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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

January 31, 1994

LICENSEE: Boiling Water Reactor Owners Group (BWROG)

FACILITY: All Boiling Water Reactors

SUBJECT: SUMMARY OF JANUARY 5, 1994, MEETING TO DISCUSS INSPECTION AND REPAIR CRITERIA FOR REACTOR INTERNALS (TAC NO. M88219)

A meeting was held on January 5, 1994, in the NRC One White Flint North Office in Rockville, Maryland, with the BWROG and NRC staff representatives. The NRC staff had requested this meeting in a letter to the BWROG dated November 9, 1993. Enclosure 1 is a list of meeting attendees.

The purpose of the meeting was to obtain an update on the BWROG's progress in developing (1) inspections of reactor internals, (2) a solution for the recent cracking of jet pump hold down beams, and (3) guidance for inspections and the repair criteria for core shroud cracking. R. Dyle of the BWROG and M. Herrera of General Electric (GE) responded to these items. Enclosure 2 is a copy of the material presented at the meeting by the BWROG. The discussions of the items on the agenda are summarized below.

INSPECTIONS OF INTERNALS

The BWROG has prioritized items for inspection and examined repair options. It is developing an engineering methodology for evaluating the most important components, and this is almost complete. The group plans to develop a program for internals and the vessel; this program must be presented to members for approval. These activities are expected to be completed by the end of the year. Then the results will be sent to the ASME Code Section XI group for codification. The plan addressing the internals will not be available to the NRC staff before midyear.

As options for inspection, the BWROG is considering enhanced visual inspection or ultrasonics or both. Qualification of inspection techniques is expected to begin during the week of January 5, 1994, at the GE facility in San Jose, California.

JET PUMP HOLD DOWN BEAMS

No new information was added to that described in Information Notice 93-101. The beam failure at Grand Gulf was a first time occurrence. GE is continuing to analyze the failure. The failure, which could be generic, appears to be related to a certain heat treatment. GE is still recommending the position described in GE Service Information Letter (SIL) No. 330. GE SIL No. 330 recommends that the beams be replaced as soon as practical if (1) the beams are of the same design as the Grand Gulf beams, and (2) the beams will have an accumulated service of more than 8 years at the next refueling outage. The failure is thought to be caused by stress corrosion cracking and some fatigue. GE is developing an inspection technique to find indications and after qualification, will recommend it to owners.

002093

030066

CORE SHROUD ACTIVITIES

The BWROG has a plan with milestones for activities related to the core shroud cracking. It intends to send plans for inspection and the screening criteria to members for comments. The results are expected to be available to the NRC after March 1994. The evaluation of the shroud cracking should be complete by summer 1994. Mitigating options such as hydrogen water chemistry and noble coatings are being studied. Guidelines for operators on how to recognize symptoms of cracking are being proposed. Flaws will be evaluated by methods like those described in the ASME Code, Section XI.

INTERGRANULAR STRESS CORROSION CRACKING (IGSCC) INSPECTION QUALIFICATION

The BWROG is working on developing a transition from the currently accepted position described in Generic Letter 88-01 "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping" to implementing Appendices 7 and 8 of the ASME Code. The NRC staff expressed support for this transition.

ACTION ITEMS

At the close of the meeting, the NRC staff observed that little, if any, new information had been presented and expressed disappointment with the BWROG's progress in meeting the scheduled milestones proposed in the action plan which had been submitted in a letter dated October 20, 1993. Therefore, the NRC staff requested the following items from the BWROG:

1. A revision of the October 20, 1993, action plan. This revision should include realistic schedules for the action plan milestones. The schedules should be specific concerning the items for review. The revised action plan should address all reactor intervals.

2. A revisit of the proposed flaw acceptance criteria for core shroud cracks. The NRC staff recommended that a more graded approach to flaw sizes; i.e., one that would include rules applying to small cracks that would be acceptable without evaluation. In generically acceptable criteria, the NRC staff would like to see a threshold above which it would review the analysis. Also, the NRC staff wishes the analysis to account for nondestructive examination uncertainties.

3. A list of jet pump holddown beams in service, including their years of service, heat treatment process, and design configuration.

4. Provide the NRC staff with copies of letters to licensees regarding vessel internals inspections.

5. The NRC staff wishes to see a smooth transition for qualifying examiners from the method currently used for IGSCC inspections to that specified by Appendices 7 and 8 of the ASME Code. The NRC staff requested to review the BWROG proposal for performing these inspections.

Donald S. Brinkman

Donald S. Brinkman, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. List of Attendees
2. Materials Presented by BWROG

cc w/enclosures:
Robin Dyle
Southern Nuclear Operating Company
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William Zarbis
GE Nuclear Energy
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Enclosure 1

ATTENDANCE LIST

January 5, 1994, Meeting With BWR Owners Group to
Discuss Inspection Guidance and Repair Criteria for BWR
Core Shrouds and Recent Cracking of BWR Jet Pump Holddown Beams

