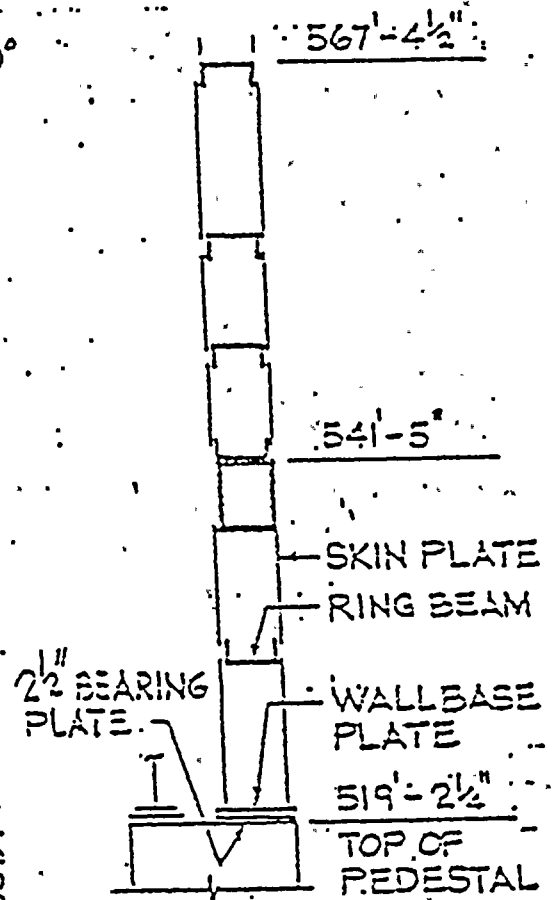


FIG. 1

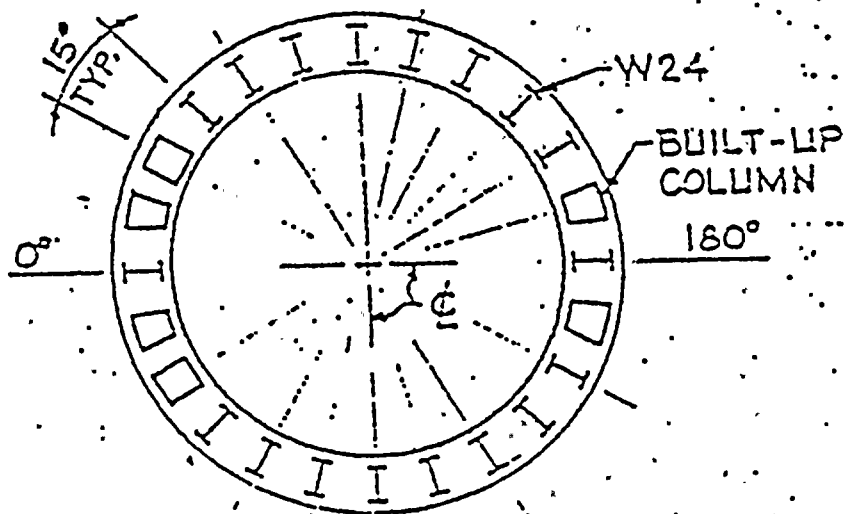
REACTOR BUILDING DRY WELL.



ISOMETRIC VIEW



SECTIONAL ELEVATION



PLAN AT THE BASE

SACRIFICIAL SHIELD WALL

ANALYSIS AND DESIGN OF SSW - BASIC DATA

- APPROVAL DOCUMENT

- o REPORT No. WPPSS-74-2-R2-B
- o APPROVED BY USNRC LETTER, OCT. 15, 1975

- CONFORMANCE WITH USNRC STANDARD REVIEW PLAN 3.8.3

- o LOADS
- o LOAD COMBINATIONS
- o ACCEPTANCE CRITERIA

- BASIS OF DESIGN

- o ELASTIC WORKING STRESS METHOD - PART 1, AISC 1959

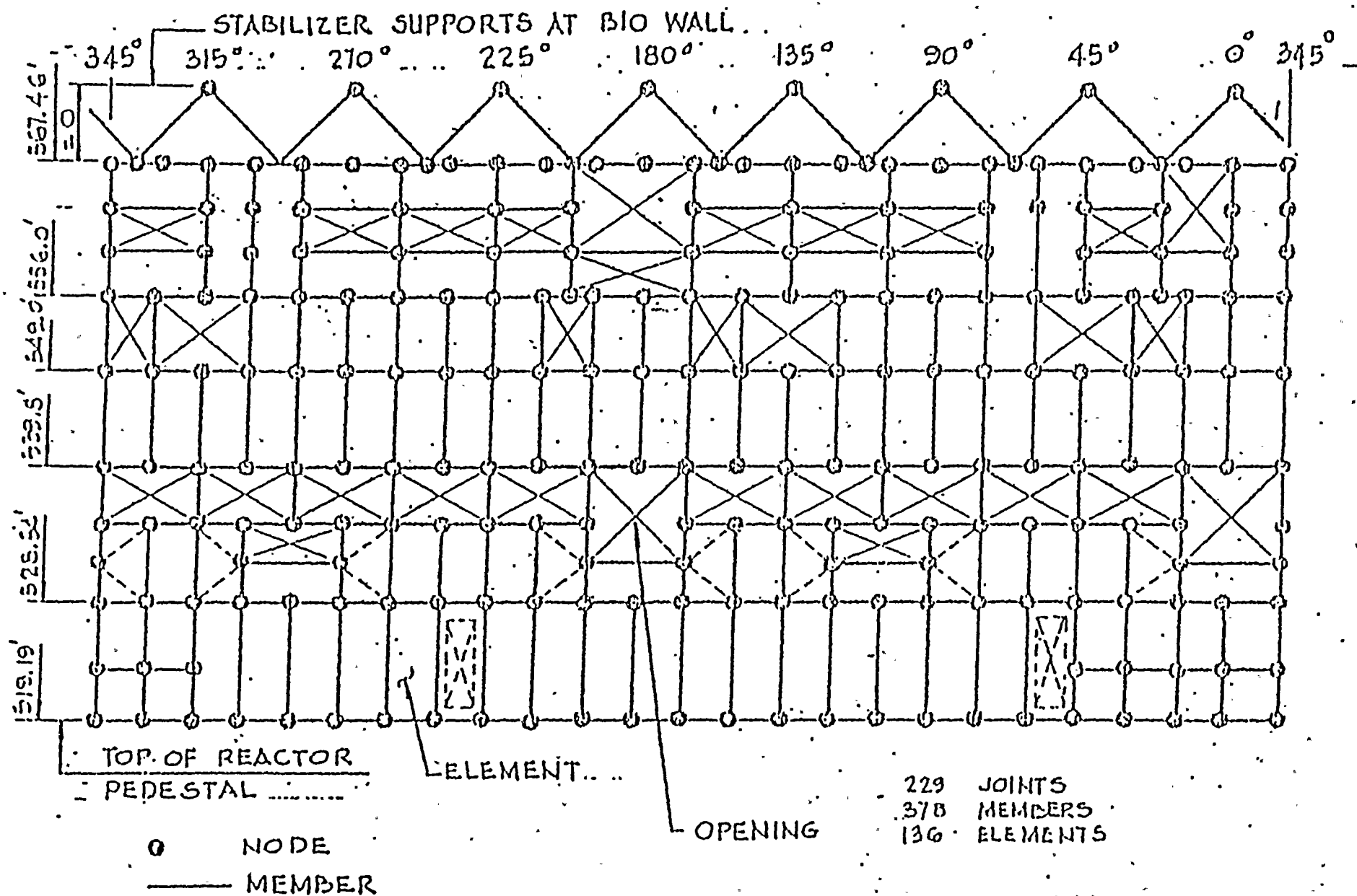


FIG. 3 COMPUTER MODEL OF THE SACRIFICIAL SHIELD WALL

ANALYSIS OF SSW AS SPACE FRAME

— ANALYTICAL MODEL CLOSELY SIMULATES ACTUAL STRUCTURE.

- BEAMS AND COLUMNS: MEMBERS OF SPACE FRAME WITH CONTINUITY AT INTERNAL JOINTS
- MODEL EXTENT: FROM RPV PEDESTAL TO CONTAINMENT VESSEL, INCLUDING STABILIZER TRUSS.
- SKIN PLATES: FINITE ELEMENTS WITH NODES AT THE FRAMEWORK JOINTS.
- ANALYSIS: VIA COMPUTER PROGRAM 'STRUDEL'



BOUNDARY CONDITIONS

- AT PEDESTAL, 24 JOINTS: ONE AT EACH COLUMN
 - o VERTICAL DEFLECTION IS ZERO
 - o NO RESTRAINT ON RADIAL MOVEMENT
 - o HORIZONTAL REACTION IS CIRCUMFERENTIAL
 - o NO MOMENT
- AT JUNCTION OF STABILIZER TRUSS AND CONTAINMENT VESSEL, 8 JOINTS.
 - o ONLY REACTION IS TANGENTIAL

SIGNIFICANT LOADS

- TYPES OF LOADS
 - o DEAD (D) AND LIVE (L)
 - o SEISMIC: OBE (E) AND SSE (E')
 - o PRESSURIZATION OF ANNULUS (PA)
 - o REACTIONS DUE TO PIPE BREAK (Y_R)
- ANNULUS PRESSURIZATION DUE TO BREAK IN
 - o RECIRCULATION OUTLET LINES
 - o RECIRCULATION INLET LINES
 - o FEEDWATER LINES
 - o RHR/LPCI LINES
- PIPE BREAK REACTIONS DUE TO BREAK IN
 - o LINES LISTED ABOVE IN ANNULUS
 - o CONTROLLING LINES IN DRYWELL



LOAD COMBINATIONS AND ACCEPTANCE CRITERIA

(USHRC STANDARD REVIEW PLAN)

- CRITICAL COMBINATIONS ARE

$$o \quad 1.6S \geq D + L + T_o + R_o + E' \quad (3)$$

$$o \quad 1.6S \geq D + L + T_A + R_A + P_A \quad (4)$$

$$o \quad 1.6S \geq D + L + T_A + R_A + P_A + Y_J + Y_R + Y_M + E \quad (5)$$

$$o \quad 1.7S \geq D + L + T_A + R_A + P_A + Y_J + Y_R + Y_M + E' \quad (6)$$

- SIGNIFICANT LOADS

o DEAD & LIVE (D & L)

o SEISMIC (E OR E')

o ANNULUS PRESSURE (P_A)

o PIPE WHIP REACTIONS (Y_R)

DESIGN OF SACRIFICIAL SHIELD WALL

- DESIGN METHOD

- o ELASTIC WORKING STRESS METHOD, PART 1 OF 1969.AISC

- MATERIAL

- o PLATES AND MEMBERS EXCEPT TOP RING - A36 STEEL
- o TOP RING - A588 STEEL
- o WELD METAL - E70XX OR EQUIVALENT

- MEMBER DESIGN: RING BEAMS AND COLUMNS

- o COMPUTER OUTPUT - 3 COMPONENTS EACH OF FORCE AND MOMENT AT ENDS OF ALL MEMBERS
- o INTERMEDIATE VALUES OF STRESS RESULTANTS OBTAINED AS REQUIRED
- o DESIGN OF EACH MEMBER TYPE - CONTROLLING STRESS RESULTANTS USED
- o END CONNECTIONS - FULL STRENGTH WELDED CONNECTIONS

- SKIN PLATE DESIGN

- o COMPUTER OUTPUT - MEMBRANE STRESSES (NORMAL AND SHEAR)
- o DESIGN - PLATE THICKNESS AND ATTACHMENT WELDS DETERMINED BY CONTROLLING STRESSES IN TYPICAL AREAS OF SSW



CONCERN NO. 1 NARRATIVE

(SSW) RING 3 AND RING 4 OF THE SSW ARE NOT WELDED TOGETHER AS SHOWN ON THE DESIGN DRAWINGS. NUMEROUS WELDS WERE MADE TO SHIMS BETWEEN THE RINGS, IN LIEU OF ACTUALLY WELDING THE RINGS TOGETHER. THE A/E, TENTATIVELY, INTENDS TO INSTALL A 2 INCH PARTIAL PENETRATION WELD AROUND THE CIRCUMFERENCE OF THE SSW TO STRUCTURALLY JOIN RING 3 TO RING 4.

INTRODUCTION

I WILL BE TALKING ON CONCERN NO. 1 WHICH INVOLVES WORK AT ELEVATION 541'5" IN THE SHIELD WALL. LET US PROCEED TO THE TRANSPARENCIES AND A SECTION OF THE WALL AT THIS LEVEL. (SEE TRANSPARENCY NO. 2)

TRANSPARENCY NO. 1 NARRATIVE

STRUCTURAL REPAIR AT INTERFACE EL. 541'5"

THIS TALK ADDRESSES THE METHOD OF TRANSMISSION OF HORIZONTAL SHEAR ACROSS THE INTERFACE AT ELEVATION 541'5" IN THE SHIELD WALL. THE PROBLEM HERE IS THAT RINGS 2 AND 3, ABOVE AND BELOW THE INTERFACE, HAVE NOT BEEN WELDED TOGETHER AS SHOWN ON THE CONTRACT DRAWINGS. IT IS NOTED THAT I HAVE USED THE TERMINOLOGY OF THE CONTRACT DRAWINGS. THE NRC MEMO REFERS TO THESE RINGS AS 3 AND 4.

THE PROPOSED CORRECTION MEASURE INVOLVES THE INSTALLATION OF A PARTIAL PENETRATION WELD ALONG THE EXTERIOR CIRCUMFERENCE BETWEEN THE TWO RINGS. THIS REPRESENTS A CHANGE FROM THE ORIGINAL DESIGN AND AS SUCH IS OF CONCERN TO USNRC.

THIS TALK WILL FIRST DESCRIBE THE CONTRACT REQUIREMENTS AND THE PROPOSED CORRECTION WELD. THEN THE DESIGN CONCEPT FOR THE CORRECTION WILL BE DISCUSSED AND FINALLY THE CONTROLLING FEATURES OF THE CORRECTION WILL BE STATED. THESE FEATURES ARE THE CONTROLLING LOADING, LOAD COMBINATION AND DESIGN MARGIN.

STRUCTURAL REPAIR AT INTERFACE EL. 541'-5"

- CONDITION AT INTERFACE EL. 541'-5"
 - o TRANSMISSION OF HORIZONTAL SHEAR ACROSS INTERFACE
 - o RINGS 2 AND 3 ARE NOT WELDED TOGETHER AS SHOWN ON CONTRACT DRAWINGS.
- CONCERN RELATIVE TO PROPOSED CORRECTION
 - o PROPOSED CORRECTION INVOLVES PARTIAL PENETRATION WELD ALONG EXTERIOR CIRCUMFERENCE BETWEEN THE RINGS.
 - o THIS REPRESENTS A CHANGE FROM ORIGINAL DESIGN
- SCOPE OF TALK
 - o CONTRACT REQUIREMENTS
 - o CORRECTION WELD DESCRIPTION
 - o DESIGN CONCEPT FOR THE CORRECTION
 - o CONTROLLING FEATURES OF CORRECTION - LOADING, LOAD COMBINATION, DESIGN MARGIN.

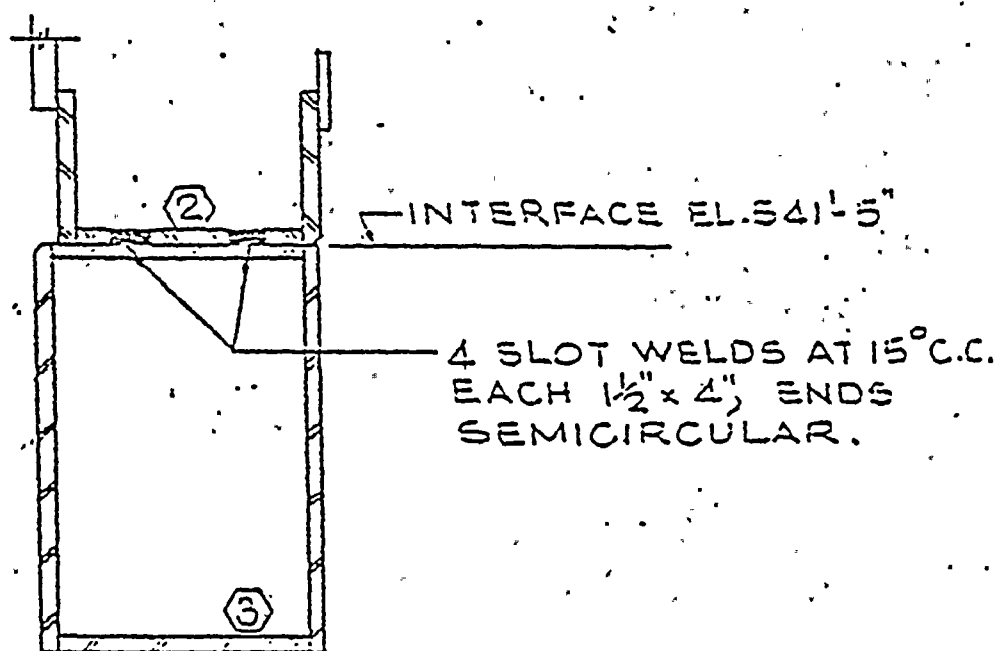
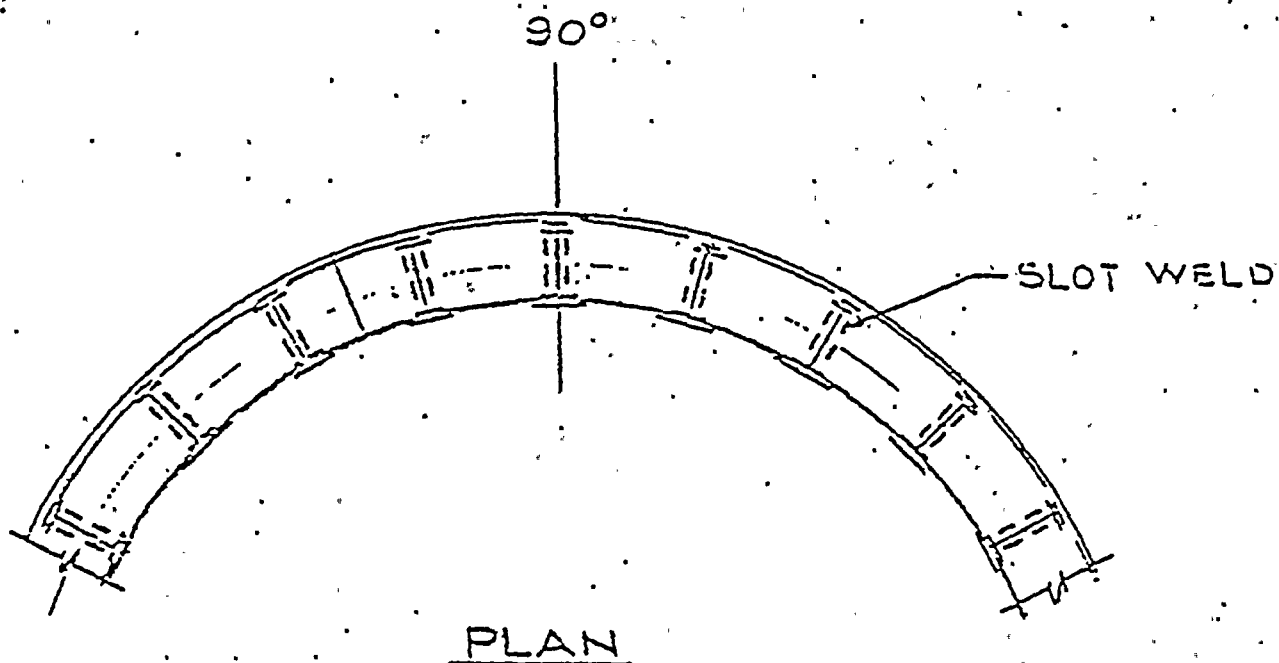
TRANSPARENCY NO. 2 NARRATIVE

