



GE Nuclear Energy

PROCEDURE: UT-NMP-309VO

REVISION No.: 0

TITLE

PROCEDURE FOR MANUAL ULTRASONIC EXAMINATION
OF PLANAR FLAW SIZING FOR NOZZLE INNER RADIUS
AND BORE REGIONS

PROJECT MANAGER GE NDE AND
ADMINISTRATIVE PROCEDURES:

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DATE: Jan 30-1995

PROJECT MANAGER:

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LEV-III
DATE: JAN. 31, 1995

UTILITY APPROVAL:

[Signature]
DATE: 2-10-95

COMMENTS: This procedure is the site specific version developed from GE-UT-309, Version 0. The following changes from the parent version have been made to incorporate Customer comments:

Revised Para. 2.2 to reflect GE NE's current personnel certification procedure.

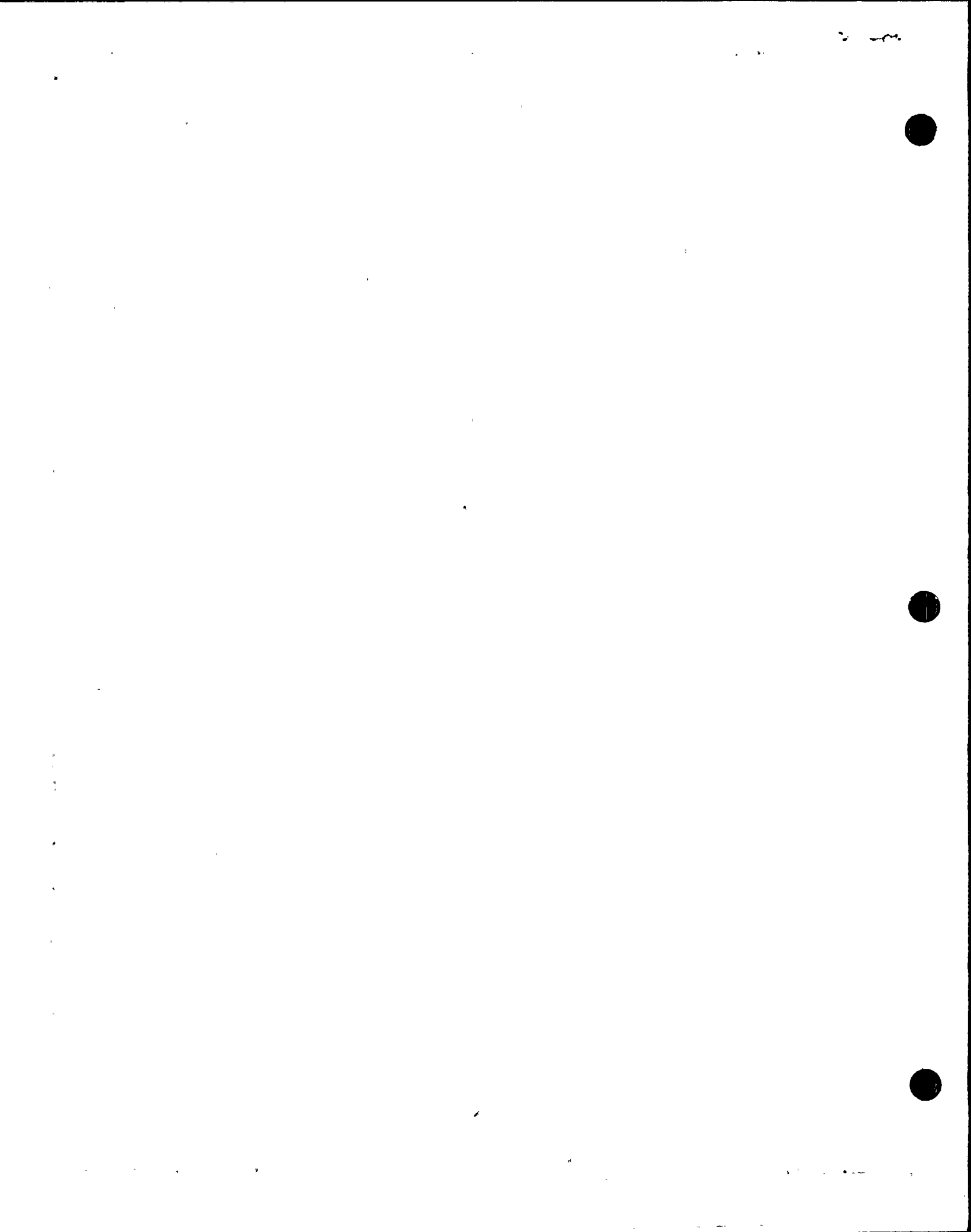
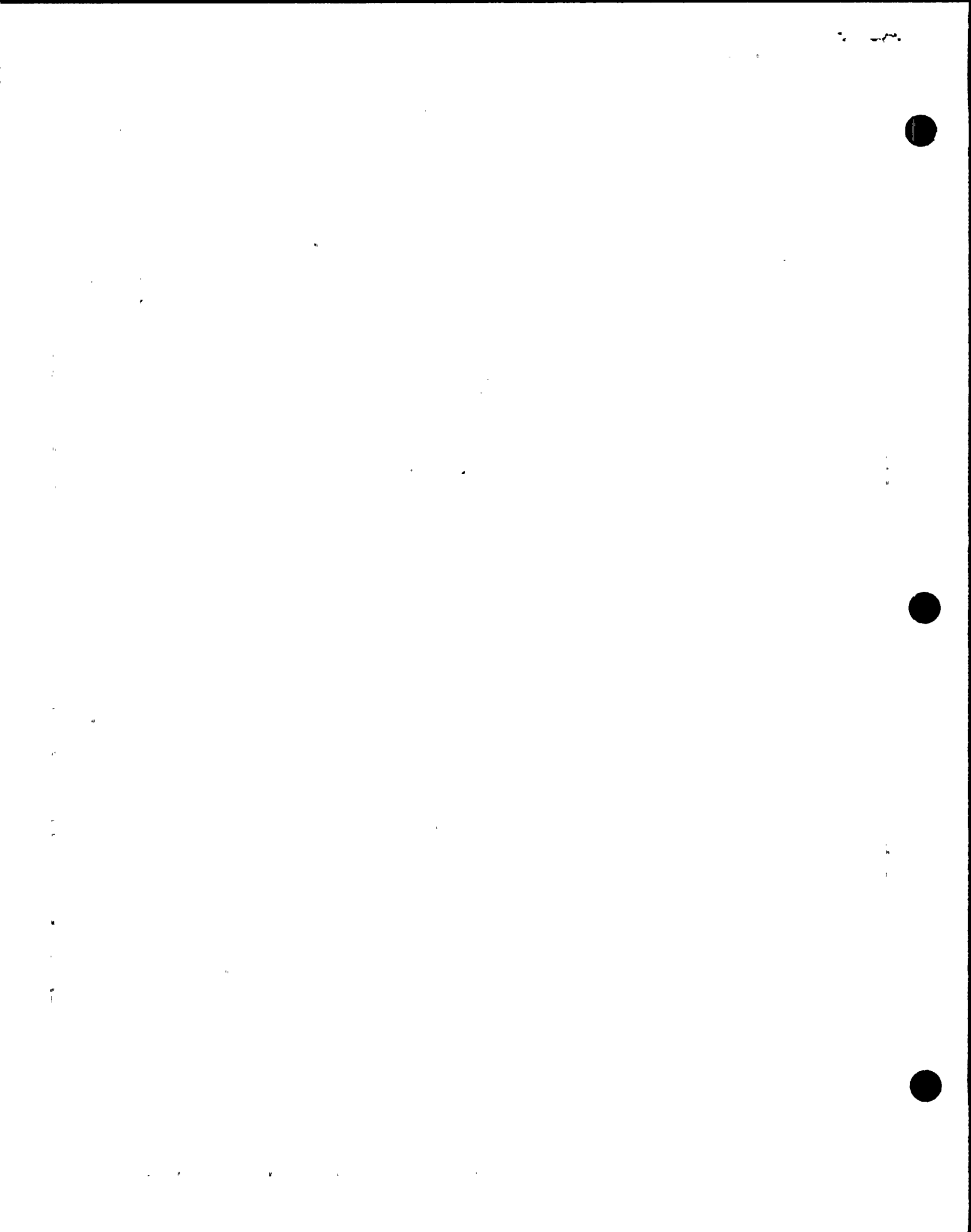