Name	Position	Organization
Donald S. Brinkman	Sr. Project Manager	NRC/NRR/PDI-1
Francis J. Williams, Jr	Project Manager	NRC/NRR/PDI-1
Maudette Griggs	Mechanical Engineer	NRC/NRR/PDI-1
Robert A. Capra	Director, PDI-1	NRC/DRPE/PDI-1
Patrick Milano	Project Manager	NRR/DRPE/PD2-1
Singh Bajwa	Acting Project Director	NRR/DRPE/PD2-I
Jack Strosnider	Chief, Materials & Chem Eng. Br	NRC/NRR/DE
Lee Banic	Materials Engineer	NRC/NRR/DE/EMCB
Jim Davis	Materials Engineer	NRC/NRR/DE/EMCB
Jim Medoff	Chemical Engineer	NRC/NRR/DE/EMCB
William H. Koo	Sr. Materials Engineer	NRC/NRR/DE/EMCB
Robert A. Hermann	Section Chief, EMCB	NRC/NRR/EMCB
Wayne Hodges	Acting Dir, Div. of Engr	NRC/NRR
Kahtan Jabbour	Hatch Project Mgr	NRC/NRR
Allen Hiser	Materials Engineer	NRC/RES/DE
Michael McNeil	Materials Engineer	NRC/RES/DE
Les R. Cupidon	Electrical Engineer	NRC/AEOD/DSP/ROAB
Ken Battige	Materials Engineer	NRC/AEOD
A. R. Jaschk	Project Manager	GE Nuclear Energy
Jim Stanley	Engineer	PECO Energy
Marcos Herrera	Principal Engr/Struct Mech.	GE Nuclear Energy
Robin Dyle	Sr Engr	SNC/BWROG
Les England	BWROG Chairman	Entergy Operations
Robert L. Phillips	Principal Mech-Nuc Engineer	TVA Browns Ferry Nuclear Plant
Frank E. Hartwig	Project Manager	TVA Browns Ferry Nuclear Plant
Terry R. Woods	Chief Materias & Insp. Engr	TVA Corp. Eng.
Michael Breck	Engineer	NUS
John Langdon	NDE Supervisor, CP&L, Brunswick	CP&L
Richard Znerder	Associate Editor	McGraw-Hill
Joel W. Whitaker	NDE Engineer	TVA Corp. Eng.
M. S. Leonard	Lead Engineer - Insp Programs	NMPC
Roy Corieri	Mechanical Engineer	NMPC/NMPI
Albert Curtis	Manager, Nuclear Projects	Aptech Engrg. Services
Hiroaki Yasui	Manager	Tokyo Electric Power Co.
Joe Lafferty	Senior Engineer	New York Power Authority
Sterling Weems	Engineer	MPR Associates
William Maher	Senior Project Engineer	PSE&G
T. W. Brombach	Corp. Technical Specialist	Entergy Operations

Bradley Ferrell	Licensing Engineer	Cleveland Electric
Paul Nichols	Senior Project Engineer	Cleveland Electric
Richard Ciemiewicz	ISI Programs	PECO Energy
Robert H. Zong	Senior Met. Engineer	PECO Energy
Drew Holland	GPUN Project Engineer	Oyster Creek
Rick Nademus	GPUN NDE Engineer	Oyster Creek
Greg Selby	Senior Engineer	EPRI NDE Center
Paul Guthrie	Manager, Materials & Welding	Tennessee Valley Authority
Robert Draper	Attorney	Winston & Shawn

