Duke Power®

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March 15, 2006

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Duke Energy Corporation
Oconee Nuclear Station, Units 1, 2, and 3
Docket Nos. 50-269, -270, -287
Request for Relief No. 2006-ON-001, Revision 1

By letter dated February 2, 2006, Duke Energy (Duke) submitted Request for Relief No. 2006-ON-001 pursuant to 10 CFR 50.55a(a)(3)(i). That request addressed Duke's plan to replace all Pressurizer level tap and sample tap nozzle safe ends composed of Alloy 600 at Oconee Nuclear Station (ONS), Units 1, 2, and 3. Duke requested an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, NB-5222(a), requiring that Code Class 1 weld joints be examined via radiographic methods to satisfy non-destructive examination requirements.

In the previous request, ASME Section III Code Case N-659-1 was cited and an argument of its ability to provide an acceptable level of quality and safety, in accordance with 10 CFR 50.55a (a)(3)(i), was made. In Revision 1, Duke is modifying the previous request by citing ASME Section III Code Case N-659-0 and making a case for why compliance with the requirements of ASME, Section III, NB-5222(a) would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, in accordance with 10 CFR 50.55a(a)(3)(ii). Furthermore, Revision 1 provides greater insight into the preliminary coverage attainable by the requested alternative ultrasonic inspection technique. Therefore, Duke hereby submits Request for Relief No. 2006-ON-001, Revision 1, attached, which has been modified to include the improvements mentioned above, as well as the information from Revision 0 that remains unaltered.

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Duke plans to replace three ONS Unit 3 level tap nozzle safe ends during the outage scheduled to begin on April 29, 2006. Duke currently plans to use the proposed alternative during all of the ONS replacement work for all Pressurizer level tap and sample tap nozzle safe ends composed of Alloy 600 through the end of 2007.

An expedited approval of the attached Request for Alternative is requested by April 14, 2006 to support planning and preparation activities for the ONS Unit 3 refueling outage that is scheduled to begin on April 29, 2006.

Please refer any questions regarding this submittal to Randy Todd ONS Regulatory Compliance at (864) 885-3418.

Sincerely,

Bruce Hamilton

Bruce Hamilton, Vice President
Oconee Nuclear Site

Enclosures:
1. 10 CFR 50.55a Request Number 2006-ON-01
2. Framatome Fabrication Drawings
3. ASME Section III Code Case N-659-0
4. Flaw Tech Qualification Block Drawings
5. Preliminary Coverage Drawings

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10 CFR 50.55a
Request Number 2006-ON-01, Revision 1

10 CFR 50.55a Request Number 2006-ON-01, Revision 1

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(ii)

--Compliance with Requirements Results in Hardship
Without a Compensating Increase in Quality and Safety--

Duke Energy Corporation
Station Oconee Units 1, 2 & 3
Request for Alternative 2006-ON-01, Revision 1

Pursuant to 10CFR50.55a(a)(3)(ii), Duke Energy Corporation requests to use an alternative to the 1983 Edition of Section III of the ASME Boiler and Pressure Vessel Code. Information is being submitted in support of our determination that compliance with the specified requirements of this code results in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

I. ASME Code Component(s) Affected:

All ASME Section III Code Class 1 Reactor Coolant System butt-welds between the Pressurizer Level and Sample Tap Nozzles and their respective Safe Ends at Oconee Nuclear Station (ONS), Units 1, 2, and 3.

A total of six level taps are being replaced in each unit of ONS (three in the steam space, and three in the water space), as well as one sample tap on each ONS Pressurizer. This amounts to a total of seven replacements per ONS Pressurizer. The existing weld numbers for the ONS Units 1, 2, and 3 level and sample nozzle-to-safe end welds are: 1PZR-WP63-1 through 1PZR-WP63-7, 2PZR-WP63-1 through 2PZR-WP63-7, and 3PZR-WP63-1 through 3PZR-WP63-7, respectively. These welds are expected to be given new "vendor weld numbers" as they are replaced by the individual modification packages. A copy of the fabrication drawings for the current pressurizer safe end design and installation is located in Enclosure 2.

II. Applicable Code Edition and Addenda:

ASME Code, Section XI 1998 Edition, through the 2000 Addenda.
ASME Code, Section III 1983 Edition, with No Addenda.

III. Applicable Code Requirements:

The 1998 ASME Code, Section XI, through the 2000 Addenda, IWA-4221 requires that items used for replacement meet the owner's design specification and original construction code for the component. However, it also states that Section III may apply when the Construction Code was not Section III, provided the requirements of IWA-4222 through IWA-4226 are met.

ASME Code, Section III requires that Class 1 weld joints be examined via radiographic methods to satisfy non-destructive examination (NDE) requirements as part of final weld acceptance during construction. For the ASME Code components listed previously, relief is requested from the requirements of 1983 ASME Section III paragraph NB-5222(a).

(a) "Butt welded joints shall be examined by the radiographic and either the liquid penetrant or magnetic particle methods."

IV. Reason for Request:

Duke Energy plans to replace all Pressurizer level tap and sample tap nozzle safe ends composed of Alloy 600 with corrosion resistant, low carbon stainless steels. The design of the replacement safe ends and welds are configured to be like those in the original designs.

The 1998 ASME Code, Section XI, IWA-4221(c), states that Section III may apply for items used for replacement provided the requirements of IWA-4222 through IWA-4226 are met. The ASME Code, Section III, NB-5200, "Required Examination of Welds," requires that circumferential welded joints in piping, pumps, and valves be examined using the radiographic (RT) method and either liquid penetrant or magnetic particle examination methods.

The geometry of the Safe End to Nozzle weld joint configuration makes RT very difficult due to the steep thickness taper and small inner diameter of the nozzle (see Enclosure 2). This configuration yields less than desirable RT results for detecting weld metal defects and presents a significant potential for re-examination due to radiographic density variation. Duke Energy believes that the present nozzle to safe end weld geometry does not yield itself to a radiographic technique that produces high confidence that will detect all unacceptable weld metal defects. Duke Energy has determined through radiographic test exposures on a mockup test piece that performing RT on this weld will require a minimum of 34 exposures to obtain full coverage. Due to this number of exposures, it has been determined that approximately 36 hours is required to perform the RT examination for one weld. Since the performance of RT involves the use of highly penetrating radioactive isotopes, there exists a personnel safety risk of

inadvertent or accidental exposure. Also, outage duration and costs are greatly increased due to the fact that parallel path outage work within the vicinity is not possible during examination of the welds using RT. Duke Energy has evaluated the use of an alternative ultrasonic method and determined that its use will provide an acceptable level of confidence for detecting weld metal defects and provides an acceptable level of quality and safety.

In short, compliance with the requirements of ASME, Section III, NB-5222 would result in hardship without a compensating increase in the level of quality and safety.

V. Proposed Alternative:

The alternative involves ultrasonic and surface examinations of Class 1 repair replacement welds. The alternative examinations will be made to satisfy the construction code requirement for radiographic examination. This proposed alternative ultrasonic examination will eliminate the hardships associated with performing radiographic examinations, while ensuring an adequate level of safety and quality. The alternative provides adequate verification that the Class 1 welds are free of unacceptable flaws that could affect structural integrity.

Prior to the use of the alternative examination, the effectiveness of the ultrasonic techniques will be demonstrated on a qualification block containing a weld with representative flaws.

The proposed alternative method will meet the requirements of ASME Section III Code Case N-659-0, "Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination, Section III, Division 1" (see Enclosure 3), with stated exceptions. Duke's strategy to meet all of the requirements of the code case is discussed below. Where literal compliance may not be met, supplemental actions are specified.

(a) *Case Requirement*: The ultrasonic examination area shall include 100% of the volume of the entire weld, plus 0.5T of each side of the welds, where T is the thickness of the weld. The ultrasonic examination area shall be accessible for angle beam examination in four directions, two directions perpendicular to the weld axis and two directions parallel to the weld axis. Where perpendicular scanning is limited on one side of the weld, a technique using the second leg of the V-path may be credited as access for the second perpendicular examination direction provided that the detection capability of that technique is included in the procedure demonstration described in (c) and (d) below.

Duke Strategy: Duke Energy must take exception to the 100% coverage requirement. At least 95.5% of the volume of the entire weld, plus 0.5T of

each side of the weld will be examined during the ultrasonic inspection. The most conservative approach to find 0.5T is to derive the actual weld thickness at each weld edge according to the fabrication drawings found in Enclosure 2. This results in 0.526" to be examined from the safe-end weld edge and 0.740" to be examined from the nozzle weld edge. When utilizing a full sectorial scan from 18° to 78° in conjunction with linear multiple-line scans of 25° and 35°, an axial scan in the direction of the nozzle results in 98.82% coverage, and an axial scan in the direction of the safe-end results in 98.49% coverage. When applying the 10 degree difference between angles as required in (b) below, the coverage of the higher end (78° to 68°) of the sectorial scan is reduced, recalculating to 95.54% for an axial scan in the direction of the nozzle, and 97.36% for an axial scan in the direction of the safe-end. Circumferential scans, which allow closer access to the taper, are predicted to produce coverage percentages that are at least equal to the cited axial percentages. The preliminary coverage drawings located in Enclosure 5 show the minimum anticipated coverage of the weld and base metal for each scanning direction. Further development may be able to produce 100% coverage in all directions. Axial and circumferential notches are being placed in the qualification block in areas considered most difficult to inspect in order to demonstrate detection capabilities. A surface dye-penetrant examination required by Section III will also be performed in this area, which will, in effect, supplement UT coverage.