CONTRACT REQUIREMENT - PROVISION FOR

SHEAR AT INTERFACE EL. 541'5"

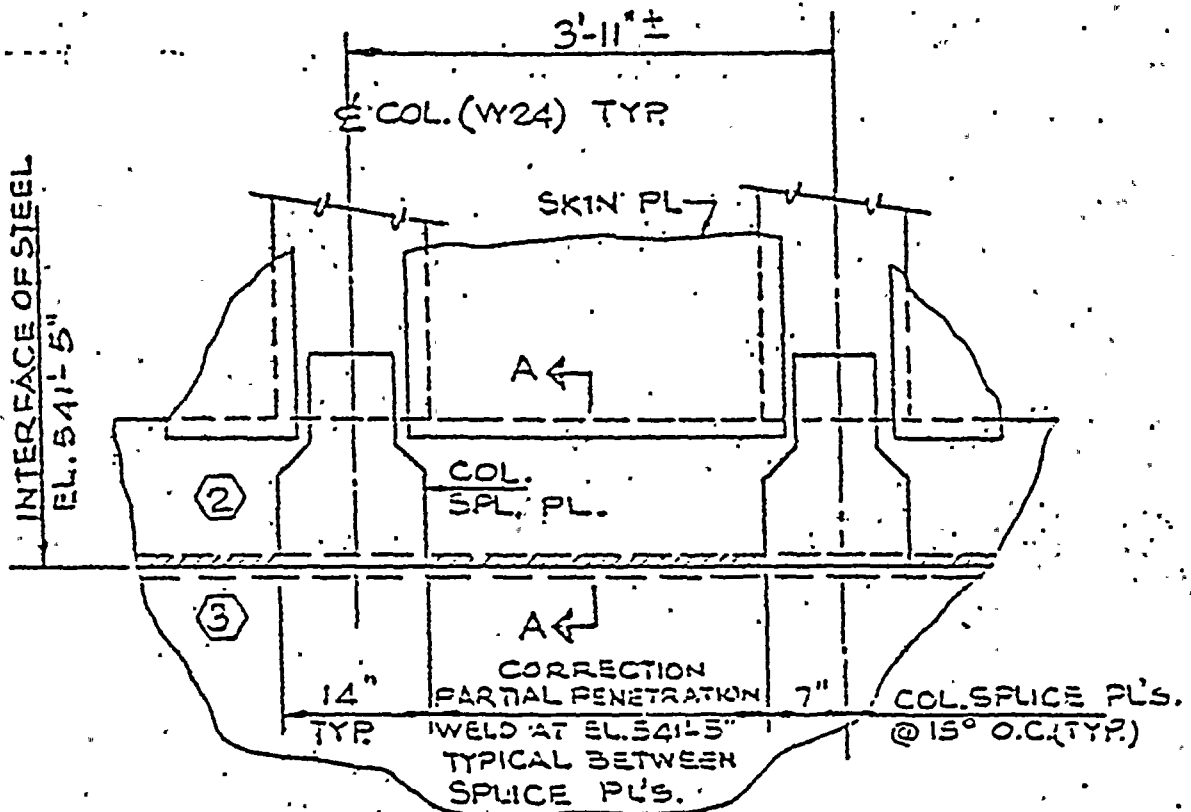
THE SPECIAL REQUIREMENTS FOR SHEAR TRANSMISSION AT THE INTERFACE AT EL. 541'5" FOLLOW FROM THE METHOD OF ERECTION OF THE SHIELD WALL. AS WAS NOTED IN THE PREVIOUS TALK, THE SHIELD WALL WAS ERECTED IN TWO PHASES WITH THE INTERFACE AT EL. 541'5" SEPARATING THE UPPER AND LOWER PORTIONS.

- o AS SEEN IN THE CROSS SECTION, THE INTERFACE LIES BETWEEN UPPER CHANNEL 2 AND THE LOWER BOX BEAM 3.
- o THE CONTRACT PROVIDED FOR TRANSMISSION OF HORIZONTAL SHEAR BY SLOT WELDS IN CHANNEL WEB JOINING THE BOX BEAM.
- o AS INDICATED IN THE PLAN, 4 SLOT WELDS WERE PROVIDED IN THE VICINITY OF EACH OF THE 24 WF COLUMNS WHICH JOIN THE CHANNEL FROM ABOVE.
- o IN ORDER TO PLUMB THE UPPER PORTION OF THE WALL ABOVE EL. 541'5", SHIMS WERE PLACED BETWEEN MEMBERS 2 AND 3. THEN, IN MANY CASES THE SLOT WELDS THROUGH THE CHANNEL WEB WERE MADE TO THE SHIMS INSTEAD OF TO MEMBER 3. THUS, THE CONTRACT REQUIREMENT WAS VITIATED.

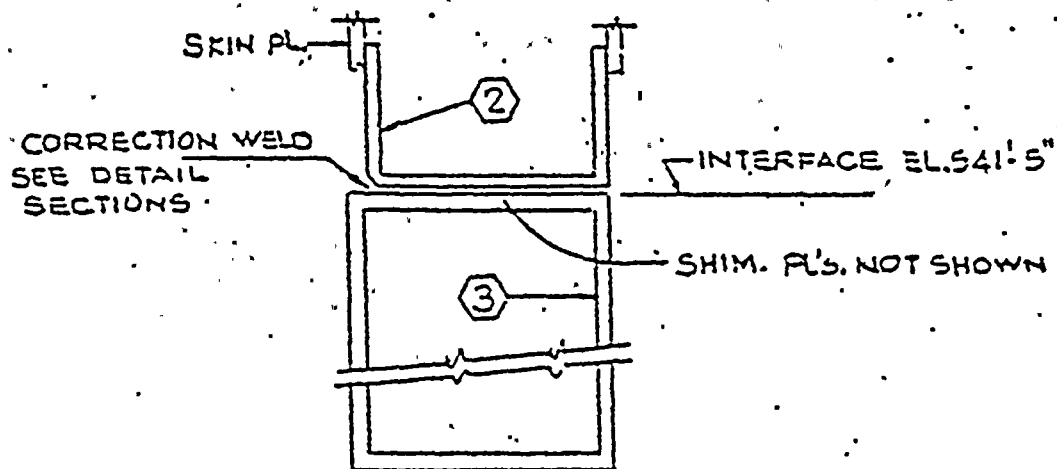


CROSS SECTION OF SAC. SHIELD WALL
AT INTERFACE

PROVISION FOR SHEAR AT INTERFACE EL. 541'-5"
CONTRACT REQUIREMENTS.



EXTERIOR ELEVATION



SECTION A-A

PROPOSED INTERFACE CORRECTION

TRANSPARENCY NO. 3 NARRATIVE

PROPOSED INTERFACE CORRECTION -
ELEVATION AND SECTION

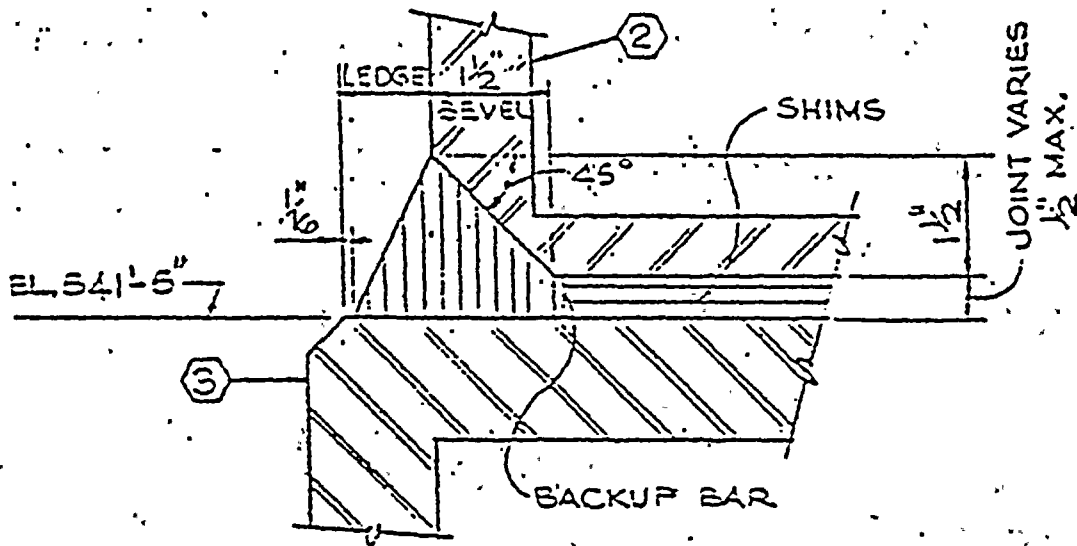
THE EXTENT AND GENERAL FEATURES OF THE CORRECTION WELD ARE SHOWN IN THESE VIEWS.

SECTION A-A, TAKEN ACROSS THE SHIELD WALL, SHOWS:

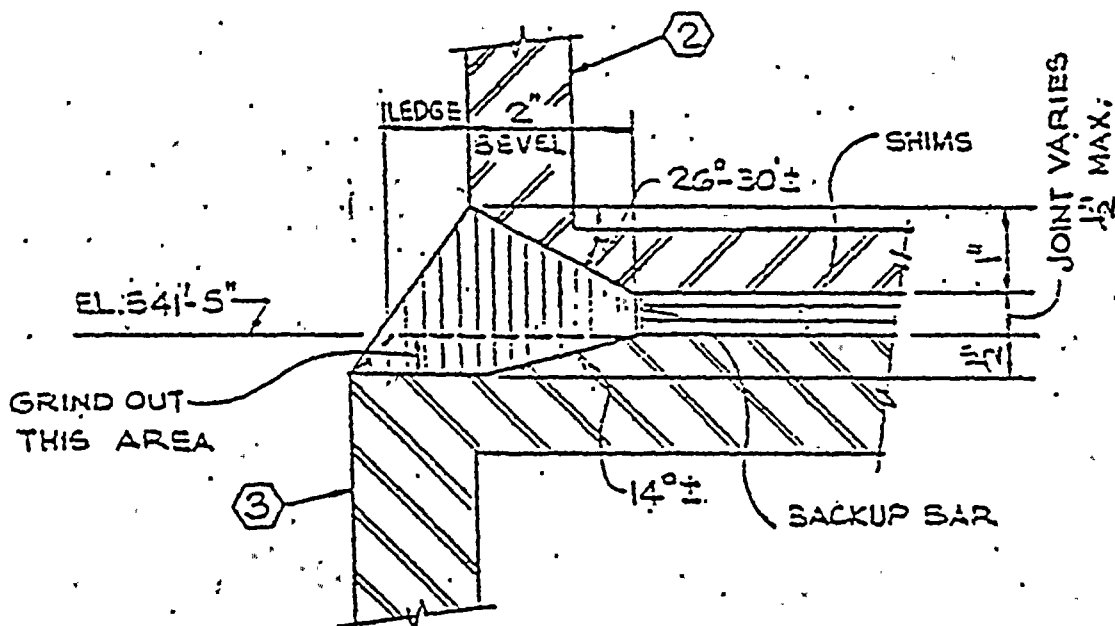
- ° CHANNEL MEMBER 2 ABOVE THE INTERFACE AND BOX MEMBER 3 BELOW THE INTERFACE.
- ° SEIM PLATES HAVE BEEN INSTALLED BETWEEN THE TWO MEMBERS UP TO A MAXIMUM THICKNESS OF 1/2 INCH.
- ° THE CORRECTION WELD IS A PARTIAL PENETRATION GROOVE WELD BETWEEN THE TWO MEMBERS.

THE UPPER VIEW IS AN EXTERIOR ELEVATION OF THE WALL.
IT SHOWS:

- ° THE INSTALLED COLUMN SPLICE PLATES WHICH JOIN THE UPPER COLUMNS TO THE BOX BEAMS BELOW THE INTERFACE.
- ° THE PROPOSED CORRECTION WELD WHICH WILL EXTEND FOR THE FULL WIDTH BETWEEN SPLICE PLATES IN EACH OF THE 24 PANELS AROUND THE WALL.



SECTION WHERE LEDGE IS A MINIMUM OF 1" WIDE

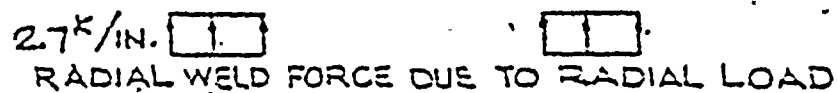


SECTION WHERE LEDGE IS LESS THAN 1" WIDE,

PROPOSED INTERFACE CORRECTION-DETAILS.

DESIGN CONCEPT - PROPOSED INTERFACE CORRECTION

- HORIZONTAL SHEARS ARE TRANSMITTED BETWEEN RING CHANNEL 2 AND RING BOX 3 :
- HORIZONTAL SHEARS FROM CHANNEL 2 ARE DUE TO
 - o HORIZONTAL REACTIONS BETWEEN SKIN PLATES AND CHANNEL
 - o HORIZONTAL REACTIONS BETWEEN W24 COLUMNS AND CHANNEL
- DIRECTIONS OF SHEARS ARE
 - o TANGENTIAL (CIRCUMFERENTIAL) FROM SKIN PLATES.
 - o TANGENTIAL AND RADIAL FROM COLUMNS
- ANALYSIS IS BASED ON ONE 15° PANEL (BETWEEN W24 COLUMNS)
 - o LARGEST COMBINED SHEAR IN ANY ONE PANEL IS USED
 - o SAME CORRECTION IS APPLIED TO ALL PANELS
- WELD DESIGN
 - o WELDING PROCEDURES WILL BE QUALIFIED IN ACCORDANCE WITH REQUIREMENTS OF AWS D1.1.
 - o ALLOWABLE STRESSES ASSOCIATED WITH PARTIAL PENETRATION GROOVE WELDS ARE USED FOR CORRECTION DESIGN.



PLAN OF PANEL SHOWING WELD RESISTING FORCES.



CONTROLLING FEATURES - PROPOSED CORRECTION

- CONTROLLING PANEL SHEAR

- o DUE TO DEAD, LIVE, SEISMIC (OBE), AND ANNULUS PRESSURIZATION AND PIPE REACTION BOTH CAUSED BY FEEDWATER BREAK.

- o PANEL TANGENTIAL SHEAR: 327.0 KIPS

- o PANEL RADIAL SHEAR: 27.4 KIPS

- CONTROLLING LOAD COMBINATION WITH ACCEPTABLE STRESS LEVEL.

- o SRP COMBINATION 5: $1.6 S \geq D + L + PA + YR + E$

- CONTROLLING DESIGN MARGIN

- o PERMISSIBLE STRESS/ACTUAL STRESS = 2.3

PROBLEM 3

(SSW) NUMEROUS DEFICIENCIES IN STRUCTURAL WELD QUALITY HAVE BEEN IDENTIFIED ON THE SSW STRUCTURE. THE DEFICIENCIES WERE IDENTIFIED IN WELDS WHICH WERE SUPPOSEDLY INSPECTED AND ACCEPTED. DEFICIENCIES INCLUDE CRACKS, UNDERCUT, OVERLAP AND SLAG ON WELDS (INDICATING INSPECTIONS COULD NOT HAVE BEEN PROPERLY PERFORMED)..

CONCERN NO. '3

WNP-2 ACTION PLAN

- ISSUED A "STOP WORK ORDER" ON SSW

- INVESTIGATION

- REVIEW OF INSPECTION RECORDS ON SSW SINCE
WALL WAS COMPLETED

- ESTABLISHED A REINSPECTION PROGRAM

- PERFORMED SAMPLE U.T. EXAMINATIONS

- PROBLEM STATUS

I SSW INSPECTION RECORDS

(SINCE WALL WAS COMPLETED)

- APPROXIMATELY 500 ATTACHMENTS/INSPECTIONS
- REVIEW OF INSPECTION REPORTS (IR) AND NONCONFORMING REPORTS (NCR) ON SSW IDENTIFIED 31 DEFECTS:

- 3 POROSITY AND SLAG
- 2 CRACKS IN BASE MATERIAL
- 18 CRACKS IN WELDMENTS
- 2 UNDERCUT
- 6 LACK OF FUSION (COLD LAP)

- MAGNETIC PARTICLE EXAMINATIONS.

--- WP-84 APPLIED (1/78)

- (A) EXAMINATION OF BASE MATERIAL
- (B) MINIMUM OF FOUR MT EXAMINATIONS
ON EACH WELDED JOINT

--- MT REPORTS BEING REVIEWED



II REINSPECTION PROGRAM

- o 100% REINSPECTION OF ALL ACCESSIBLE WELDS BY AN AWS WELD INSPECTOR AND A WELDING ENGINEER
- o IDENTIFICATION OF TYPE AND EXTENT OF DEFICIENCIES
- o CURRENT STATUS
 - ESTIMATED NUMBER OF ACCESSIBLE WELDS ON SSW 1500
 - NUMBER INSPECTED AS OF JANUARY 31, 1980 1014
 - NUMBER OF WELDS CONFORMING TO AWS D1.1 509
 - NUMBER OF NONCONFORMING TO AWS D1.1 505
- o TYPE OF DEFICIENCIES:
 - POROSITY
 - INCOMPLETE FUSION ("OVERLAP", "COLD LAP")
 - IMPROPER PROFILE EXCESS CONVEXITY, UNDERSIZED,
 - CRATERS - NOT CRACKED
 - ARC STRIKES

III SAMPLE U.T. EXAMINATIONS

- PERFORMED UT EXAMINATIONS OF ELEVEN ELECTROSLAG GROOVE WELDS
- ALL WELDS WERE ACCEPTABLE

III PROBLEM STATUS

- THE SIGNIFICANCE OF THE REJECTABLE INDICATIONS WILL BE ANALYSED.
- ANY DEFECT THAT IS DETERMINED TO BE STRUCTURALLY SIGNIFICANT WILL BE EVALUATED VERSUS THE ORIGINAL DESIGN LOADING
- OVERALL INVESTIGATION OF SSW IS NOT COMPLETE, INDIVIDUAL DEFECT EVALUATION HAVE NOT BEEN PERFORMED, AND WE HAVE NOT REACHED A FINAL CONCLUSION.