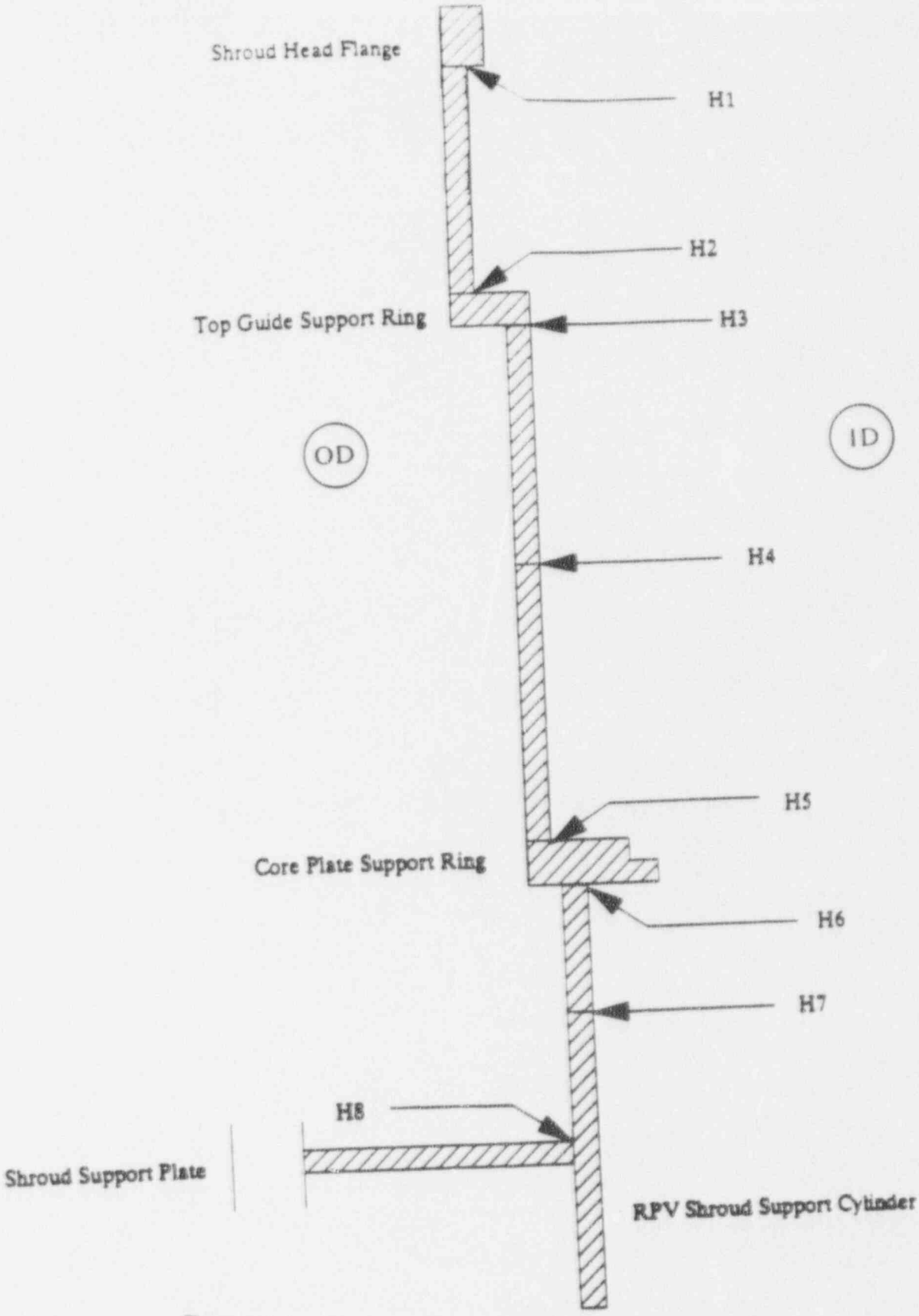
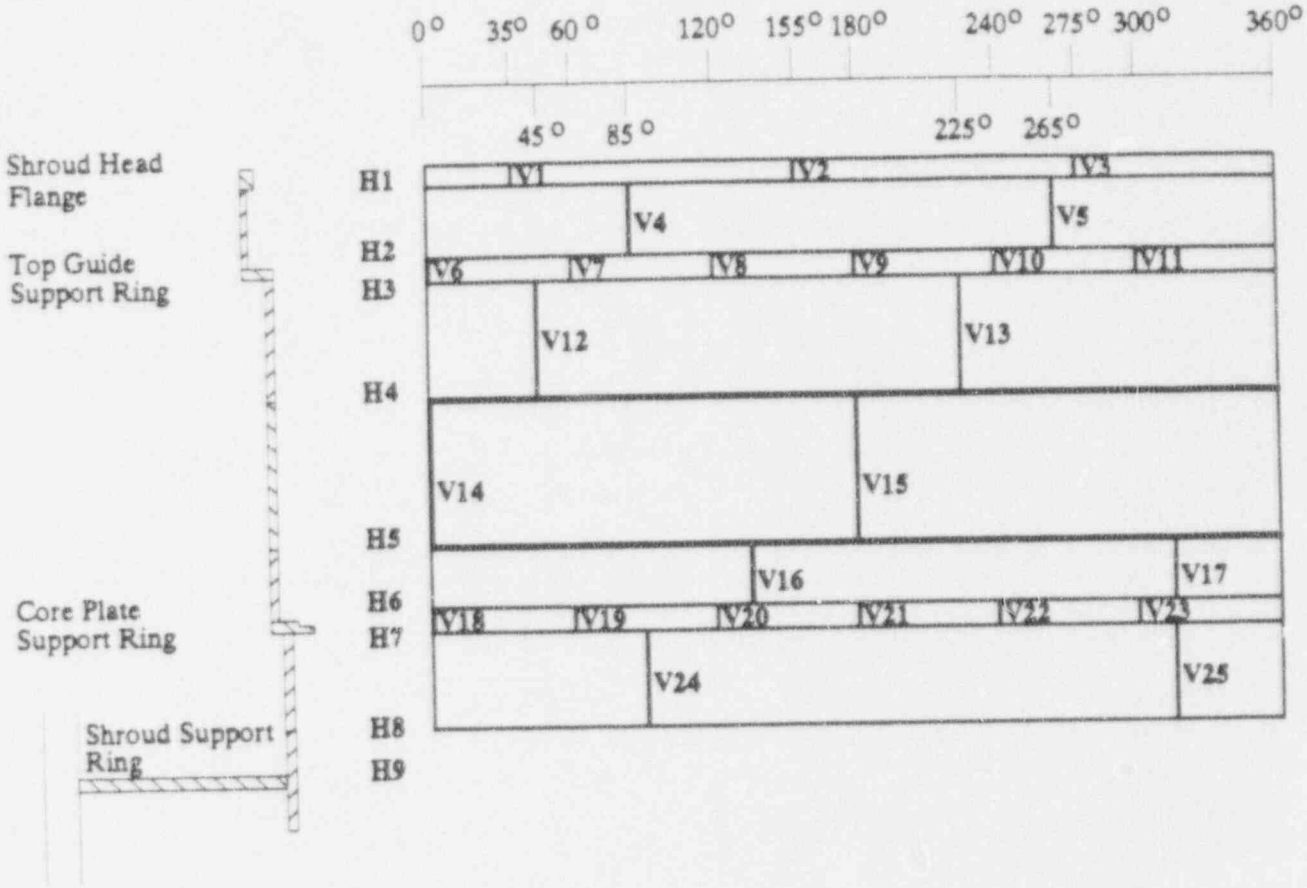

Shroud Head Flange
H1
H2
Top Guide Support Ring
H3
OD
ID
H4
H5
Core Plate Support Ring
H6
H7
H8
Shroud Support Plate
RPV Shroud Support Cylinder

Figure 1-1



NOT TO SCALE

Figure 2-1 - Sketch Showing Typical Welds in Core Shroud

Table 3-1 - Conservatisms Included in Screening Criteria

1. All surface indications were assumed to be through-wall for analysis.
2. The screening criteria limit one-fourth of allowable circumferential flaw to any arbitrary 90° sector.
3. All indications are assumed to be grouped together for the limit load calculation and no credit is taken for the spacing between indications.
4. ASME Code primary pressure boundary safety margins were applied even though the shroud is not a primary pressure boundary.
5. ASME Code, Section XI proximity rules were applied.
6. An additional proximity rule which accounts for fracture mechanics interaction between adjacent flaws was used.
7. The highest stress computed for any single location was used for all locations.
8. Both LEFM and limit load analysis were applied, even though LEFM underestimates allowable flaw size for austenitic materials and is not required per ASME Code Section XI procedures.
9. The bounding crack growth estimated for the next fuel cycle was included in flaw lengths used for evaluation (See Appendix A).
10. A proximity rule to account for perpendicular flaws was applied, although not required by Section XI.