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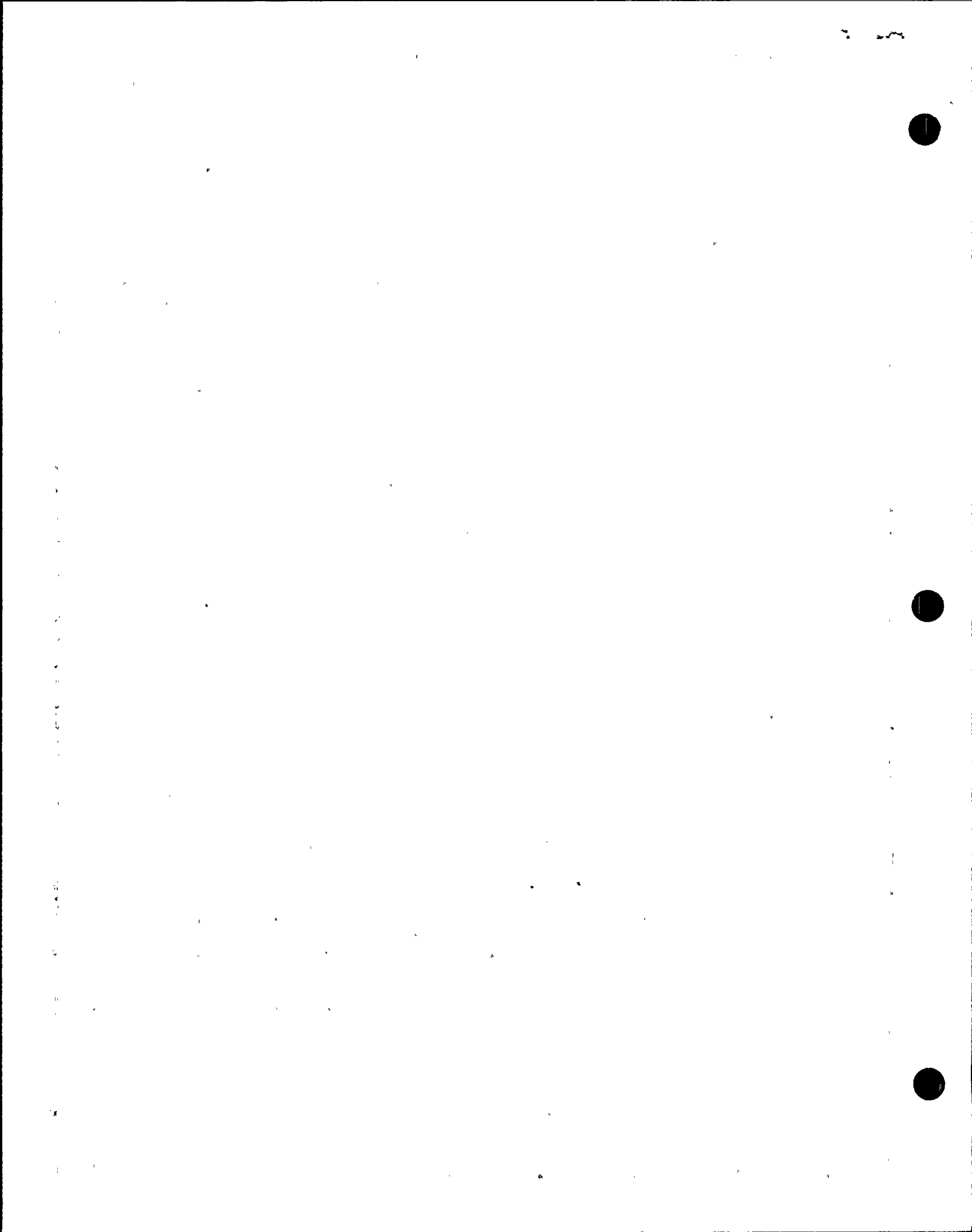