(b) *Case Requirement:* The ultrasonic examination shall be performed in accordance with Section V, Article 5 up to and including the 2001 Edition. A straight beam and two angle beams having nominal angles of 45 and 60 deg should generally be used; however, other pairs of angle beams may be used provided the measured difference between the angles is at least 10 deg. Alternatively, ultrasonic examination may be performed by a procedure qualified in accordance with the performance demonstration methodology of Section XI, Appendix VIII provided the entire volume of the weld examination is included in the demonstration.

Duke Strategy: The ultrasonic examination will be performed in accordance with ASME Code, Section V, 1998 Edition through the 2000 Addenda, Article 5, using an automated phased array system. The requirements for straight and angle beams, as discussed above, will be met in the phased array process.

(c) *Case Requirement:* A written procedure shall be followed. The procedure shall be demonstrated to perform acceptably on a qualification block or specimen with both surface and subsurface flaws as described in (d) below.

Duke Strategy: A procedure will be written and performed to demonstrate its success on the qualification block described in (d).

(d) *Case Requirement:* The qualification block material shall conform to the requirements applicable to the calibration block. The material from which blocks are fabricated shall be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis, tensile properties, and metallurgical structure may be used. Where two or more base material thicknesses are involved, the calibration block thickness shall be of a size sufficient to contain the entire examination path. The qualification block configuration shall contain a weld representative of the joint to be examined, including, for austenitic materials, the same welding process. The qualification blocks shall include at least two planar flaws in the weld, one surface and one subsurface oriented parallel to the fusion line, no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Fig. T-542.2.1 of Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NB-5330, NC-5330, or ND-5330 for the thickness of the weld being examined. Where a Section XI, Appendix VIII, performance demonstration methodology is used, supplemental qualification to a previously approved procedure may be demonstrated through the use of a blind test with appropriate specimens that contain a minimum of three different construction-type and fabrication-type flaws distributed throughout the thickness of the specimen.

Duke Strategy: A calibration block will be made to meet the requirements of ASME Section V, Article 5, and the thickness will be of a size sufficient to contain the entire examination path. The qualification block (See Enclosure 4), conforms to the requirements applicable to the calibration block, as well as to all material and weld requirements discussed above. The qualification block materials are composed of the same material specifications, product forms, and heat treatment conditions as the actual components being welded. Additionally, the weld of the qualification block is formed by the same welding process as will be performed in the field. The qualification block includes one surface crack and two subsurface lack of side-wall fusion flaws oriented parallel to the fusion line with dimensions meeting the specifications of ASME Code, Section V, 1998 edition, through the 2000 Addenda, Article 5, and ASME Code, Section III, 1983 edition, NB-5330. Axial and circumferential notches (Enclosure 4, Notches 4 and 5, respectively) are also being placed in the qualification block in areas considered most difficult to inspect in order to demonstrate detection capabilities.

(e) *Case Requirement:* This Case shall not be applied to weld examination volumes that include cast products forms or corrosion-resistant-clad austenitic piping butt welds.

Duke Strategy: The welds being examined do not include cast product forms or corrosion-resistant-clad austenitic piping butt welds.

(f) *Case Requirement:* A documented examination plan shall be provided showing the transducer placement, movement and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan shall also include ultrasonic beam angle used, beam directions with respect to weld centerline, and volume examined for each weld.

Duke Strategy: A conservative preliminary coverage drawing, utilizing a full sectorial scan from 18° to 78° in conjunction with linear multiple-line scans of 25° and 35°, is located in Enclosure 5. Various scan techniques that employ full use of steering, sweeping, and skewing shall be applied. A final documented examination plan containing the information requested above is being prepared and will be available on site for review upon request of the ANII and/or NRC inspectors prior to use.

(g) *Case Requirement:* The evaluation and acceptance criteria shall be in accordance with NB-5330, NC-5330, or ND-5330, as acceptable.

Duke Strategy: The evaluation and acceptance criteria will be in accordance with NB-5330. Additionally, any flaws characterized as surface-connected cracks, lack of fusion, or lack of penetration may be evaluated by a supplemental penetrant examination performed in accordance with NB-5000.

(h) *Case Requirement:* For welds subject to inservice ultrasonic examination, the examination and evaluation shall also meet the requirements of the applicable Edition of Section XI for preservice examination.

Duke Strategy: These welds are exempt from Section XI volumetric pre-service and in-service examinations due to their size.

(i) *Case Requirement:* The ultrasonic examination shall be performed using a device with an automated computer data acquisition system.

Duke Strategy: The UT examination will be performed using a device with an automated computer data acquisition system.

(j) *Case Requirement:* Data shall be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from examination volume in (a) shall be included in the data record.

Duke Strategy: Data will be recorded in its raw form and fully documented when creating data records.

(k) *Case Requirement:* Personnel who acquire and analyze UT data shall be qualified and trained using the same type of equipments in (i), and

demonstrate their capability to detect and characterize the flaws using the procedure as described in (c).

Duke Strategy: UT Level II and Level III examiners will acquire the UT data, and a UT Level III will analyze the data. The capabilities of all participants to detect and characterize the flaws using the procedure will be demonstrated to the Authorized Nuclear Inservice Inspector prior to inspection.

(l) *Case Requirement:* Review and acceptance of the procedure by the Authorized Nuclear Inspector is required.

Duke Strategy: Review and acceptance of the procedure by the Authorized Nuclear Inservice Inspector will be achieved prior to beginning inspections.

(m) *Case Requirement:* All other related requirements of the applicable subsection shall be met.

Duke Strategy: Related requirements of the applicable subsection will be met.

(n) *Case Requirement:* Flaws exceeding the acceptance criteria referenced in this Case shall be repaired, and the weld subsequently reexamined using the same ultrasonic examination procedure that detected the flaw.

Duke Strategy: Flaws exceeding the acceptance criteria will be repaired and reexamined using the same ultrasonic examination procedure.

(o) *Case Requirement:* This Case number shall be recorded on the Data Report.

Duke Strategy: The Data Report will reference Code Case N-659-0.

VI. Justification for Granting of Alternative:

As discussed previously, the requirement specified in ASME Section III, that circumferential welded joints in piping, pumps, and valves be examined using RT, results in a significant hardship without a compensating increase in the level of quality and safety.

Based on the review of the joint configuration of the planned welds it has been determined that performing RT would be a very difficult task, requiring a minimum of 36 hours for 34 shots per weld without a high confidence level that the weld geometry will yield itself to a RT technique that would detect all unacceptable weld metal defects. Since the performance of RT involves the use of highly penetrating radioactive isotopes, using a qualified UT method will eliminate the associated personnel safety risks and the normal anticipated exposure to the background radiation levels. Also, outage duration and costs will

be reduced by allowing parallel path outage work to progress uninterrupted during examination of the welds.

Furthermore, given their intended use as described in this alternative request, qualified ultrasonic methods are an acceptable substitute for radiography. By meeting requirements of ASME Section III, Code Case N-659-0, assurance is provided that flaws will be detected.

A qualified UT method meeting requirements of ASME Section III, Code Case N-659-0 would, while avoiding the hardships associated with RT, provide adequate results compared to the RT method. NRC staff approval is requested in accordance with 10 CFR 50.55a(a)(3)(ii).

VII. Duration of Proposed Alternative:

This relief will be implemented during the next scheduled refueling outages for each of the three Oconee Units. Duke currently plans to replace three ONS Unit 3 level tap nozzle safe ends during the outage scheduled for April 2006. In October of 2006, Duke plans to replace all seven ONS Unit 1 level and sample tap nozzle safe ends. Replacement of the seven level and sample taps for ONS Unit 2 is expected to occur during the Spring of 2007 outage. In October of 2007, Duke plans to replace the remaining level and sample taps for ONS Unit 3. The expected date for completion of all of the pressurizer level and sample tap replacements is by the end of 2007.

An expedited NRC staff approval is requested by April 14, 2006 to support planning and preparation activities for the ONS Unit 3 refueling outage that is scheduled to begin on April 29, 2006.

