



MPR Associates, Inc.
320 King Street
Alexandria, VA 22314

CALCULATION TITLE PAGE

Client Niagara Mohawk Power Corporation		Page 1 of 8 + ATTACHMENTS	
Project NMP-1 RWCU Weld 33-FW-22 Overlay Design		Task No. 085-9708-295-0	
Title SSFLAW Overlay Size		Calculation No. 085-295-02	
Preparer/Date	Checker/Date	Reviewer/Date	Rev. No.
<i>Randolph c Trench</i> 5/16/97	<i>Paul S. Kuntz</i> 5/16/97	<i>J S Nestor</i> 5/16/97	0
<i>Randolph c Trench</i>			
<i>Randolph c Trench</i> 5/16/97	<i>Paul S. Kuntz</i> 5/16/97	<i>J S Nestor</i> 5/16/97	1

QUALITY ASSURANCE DOCUMENT

This document has been prepared, checked, and reviewed in accordance with the Quality Assurance requirements of 10CFR50 Appendix B, as specified in the MPR Quality Assurance Manual.

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PDR ADDCK 05000220
P PDR





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RECORD OF REVISIONS

Calculation No.
085-295-02

Prepared By

M. C. Trumb

Checked By

P. Smith

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Revision	Description
0	Initial Issue
1	Changed title of Attachment 1.





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ATTACHMENTS

- 1 SSFLAW Program Output
- 2 Examination Report for Weld 33-FW-22 dated 5/15/97





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1.0 PURPOSE

The purpose of this calculation is to determine the thickness of an overlay to be installed at the location of Weld 33-FW-22 in the NMP-1 RWCU piping system.

2.0 SUMMARY

The overlay size is:

Thickness: 0.25-inch minimum

Length: 2.5-inch minimum, centered on the nozzle side edge of the weld crown

3.0 APPROACH

In 1988 NMPC obtained computer program SSFLAW, which calculates overlay sizes using the method presented in Reference 1. Reference 2 describes the program, its development, and use, and provides a user manual for the program.

The program performs the following operations:

- SSFLAW assumes the crack extends 360 degrees around the pipe and penetrates fully through the original pipe wall. The crack is assumed to stop at the overlay.

1975





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- SSFLAW then uses the stresses applied to the section to determine the overlay thickness needed to prevent plastic collapse of the section, including a factor of safety of 2.77 as required by NUREG-0313, Revision 2.

4.0 CALCULATION

4.1 Program SSFLAW Inputs

Appendix A to the SSFLAW user's manual (Reference 2) describes the inputs required to run the program. The required inputs for overlay sizing are listed below, along with the values to be used in the program.

- Pipe Material. Per Reference 3, the nozzle is made of Type 304 stainless steel.
- Material Design Stress Intensity (S_m) and Yield Strength (S_y). SSFLAW default values for these parameters are used. The program calculates these parameters for Type 304 material at the input temperature of the system (discussed below).
- Operating Temperature. Per Reference 3, the design nozzle temperature is 575°F.
- Pressure. Per Reference 3, the design pressure of the nozzle is 1300 psig.
- Pipe Outside Diameter and Wall Thickness. Per Reference 3, the weld is in nominal 6-inch piping (6.625-inch actual OD) with 0.38-inch minimum wall thickness.





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• **Applied Stresses.** Stresses are calculated in Reference 4 as follows:

Applied Tensile Stress:	0.4 ksi
Applied Bending Stress:	12.0 ksi

Note that the above stresses include secondary stresses due to thermal expansion. Treating thermal stresses as primary stresses is required by NUREG-0313, Revision 2 for overlays fabricated from SMAW weld metal. Per the SSFLAW user manual, pressure stress is calculated separately by the program and so is not to be included in the input stresses.

Note that the following parameters are specified for input into Program SSFLAW but are not needed for the overlay sizing calculation method:

Weld Type
Residual Stress State
Flaw Orientation, Length and Depth
Service Interval
Reference Source for Allowable Flaw Size

Therefore, for Program SSFLAW runs made in this calculation, the input values for these parameters are selected as default values.

4.2 **Program SSFLAW Results**

Attachment 1 presents the printout from Program SSFLAW run for the above inputs. The results show that an overlay thickness of 0.25-inch minimum is acceptable for the applied stresses.

Program SSFLAW was developed and used in accordance with the MPR Associates Quality Assurance Program.





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5.0 OVERLAY LENGTH CALCULATION

Code Case N-504 (Reference 5) provides the following instruction for determining the length of the overlay required beyond each edge of the observed flaws:

$$\text{Length} = 0.75 \sqrt{(R)(t)}$$

where R = outer radius and t = nominal wall thickness of pipe.