1.0 SCOPE

- 1.1 This procedure defines the methods and requirements for the shear wave ultrasonic sizing of planar flaws located in the nozzle inner radius and bore regions. These regions are identified as zones 1, 2A, 2B, 3, 4A, 4B and 5 (Figure 1). The objective of the method given herein is to determine the through wall size of planar flaws using the flaw tip diffraction method.
- 1.2 The examinations are performed from the exterior surfaces of the reactor pressure vessel, the nozzle outer blend radius and the nozzle forging OD cylindrical surface. The scanning surface, refracted angle and rotation angle for each zone are determined by the nozzle design.
- 1.3 The techniques described in this procedure were qualified on GE's full size clad removed feedwater nozzle mockup. The mockup contains a set of electrostatic discharge machine (EDM) notches (nominal 0.15", 0.25" & 0.35" deep) in each of the five zones of interest.
- 1.4 The provisions permitted in ASME B&PVC, Section XI, Paragraph IWA-2240 are the basis for this procedure. Articles 4 and 5 of ASME B&PVC Section V were used as guidelines during procedure development.

2.0 REFERENCES

- 2.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section V and XI 1983 Edition, Summer 1983 Addenda.
- 2.2 General Electric document 386HA480, "Certification of Nondestructive Test Personnel".
- 2.3 General Electric Procedure GE-ADM-1001, "Procedure for Performing Linearity Checks on Ultrasonic Instruments".
- 2.4 General Electric Quality Manual, QAM-003, "Quality Assurance Manual for Inservice Inspection".
- 2.5 NEDE - 31735P Class 3 " BWROG Manual for Materials and Processes".
- 2.6 USNRC NUREG 0619, BWR Feedwater Nozzle & Control Rod Drive Return Nozzle Cracking, November 1980.
- 2.7 The following documents must be available, but are not considered a part of this Procedure.
 - 2.7.1 Reactor Vessel Fabrication Drawings, Nozzle Forging, and Nozzle Assembly Drawings applicable to the nozzles.
 - 2.7.2 Detailed nozzle identification plan approved by the owner.