SSW/PWR

PROBLEM:

(SSW) Voids in the concrete have been identified in the SSW. The voids recently identified may effect the previously accepted corrective action plan, due to the potential increase in magnitude of the voiding problem. This plan may involve use of the operating plant to detect additional voids. Voids also exist between rings 3 and 4 of the SSW (see item #1)

RESPONSE by J. CELNIK:

SHIELDING DESIGN ASPECTS OF SSW

- FUNCTION
 - SHIELD SAFETY-RELATED EQUIPMENT IN DRYWELL
 - PROTECT PERSONNEL DURING SHUTDOWN
- DESIGN CONCEPT (GE)
 - 2' ORDINARY CONCRETE (BETWEEN $\frac{1}{4}$ " STEEL PLATES)
AND 2" STEEL PLATE FOR SHIELDING
- METHOD OF ANALYSIS
 - NRN (1-D REMOVAL - DIFFUSION) + QAD (POINT-KERNEL)
 - VERIFIED WITH ANISN (1-D DISCRETE ORDINATES)
- COMPARISON WITH OTHER ANALYTICAL RESULTS
AND EXPERIMENTAL DATA (ANS, EPRI, NRC)
 - SHIELDING BENCHMARKS
 - OPERATING DATA
- CONCLUSION
 - SSW SHIELD DESIGN IS ADEQUATE
 - DRYWELL DOSE RATES COMPARABLE TO THOSE IN OPERATING
PLANTS

SHIELDING CONCERNS

A: SHIM GAPS

- SSW CONSTRUCTION
 - JOINING OF UPPER AND LOWER PORTIONS AT EL. 541'-5"
 - SHIM INSERTS FOR CONSTRUCTION TOLERANCES
- DISCOVERY OF GAPS
 - DURING INVESTIGATION OF PLUG WELD OF RINGS TO SHIMS
- SURVEY AND DOCUMENTATION
 - 100% CIRCUMFERENTIAL INSPECTION PERFORMED
 - RESULTS
 - 40 SHIM GAPS (25 EXTEND FULL RADICAL WIDTH)
 - LARGEST GAP AREA IS 3/8" X 2 1/2"
- CONCERNS
 - RADIATION STREAMING

RESOLUTION

- FIX METHODOLOGY TO BE CONFIRMED BY PROTOTYPE TESTING

PROTOTYPE TESTING

- CONSTRUCT CHANNELS EXEMPLIFYING GAPS
- INSERT STEEL WOOL BACKING
- POUR SHIELD MATERIAL

(NOTE: SHIELD MATERIAL EXCEEDS SHIELDING EFFECTIVENESS OF SSW)

- VERIFY FILL ADEQUACY

VERIFICATION

- PROTOTYPE TESTING PROGRAM
- IN-SERVICE RADIATION SCAN PROGRAM TO DETECT MINOR GAPS IN SSW AT SHIM LEVEL
- ANY MINOR STREAMING TO BE CORRECTED

B: SSW CONCRETE VOIDS

o POUR TECHNIQUE

- FROM TOP WITH WEEP HOLES (TYPE A)
- FOR 24 COMPARTMENTS ABOVE EL: 541'-5"
FROM WINDOW ON SIDE (TYPE B)

o VOID DISCOVERY

- ON TOP OF SSW, BUT OF NO CONCERN BECAUSE
SIGNIFICANTLY REDUCED RADIATION LEVELS ;
COMPARTMENT HAS BAFFLES WHICH MAY RESTRICT
FLOW (TYPE C)
- UPON INVESTIGATION OF PLUG WELD AND REMOVAL
OF SKIN PLATE, DISCOVERY OF CORNER VOIDS ;
VOID DUE TO POUR TECHNIQUE (TYPE B)

o CONCERNS

- RADIATION STREAMING

o SUSPECT REGION

- 24 COMPARTMENTS ABOVE EL. 541'-5" (TYPE B)
- POSSIBLY IN TYPE C COMPARTMENTS ;
IMPORTANT CONCERN PRIMARILY IN CORE REGION

INSPECTION PROGRAM

- 100% OF COMPARTMENTS TYPE B
- 100% OF TYPE C IN CORE REGION
- RANDOM SAMPLING OF OTHER

NUMBER ~~OF~~ BE DETERMINED BY VOIDS LOCATED
To

RESOLUTION

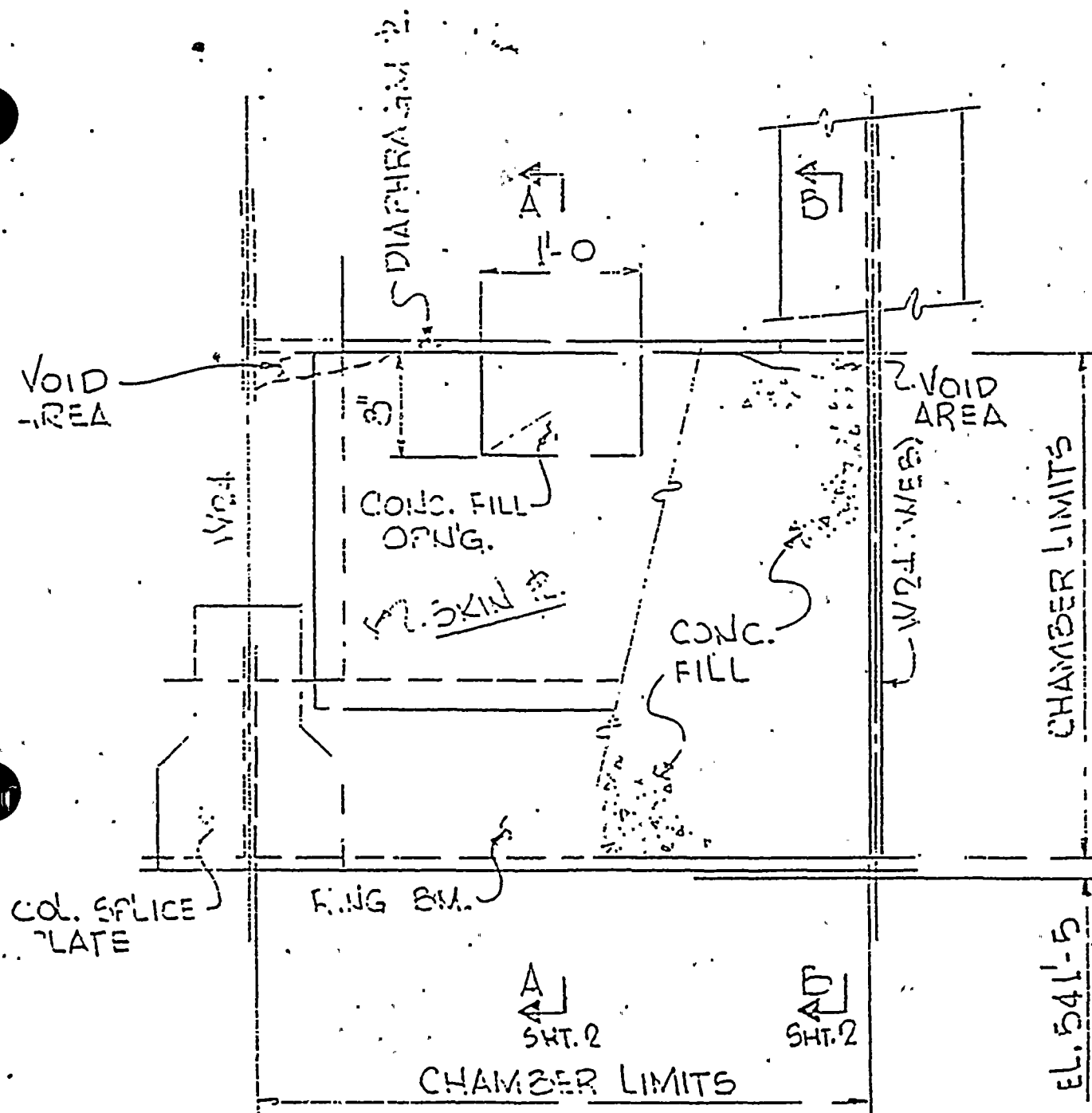
- FIX METHODOLOGY TO BE CONFIRMED BY PROTOTYPE TESTING

PROTOTYPE TESTING

- TEST ADEQUACY OF METHOD OF DETECT HOLES
 - DRILL HOLE IN UPPER CORNERS OF COMPARTMENT
 - BOROSCOPE
 - IF VOID IS FOUND, DETERMINE EXTENT
 - REMOVE SKIN PLATE
 - COMPARE VISUAL EXAMINATION WITH PREVIOUS RESULT
- TEST FILL PROCEDURE
 - DRILL HOLE, BOROSCOPE, LOCATE VOID (IF ANY)
 - FILL HOLE WITH COMPENSATORY SHIELD MATERIAL
 - REMOVE SKIN PLATE
 - VERIFY FILL

IN-SERVICE RADIATION SCAN PROGRAM

- LOCATE AND FIX ANY MINOR VOIDS STILL PRESENT



ELEVATION! LOOKING @ OUTBOARD FACE
OF SAC-SHIELD WALL

CATEGORY I

SHEET 1

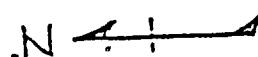
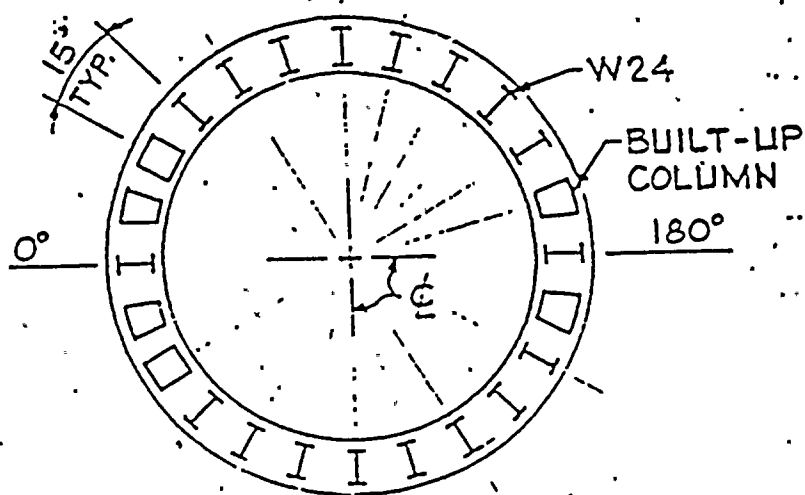
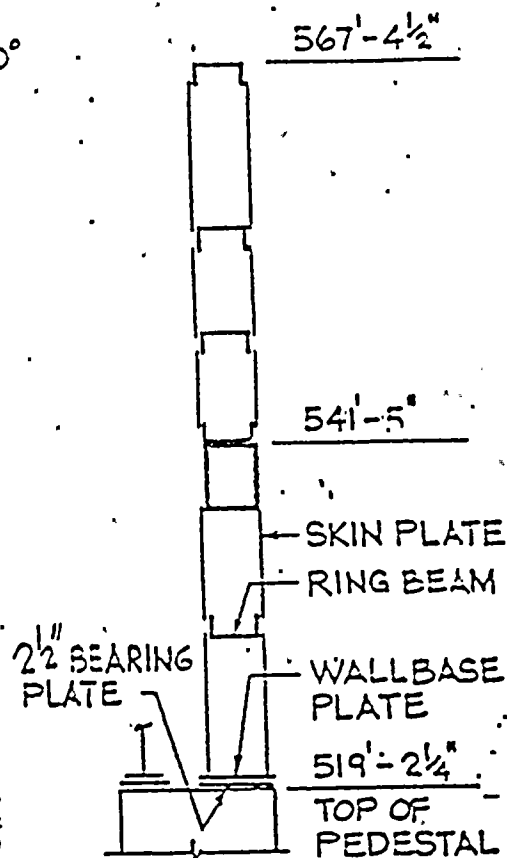
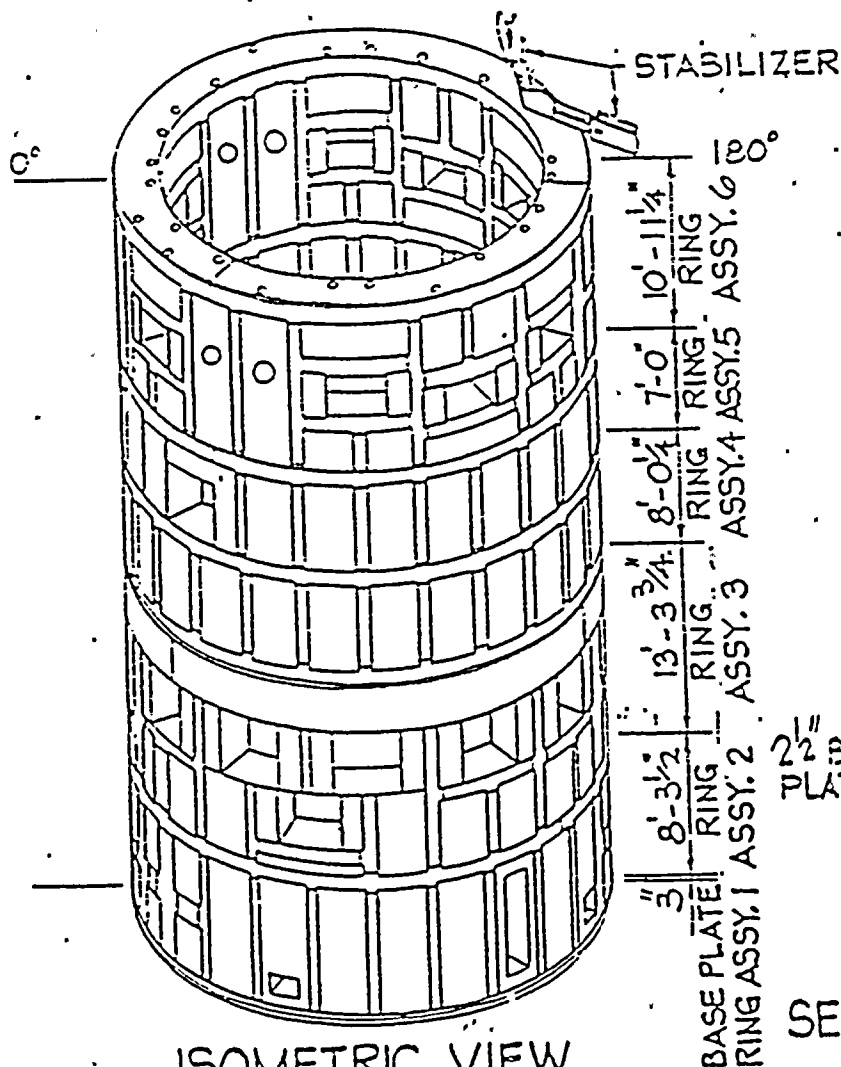
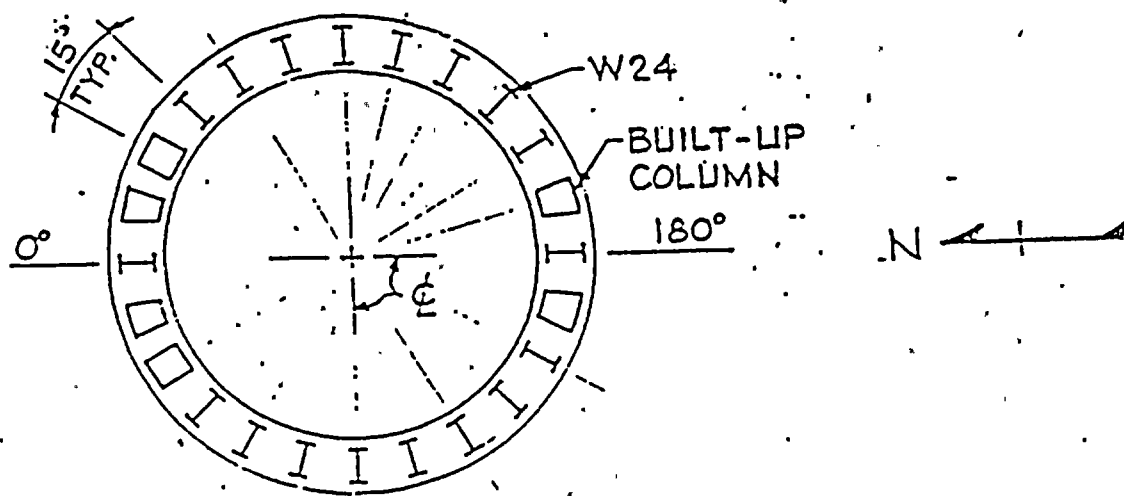
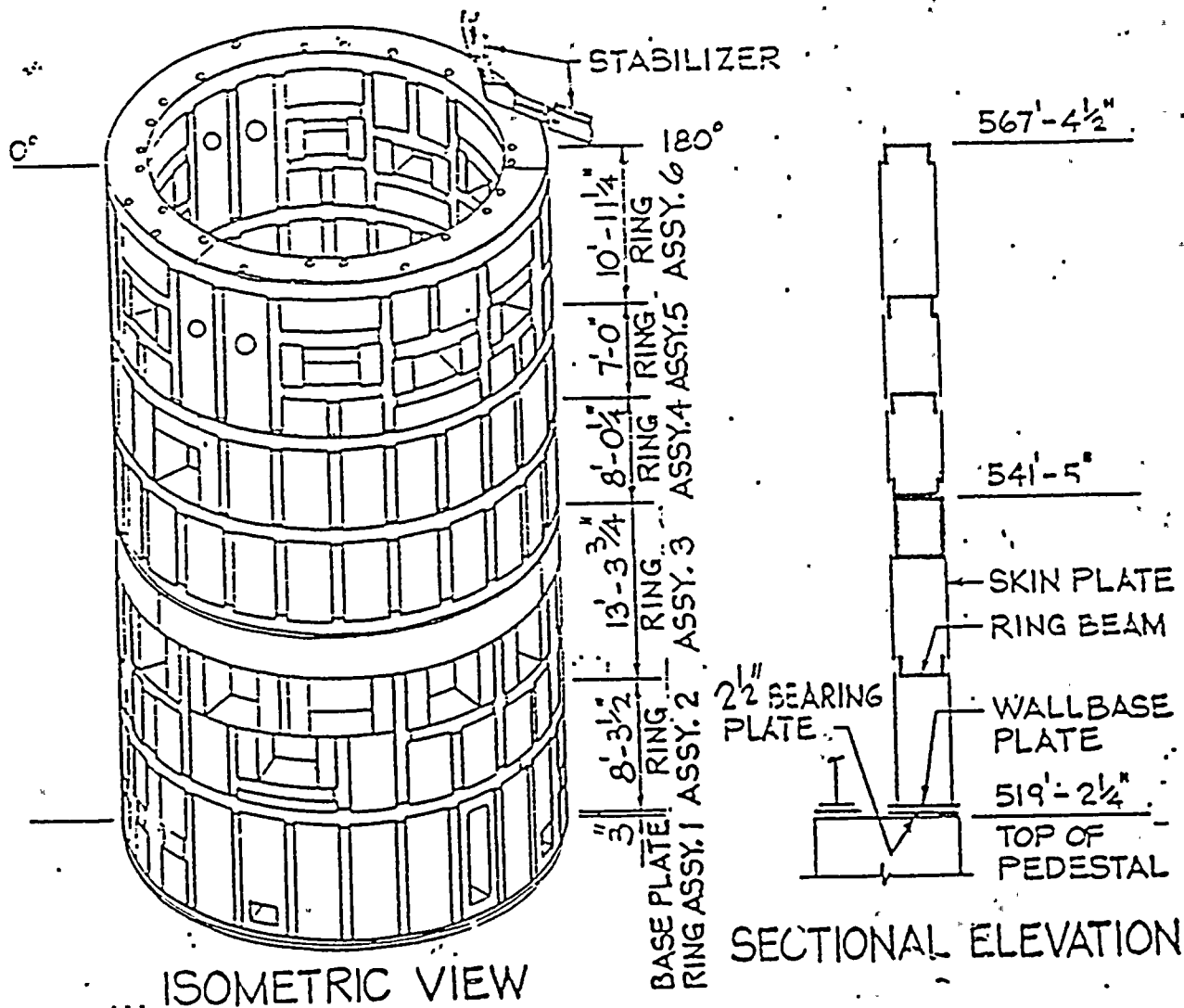
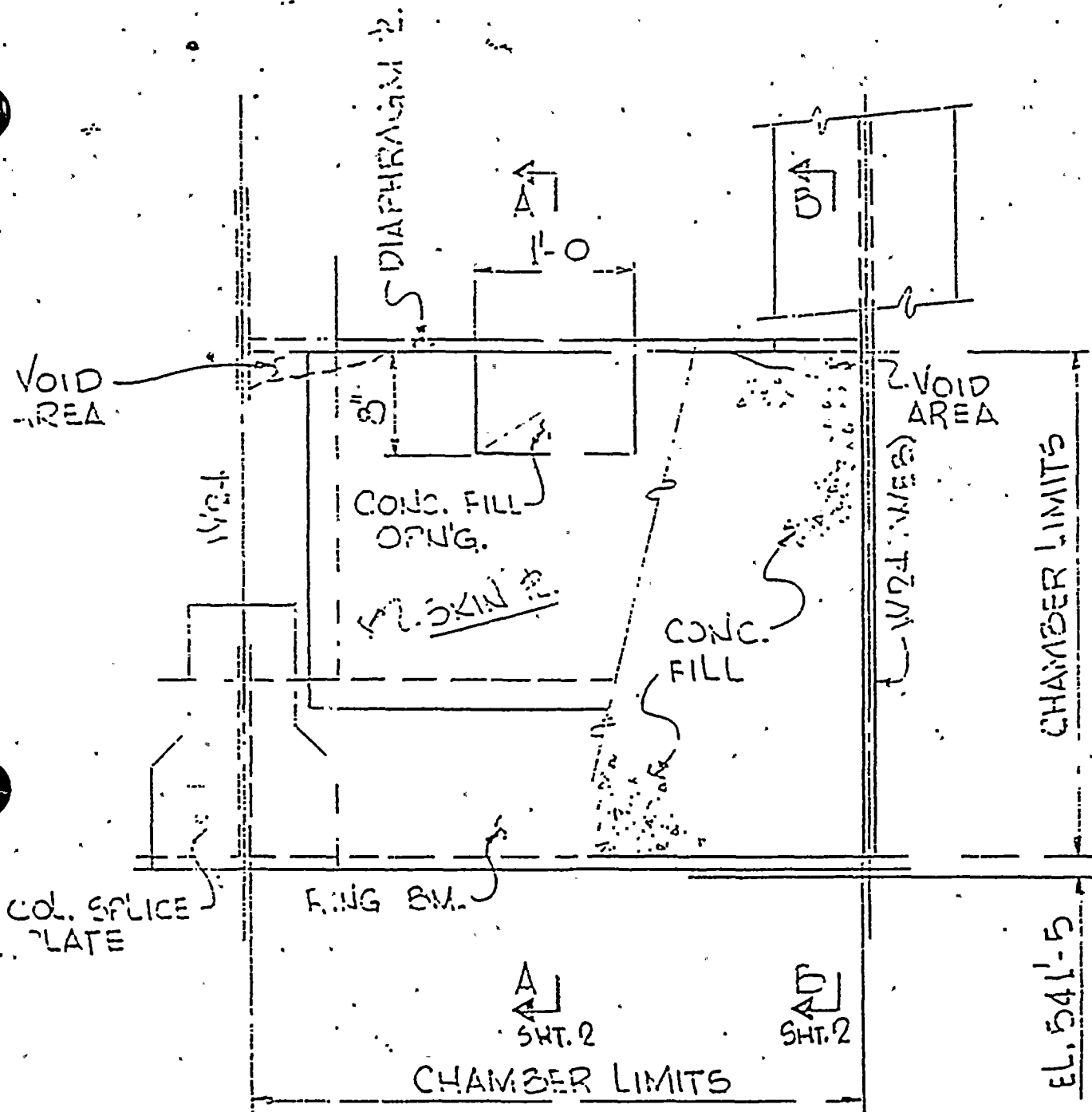