VIII. Precedents

This proposed alternative is similar, but not identical, to a relief request submitted by Union Electric Company's Callaway Plant in a letter dated November 18, 2004 (i.e. ADAMS Accession Number ML043450359), as approved by NRC letter dated May 19, 2005 (i.e. ADAMS Accession Number ML050760129).

This proposed alternative is similar, but not identical, to a relief request submitted by Progress Energy Corporation's Brunswick Plant in a letter dated August 9, 2005 (i.e. ADAMS Accession Number ML052280213).

IX. References:

1. Title 10 of the Code of Federal Regulations, Part 50, Section 55a, Codes and Standards (i.e., 10 CFR 50.55a)

2. ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1998 Edition, through the 2000 Addenda

3. ASME Code, Section III, "Rules for Construction of Nuclear Power Plant Components," 1983 Edition, with no addenda

4. ASME Code, Section III, Code Case N-659-0, "Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1." September 17, 2002

5. EPRI Technical Report 1003545, "Alternative Volumetric Examination Methods: UT in Lieu of RT for Repair/Replacement Activity," December 2002

6. NRC "Safety Evaluation by the Office of Nuclear Reactor Regulation, Second Ten-year Interval Inservice Inspection Program Plan, Request for Relief to use an Alternative Examination Method, Union Electric Company, Callaway Plant, Unit 1, Docket No. 50-483." ML050760129, 05-19-2005

7. Progress Energy. "Brunswick, Units 1 & 2, Relief Request RR-36, Use of Ultrasonic Examinations in Lieu of Radiographic Non-Destructive Examinations." ML052280213, 08-09-2005

8. Union Electric Co. "Callaway, Unit 1, Request for Relief from ASME Section III Requirements Regarding Non-Destructive Examination of Welds Performed Under Site Repair/Replacement Program." ML043450359, 11-18-2004

Prepared By: Rachel L. Doss Date: 3/13/06
Rachel L. Doss

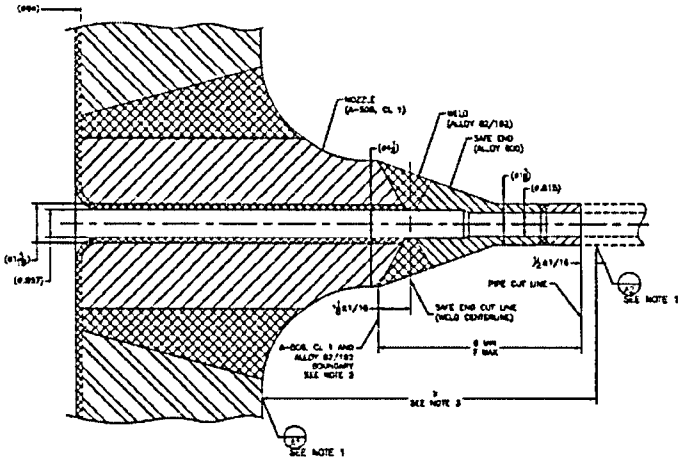
NDE Level III Review By: James J. McArdle III Date: 3/13/06
James J. McArdle III

Reviewed By: David W. Peltola Date: 3/13/06
David W. Peltola

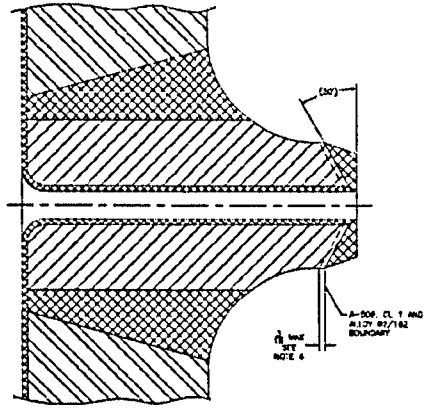
Framatome Fabrication Drawings

A AREVA FRAMATOME ANP, INC., AN AREVA AND SIEMENS COMPANY

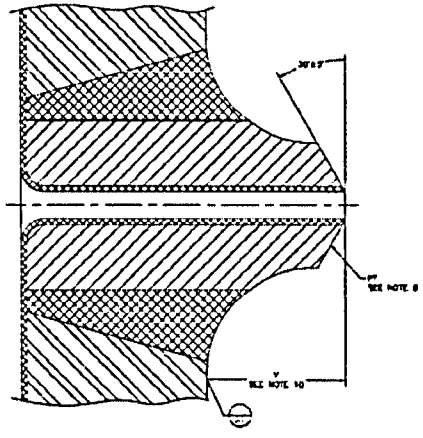
REVISIONS (ALL SHEETS SHARE REV LEVEL)



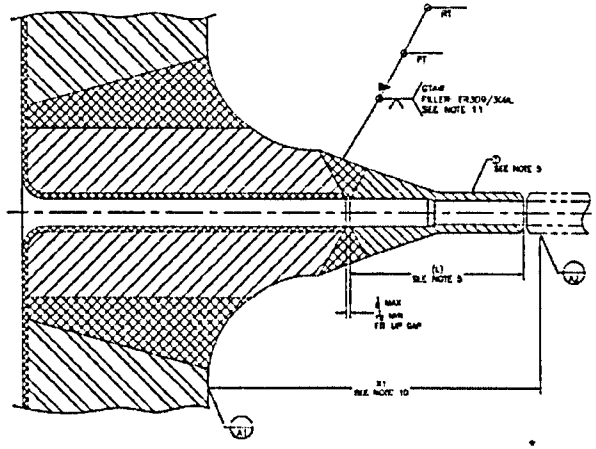
STEP 1
CUT PIPE, CUT AND
REMOVE SAFE END



STEP 2
REMOVE ALLOY 82/182
WELD MATERIAL



STEP 3
FORM WELD PREP



STEP 4
WELD SAFE END

BILL OF MATERIAL

ITEM	QTY	PART NO	DD	F/P	DESCRIPTION	MAT'L SPEC
1	-	50866825D	B	F	REPLACEMENT SAFE END	SEE NOTE 9

NOTES:

1. CREATE DATUM TARGETS A1 AND A2 USING A LOW STRESS MARK ON THE PRESSURIZER SHELL AND PIPE/VALVE RESPECTIVELY.
2. ETCH AS NECESSARY TO ESTABLISH WELD BOUNDARY
3. MEASURE AND RECORD DISTANCE X BETWEEN DATUM TARGET A1 AND DATUM TARGET A2
4. SCRIBE A LINE AROUND THE NOZZLE 3/16 INCH INBOARD (TOWARD PRESSURIZER) OF THE A-508 AND ALLOY 82/182 WELD BOUNDARY (NOT MACHINE OR GRIND IT) REMOVE EXISTING ALLOY 82/182 MATERIAL. ETCH TO ENSURE ALL WELD MATERIAL IS REMOVED FROM BASE METAL. DO NOT MACHINE MORE THAN 3/16 INCH INBOARD OF ALLOY 82/182 AND NOZZLE FUSION LINE.
5. DURING REATTACHMENT OF PIPE/VALVE, THE OUTBOARD END OF THE REPLACEMENT SAFE END SHALL BE CUT TO LENGTH AND A WELD PREP FORMED IN ACCORDANCE WITH FANP DOCUMENT 02-5066268 (LATEST REVISION).
6. WELD PREP SURFACE SHALL BE PT EXAMINED PRIOR TO WELDING
7. DIMENSIONAL INFORMATION FOR THE EXISTING CONFIGURATION IS TAKEN FROM DOCUMENTS REFERENCED IN FANP DOCUMENT 51-5066930 (LATEST REVISION)
8. ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE SPECIFIED
9. MATERIAL SHALL MEET THE REQUIREMENTS OF SA 479, TYPE 316 WITH A MAXIMUM CARBON CONTENT OF 0.03 WT % AND A MAXIMUM COBALT CONTENT OF 0.2 WT % AND A MINIMUM TENSILE STRENGTH OF 75 KSI
10. AFTER REPOSITIONING PIPE/VALVE, THE DIFFERENCE BETWEEN DIMENSIONS X AND X1 PIECE MAY BE NEEDED BETWEEN THE REPLACEMENT PIPE/VALVE AND SAFE END
11. GRIND WELD AS REQUIRED TO FACILITATE NDE

ONS-1, ONS-2 AND ONS-3
PRESSURIZER
UPPER LEVEL SENSING
NOZZLE MODIFICATION

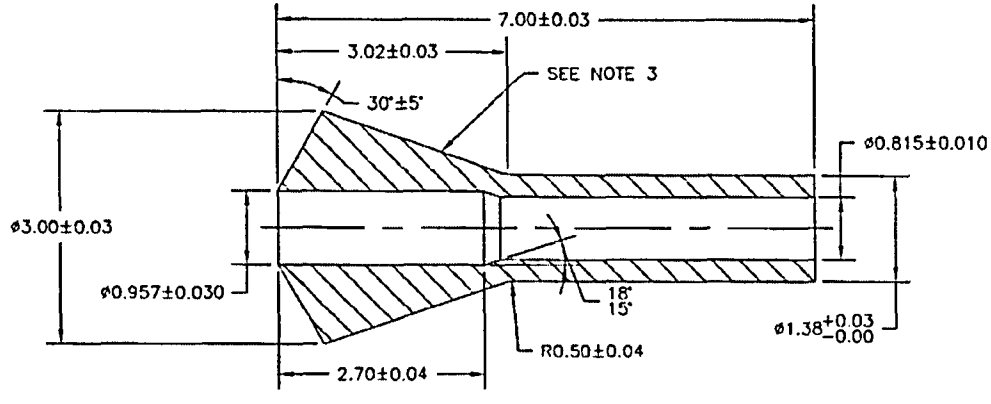
SHEET 1 OF 1 | SCALE: NONE | 50866825 D | 0