3.0 PERSONNEL

- 3.1 All personnel performing, reviewing or evaluating the results of examinations to this procedure shall be certified to a minimum of Level II in accordance with paragraph 2.2. Personnel shall demonstrate proficiency in sizing notches on GE's clad removed feedwater nozzle mockup. Documentation of proficiency shall be furnished by GE Nuclear Energy NDE Development Group and shall become part of the individual's NDE Certification Package.
- 3.2 Personnel shall also be trained on GE's feedwater nozzle mockups with the techniques described in GE-UT-311 or equivalent.

4.0 EQUIPMENT

- 4.1 The ultrasonic instrument shall be the pulse-echo type and shall be equipped with a calibrated dB gain control or attenuator stepped in increments of 2 dB or less and shall meet the requirements of paragraph 2.3.
- 4.2 The ultrasonic instrument shall be equipped with a coarse delay that will allow indications to be sized with a 5" or less screen range.
- 4.3 Search units will be selected by the examiner performing the sizing, depending on the flaw being investigated. Frequencies from 1 to 5 MHz will be used, with active element sizes from .50" to 1.0" diameter (round or square).
- 4.4 The search unit wedge design used for sizing will depend on nozzle geometry and flaw location; multiple wedges may be required. Wedge angles are selected to produce a beam angle with respect to the plane of the flaw of 45° to 60°. A standard 70° wedge may be required for calibration.
- 4.5 Coaxial cables of any convenient length may be used for examination. The length, type of cable, and number of connectors used shall be recorded on the Calibration Data Sheet.
- 4.6 The ultrasonic couplant to be used shall be in sufficient quantities to maintain adequate acoustic contact between the search unit and component, and shall be certified in accordance with paragraph 2.5.
- 4.7 The calibration block used shall have three flat-bottom holes, approximately .118" in diameter, with depths in increments of .250", drilled parallel to the direction of the sound beam. The block material shall be carbon steel. This block will be maintained by GE.
- 4.8 Alternate calibration blocks may be used to set the sweep provided the reflectors meet the intent of paragraph 4.7



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5.0 CALIBRATION

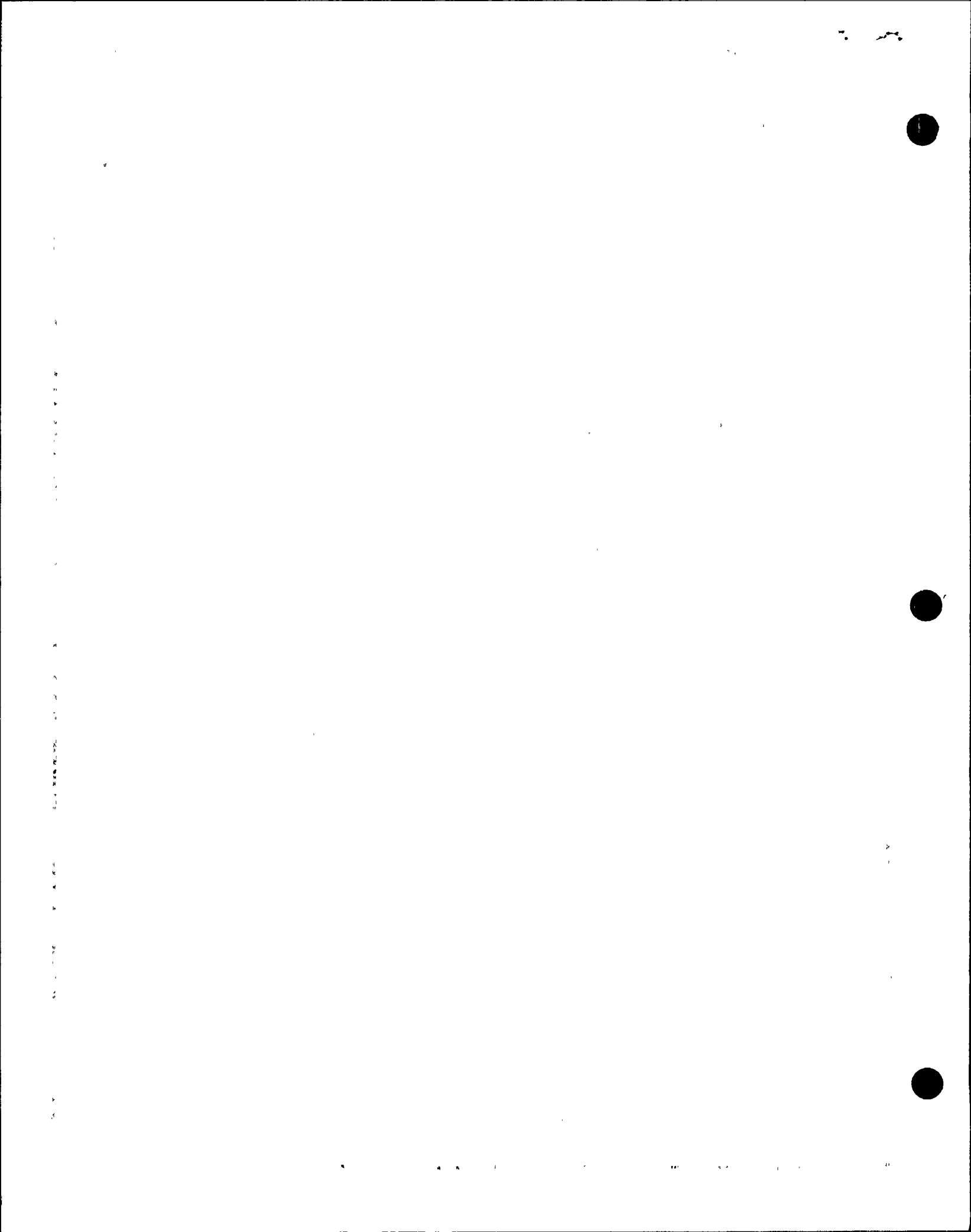
- 5.1 Obtain reflections from the reflectors simultaneously. Adjust range and delay controls so that the difference in metal path between the reflectors to be the actual metal path. The screen range shall be a maximum range of 5". These range settings shall be used for sizing.
- 5.2 Record all instrument settings on a Calibration Sheet.
- 5.3 Calibration shall be verified using this calibration block at the start and finish of each series of examinations and at intervals not exceeding four hours. If the indicated difference in metal path between the shallowest and deepest reflector is found to have changed by more than 0.050", all data taken since the last acceptable calibration verification shall be voided, a new calibration performed and the flaws shall be resized.