Accordingly, the required overlay length beyond each end of the observed flaws for this 6-inch OD, schedule 80 pipe is:

$$\text{Length} = 0.75 \sqrt{(6.625'' / 2)(0.432'')} = 0.9''$$

Per Reference 6 (Attachment 2), the observed length of the indication is 0.531-inch (equal to 7/16-inch plus 3/32-inch). The required length is then:

$$0.531'' + 2(0.9'') = 2.33''$$

Use 2.5-inch minimum length centered on the nozzle side edge of the weld crown.

... ..
... ..





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5.0 REFERENCES

1. "Evaluation of Flaws in Austenitic Steel Piping," Section XI Task Group for Piping Flaw Evaluation (ASME Code), Journal Of Pressure Vessel Technology, Volume 108, No. 3, August 1986.
2. MPR Report MPR-1037, Revision 1, "SSFLAW -- A Computer Program to Evaluate Cracks in Stainless Steel Piping (Version 1.1)," April 1988.
3. Southwestern Engineering Company Drawing 77528, Rev. 17, "Regenerative Clean-up Heat Exchanger" (for RWCU HX ND-03).
4. MPR Calculation 085-295-01, "NMP-1 RWCU Weld 33-FW-22 Overlay Design, Stresses for Input to Program SSFLAW," Revision 0.
5. ASME Boiler And Pressure Vessel Code Case N-504, dated April 30, 1992.
6. NMPC Radiographic Examination Report for Weld 33-FW-22 dated 5/15/97. [Included as Attachment 2.]





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ATTACHMENT 1

SSFLAW Program Output



CALC 514-33 M009 Rev 0
page 11 of 14
SSFLAW
Version 1.1
(April 5, 1988)

DOC. NO. 085-295-02
ATTACHMENT 1
SHEET 2 OF 2

Overlay Sizing Calculation Results

33-FW-22 Weld Overlay Sizing Date: 5/16/97

Pipe Material: Type 304 Stainless Steel
Sm= 16.67 ksi
Sy= 18.50 ksi

Pipe Geometry:

Outside Diameter= 6.625 in
Wall Thickness= 0.380 in

System Operating Conditions:

Pressure= 1300.0 psig
Temperature= 575.0 F

	Normal Conditions	Faulted Conditions
Tensile Stress (ksi)	0.40	0.40
Bending Stress (ksi)	12.00	12.00
Pressure Stress (ksi)	5.02	5.02

Required Weld Overlay Dimensions:

Overlay Thickness= 0.233 in
Overlay Length= 1.12 in

Not Used. See Section 5
of calculation

Prepared by: R. C. Tumb
checked by: P. Kuntz





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085-295-02

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Checked By

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ATTACHMENT 2

Radiographic Examination Report for Weld 33-FW-22 dated 5/15/97



NIAGARA MOHAWK

RT EXAMINATION REPORT

Nine Mile Point Unit 1
 ISO/Dwg.: _____
 System: CU Rx w/Tr clean up

NDE Report: _____
 Page 1 of 1
 Work Document: _____
 Exam Item: _____
 Procedure: _____

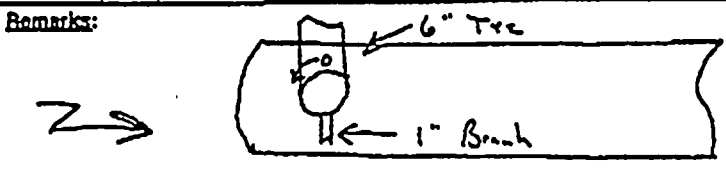
Material Type: CS/SS
 Joint Type: Butt
 Base Metal Thickness: .432
 Weld Thickness: .494
 Pipe Diameter or
 Weld Length: 21"

Radiation Source and SIN: IR¹⁹²
 No. of Curies: 47 KV: _____ MA: _____
 Source to Object Distance: .6506
 Object to Film Distance: .494
 Film Load: Single _____ Double X Other _____
 Processing: Manual X Auto _____
 Densitometer Number: 10573

Welding Process(es) Used: _____
 Penetrant Material and No.: ASTM #15 SS
 Location: Film Side: X Source Side: _____ Required T Hole: 2T
 Shim Material and Thickness: _____
 Screen Material and Thickness: Front: .010 Back: .010
 Technique Used: DWE/SW
 Geometric Unsharpness (UG): .012