FIG. 2 SACRIFICIAL SHIELD WALL



PLAN AT THE BASE

FIG. 2 SACRIFICIAL SHIELD WALL



ELEVATION! LOOKING @ OUTBOARD FACE
OF SAC-SHIELD WALL

CATEGORY I

SHEET 1

ITEM 4: (SSW) NDE records associated with the SSW contain photocopied inspector's UT/PT acceptance signatures. (See Item 9 for a related item on pipe whip restraints.) (See also #5.)

Requirement

The specification required ultrasonic testing for checking electroslog welded tee joints for lamellar tearing and was limited to base metal thickness of $1\frac{1}{4}$ " and greater.

There was no specification requirement for performing PT. PT used by Leckenby for informational purposes in "chasing out" defects.

AWS Code requires verification by NDE that all defects have been corrected. Leckenby used UT to perform this.

Results

Total Leckenby UT Reports issued - 27

UT Reports with photocopied signatures - 15, affecting a total of 87 welds.

Total Leckenby PT Reports - 30; 4 have been verified as having UT performed after completion of weld repair.

Corrective Action

- Sworn statement by Leckenby inspector indicated photocopying was used to expedite report processing.
- Indication that UT was performed was the rejection of 4 welds which were repaired and re-examined by UT.
- PT was performed for these welds for information purposes only.
- Further investigation will be made to verify that all weld repairs were re-examined by UT.

ITEM 5: (SSW) NDE qualification records cannot be located for one individual who performed ultrasonic testing on the SSW. Individual is no longer employed by subcontractor.

Action

Complete documentation review of SSW NDE records performed. All UT was performed by Mr. G. Hamilton. Qualification records for Hamilton are available and under review for acceptability.

Mr. C. Baldinger performed UT on 3 weld procedure qualifications. NDE certification is not available. UT for weld procedure qualifications not required by code or specification and required tensile and bend tests were performed and were acceptable.

Corrective Action

- Continued investigation to assure Mr. Hamilton's certifications are acceptable.
- Continued investigation of records and reports to assure any additional concerns are identified and resolved.

ITEM 6:

(SSW) No procedures were generated or records maintained on forming of the curved plates used in the SSW.

Requirement

No requirement in specification for procedure or records on forming of plate.

Comment

Leckenby subcontracted work to Seattle Boiler Works. Leckenby states that common industry practice is to heat and/or cold form A-36 material. AE metallurgist statement confirms that this is industry-accepted practice and with no detrimental effects.

Supply System's position is that forming of plate was not a special process as defined in Appendix B of 10CFR50.

Corrective Action

No additional action required.

ITEM 15: (SSW) Interviews with Leckenby p. 51 established that SSW segments 2A, 3A, 3B, and 3C were heat straightened without the benefit of controlling procedures or maintenance of quality records. Heat straightening (application of heat and mechanical force) was applied to correct weld distortion.

Requirements

No requirement in specification for procedure or records on forming of plate.

Comment

Heating, straightening and cold forming is standard industry practice with no detrimental effects per metallurgist statement. Leckenby confirms that this is standard practice and that procedures are not required. Leckenby's documentation will confirm this information.

The Welding Institute, Cambridge, England, 1968 paper "Control of Distortion in Welded Fabrications", states:

- Heat wedge - shaped zones to straighten rolled steel sections
- Heat local zones to correct out-of-flatness or buckles
- Heat in straight lines to correct angular distortion. Sometimes use water-jet cooling on reverse side.

Corrective Action

No additional action required.



ITEM 16: (SSW) 215 quality review of Leckenby program did not include verification that all required UT examinations were performed, as required by spec. and Leckenby procedure.

Requirement

Spec 215 requires sample UT inspection as follows:

<u>No. Welds</u>	<u>To Examine</u>
2 - 8	2
9 - 15	4
16 - 25	6

If no indication of lamellar tearing is found after 24 UT examinations, the UT exam shall be reduced to 2 per 100.

Comment

Leckenby made 1,270 electroslog welds. Without regard to size limitations (material greater 1½"), the required number of areas to exam would be 46. Leckenby performed ultrasonic tests on 83 welds. Test results are contained in 27 UT reports. This is in excess of the specification requirement. In addition, Leckenby examined an additional 2% of other type welds. In total, about 200 weld areas were examined by UT.

Corrective Action

Records available to verify proper inspection. Additional investigation is continuing to assure all associated certification records are in order.

ITEM 17: (A) (SSW) Procedure deficiencies. Leckenby used liquid penetrant testing to examine SSW structures at Leckenby shops. Leckenby representatives reported that there was no approved LP procedure at the time inspections were performed.

(B) The Leckenby procedure which provides for weld sequence control (entitled "Sacrificial Shield Wall Assembly Procedure") has no procedure number, no revision number, no date, no evidence of ever being approved. AWS D1.1, paragraph 3.4.3 required submittal to the engineer of weld sequence and distortion control program.

Results

- Liquid penetrant examinations are not required by code or specification.
- Leckenby does have an approved liquid penetrant procedure.
- Only 3 liquid penetrants reports were submitted for record purposes. At least 4 examined by liquid penetrant were subsequently examined and accepted by UT. (UT did not have photocopied signature).
- Leckenby's fab and erection procedure shows the general sequence of fabrication.
- Leckenby has a commercial document which depicts sequence of restrained joints. This document was made available (1/29/80) and is under review by Engineering.

Corrective Action

- A. Additional investigation to determine that all repaired areas were re-examined by UT.
- B. Completion of weld sequencing review by Engineering.

(A) CONCERN NO. 18

(SSW) Leckenby, as SSW fabricator, hired a consultant to determine the cause of an unusual crack in the SSW. B&R rejected the consultant's determination. According to Leckenby, their consultant's opinion was misunderstood by B&R. B&R has not had an opportunity to review the consultant's last letter (dated June 21, 1977).

(B) BACKGROUND

During initial installation of radial beams at elevation 541', a crack was discovered in the SSW at the point of attachment. Leckenby, through their consultant, proposed a cause for the cracking to the Owner/AE. Burns and Roe reviewed and disagreed with the consultant's proposal. A response was forwarded to Leckenby at that time.

Subsequently, the NRC was informed of the existence of a second letter from the consultant to Leckenby, in which the consultant clarified his initial position.

The NRC questions whether Burns and Roe received, reviewed and responded to the letter.

(C) RESOLUTION

No action is required.

(D) DISCUSSION

This item should not be cause for concern, because the cracks in the SSW where the radial beams are attached have all been repaired, and the adequacy of the repairs has been confirmed by ultrasonic examination. All 24 radial beams have been disassembled and rewelded to the SSW and the adequacy of the attachments has been confirmed by ultrasonic examination. Thus, the explanation now of the cause of the cracking is academic, except for its possible commercial importance.

At the time the subject crack was discovered in the SSW where a radial beam was welded to it, three radial beams had been attached and the installation of the fourth was in progress. Examination of these attachments revealed that two of the three were cracked.

Corrective action consisted of the following:

1. The radial beams were all removed from the SSW.
2. The cracks were weld repaired and the repairs were determined to be sound by U-T.
3. The attachment areas for all remaining radial beams were examined by U-T and found to be sound.

#19

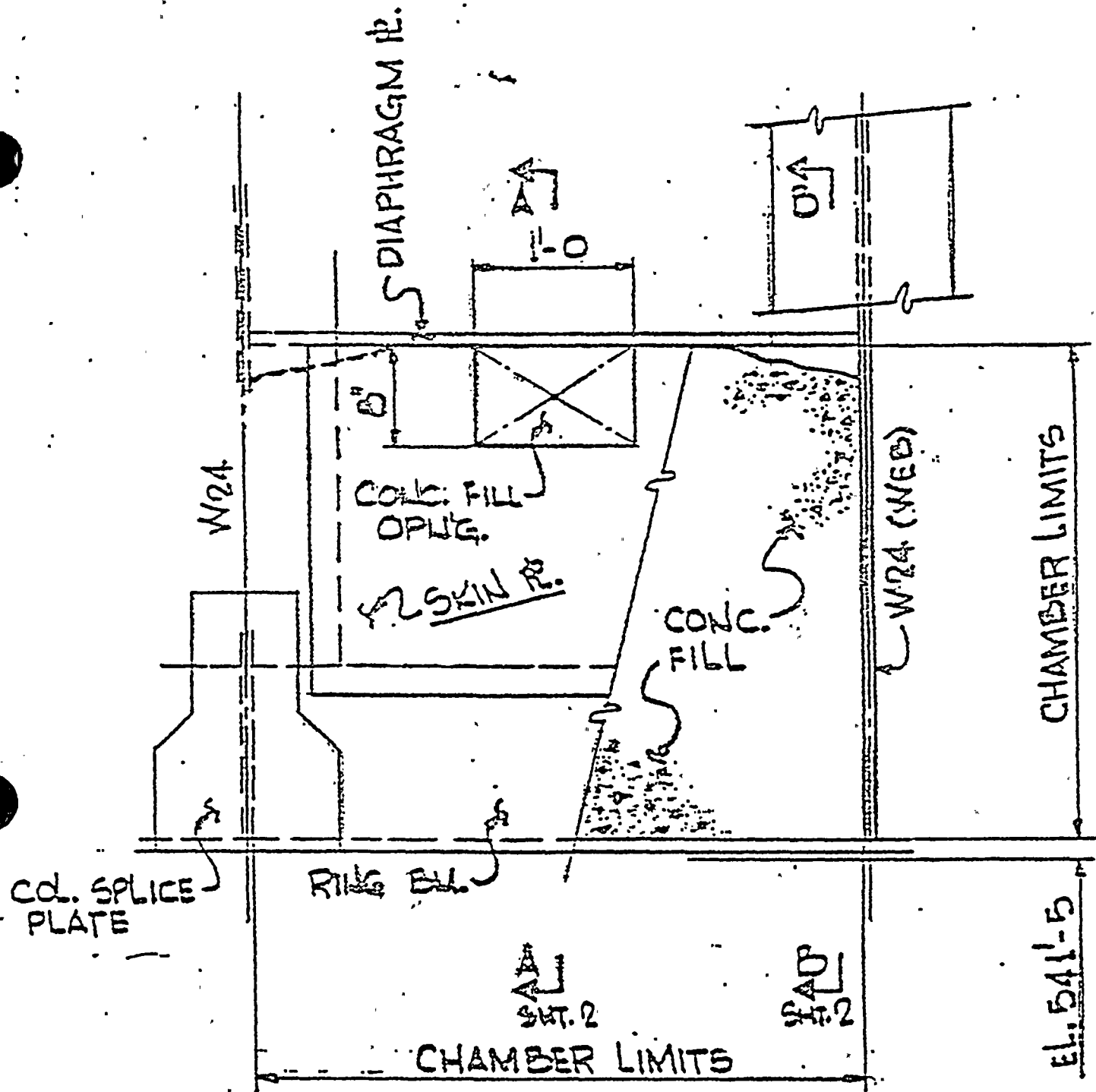
(SSW) Free water in the SSW structure - NRC RV previously understood that the existence of free water in the SSW was one isolated case. However review of 16 contract 215 IR's shows seven (7) cases (IR2525 (2 welds), IR 3069, IR 1703, 1464 (two locations), and IR 2915) where free water or moisture emanated from the SSW. It is not clear, considering the compartmented structure of the SSW, how water from an external source (i.e. weather) could be the source of all leaking welds. Need to assure water is not/wax-not detrimental (not present on back side of joint during welding).