6.0 EXAMINATION

- 6.1 Position the search unit to obtain a signal from the flaw base "corner trap". The sweep delay (but not range) may be adjusted as needed to bring the signals on screen.
- 6.2 Manipulate the search unit until the flaw base and tip signals appear simultaneously on the CRT. Record separation in metal path between the tip and corner signal. This separation, divided by the cosine of the incident angle of the sound beam, yields the actual flaw depth.
- 6.3 It may be necessary to add instrument gain to display the tip and corner signals. Gain may be added until the baseline noise could obscure the tip signal.
- 6.4 The contact surface from which the examination is conducted must be clean and free of any weld spatter or other conditions which would interfere with free movement of the transducer or impair coupling of ultrasonic waves to and from the material being examined. Unacceptable surface conditions shall be reported to the Owner.

7.0 RECORDING

- 7.1 For each flaw, thru-wall dimension, orientation, location and end point measurements shall be recorded on the appropriate sizing data sheets.
- 7.2 Reference points for physical measurements shall be in accordance with the nozzle reference plan as shown in Figure 2. The transducer distance "D" shall be referenced to the appropriate reference. The "W" azimuth position of the transducer shall be measured from 0°(TDC). The "W" measurement will be taken on the nozzle OD cylindrical surface for all scans except the safe end scan which will be taken from the safe end OD surface. For transducer positions between 0° to 180°, the value of "W" is a positive value and transducer positions between 180° to 360°, the "W" is a negative value.