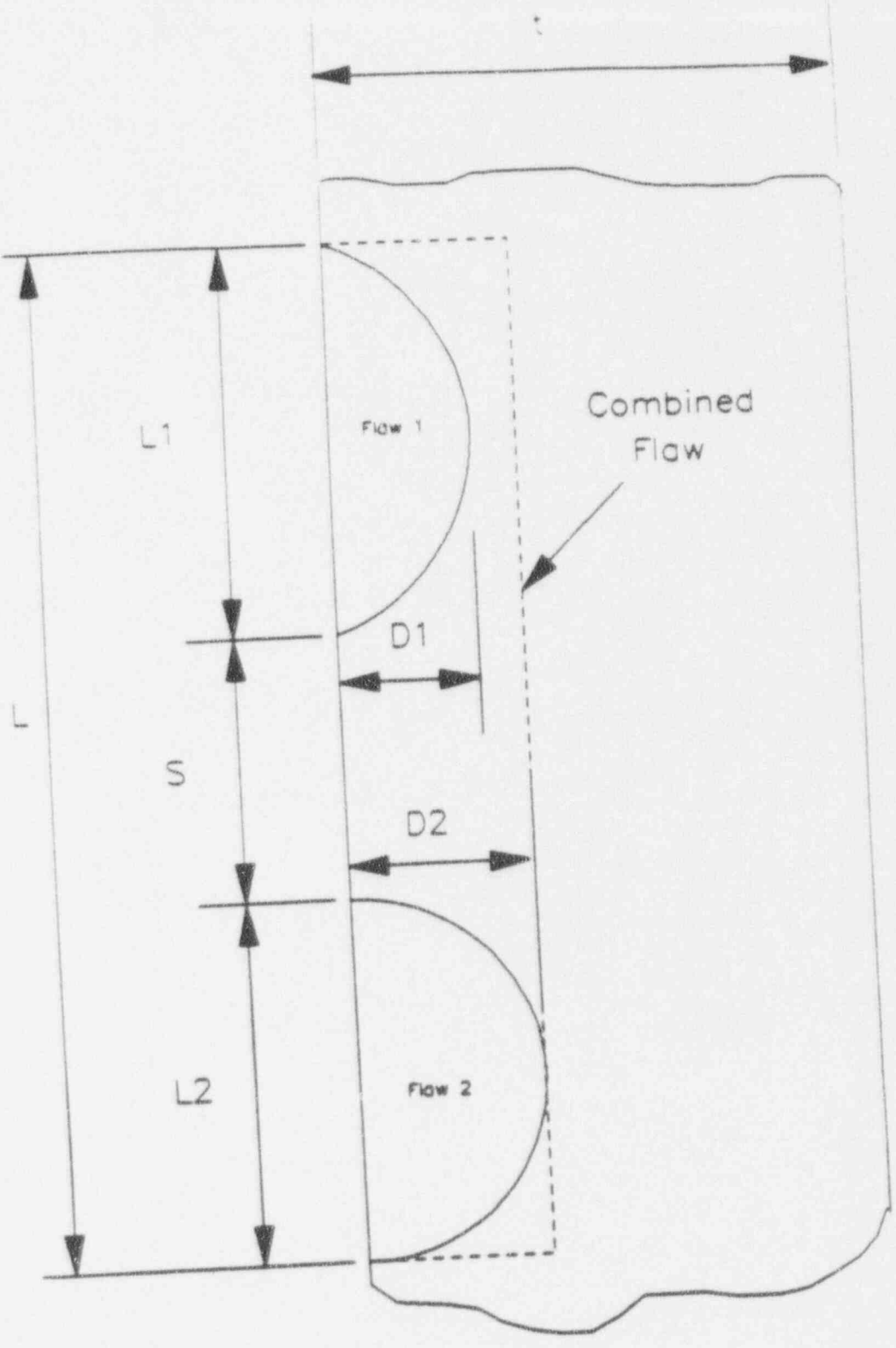


Figure 3-1 – ASME Code Proximity Criteria

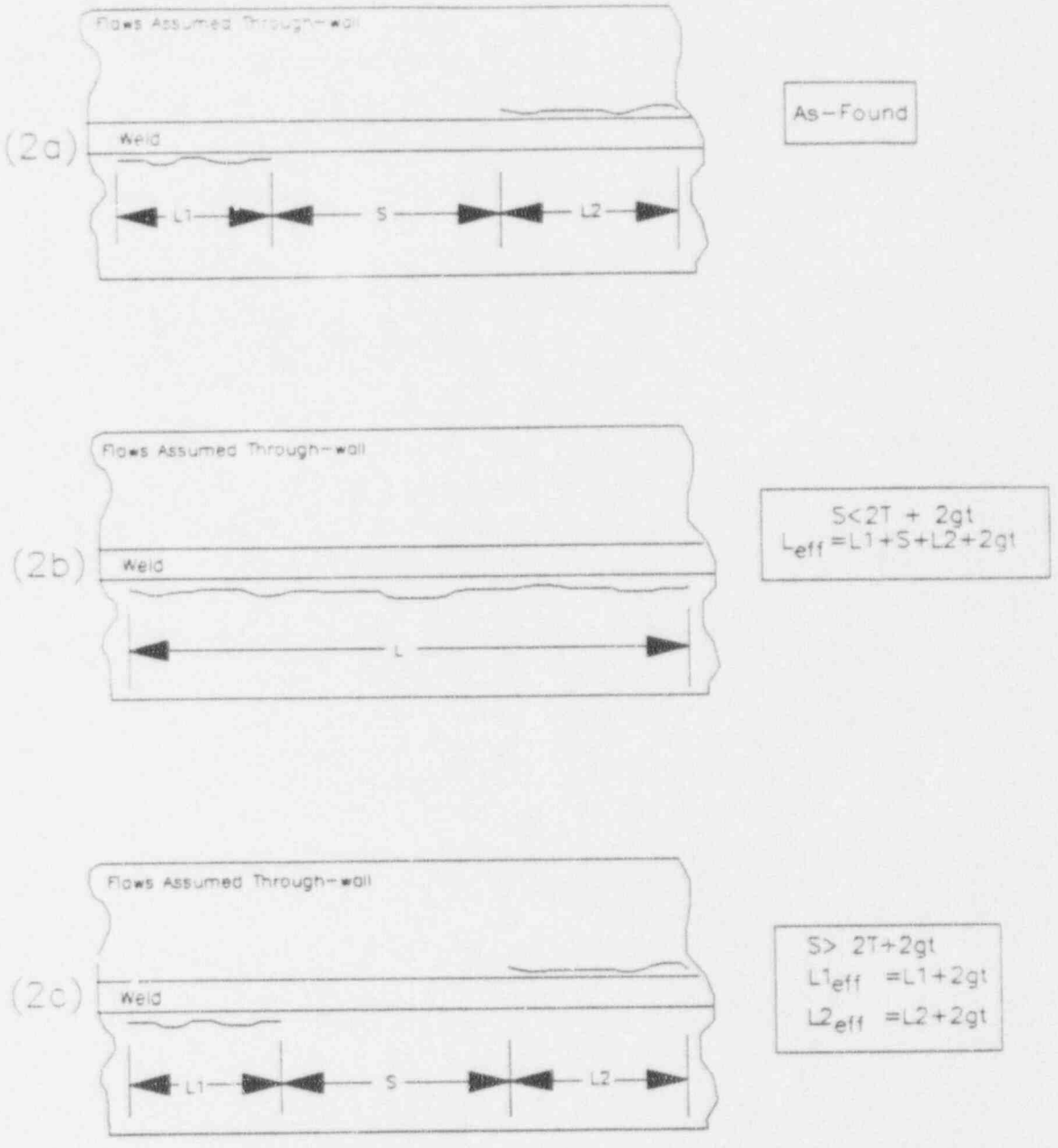