PROBLEM N.º 19

- FREE WATER INSPECTION REPORTS (IR's)
 - TOTAL 7 LOCATIONS - ALL SKIN PLATES
 - 6 WELDS MADE PRIOR TO PLACING CONCRETE
 - 1 WELD MADE AFTER PLACEMENT
- CORRECTIVE ACTION
 - ALL 7 WELDS REPAIRED
 - ALL WINDOW PLATES INSPECTED AND REPAIRED WHERE NECESSARY





ELEVATION LOOKING @ OUTBOARD FACE
OF SAC-SHIELD WALL

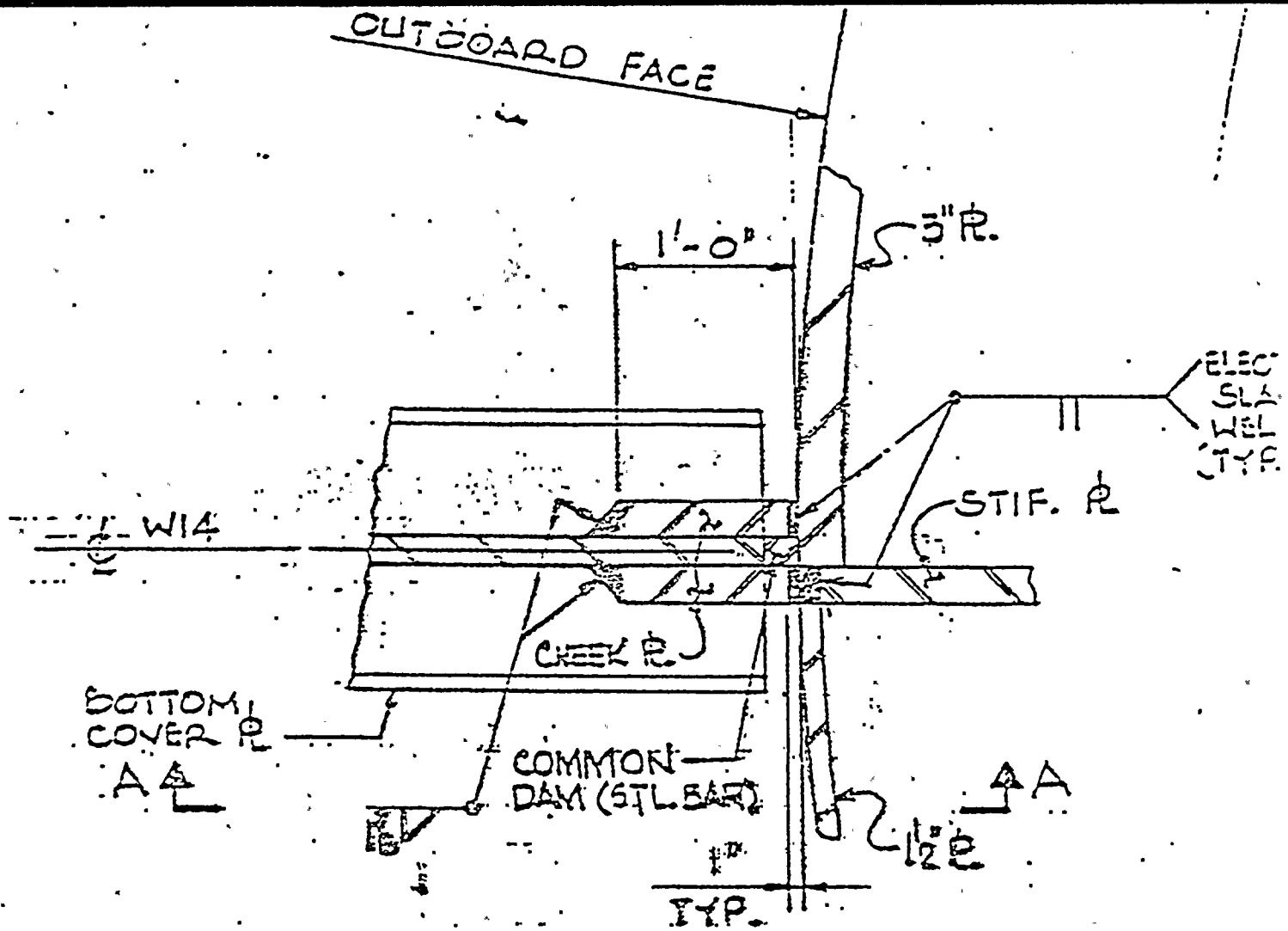
#15

(SSW) Leckenby, as SSW fabricator, hired a consultant to determine the cause of an unusual crack in the SSW, B&R rejected the consultants determination. According to Leckenby, their consultants opinion was misunderstood by B&R. B&R has not had an opportunity to review the consultants last letter (dated June 21, 1977).

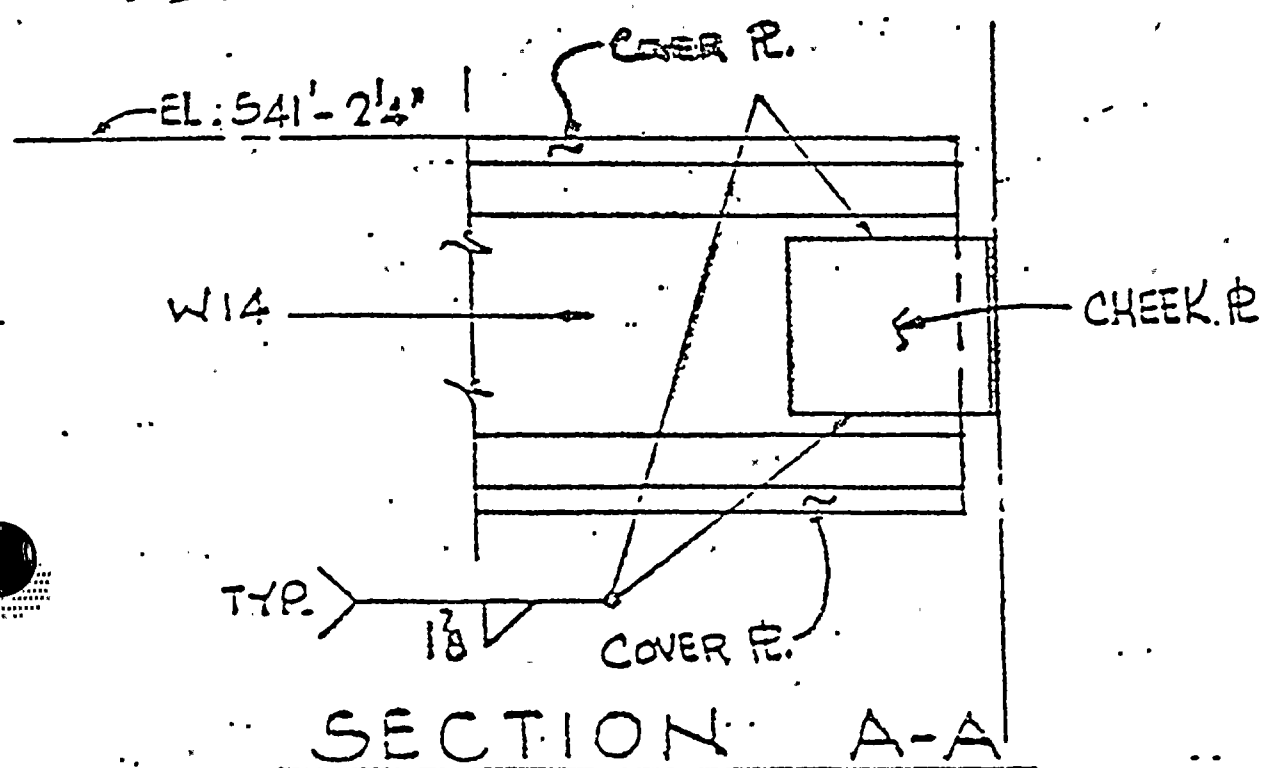
PROBLEM #18

• DESCRIPTION OF CRACK

- CONSULTANTS LETTER HAS BEEN REVIEWED
- THEORIES OF CAUSE OF CRACK DISPUTED
- BEAMS AFFECTED WERE CORRECTED -
SUBSEQUENT BEAMS WERE WELDED
SUCCESSFULLY WITH REVISED WELDING
SEQUENCE & PROCEDURE.
- FURTHER ACTION - NONE REQUIRED



PLAN - TYP. BEAM CONN. @ SAC. SHIELD WALL
FOR W14 x 426 WITH COVER PLATES T. & B.



PROBLEM 20

(SSW) B&R Dwg. S-802 note 3 refers to the spec. for PWHT requirements of the stabilizer assemblies on the SSW. The spec. does not appear to specifically address PWHT of stabilizers. It is, therefore, not clear whether designers intended to have PWET. Material involved is A514, A588, and SA537, 1 3/4" & 2" thick, full penetration welds. The SSW @ stabilizer level is also A588 Grade A Steel 2 1/2" & 2 1/2" thick with full penetration welds (U channel 1 B&R dwg. S783.).

o POSTHELD HEAT TREATMENT (PHHT).

o DRAWING S-802 (STABILIZER TRISS) REFERS TO SPECIFICATIONS

o REQUIREMENTS FOR PHHT IN SECTION 17D FOR CONTRACT 215 ADOPTS AND SUPPLEMENTS AWS D1.1

o MATERIAL INVOLVED

<u>ITEM</u>	<u>MAT'L</u>	<u>CODE</u>	<u>CONTRACT</u>
o STABILIZER - TRISS	A 514	(AWS D1.1)	- CONT. 215
o VESSEL ATTACHMENT	SA 537	(ASME CODE)	PDH (CONT. 215)
o SAC HALL RING BEAM	A 588	(AWS D1.1)	- CONT. 215

o DISPOSITION

o A 514 - QUENCHED & TEMPERED - PHHT NOT RECOMMENDED BY AWS D1.1

o SA 537 - PHHT REQUIRED BY ASME CODE & COMPLIED WITH

o A 588 - AWS D1.1 SILENT ON PHHT - VENDOR QUALIFIED PROCEDURE W/O PHHT.

SUBJECT: PROBLEMS ASSOCIATED WITH QUALITY ASSURANCE RECORDS
FOR PIPE WHIP RESTRAINT

CONTRACT INFORMATION:

MADE UNDER	2808-90 / LECKENBY COMPANY
INSTALLED BY	2808-215 / WSH DOECON/GERI

WHERE USED: INSIDE PRIMARY CONTAINMENT - ATTACHED TO SACRIFICIAL
SHIELD WALL AND RELATED STRUCTURAL STEEL

FUNCTION: TO PROVIDE WHIP RESTRAINT FROM RESULTANT PIPE BREAK
OF MAIN STEAM OR FEEDWATER LINES

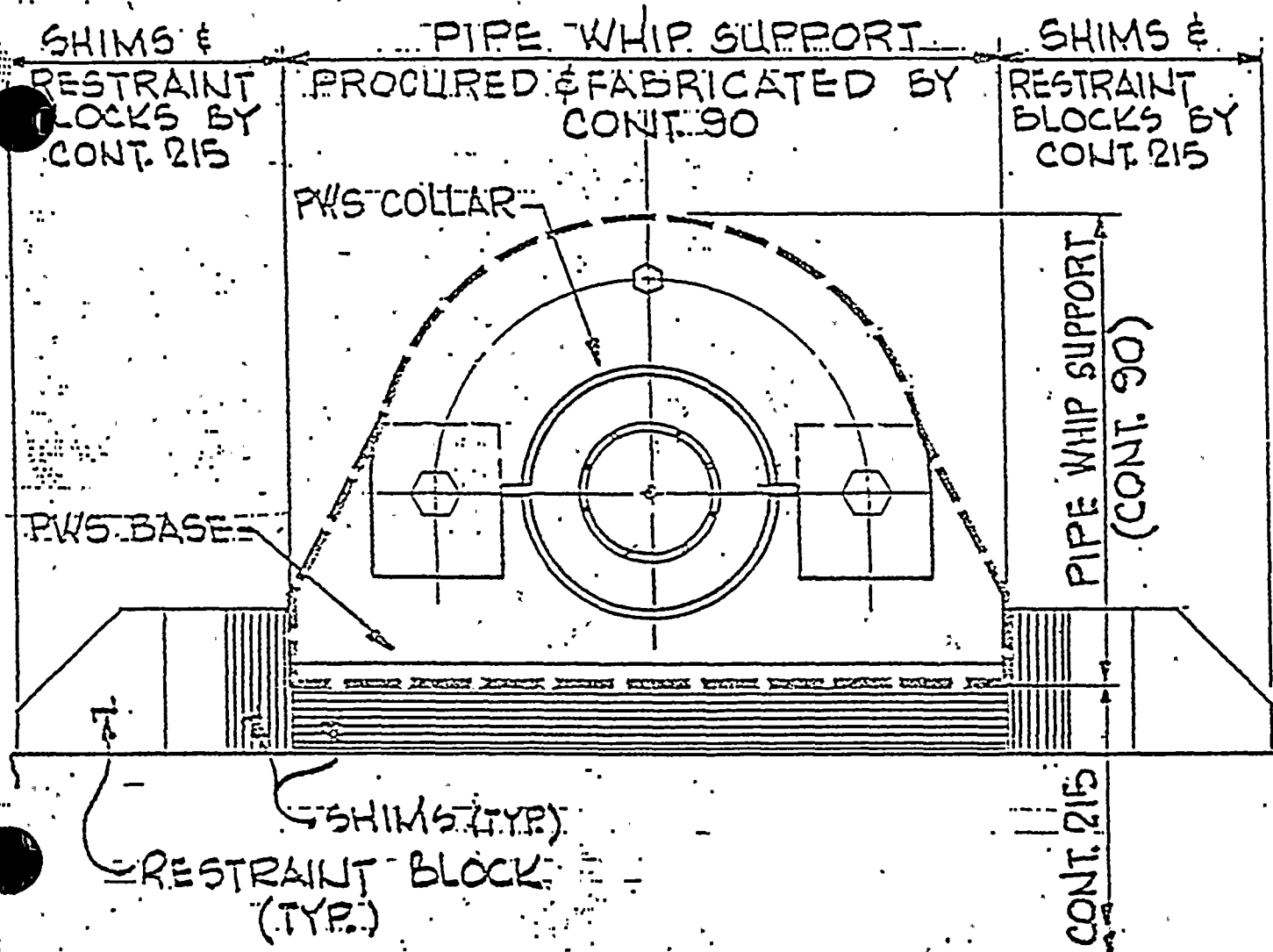
QUANTITY OF HARDWARE INVOLVED

1. INSTALLED AND ACCEPTED	30
2. INSTALLED - INSPECTION COMPLETE	21
3. NOT INSTALLED	<u>120</u>
TOTAL	179

TYPES/QUANTITIES OF PIPE WHIP RESTRAINTS

1. TYPE 1	-	41
2. TYPE 2	-	26
3. TYPE 3	-	47
4. TYPE 3A	-	25
5. TYPE 3B	-	13
6. TYPE 3C	-	2
7. TYPE 3D	-	<u>2</u>
8. TYPE 4	-	14
9. TYPE 4A	-	<u>9</u>
TOTAL		179

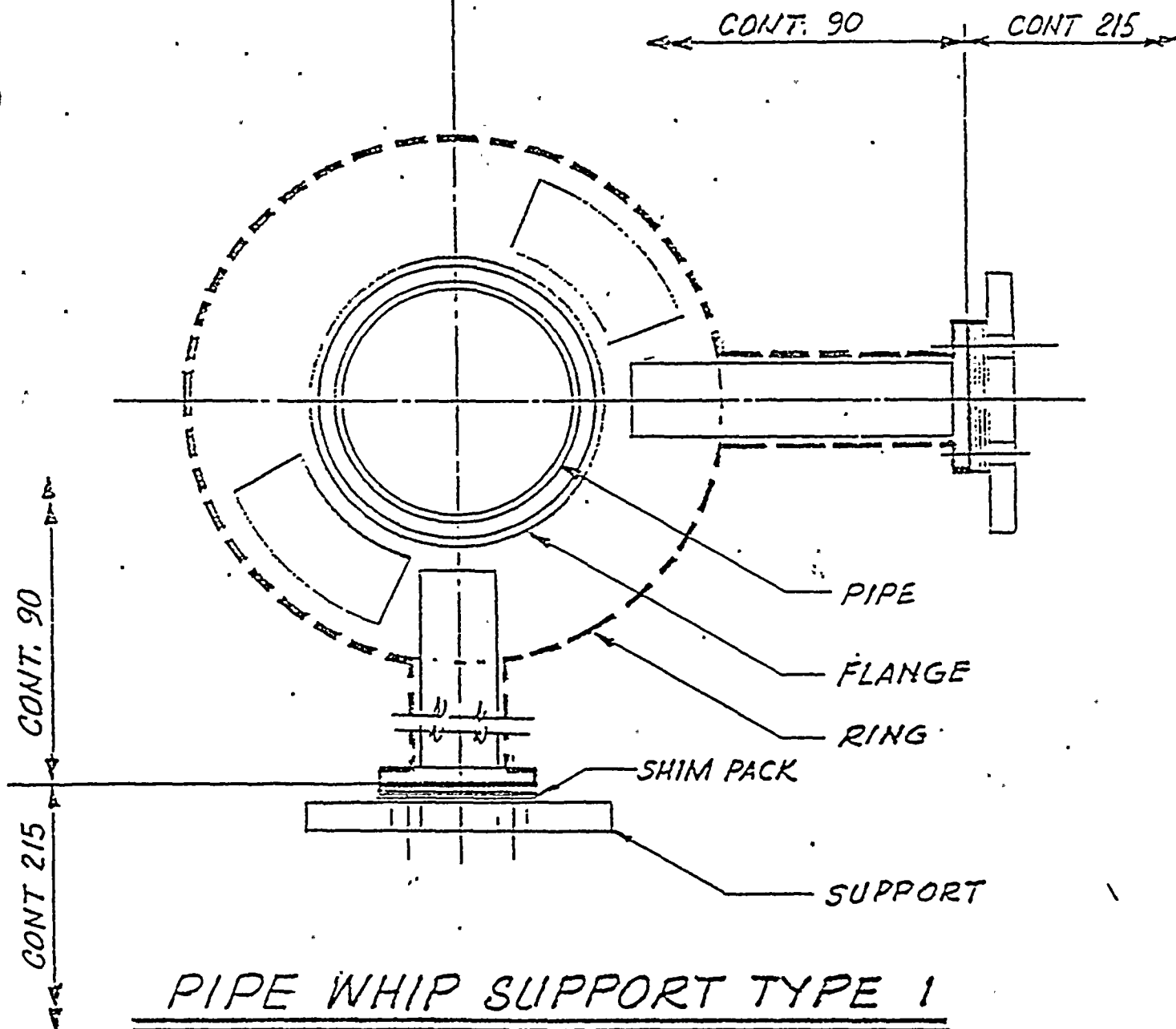
Ø PWS



PIPE WHIP SUPPORT TYPE 2, 3 & 4
CONTRACT DELINEATION

NOTES:

1. MATERIAL FOR PIPE WHIP SUPPORTS PROCURED & FABRICATED BY CONT. 90.
2. PIPE WHIP SUPPORTS INSTALLED BY CONT. 215.
3. SHIMS & RESTRAINT BLOCKS FURNISHED & INSTALLED BY CONT. 215.