7.3 The "W" and "D" measurements shall be to the nearest 0.10" and recorded on the examination data sheet.

8.0 EVALUATION

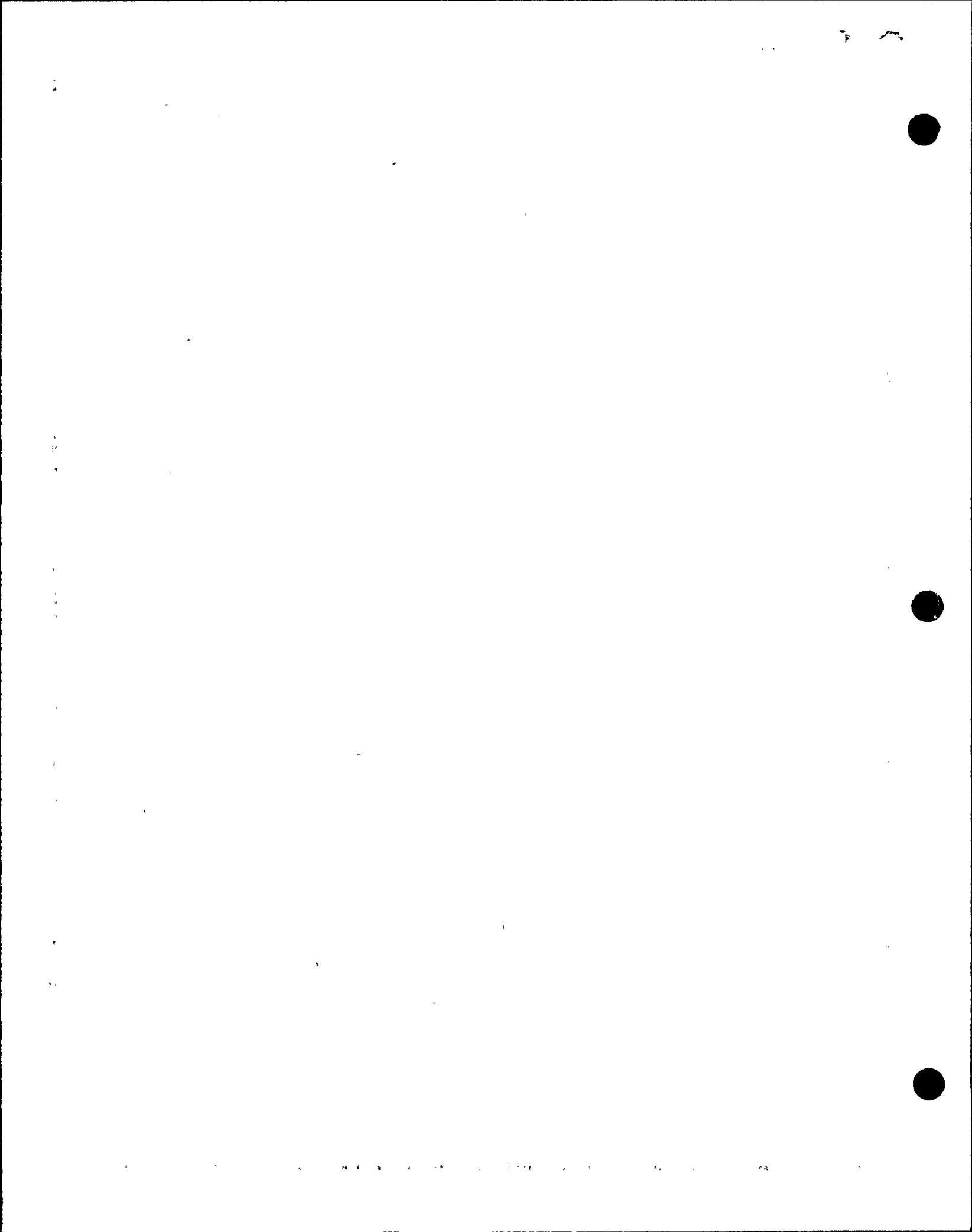
8.1 Evaluation of indications will be performed by GE.

8.2 Final disposition of indications is the responsibility of the Owner.

9.0 REPORTING

9.1 A report of the examination shall be submitted to the Owner in accordance with contract requirements.

9.2 All flaw indications shall be reported to the Owner within twenty-four hours of final sizing determination, or as required by contract.