Figure 3-2 – APPLICATION OF PROXIMITY PROCEDURE TO NEIGHBORING CIRCUMFERENTIAL FLAWS

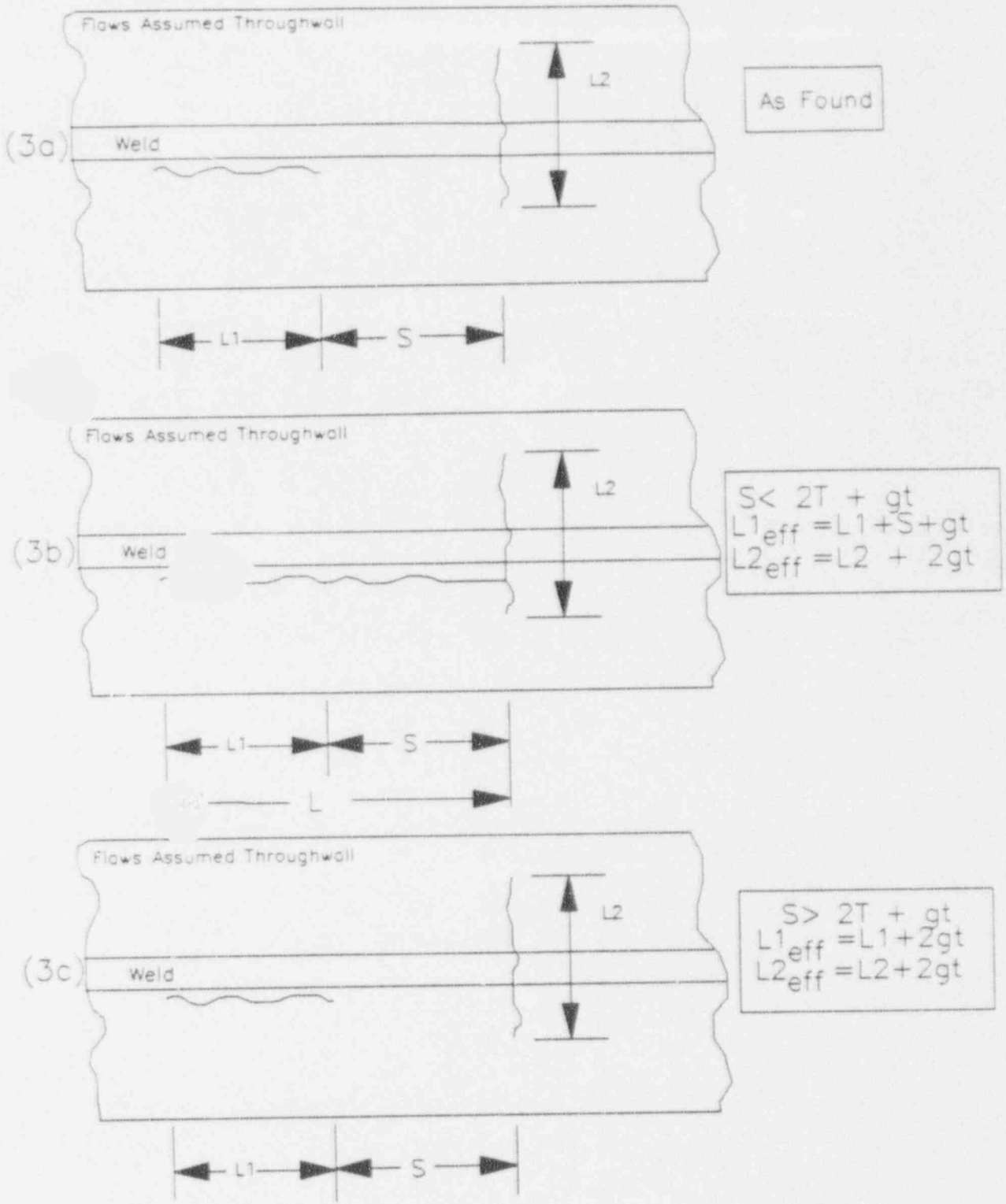


Figure 3-3 – APPLICATION OF PROXIMITY