AREVA

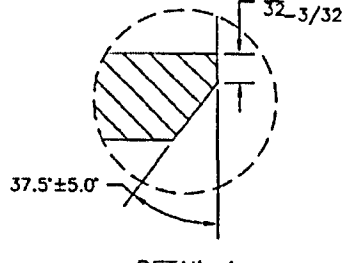
FRAMATOME ANP, INC., AN AREVA AND SIEMENS COMPANY

REVISIONS (ALL SHEETS SAME REV LEVEL)

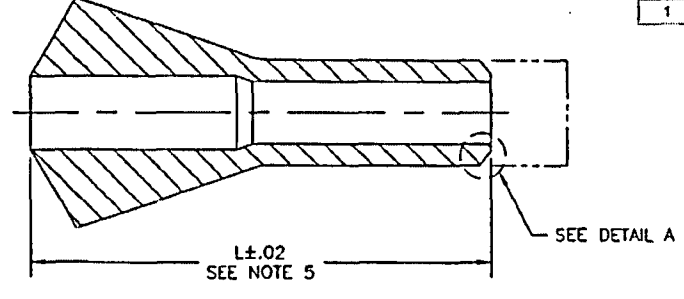
REV	DESCRIPTION	DATE	APPROVALS	MP



PRELIMINARY MACHINED SAFE END



DETAIL A



① FINAL MACHINED SAFE END

BILL OF MATERIAL

ITEM	QTY	PART NO.	DS	F/P	DESCRIPTION	MAT'L SPEC
1	-	5066926-001	B	F	REPLACEMENT SAFE END	SEE NOTE 1

NOTES:

1. THE SAFE END MATERIAL SHALL MEET THE REQUIREMENTS OF SA-479, TYPE 316 WITH A MAXIMUM CARBON CONTENT OF 0.03 WT % AND A MAXIMUM COBALT CONTENT OF 0.2 WT % AND A MINIMUM TENSILE STRENGTH OF 75 KSI AND BE IN ACCORDANCE WITH ARTICLE NB-2000 OF SECTION III OF THE ASME BOILER AND PRESSURE VESSEL CODE. THE MATERIAL WILL BE PROVIDED BY FANP.

2. LIQUID PENETRANT INSPECT ALL ACCESSIBLE NEWLY MACHINED SURFACES ON THE PRELIMINARY MACHINED AND THE FINAL MACHINED SAFE END

3. APPLY PART IDENTIFICATION MARKINGS TO THIS SURFACE WITH A VIBRATOOL. IDENTIFICATION MARKINGS SHALL CONSIST OF THE MATERIAL HEAT NUMBER, MATERIAL SPECIFICATION, THE FANP PART NUMBER, AND A UNIQUE SERIAL NUMBER. THE REQUIRED SERIAL NUMBERING WILL BE SPECIFIED ON THE FANP PURCHASE ORDER.

4. THE PRELIMINARY MACHINED SAFE END SHALL BE 100% DIMENSIONALLY INSPECTED. ALL NEWLY MACHINED FEATURES ON THE FINAL MACHINED SAFE END SHALL BE DIMENSIONALLY INSPECTED.

5. FINAL LENGTH WILL BE DETERMINED DURING INSTALLATION. SEE FANP DOCUMENT 02-5066925D (LATEST REVISION) FOR ADDITIONAL INSTRUCTIONS.

THIRD ANGLE PROJ

TOLERANCES ON (UNLESS OTHERWISE SPECIFIED)			
0 to 12	12 to 48	48 OR MORE	
± 12	± 48	MORE	
3 PLACE MACHINED	± .003	± .010	± .031
2 PLACE MACHINED	± .02	± .06	± .19
FRACTIONAL MACHINED	± 1/64	± 1/16	± 1/4

STRAIGHTNESS	.005 INCH C20 MAX
FLATNESS	.005 INCH C20 MAX
TRUE POSITION/CLARITY	.05 INCH C20 MAX
BREAK CORNERS	.02 MAX R OR CHFR
ANGULAR DIMENSIONS	±0°30'
CHAMFER ANGLE TOLERANCE	±5°
SURFACE FINISH	125 MICROINCHES

ALL REQUIREMENTS INCLUDED AND AT LEFT APPLY UNLESS OTHERWISE STATED.
TOLERANCE DEFINITIONS ARE PER ASME Y14.5M 1994
SURFACE FINISH DEFINITIONS ARE PER ASME B46.1 01 M95
ALL DIMENSIONS APPLY AT PART TEMPERATURE OF 68°F
CONCENTRICITY TOLERANCE .015 W.R.T. FIRST REVOLVED MACHINED FEATURE
ALL LINEAR DIMENSIONS ARE IN INCHES - DO NOT SCALE FROM DRAWING

REPLACEMENT SAFE END

DRAWN BY S.M. HUNTER	PASSED BY J.D. DISHMAN for D.H. WOOD	SHEET 1 OF 1	DATE 7/13/05	DRAWING NUMBER 5066926 B	REV 0
CHKD BY J.D. COX	APPD BY [illegible]	CONTRACT # 1231877	SCALE NONE		

ASME Section III Code Case N-659-0

CASE

N-659

CASES OF ASME BOILER AND PRESSURE VESSEL CODE

Approval Date: September 17, 2002
See Numeric Index for expiration and any reaffirmation dates.

Case N-659
Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination Section III, Division 1

Inquiry: Under what conditions and limitations may an ultrasonic examination be used in lieu of radiography where radiography is required by NB-5200, NC-5200, ND-5200 and substitution of ultrasonic examination would not otherwise be permitted?

Reply: It is the opinion of the Committee that all welds in material ½ in. or greater in thickness may be examined using the ultrasonic (UT) method in lieu of the radiographic (RT) method, provided that all of the following requirements are met:

(a) The ultrasonic examination area shall include 100% of the volume of the entire weld, plus 0.5T of each side of the welds, where T is the thickness of the weld. The ultrasonic examination area shall be accessible for angle beam examination in four directions, two directions perpendicular to the weld axis and two directions parallel to the weld axis. Where perpendicular scanning is limited on one side of the weld, a technique using the second leg of the V-path may be credited as access for the second perpendicular examination direction provided that the detection capability of that technique is included in the procedure demonstration described in (c) and (d) below.

(b) The ultrasonic examination shall be performed in accordance with Section V, Article 5 up to and including the 2001 Edition. A straight beam and two angle beams having nominal angles of 45 and 60 deg should generally be used; however, other pairs of angle beams may be used provided the measured difference between the angles is at least 10 deg. Alternatively, ultrasonic examination may be performed by a procedure qualified in accordance with the performance demonstration methodology of Section XI, Appendix VIII provided the entire volume of the weld examination is included in the demonstration.

(c) A written procedure shall be followed. The procedure shall be demonstrated to perform acceptably on a qualification block or specimen with both surface and subsurface flaws as described in (d) below.

(d) The qualification block material shall conform to the requiremnts applicable to the calibration block. The material from which blocks are fabricated shall be one of the following: a nozzle dropout from the component; a component prolongation; or material of the same material specification, product form, and heat treatment condition as one of the materials joined. For piping, if material of the same product form and specification is not available, material of similar chemical analysis, tensile properties, and metallurgical structure may be used. Where two or more base material thicknesses are involved, the calibration block thickness shall be of a size sufficient to contain the entire examination path. The qualification block configuration shall contain a weld representative of the joint to be examined, including, for austenitic materials, the same welding process. The qualification blocks shall include at least two planar flaws in the weld, one surface and one subsurface oriented parallel to the fusion line, no larger in the through-wall direction than the diameter of the applicable side-drilled hole in the calibration block shown in Fig. T-542.2.1 of Section V, Article 5, and no longer than the shortest unacceptable elongated discontinuity length listed in NB-5330, NC-5330, or ND-5330 for the thickness of the weld being examined. Where a Section XI, Appendix VIII, performance demonstration methodology is used, supplemental qualification to a previously approved procedure may be demonstrated through the use of a blind test with appropriate specimens that contain a minimum of three different construction-type and fabrication-type flaws distributed throughout the thickness of the specimen.