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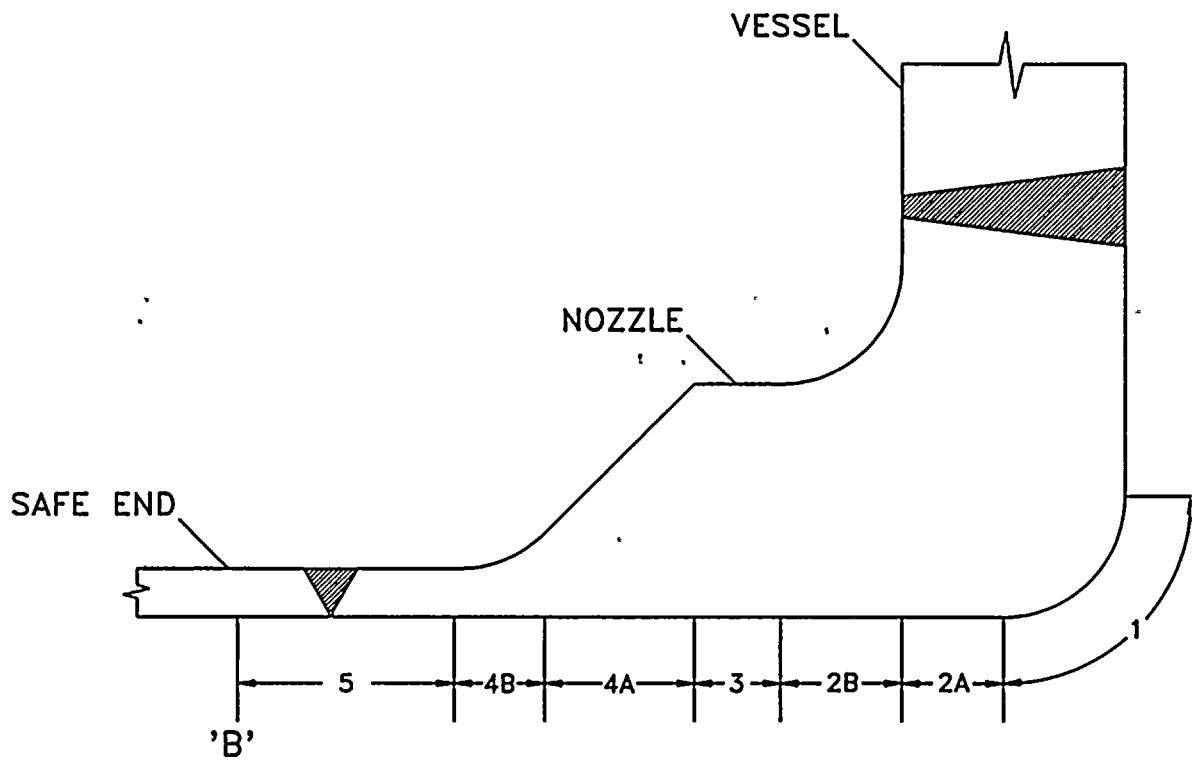
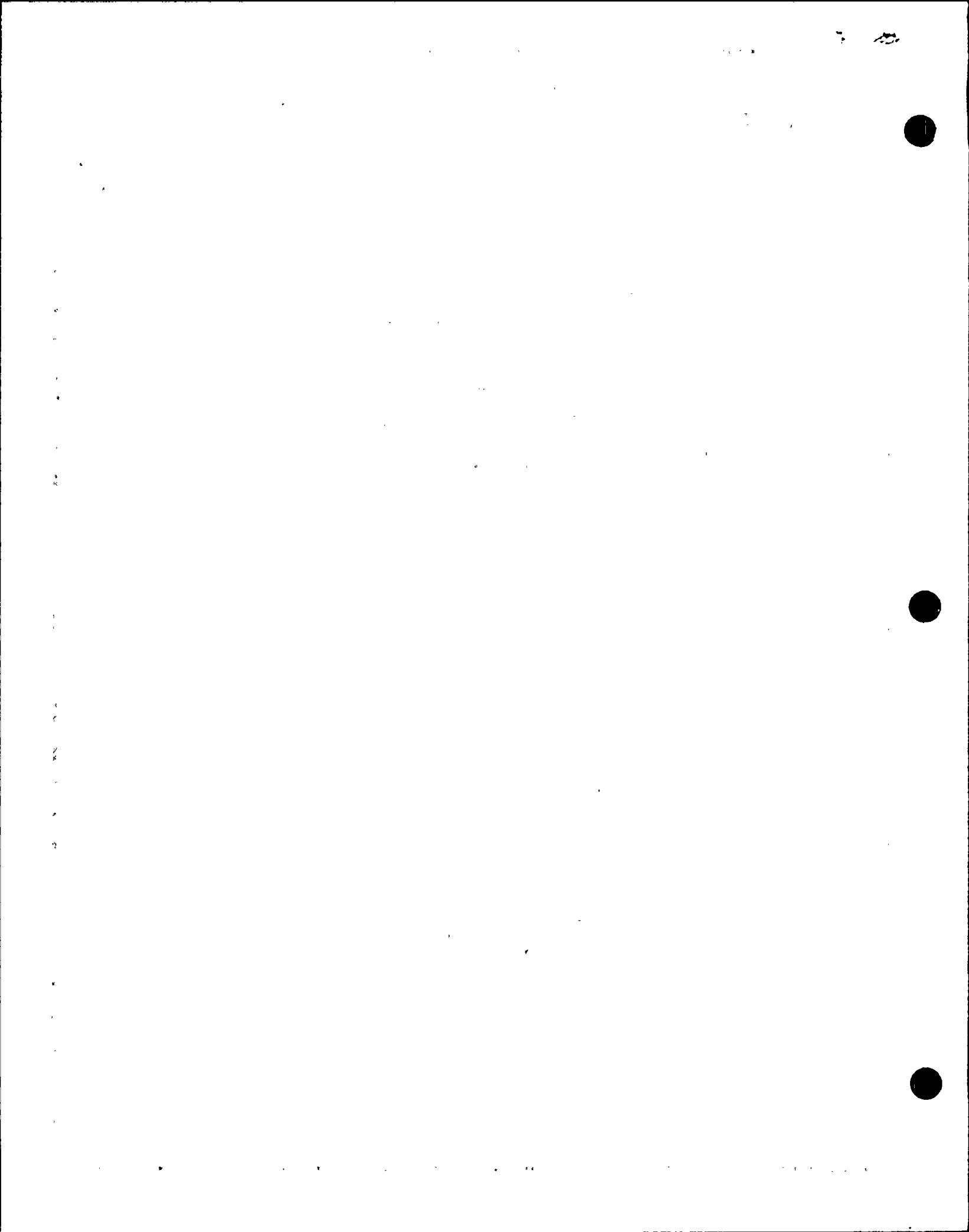