Weld SN	Area of Interest	Porosity	Slag Inclusions	Cracks	Incomplete Fusion	Incomplete Penetration	Undercut	Burn Thru/Suck Back	Film Artifact	Tungsten Inclusion	High-Low	No Apparent Defect	Penetrant Density	Area of Interest Density	Accept	Reject	Film Interceptor	Level	Date
33FW22	0 - S.2						X								X		raised bead on o.D surface, OD pitting	III	5/15/97
	S.2 - 10.5			X		X									X		Transverse & long .OD pitting, undercut	III	5/15/97
	10.5-20														X		OD pitting	III	5/15/97
	10.5-15.7						X								X			III	5/15/97
	15.7-0	X					X								X			III	5/15/97

Joe Oliver
Joe Oliver
Joe Oliver
Joe Oliver



New "0" marker is due west, old "0" marker is due south

Exam Item Acceptable? Yes No

Acceptance Criteria: _____
 Examiner 1: Joe Oliver Joe Oliver Level: III Date: 5/15/97
 Examiner 2: Ken Kemp Howard W. King Level: II Date: 5/15/97
 Reviewer: _____ Level: _____ Date: _____
 ANII: _____ Date: _____
 Previous Outage Date Reviewed? Yes X No _____
 Reviewer [Signature]

CONS. FLM

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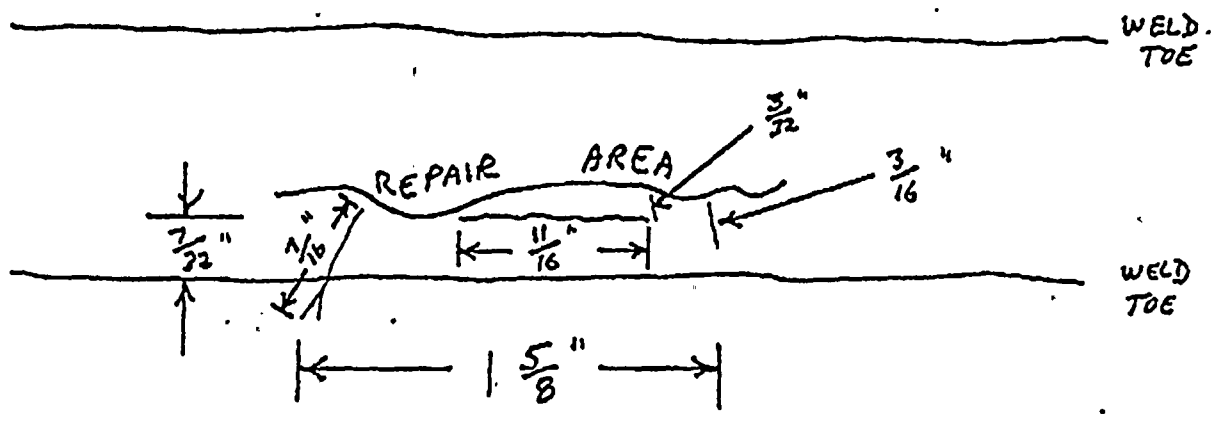
Plant/Unit: Nine Mile Point Unit
ISO/Dwg.:
System:

NDE Report: _____
Work Document: _____
Page ____ of ____
Exam Item: _____
Procedure/Rev.: _____