(e) This Case shall not be applied to weld examination volumes that include cast products forms or corrosion-resistant-clad austenitic piping butt welds.

(f) A documented examination plan shall be provided showing the transducer placement, movement and component coverage that provides a standardized and repeatable methodology for weld acceptance. The examination plan shall also include ultrasonic beam angle used, beam directions with respect to weld centerline, and volume examined for each weld.

(g) The evaluation and acceptance criteria shall be in accordance with NB-5330, NC-5330, or ND-5330, as acceptable.

(h) For welds subject to inservice ultrasonic examination, the examination and evaluation shall also meet the requirements of the applicable Edition of Section XI for preservice examination.

CASE (continued)

N-659

(i) The ultrasonic examination shall be performed using a device with an automated computer data acquisition system.

(j) Data shall be recorded in unprocessed form. A complete data set with no gating, filtering, or thresholding for response from examination volume in (a) shall be included in the data record.

(k) Personnel who acquire and analyze UT data shall be qualified and trained using the same type of equipment as in (i), and demonstrate their capability to detect and characterize the flaws using the procedure as described in (c).

(l) Review and acceptance of the procedure by the Authorized Nuclear Inspector is required.

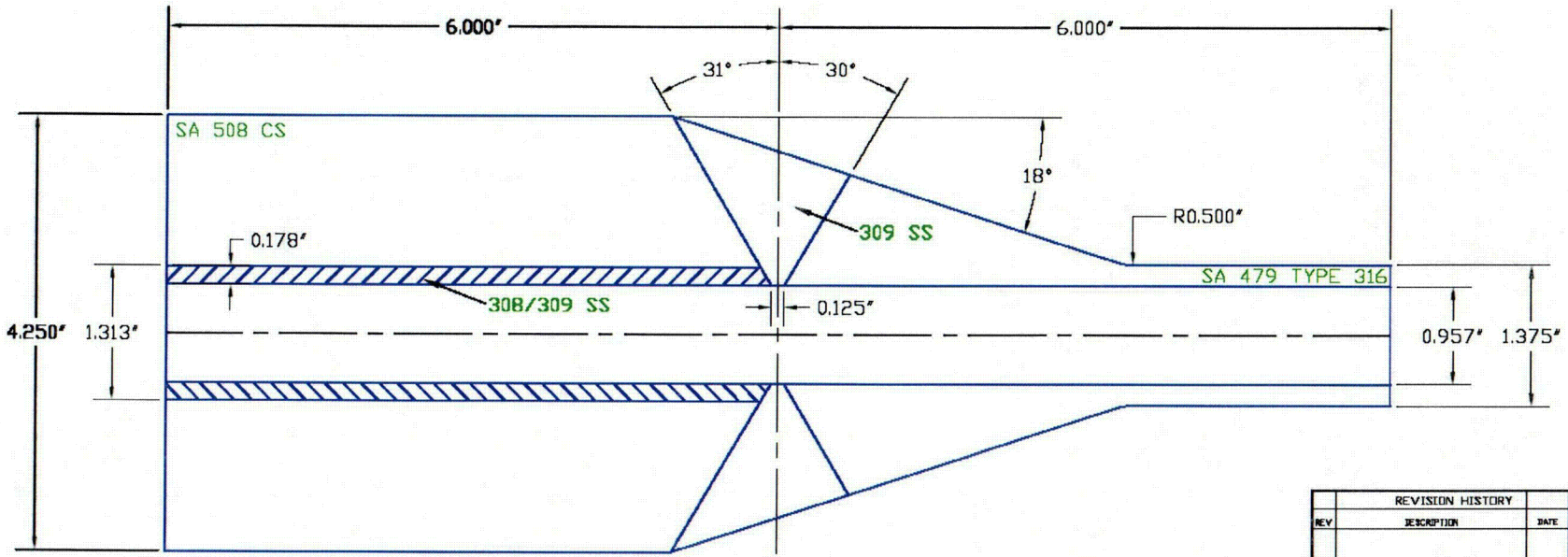
(m) All other related requirements of the applicable subsection shall be met.

(n) Flaws exceeding the acceptance criteria referenced in this Case shall be repaired, and the weld subsequently reexamined using the same ultrasonic examination procedure that detected the flaw.

(o) This Case number shall be recorded on the Data Report.

Flaw Tech Qualification Block Drawings

OVERALL DIMENSIONS(NOMINAL)/WELD PREP & PROFILE



REVISION HISTORY			
REV	DESCRIPTION	DATE	APPR

CLIENT: DUKE ENERGY
Drawing No. 180409pg1.dwg

FlawTech
Flaw Manufacturing Technology

SPECIMEN/PART NUMBER: LD-04-09

TITLE: PZR Level Safe End

DESCRIPTION: 508 CS Nozzle > 316 SS Safe End

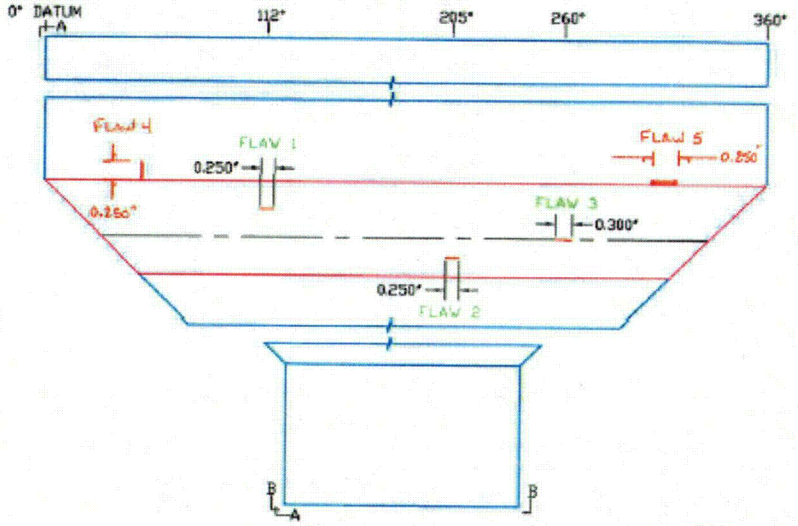
DRAWING BY: JC | DATE: 1/5/06 | APPROVED BY: | DATE:

REVISION #: 0

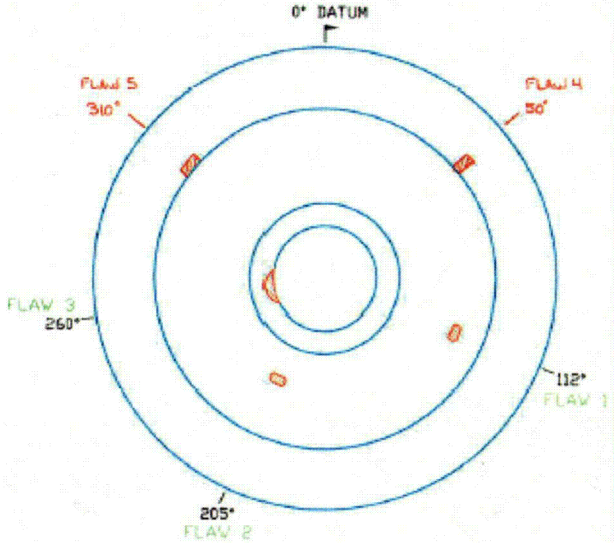
SCALE: SEE VIEW | SHEET 1 OF 2

SCALE: 1:1

FLAT OUTSIDE DIAMETER VIEW

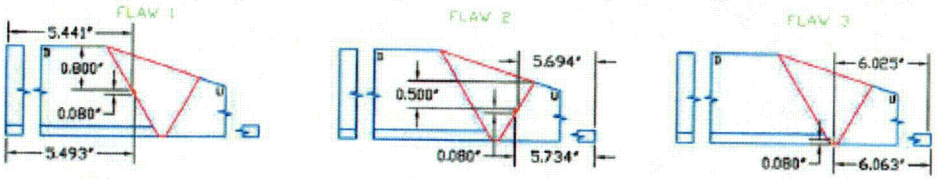


VIEW B-B



SCALE: 1:2

VIEW A-A



This drawing is representative of the PZR Level Safe End As-Built along with the addition of Flaw 4-(Axial EDM Notch) and Flaw -5(Circ EDM Notch). Final details along With changes shown will be incorporated into Rev. 2 of this component.