FIGURE 1





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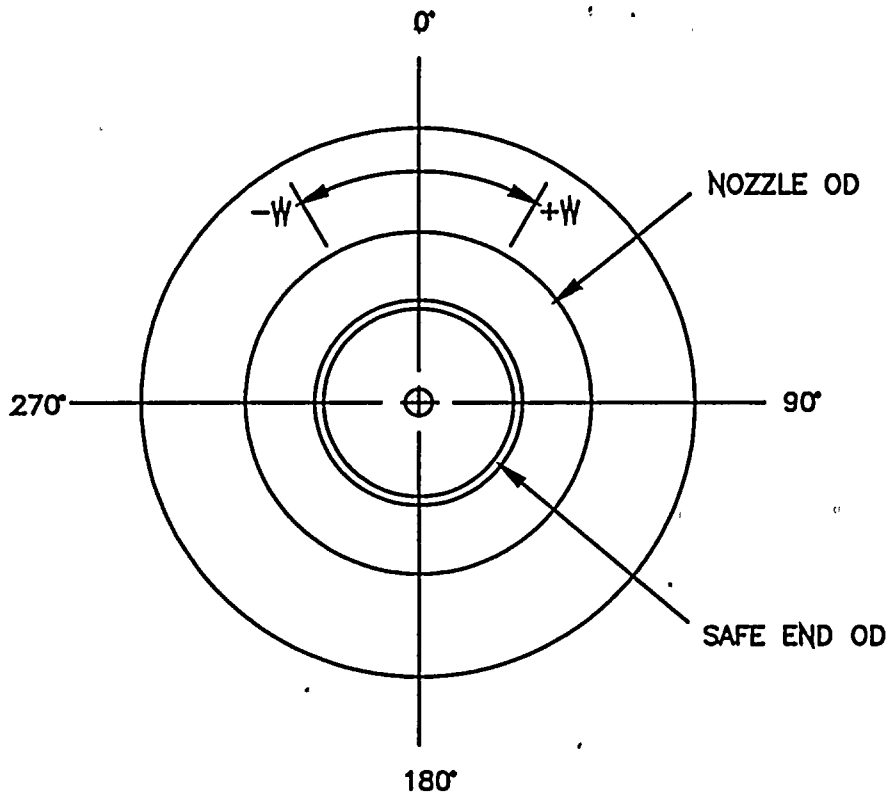
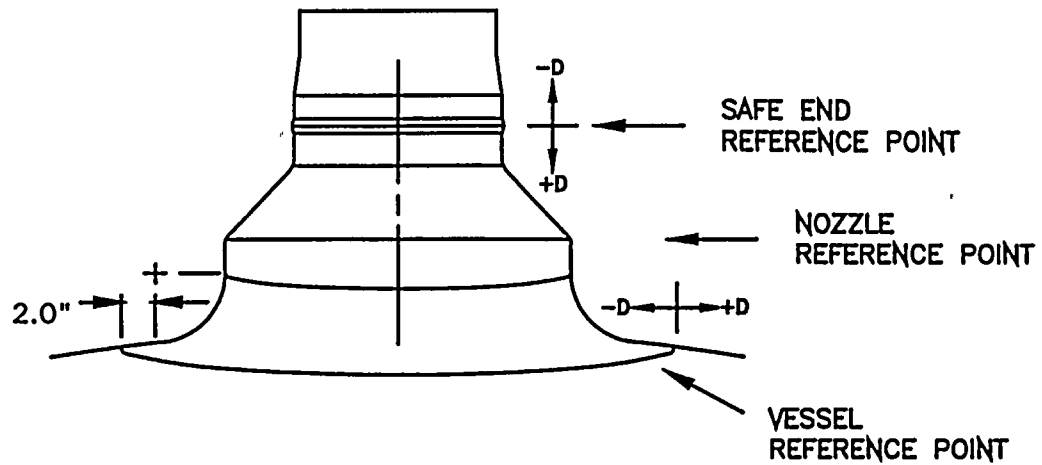


FIGURE 2