PROBLEM CHRONOLOGY

1. MID 1979 - EMPHASIS WAS PLACED ON CONTRACT 2808-90 CLOSE OUT.
2. SAMPLE OF DOCUMENTATION REVIEWED AND FOUND UNACCEPTABLE.
3. 100% REVIEW REVEALED MISSING DOCUMENTATION AND MATERIAL SUBSTITUTION.
4. SUPPLIER CONTACTED - AGREED TO SEND DOCUMENTS.
5. OCTOBER 1979 - SUPPLIER PROVIDED BALANCE OF DOCUMENTATION.
6. EARLY NOVEMBER - DOCUMENTATION REVIEW REVEALED NUMEROUS DEFICIENCIES.

NOTIFICATION

1. TELEPHONE CALL TO REGION V ON NOVEMBER 20, 1979.

2. BEGAN EVALUATION AS POTENTIAL 50.55(e)

NOTE: ALTHOUGH THIS ITEM IS BEING TRACKED AS A
50.55(e), THE CONSEQUENCES OF FAILURE OF
DEFECTIVE HARDWARE HAS YET TO BE CONCLUDED.
(FINAL REPORT TO HRC PENDING.)

3. STOP WORK ISSUED TO SITE CONTRACTORS ON NOVEMBER 21, 1979.

4. RECEIVED HRC LETTER DATED NOVEMBER 21, 1979 REQUESTING THAT PROPOSED
CORRECTIVE ACTION BE PROVIDED BEFORE INSTALLATION IS ALLOWED TO PROCEED.

5. SUPPLY SYSTEM RESPONDED TO HRC WITH CORRECTIVE ACTION PLAN BY LETTER
DATED DECEMBER 10, 1979.

PROBLEM SUMMARY

<u>I</u>	<u>DOCUMENTATION PROBLEMS</u>	<u>NUMBER OF PWR'S AFFECTED</u>
1.	UT report does not specify area of examination	145
2.	Transducer angle not shown	9
3.	No evidence of straight beam UT prior to angle beam	41
4.	No evidence of angle beam UT examination	6
5.	Date of stress relief on strip chart not same as on cert.	32
6.	NDT for welds back dated without justification	3
7.	Welder's ID numbers on reports corrected to same as weld map without explanation	18
8.	Wrong year on UT report	5
9.	No traceability to strip chart	3
10.	Welder's ID missing from UT report	1
11.	Dates indicate UT was performed before stress relief	3
12.	No evidence weld procedure submitted	2
13.	Weld map does not show repair	1
14.	No weld procedure identified for rework	8

I. DOCUMENTATION PROBLEMS

NUMBER OF
PWR'S AFFECTED

15. Weld map shows repair, no reject tag
16. Welds added to report and back dated without explanation
17. Physical properties not shown on MTR
18. Weld no. 17 listed as weld no. 27
19. MT report for repair not in file
20. No weld numbers on UT report
21. 1½" diameter nuts; bolts and washers trace to 1 1/8"
22. Welder's ID on UT report not same as ID on weld map
23. No weld no. 17 on UT report
24. Welds listed as PWS 32-2 should be 36-2
25. Traceability of plate to wrong MTR
26. Legibility of MTR
27. Drawing calls for full penetration, weld symbol is for fillet weld
28. Dates on NDE reports, manufacturing orders and weld map do not match
29. Most signatures on UT reports were from a xerox master
30. Procedures dispositioned "As Noted" not resubmitted
31. PED's incorporated into drawings without resubmitting drawings

1

1

4

1

1

1

2

1

1

1

2

2

1

-

-

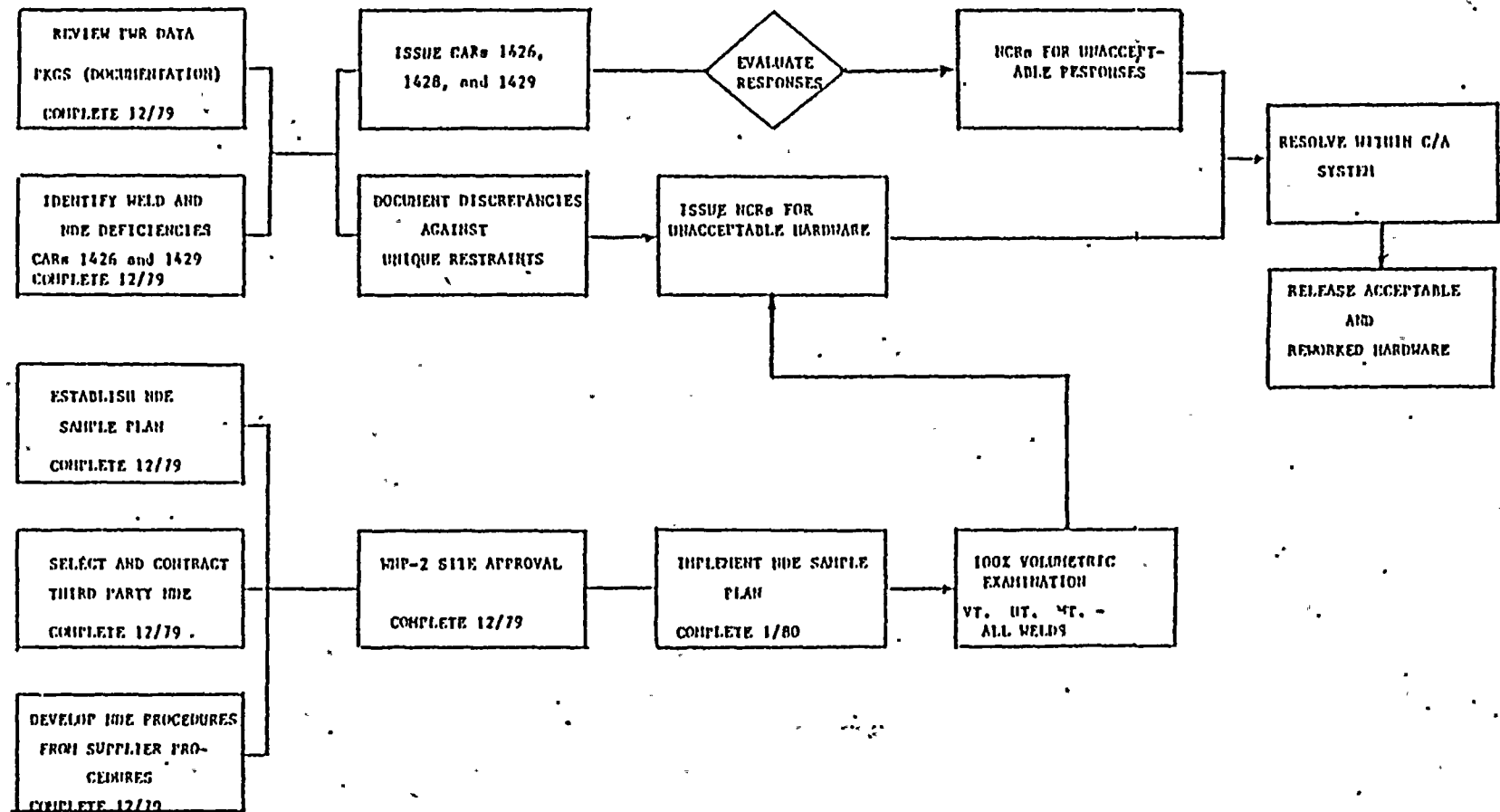
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DOCUMENTATION PROBLEMS IDENTIFIED

II <u>DOCUMENTATION PROBLEMS WHICH AFFECT HARDWARE (NON-CONFORMING)</u>	<u>NUMBER OF PWR'S AFFECTED</u>
1. Used wrong weld rod	70
2. Data shows impact test results do not comply	2
3. Charpy impact done at -100 ⁰ , S/B -150 ⁰	14
4. Wrong chemical composition on MTR for bolts	2
5. Cannot verify MT & UT performed	1
6. Cannot verify UT performed	5
7. No evidence weld repaired per reject tag	1
8. No evidence weld no. 16 NDE inspected	1
9. No evidence of MT	1
10. Plate 1/2x6 is A516, should be A-36	2
11. Wrong weld procedure used	1
12. Wrong chemical composition on MTR	1
13. Physical properties now shown on MTR & wrong grade	42
14. Cannot determine if stress relief done after rework	8
15. Welding operators not qualified for electro slag welding	58
16. ESW procedure not qualified for material over 3.3 inches or under 1.5 inches	4
17. Weld procedures not qualified in PWHT condition	58
18. No evidence of stress relief after straightening	7

PIPE WELD RESTRAINT CORRECTIVE ACTION PLAN
(EFFORTS BEGAN 12/79)





HIDE SAMPLE PROGRAM

TYPE	PIR's	PIR's INSPECTED	PIR's REJECTED	(HT) WELDS ACC/REJ	(UT) WELDS ACC/REJ
1	41	7	4	17/19	23/1
2	26	6	5	13/15	10/2
3	47	6	5	5/19	53/14
3A	25	4	3	0/12	7/1
3B	13	1	1	0/2	0
3C	2	0	0	0	0
3D	2	1	1	10/1	0/4
4	14	3	3	0/14	3/6
4A	9	1	0	0	4/0

179

29

22

53/02

100/28

$\frac{02(100)}{135}$

60% Rej.

$\frac{20(100)}{120}$

21% Rej.

ITEM 7: (PWR) Pipe Whip Restraints of the same or similar design were provided under two contracts. One contract (#90) required NDE and PWHT of welds, the other (#215) required only visual inspection of welds. (215 PWRs may not have been PWHT'd).

- PWR - NDE and PWHT requirements

- Contract Scope

- PWR - All were provided by Contract 90

- PWR Support Steel - Contract 215

- Specification Requirements

- Contract 90 (Mat'l A516, A537)

- AWS D1.1 + PWHT, NDE

- Contract 215 (Mat'l A36)

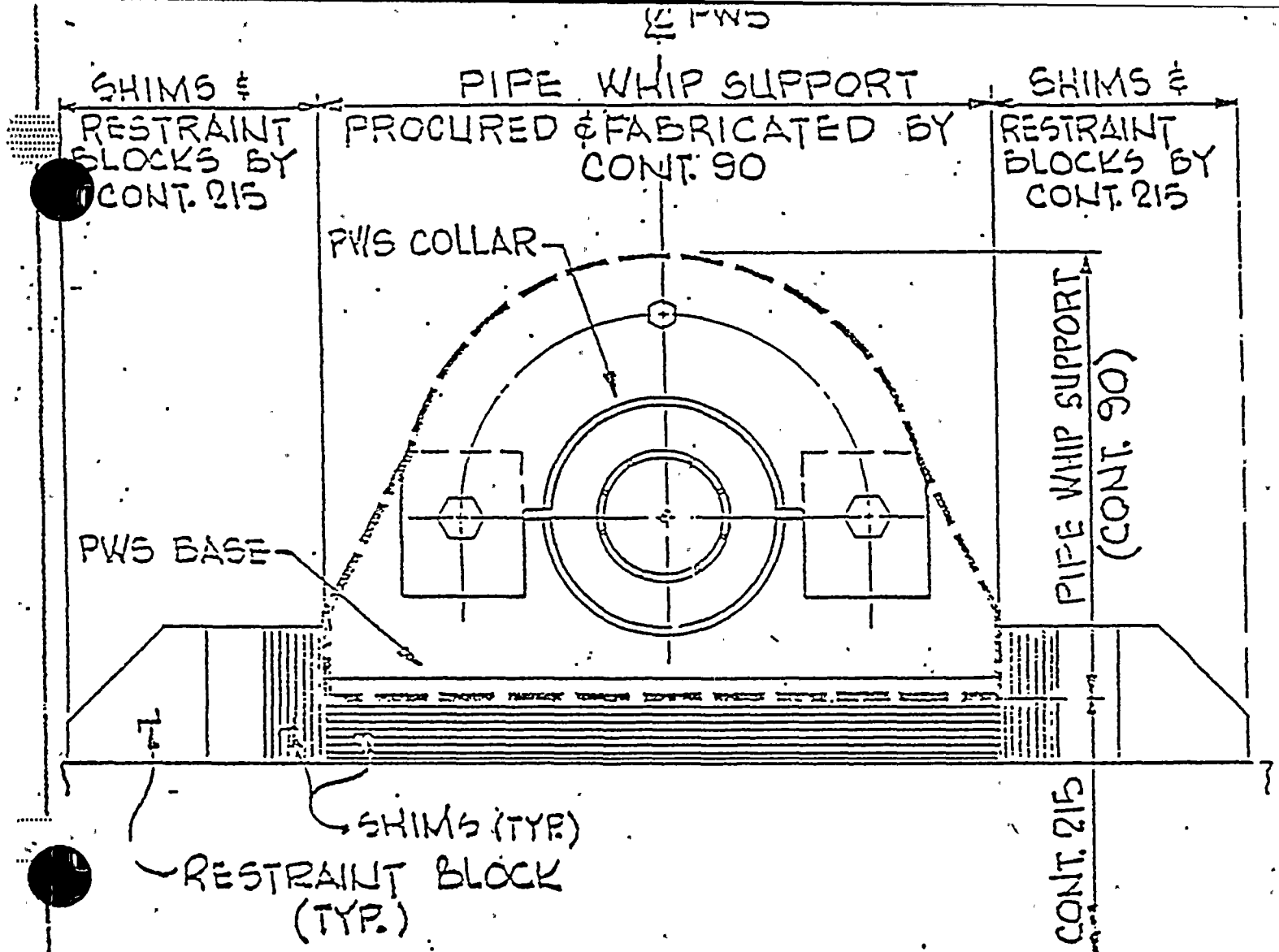
- AWS D1.1

- Rationale for Different Requirements

- NDE (UT & MT) was specified on the PWR because a rigid weld inspection would provide assurance that the PWR weldments would withstand a pipe whip.

- PWHT of the PWRs was specified to assure retention of dimensional tolerances between the PWR and the pipe.

- PWHT not required on support steel because design of supports allows flexibility.



PIPE WHIP SUPPORT

CONTRACT DELINEATION

NOTES:

1. MATERIAL FOR PIPE WHIP SUPPORTS PROCURED & FABRICATED BY CONT. 90.
2. PIPE WHIP SUPPORTS INSTALLED BY CONT. 215.
3. SHIMS & RESTRAINT BLOCKS FURNISHED & INSTALLED BY CONT. 215.



ITEM 8: (PWR) NDE records associated with pipe whip restraints (PWRs) contain photocopied inspector's acceptance signatures for ultrasonic and magnetic particle testing. (See Item 4 for a related item on the SWH).

Action

Review of UT and MT inspection reports indicate that virtually all of the reports have photocopied signatures, (IOM J Bean to J Steidl, dated 1/7/80). This has been verified to be a common practice by Leckenby (see sworn statements by Messrs. P. D. Moore and E. B. Hamilton). This concern affects basically all 179 restraints.

Corrective Action

The reinspection of all restraints will generate new NDE records which will become the final inspection records.



ITEM 9: (PWR) NDE qualification records cannot be found for one, or possibly two, individuals who performed UT and MT on the PWRs. Contractor's qualification procedure is not in full accord with SNT-TC-1A.

Action

- Review of UT and MT inspection reports indicated questionable training and qualification of Level II inspectors and of Level III examiners. Both NRC and WPPSS visited Leckenby to evaluate certification adequacy. Certification records for Mr. Baldinger could not be found.
- In a sworn statement to the NRC on December 6, 1979, Mr. Phillip D. Moore, Leckenby QA Manager, attested that Mr. Baldinger had the experience, training, and was properly certified to SNT-TC-1A Level II.
- B&R Source Surveillance Report, 10-26-76, indicated Baldinger's certification records were reviewed for UT and MT and were adequate.
- A review of the personnel qualification procedure revealed that specific requirements of SNT-TC-1A were not properly specified in the areas of training, education, and re-examinations.

Corrective Action

The reinspection records which will include qualified/certified personnel and procedures will become the final inspection records.

ITEM 10: (PWR) The electroslag welding procedure used in the welding of PWRs was not qualified using post weld heat treatment as required by the code (AWS D1.1).

Response/Status.

1. This deficiency was identified as Item IV of CAR 1426.
2. Leckenby responded to this item by agreeing to requalify the electroslag welding procedure.
3. An Engineering evaluation will be made to determine if PWHT for procedure qualification is necessary.

ITEM 11: (PHR) Approximately 90 typical joint configurations specified on design drawings for the PHR use fillets which are smaller than the minimum fillet weld size specified in the applicable code.

Results

- Majority of welds reviewed - Contract 215 rather than Contract 90.
- Concern involves Engineer rationale for acceptance.
 - Structural need is not prime concern; providing inspection indicates good quality.
- Review of design indicates not needed for strength.
- Subsequent inspection of weld records indicate confidence in original weld inspection.
- No weld undersized by more than 1/16".

Corrective Action

- Welds installed to date - accept as is. (No.?)
- Weld not installed - PED will be issued. (No.?)

ITEM 12: (PWR) Numerous record irregularities and inconsistencies exist between weld maps, manufacturing orders (M.O.), welder and inspection records associated with PWRs. Inconsistencies include: conflicting inspection dates; changes in inspector I.D. numbers without clarifying information; records indicate some inspections were performed by an individual at a time he was not working for the company; inspections following stress relieving are dated with dates which precede stress relieving; welder I.D. numbers and electrode I.D. numbers have been changed without clarifying information; NDE records list wrong AWS UT legend number; weld procedure numbers have been changed with no explanation; different signatures for one welder qualifier; missing inspection results.

Action

100% record review completed with deficiencies identified by restraint number. IOM dated 1/7/80.

Corrective Action

- NDE reinspection program will resolve many NDE and personnel qualification deficiencies.
- Balance of deficiencies will be identified on NCRs.
- New welding deficiencies identified by reinspection will be identified on NCRs.
- Resolution of problems, administered through standard program, which will entail engineering evaluation and rework as required.

ITEM 21: (PWR) Specification calls out the use of high strength (A325 or A490) bolt and use of the high strength bolting specification (AISC). Drawings call out A320 and A540 bolt. These bolts are installed, but are not installed in accordance with high strength bolting specification - i.e., plate or bar washers have not been used over long slotted holes.

Action

- Contract 90 specifies A325 and A490 bolts and specifies use of AISC High Strength Bolting Specification.
- Installation drawings specified A320 and A540 bolts.
- Existing A320 bolts not installed per AISC.

Corrective Action

- Contractor will be instructed to use strip washers.
- Spec will be revised to require strip washers although this was not required in previous AISC code.



ITEM 7:

(PWR) Pipe Whip Restraints of the same or similar design were provided under two contracts. One contract (#90) required NDE and PWIT of welds, the other (#215) required only visual inspection of welds. (215 PWRs may not have been PWIT'd).