SCALE: 1:1

NOTES

1. FLAW LENGTH TOLERANCE ±0.080" W/ MAX 0.320"
2. FLAW HEIGHT TOLERANCE ±0.040" W/ MAX 0.090"
3. ID STAMP ON PIPE END, NOZZLE SIDE AT 90°
4. SEE PAGE 1 OF 2 FOR MATERIAL TYPES

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPR
1	Added As-Built Dimensions	2/1/06	

CLIENT: DUKE ENERGY — Drawing No. 100408pg2-1.dwg

FlawTech — Flaw Manufacturing Technology — SPECIMEN/PART NUMBER 10-04-06

TITLE: PZR Level Safe End

DESCRIPTION: 508 CS Nozzle & 316 SS Safe End

DRAWING BY:	DATE:	APPROVED BY:	DATE:

REVISION # 1

SCALE: SEE VIEW — SHEET 2 OF 2

SCALE: 1:2

FLAW	FLAW TYPE	UP/DOWN	FLAW ORIENTATION	FLAW DEPTH	FLAW LENGTH	FLAW HEIGHT	END REF. TO FLAW C/L	END REF. TO FLAW TIP	END REF. TO FLAW BASE	O.D. TO I.D. THICKNESS	DEGREE LOCATION	GEOMETRY/NOTES
1	Lack of Fusion	DOWN	CIRC	0.800"	0.250"	0.080"	N/A	5.441"	5.493"	1.658"	112°	
2	Lack of Fusion	UP	CIRC	0.500"	0.250"	0.080"	N/A	5.694"	5.734"	1.658"	205°	
3	Crack	UP	CIRC	1.275"	0.300"	0.080"	N/A	6.025"	6.063"	1.658"	260°	
4	Lack of Fusion	Down/Ups	Axial	OD Surface	0.250"	0.149"					50°	
5	Lack of Fusion	UP/Down	Circ.	OD Surface	0.250"	0.130"					310°	

Preliminary Coverage Drawings

AREA OF INTEREST

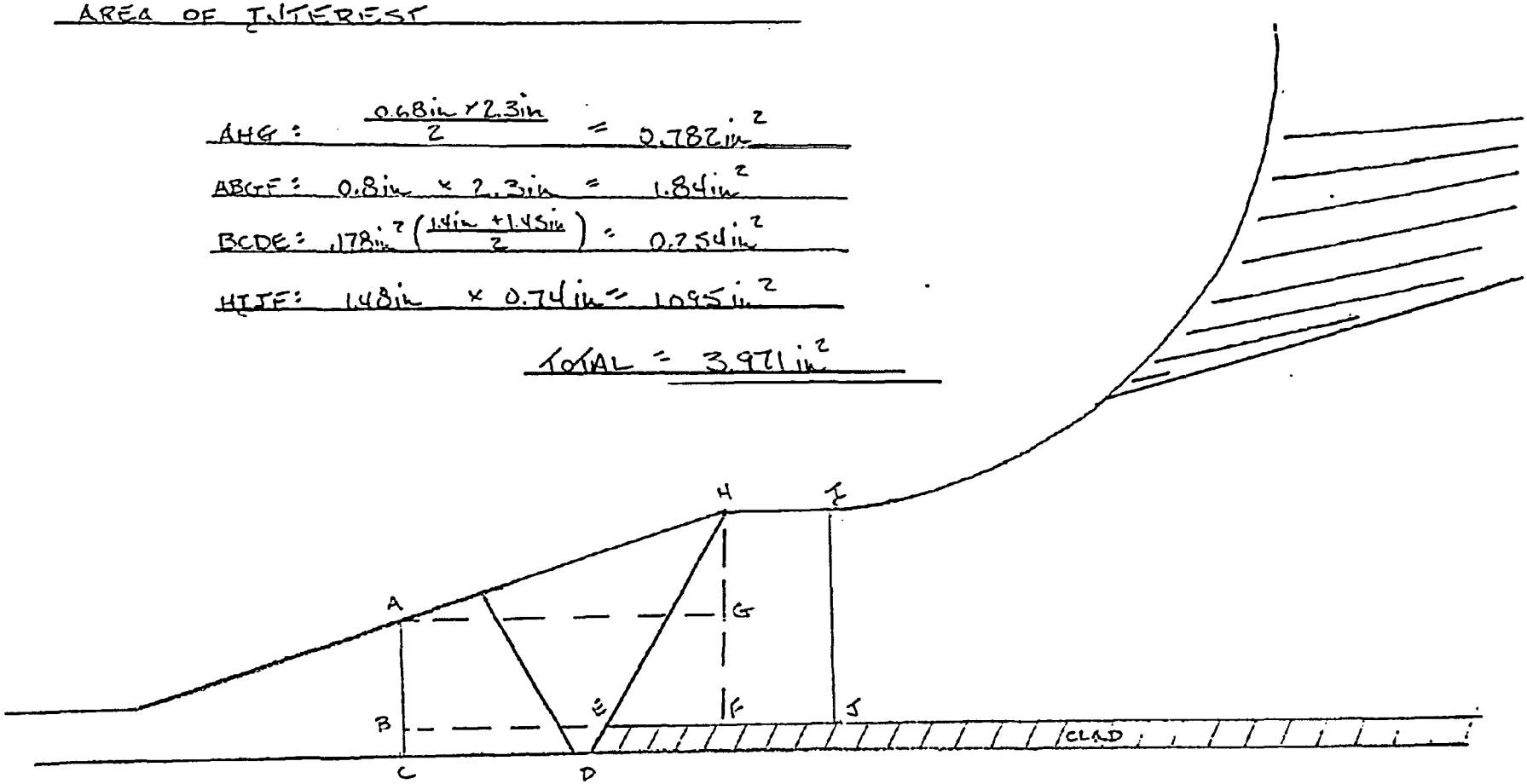
AHG: $\frac{0.68in \times 2.3in}{2} = 0.782in^2$

ABGF: $0.8in \times 2.3in = 1.84in^2$

BCDE: $.178in^2 \left(\frac{1.4in + 1.45in}{2}\right) = 0.254in^2$

HIJF: $1.48in \times 0.74in = 1.095in^2$

TOTAL = $3.971in^2$



COVERAGE: FULL

PART.