PROCEDURE TO NEIGHBORING AXIAL AND CIRCUMFERENTIAL FLAWS

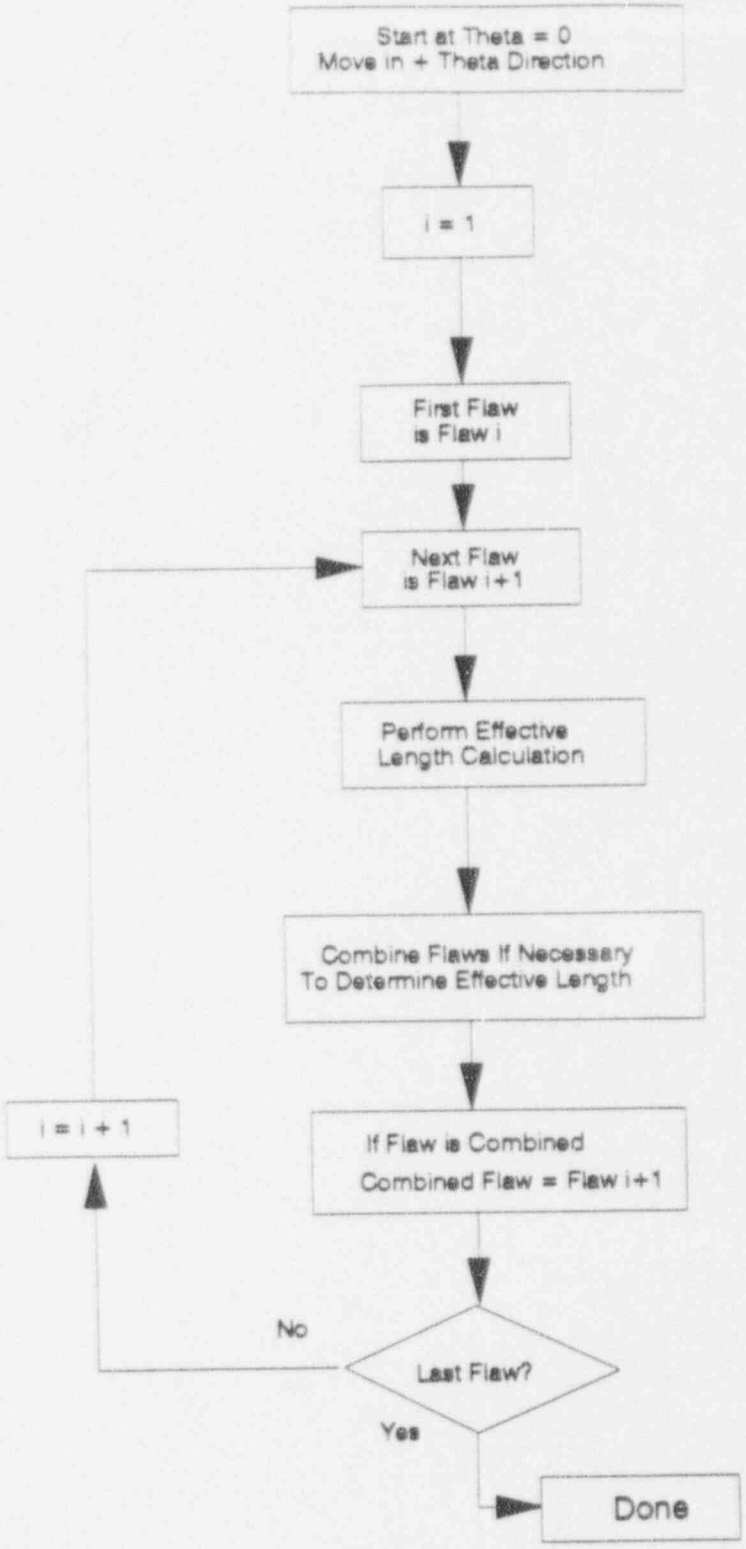


Figure 3-4 Process For Determining Effective