- PWR - NDE and PWIT requirements

- Contract Scope

- PWR - All were provided by Contract 90

- PWR Support Steel - Contract 215

- Specification Requirements

- Contract 90 (Mat'l A516, A537)

- AWS D1.1 + PWIT, NDE

- Contract 215 (Mat'l A36)

- AWS D1.1

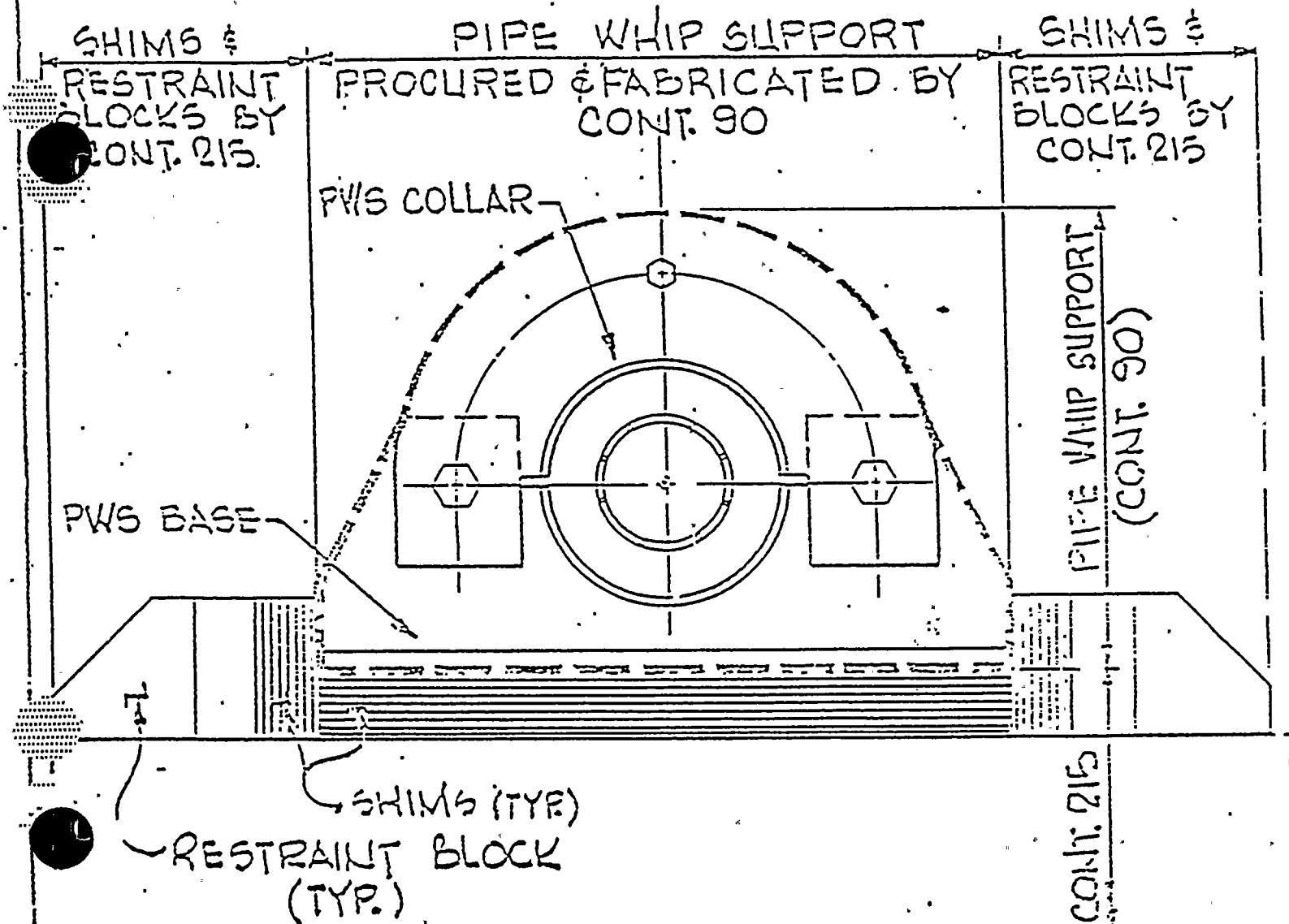
- Rationale for Different Requirements

- NDE (UT & MT) was specified on the PWR because a rigid weld inspection would provide assurance that the PWR weldments would withstand a pipe whip.

- PWIT of the PWRs was specified to assure retention of dimensional tolerances between the PWR and the pipe.

- PWIT not required on support steel because design of supports allows flexibility.





PIPE WHIP SUPPORT

CONTRACT DELINEATION

NOTES:

1. MATERIAL FOR PIPE WHIP SUPPORTS PROCURED & FABRICATED BY CONT. 90.
2. PIPE WHIP SUPPORTS INSTALLED BY CONT. 215.
3. SHIMS & RESTRAINT BLOCKS FURNISHED & INSTALLED BY CONT. 215.

ITEM 8: (PWR) NDE records associated with pipe whip restraints (PWRs) contain photocopied inspector's acceptance signatures for ultrasonic and magnetic particle testing, (See Item 4 for a related item on the SSH).

Action: Review of UT and MT inspection reports indicate that virtually all of the reports have photocopied signatures, (IOM J Dean to J Steidl, dated 1/7/80). This has been verified to be a common practice by Leckenby (see sworn statements by Messrs. P. D. Moore and E. B. Hamilton). This concern affects basically all 179 restraints.

Corrective Action: The completion of the sample UT and MT program now establishes the need for a 100% reinspection of all restraints. These reinspection records will become the final inspection records and the problem of photocopied signatures will be negated.

ITEM 9: (PWR) NDE qualification records cannot be found for one, or possibly two, individuals who performed UT and MT on the PWRs. Contractor's qualification procedure is not in full accord with SNT-TC-1A.

ACTION:

- o Review of UT and MT inspection reports indicated questionable training and qualification of Level II inspectors and of Level III examiners. Both NRC and WPPSS visited Leckenby to evaluate certification adequacy. Certification records for Mr. Baldinger could not be found.
- o In a Sworn statement to the NRC on December 6, 1979, Mr. Phillip D. Moore, Leckenby QA Manager, attested that Mr. Baldinger had the experience, training, and was properly certified to SNT-TC-1A Level II.
- o B&R Source Surveillance Report, 10-26-76, indicated Baldinger's certification records were reviewed for UT and MT and were adequate.
- o A review of the personnel qualification procedure revealed that specific requirements of SNT-TC-1A were not properly specified in the areas of training, education, and re-examinations.

CORRECTIVE ACTION:

The completion of the sample UT and MT program now establishes the need for 100% reinspection. These reinspection records including qualified/certified personnel will become the final inspection records.

NRC CONCERNS
PIPE WHIP RESTRAINTS

PROBLEM: (ITEM 10 OF 21)

(PWR) The electroslag welding procedure used in the welding of PWRs was not qualified using post weld heat treatment as required by the code (AMS D1.1).

RESPONSE/STATUS:

1. This deficiency was identified as item IV of CAR 1426.
2. Leckenby responded to this item by agreeing to requalify the electroslag welding procedure.
3. An Engineering evaluation will be made to determine if PWHT for procedure qualification is necessary.

PROBLEM 11

(PWR) APPROXIMATELY 90 TYPICAL JOINT CONFIGURATIONS SPECIFIED ON DESIGN DRAWINGS FOR THE PWR USE FILLETS WHICH ARE SMALLER THAN THE MINIMUM FILLET WELD SIZE SPECIFIED IN THE APPLICABLE CODE.

PROBLEM NO. 11

FILLET WELDS - MINIMUM SIZE

- o Majority of welds reviewed - Contract 215 rather than Contract 90.
- o Concern involves Engineer rationale for acceptance.
 - Structural need is not prime concern; providing inspection indicates good quality.
- o Review of design indicates not needed for strength.
- o Subsequent inspection of weld records indicate confidence in original weld inspection.
- o Rationale presently reflected in present AWS Code - Maximum required 5/16".
- o No weld undersized by more than 1/16".

Corrective Action

- o Welds installed to date - accept as is.
- o Weld not installed - PED will be issued.

#12 (PWR) Numerous record irregularities and inconsistencies exist between weld maps, manufacturing orders (M.O.), welder and inspection records associated with the PWR's. Inconsistencies include: Conflicting inspection dates; changes in inspector I.D. numbers without clarifying information; records indicate some inspections were performed by an individual at a time he was not working for the company; inspections following stress relieving are dated with dates which precede stress relieving; welder I.D. Nos. and electrode I.D. Nos. have been changed without clarifying information; NDE records list wrong AWS UT legend number; weld procedure Nos. have been changed with no explanation; different signatures for one welder qualifier; missing inspection results.

ITEM 12: Numerous record irregularities and inconsistencies exist

Action: • 100% record review completed with deficiencies identified by restraint number. IOM dated 1/7/80.

Corrective Action:

- NDE reinspection program will resolve many deficiencies.
- Balance of deficiencies will be identified on NCRs.
- New welding deficiencies identified by reinspection will be identified on NCRs. .
- Resolution of problems, administered through standard program.

PROBLEM 21

(PWR) SPEC. CALLS OUT THE USE OF HIGH STRENGTH (A325 OR A490) BOLT AND USE OF THE HIGH STRENGTH BOLTING SPECIFICATION (AISC). DRAWINGS CALL OUT A320 AND A540 BOLT. THESE BOLTS ARE INSTALLED, BUT ARE NOT INSTALLED IN ACCORDANCE WITH HIGH STRENGTH BOLTING SPECIFICATION - I.E. PLATE OR BAR WASHERS HAVE NOT BEEN USED OVER LONG SLOTTED HOLES.

PROBLEM NO. 21

- o Contract 215 does not address A320 and A540 bolts.
- o Should be installed to high strength bolting specs, including strip washers in slotted holes.

Corrective Action

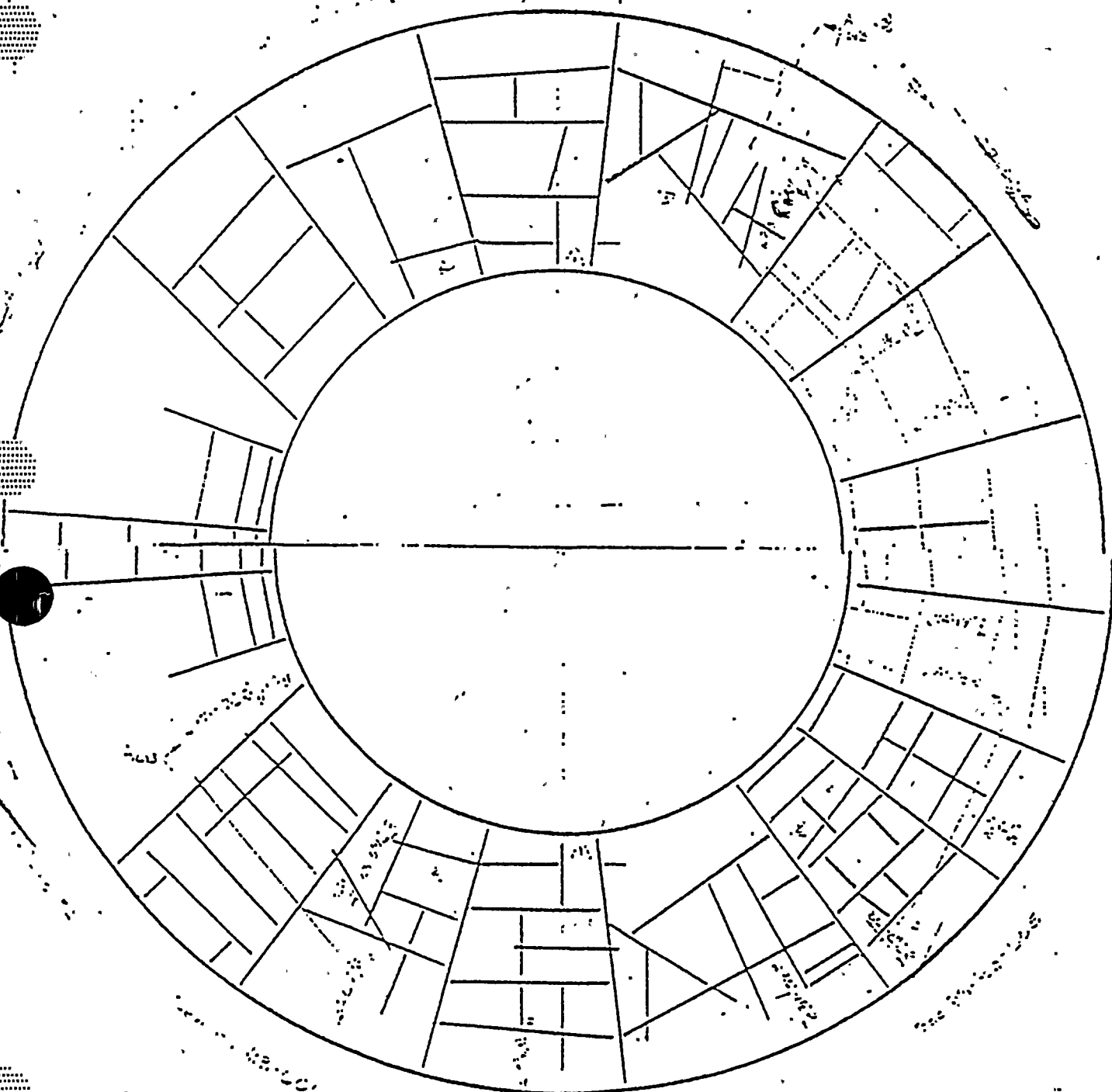
- o Contractor will be instructed to use strip washers.
- o Spec will be revised to require strip washers although this was not required in previous AISC Code.

STRUCTURAL STEEL - DRYWELL

TOPIC

- G CRACKS FOUND IN FIELD WELDS DURING ERECTION
- c 100% MT OF ALL FIELD WELDS
- G ALL DEFECTS REPAIRED AND WELDS RE-EXAMINED
- c ALL NEW FIELD WELDS MADE USING CONSERVATIVE,
CONTROLLED PROCEDURES.







#13

(RS) The generic procedure used to repair laminations in the weld zone of SSW related structures (RS) requires grinding of the laminations to a maximum depth of 3/8", followed by rewelding. This falls short of the AWS code, which requires grinding to depths of 1" with supplementary ultrasonic tests as required (if laminations are longer than 1 inch.)



PROBLEM

6 DURING WELDING ON STRUCTURAL STEEL
ALL SURFACES REQUIRED MT.

6 DEFECTS TO BE GROUND TO $\frac{3}{8}$ "

6 AWS REQUIRES LAMINATIONS GROUND TO 1"

CONCLUSION

0 DEFECTS IN QUESTION NOT LAMINATIONS

0 DEFECTS WERE SURFACE ROLLING DEFECTS

0 GRINDING DEPTH ADEQUATE FOR NON-LAMINAR DEFECTS

0 ALL INDICATIONS EVALUATED PER AWS D1.1.

DISCUSSION

0 DEFECTS NOT ON EDGE OF MEMBER BUT ON FACE.

0 TYPICAL OF ROLLING DEFECTS

0 MATERIAL CONFORMS TO APPLICABLE MILL SPECIFICATIONS

0 DEFECTS NOT LAMINAR

0 95% REMOVED WITHIN 3/8"

0 OTHERS EVALUATED ON CASE-BY-CASE BASIS PER CRITERIA OF AWS D1.1

#14

(RS) Steel structures bridging from the SSW to the containment wall have undergone significant weld repairs in the past two years. Licensee consultants have determined a need to maintain some minimum temperature of weld joints to ensure adequate nilductility transition temperature characteristics of the structural welds.

FRACTURE SAFE DESIGN OF DRYWELL STRUCTURAL STEEL

PROBLEM:

- 6 DEFECTS FOUND IN FIELD WELDS
- 6 ALL WELDS INSPECTED (MT) AND REPAIRED
- 6 CONSULTANT RECOMMENDED MINIMUM TEMPERATURE OF
140° DURING OPERATION
- 6 140° ABOVE MAXIMUM DESIGN TEMPERATURE



CONCLUSIONS:

- 0 OK IF MINIMUM DRYWELL TEMPERATURE IS ABOVE 100° F.,
WHEN LOCA POSTULATED.