CALC S14-33M009 Rev 0
page 14 of 14

5.2

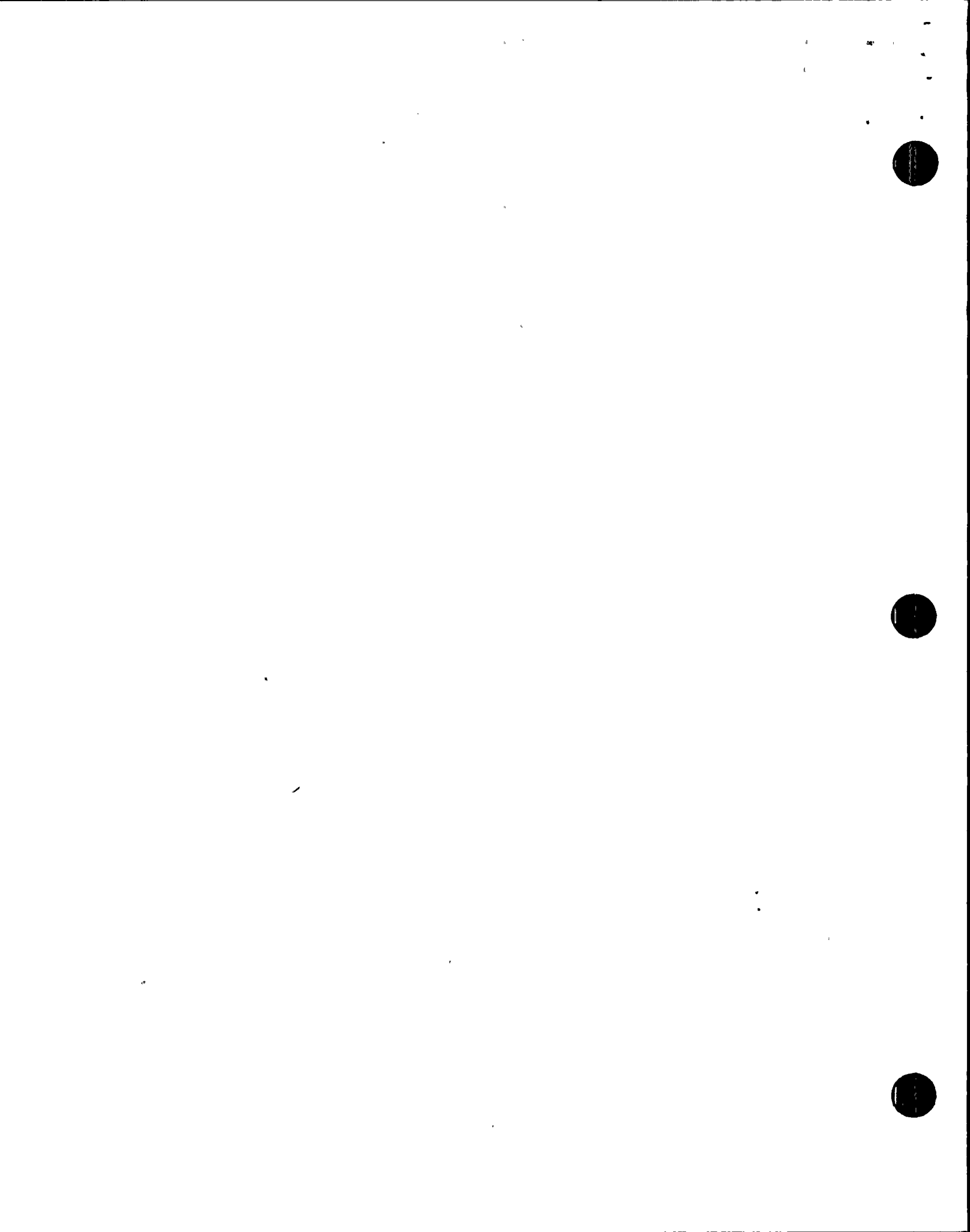
10.5



NOT TO SCALE
-ENLARGED TO SHOW
DETAIL-

DOC. NO. 085-295-02
ATTACHMENT 2
SHEET 3 OF 3

Examiner 1: _____ Level: _____ Company: _____ Date: _____
Examiner 2: _____ Level: _____ Company: _____ Date: _____
Reviewer 1: _____ Level: _____ Company: _____ Date: _____
ANII: _____ Date: _____



NINE MILE POINT NUCLEAR STATION

Unit (1, 2 or 0=Both) : 1

Discipline : STRUCTURAL

Title
RWCU WELD 33-FW-22: STRESSES FOR INPUT TO SSFLAW

Calculation No.
S14-33M008

(Sub)system(s)
33

Building
RX

Floor Elev.
261

Index No.
S14

Originator(s)
RANDY TRENCH (MPR)

Checker(s) / Approver(s)
PAUL KNITTLE (MPR), JIM NESTELL (MPR)

Accepted by C.E. Stoup 5/16/97 / Mohammed Alsi 5-19-97
Design

Rev	Description	Change No.	By	Date	Chk	Date	App	Date
0	INITIAL ISSUE	N/A	RCT*	5/16/97	PK	5/16/97	JEN	5/16/97

* SEE PAGE 1 FOR MPR SIGNATURES

Computer Output/Microfilm Filed Separately (Yes / No / NA): NO

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Superseded Document(s) : NONE

Document Cross Reference(s) - For additional references see page(s) : NONE

Ref No	Document No.	Doc Type	Index	Sheet	Rev
1	C-26852-C	DR	S14	2	11

General Reference(s) :
SEE SECTION 4.0

Remarks :
WELD OVERLAY REPAIR OF SUSPECTED IGSCC

Confirmation Required (Yes / No) : No
See Page(s) : _____

Final Issue Status
(APP / FIO / VOI) : APP

File Location
(Calc / Hold) : Calc

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Required (Yes / No) : No

Evaluation Number(s) / Revision :
Copy of Applicability Review Attached (Yes / N/R)?N/R

Component ID(s) / EPN(s) / Line Number(s) :
NONE

Key Words : SSFLAW, WELD OVERLAY DESIGN, RWCU