Circumferential Flaw Length

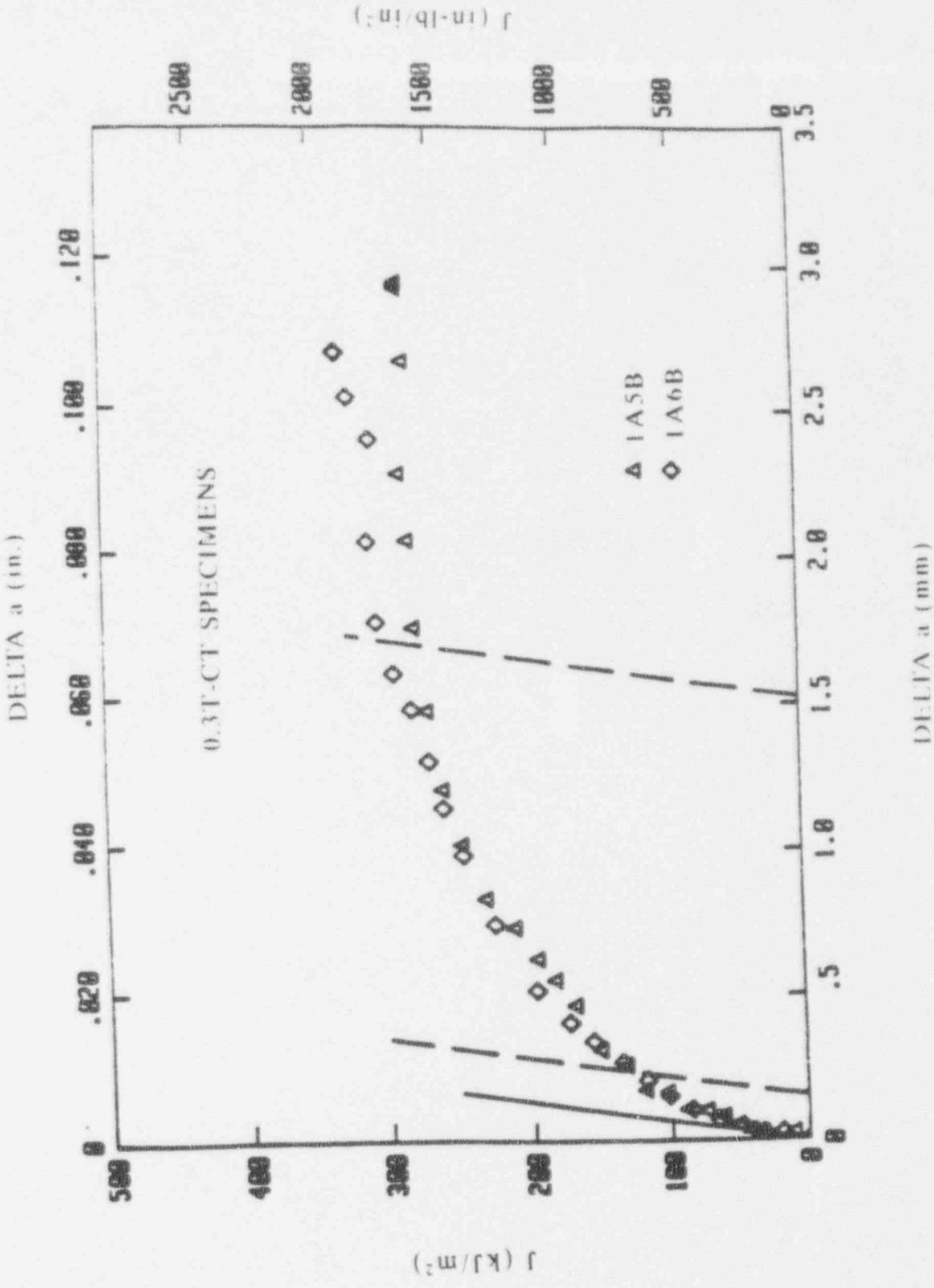
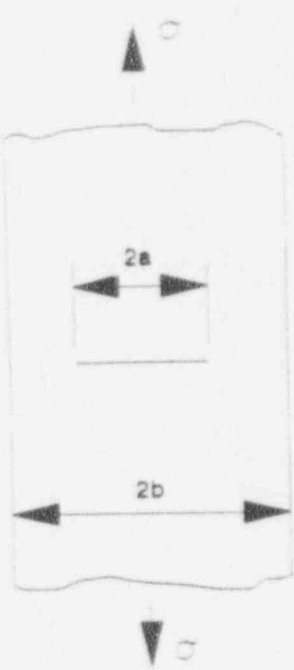
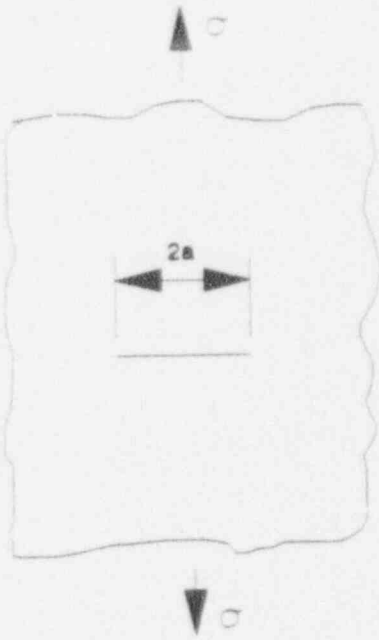