RESOLUTION:

C FRACTURE MECHANICS EVALUATION

G FIND MINIMUM TEMPERATURE FOR ADEQUATE SAFETY MARGIN

- STRESS ANALYSIS AND FLAW MODELLING
- MATERIAL PROPERTIES
- TEMPERATURE DEFINITION IN DRYWELL
- FIND EFFECT OF TEMPERATURE ON CRITICAL FLAW SIZE

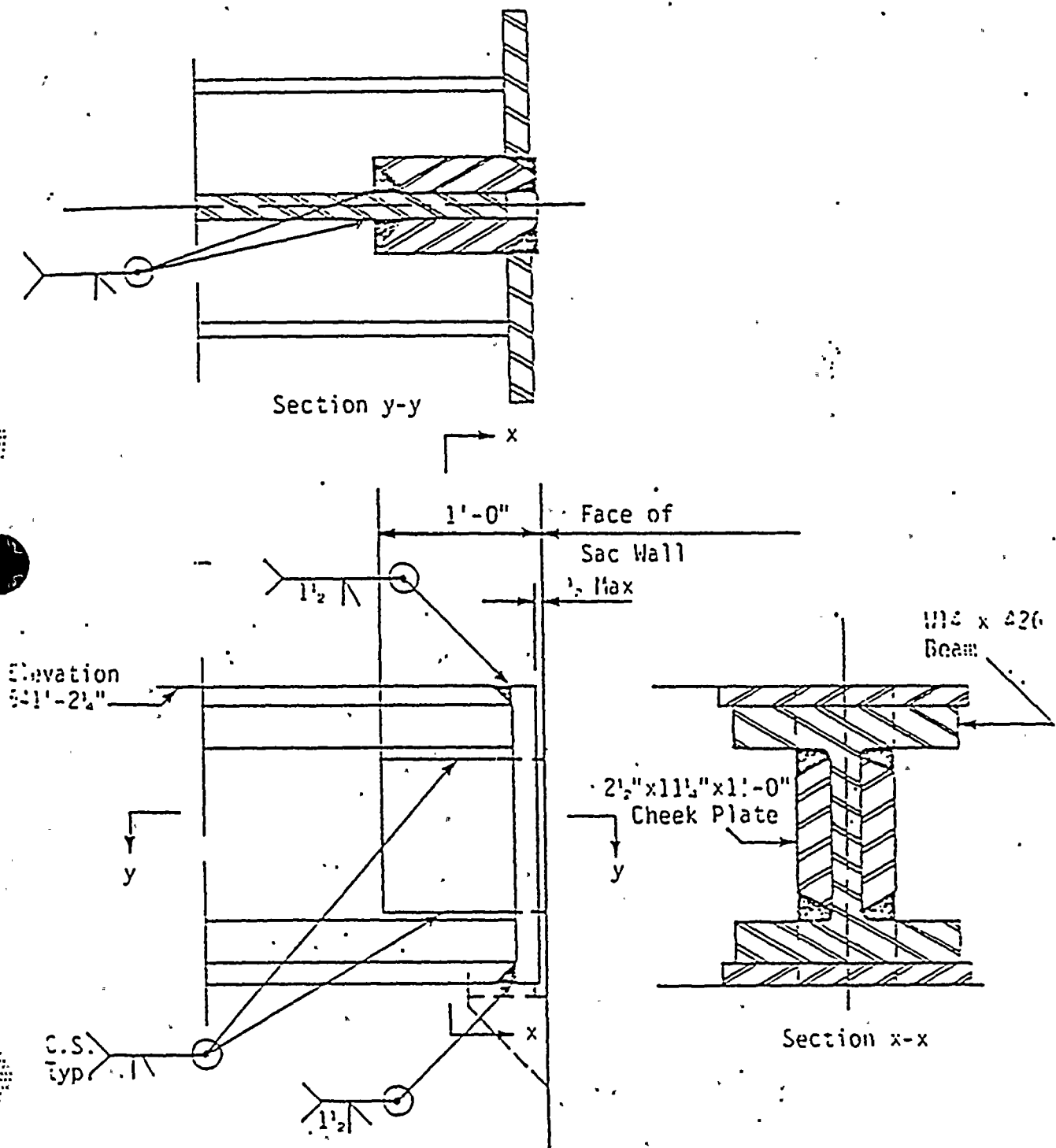
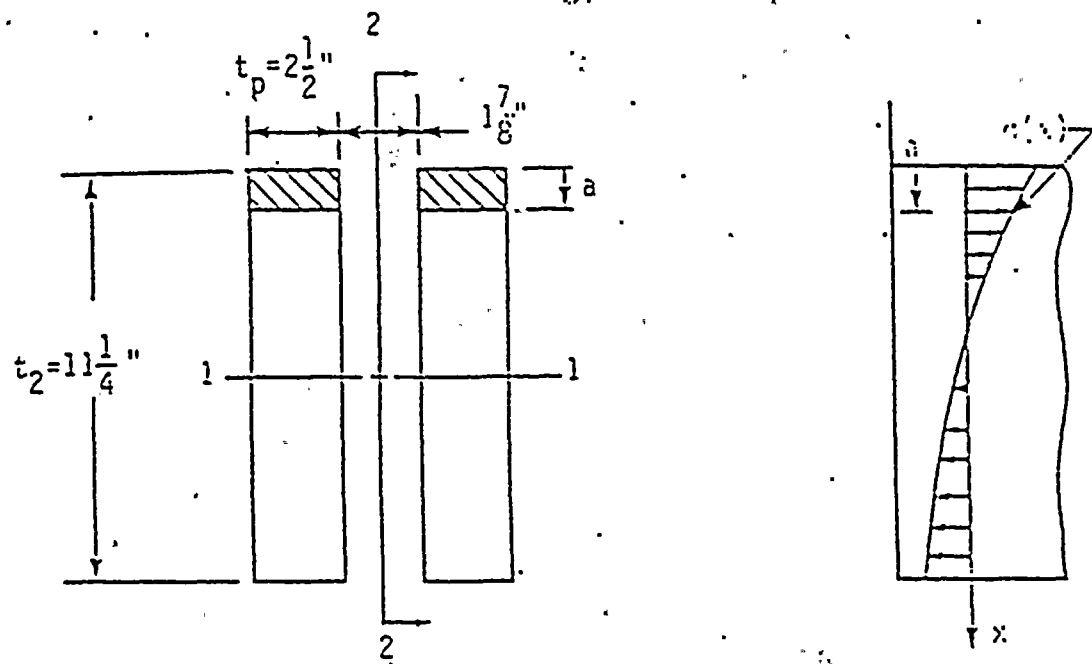
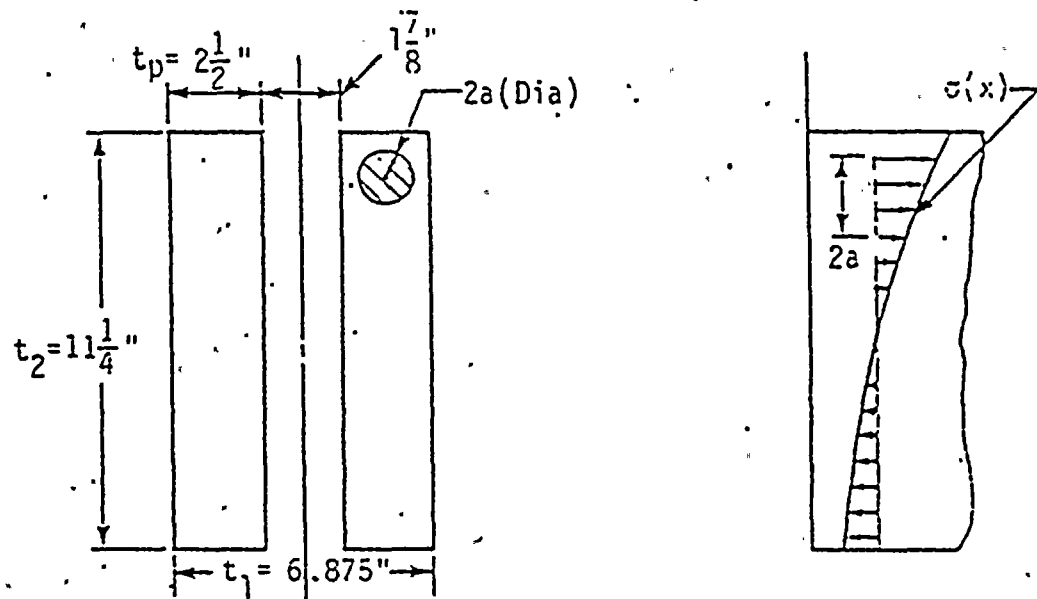


Figure 3.10 - Schematic Showing Cheek Plate Attachment.



a) Edge Crack in Cheek Plate-to-Wall Weldment.



b) Buried Circular Crack in Cheek Plate-to-Wall Weldment.

Figure 3.11 - Schematic Showing Postulated Cracks in Cheek Plate Plate Connection.

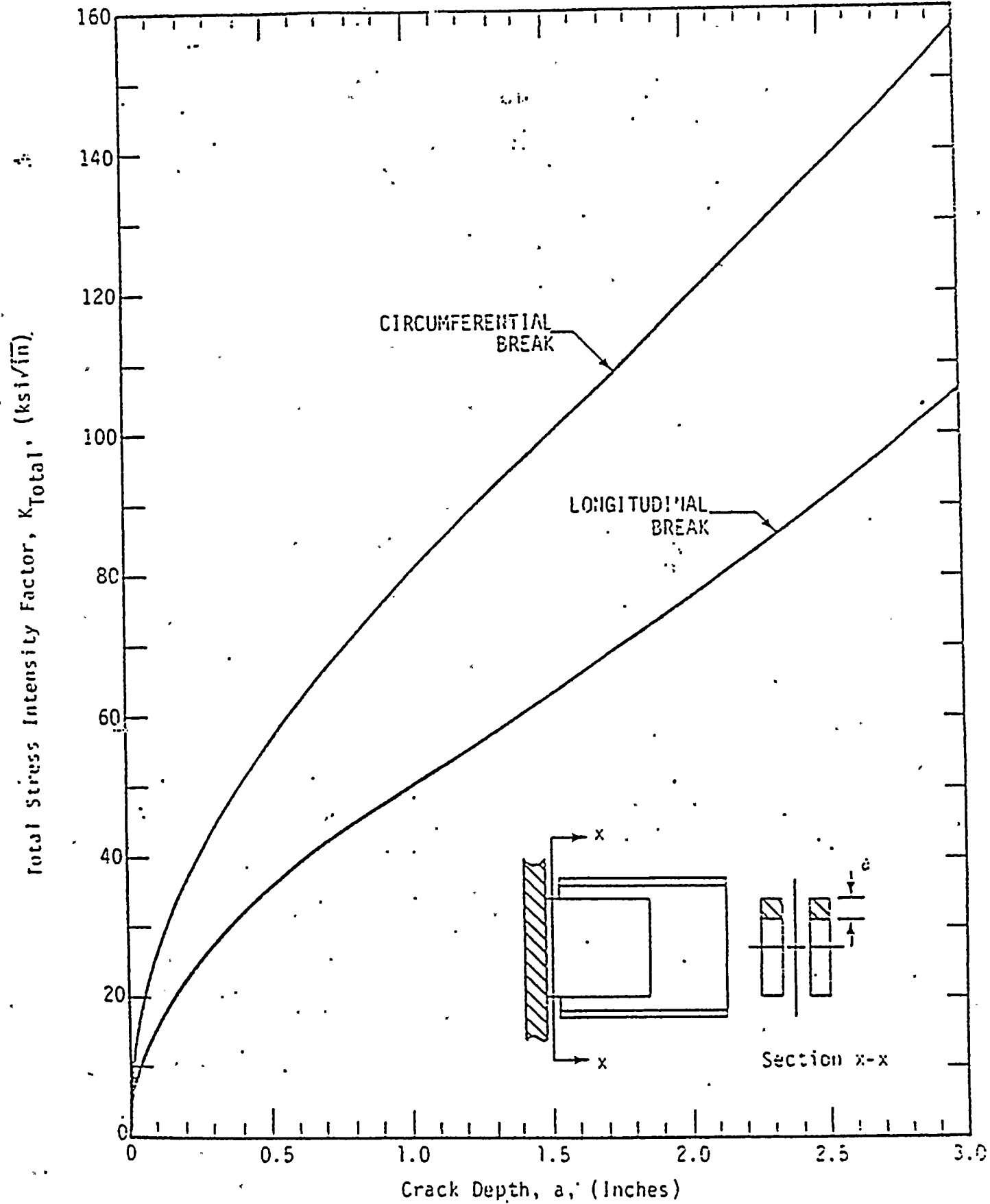


Figure 3.14 - Total Stress Intensity Factor For an Edge Crack in the Cheek Plate-to-Wall Connection Weld (With Residuals).



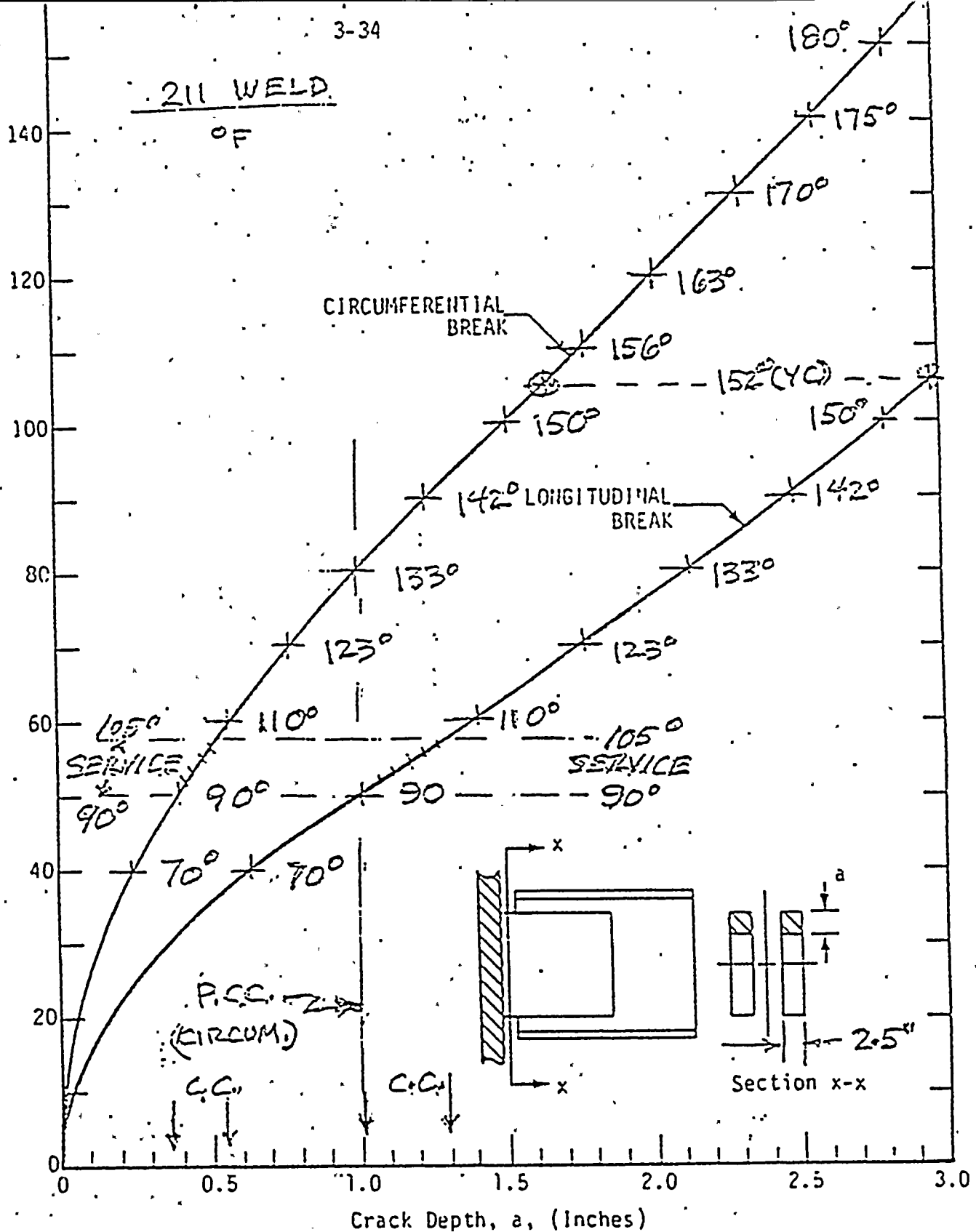
Total Stress Intensity Factor, K_{Total} , (ksi/in)

Figure 3.14 - Total Stress Intensity Factor for an Edge Crack in the Cheek Plate-to-Wall Connection Weld (With Residuals).

CIRCUMF. BREAK
LONG. BREAK

SMALL C.C. SIZE
C.C. = 0 P.C.C. CRACK SIZE

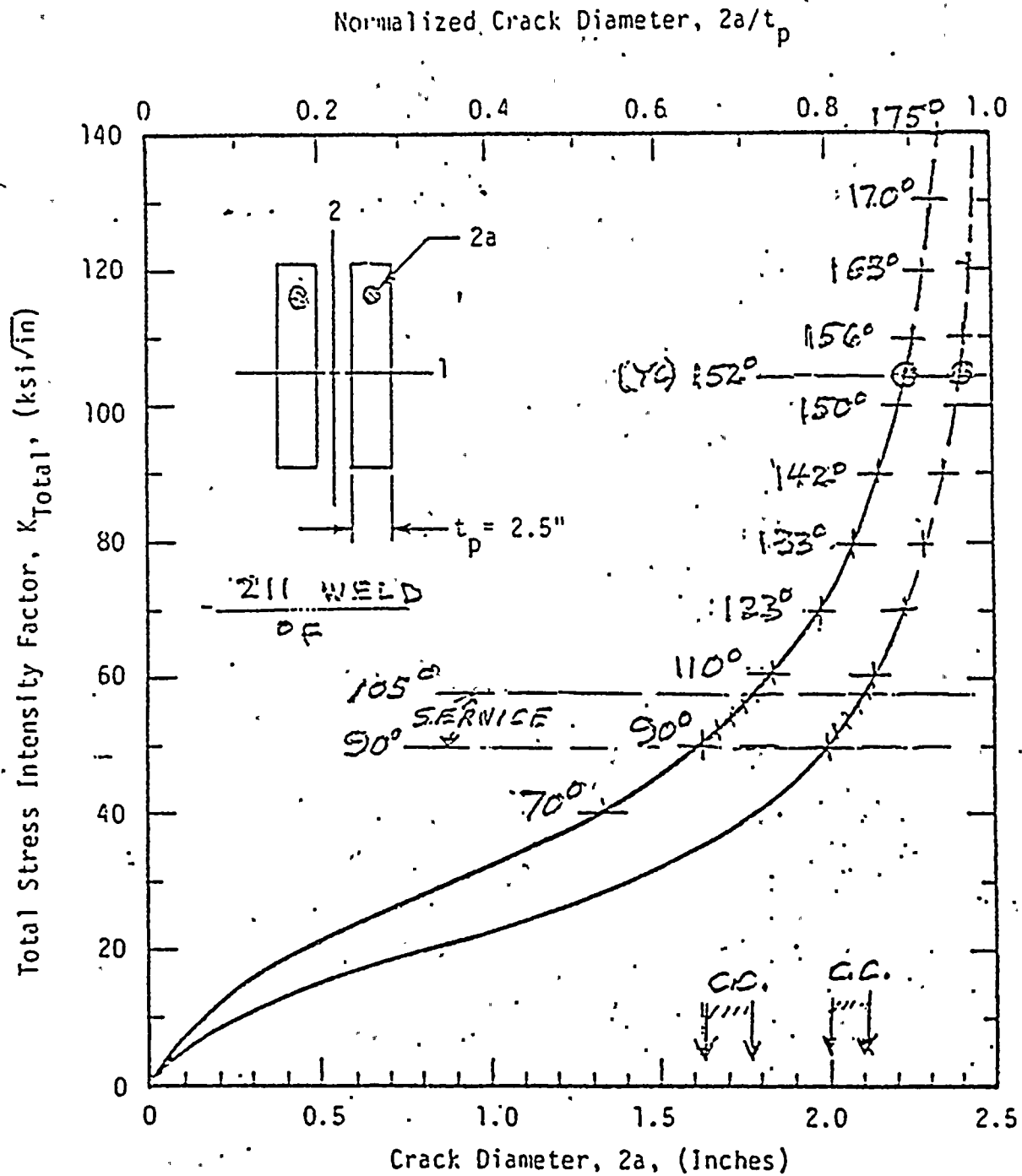


Figure 3.16 - Total Stress Intensity Factor as a Function of Crack Diameter For a Buried Circular Crack in the Cheek Plate-to-Wall Weld Connection (With Residuals).

LARGE G.C. SIZE — TWO DEFECTS NOT REALISTIC



[illegible]

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[illegible]