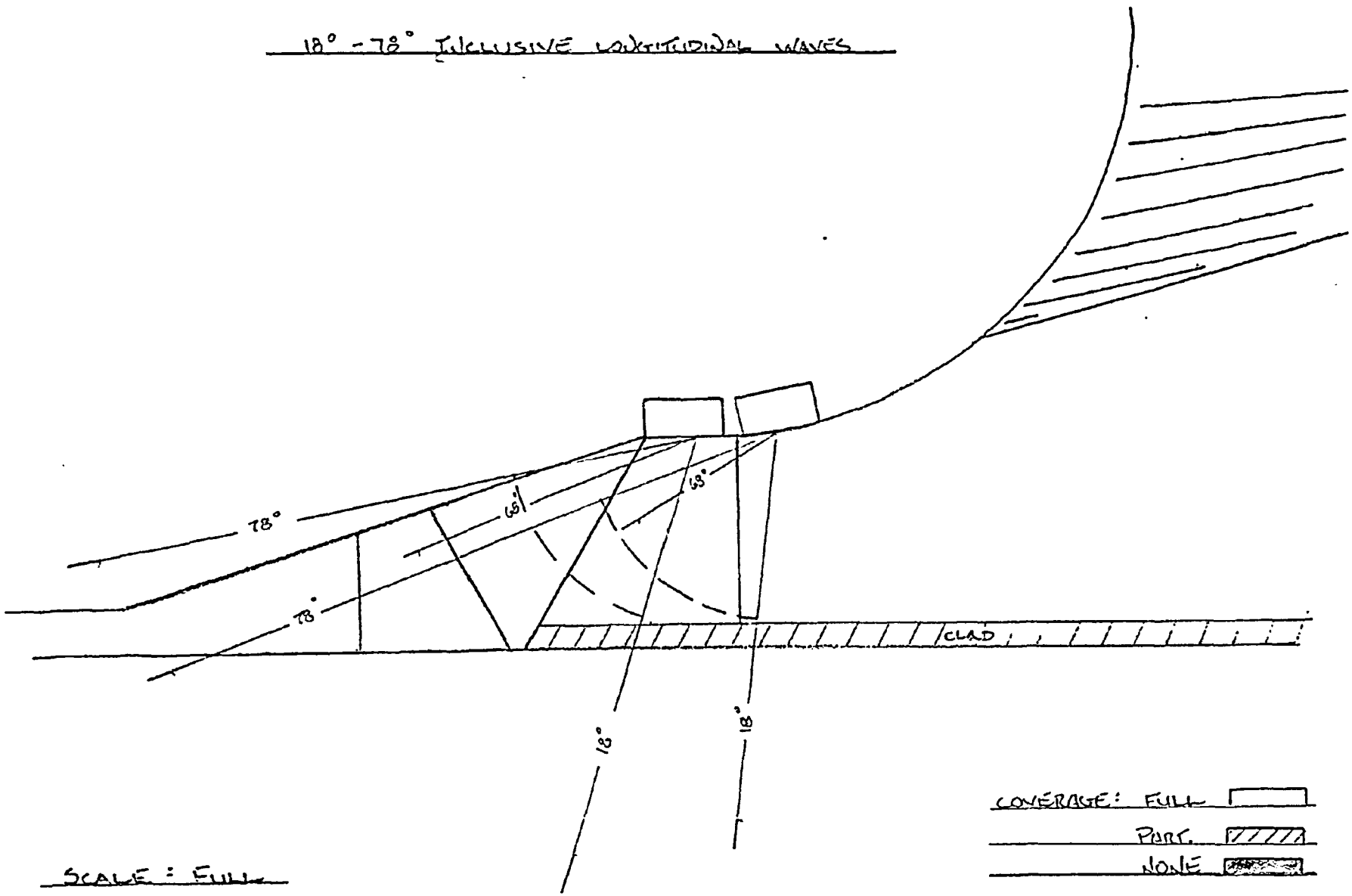
NONE

SCALE: FULL

ONS PZR LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATION

AXIAL SECTORIAL SCAN TOWARD SAFE END

18° - 78° INCLUSIVE LONGITUDINAL WAVES



COVERAGE: FULL

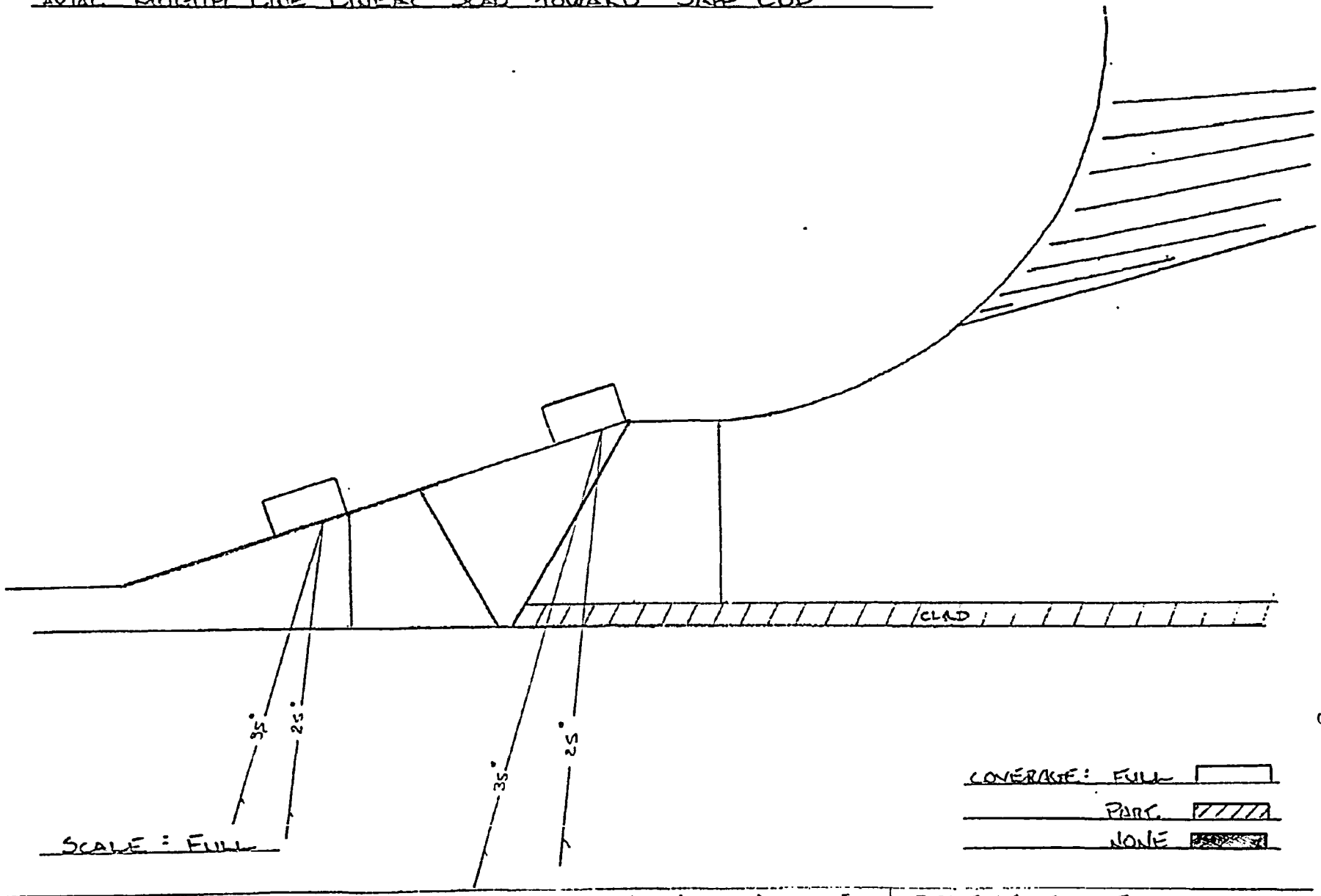
PART.

NONE

SCALE: FULL

0.1R DTD LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATED

AXIAL MULTIPLE LINE LINEAR SCAN TOWARD SAFE END



N1K D70 LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATIONS

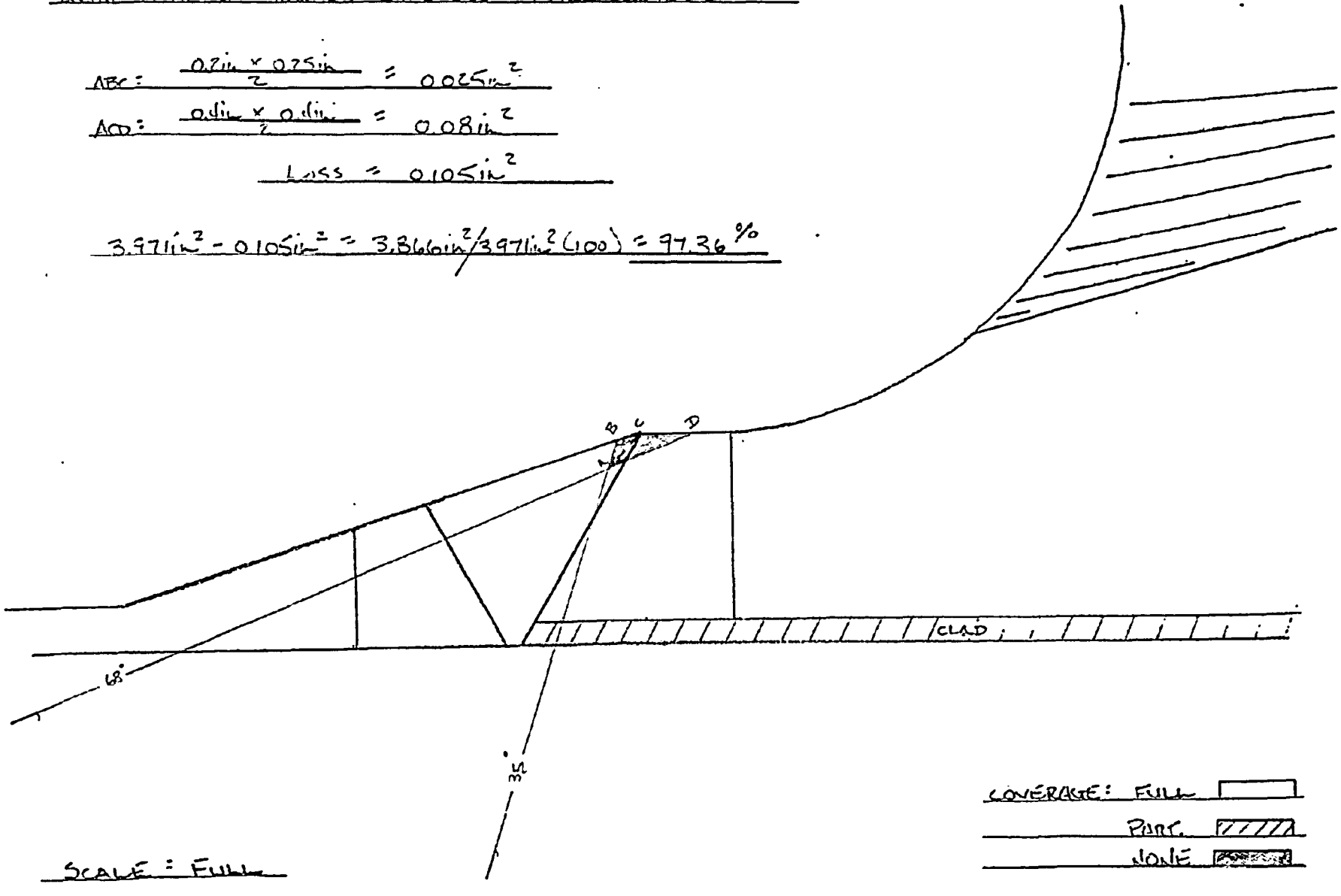
AXIAL PERCENT TOWARD SAFE-END - FULL COVERAGE

$\Delta ABC: \frac{0.2in \times 0.25in}{2} = 0.025in^2$

$\Delta ACD: \frac{0.4in \times 0.4in}{2} = 0.08in^2$

$Loss = 0.105in^2$

$3.971in^2 - 0.105in^2 = 3.866in^2/3.971in^2(100) = 97.36\%$



COVERAGE: FULL

PART.