Figure 3-5 Comparison of J-R Curves For Two Irradiated Stainless Steel Specimens



$K = \sigma\sqrt{\pi a} * F$

Finite Plate



$K = \sigma\sqrt{\pi a}$

Infinite Plate

a/b	F
0.0	1.0
0.1	1.006
0.2	1.0246
0.3	1.0577
0.4	1.1094
0.5	1.1867

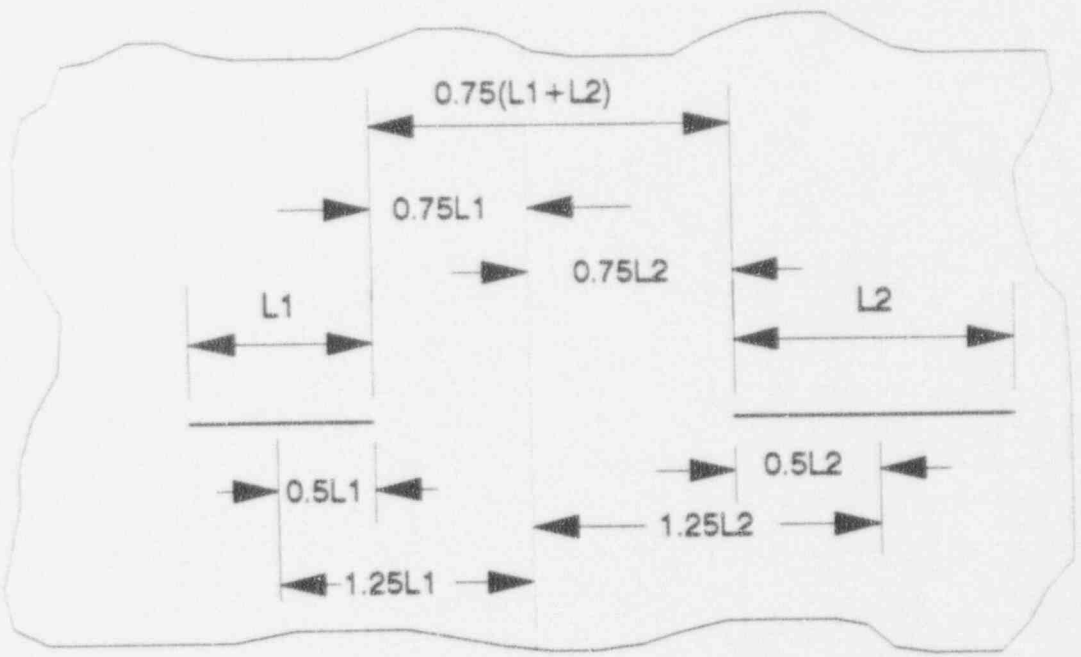


Figure 3-6 Schematic Illustrating Flaw Interaction

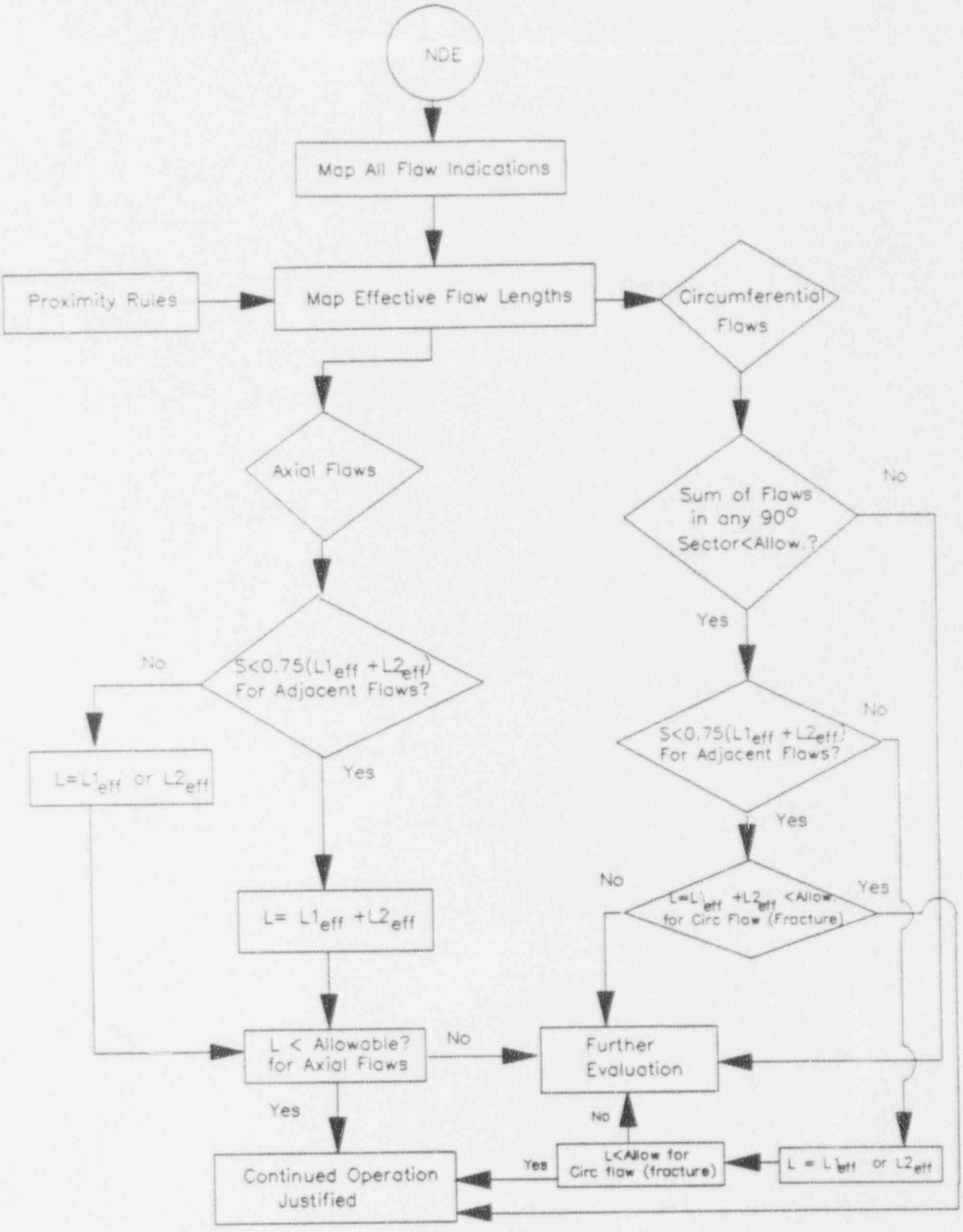


Figure 3-9 SCHEMATIC OF SCREENING CRITERIA

5. The NRC staff wishes to see a smooth transition for qualifying examiners from the method currently used for IGSCC inspections to that specified by Appendices 7 and 8 of the ASME Code. The NRC staff requested to review the BWROG proposal for performing these inspections.

Original signed by:

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*See previous concurrence

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