NONE

SCALE: FULL

DIG DTP LEVEL SAFE END PRELIMINARY SCALE PLAN - AREA & PERCENT OF COVERAGE CALCULATIONS

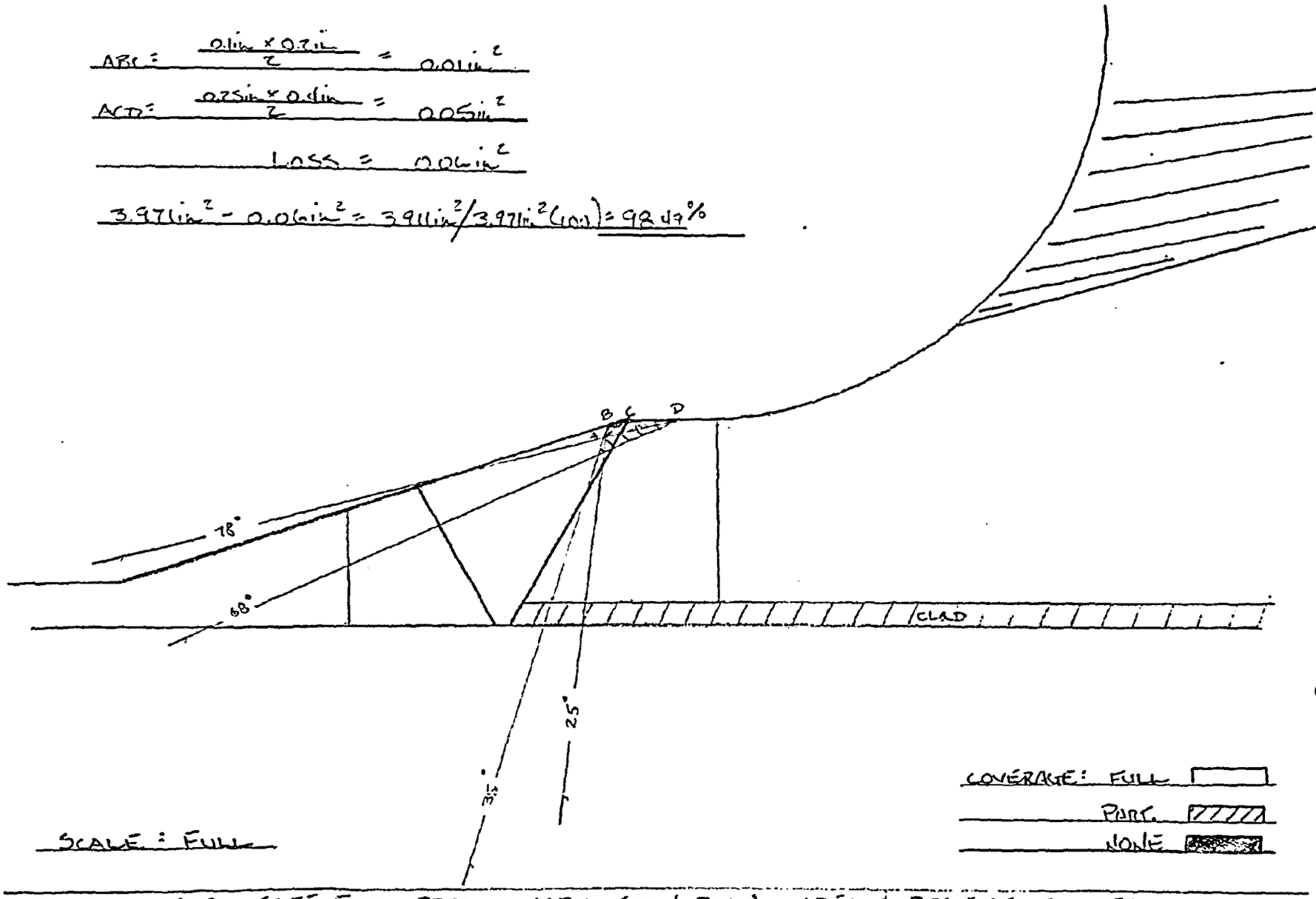
AXIAL PERCENT TOWARD SAFE END - FULL/PARTIAL COVERAGE

$ABL: \frac{0.1in \times 0.7in}{2} = 0.04in^2$

$ACT: \frac{0.25in \times 0.4in}{2} = 0.05in^2$

LOSS = $0.01in^2$

$3.97in^2 - 0.01in^2 = 3.96in^2 / 3.97in^2 (100) = 98.49\%$



COVERAGE: FULL

PART.

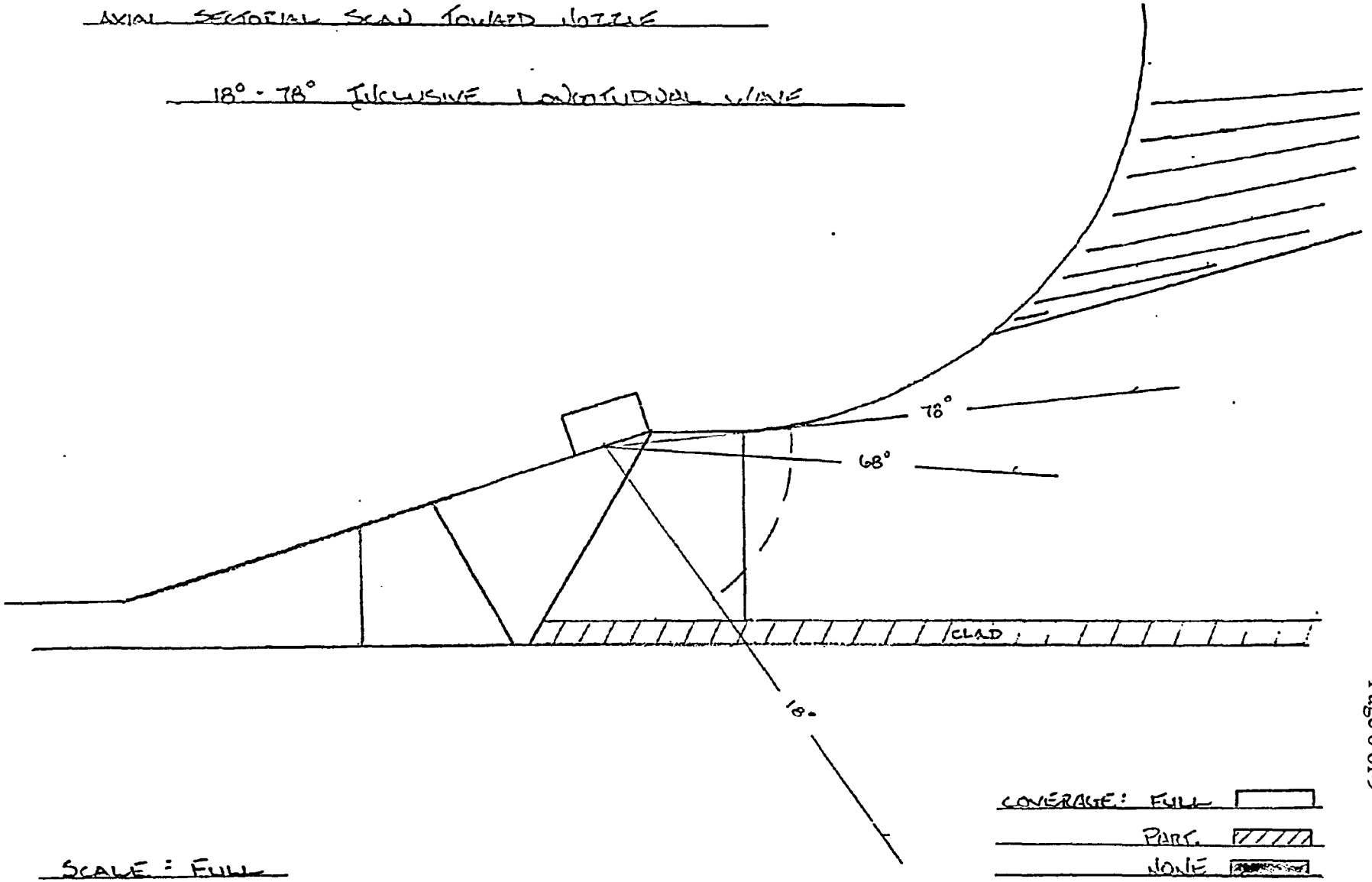
NONE

SCALE: FULL

OUTBOARD LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATIONS

AXIAL SECTORIAL SCAN TOWARD NOZZLE

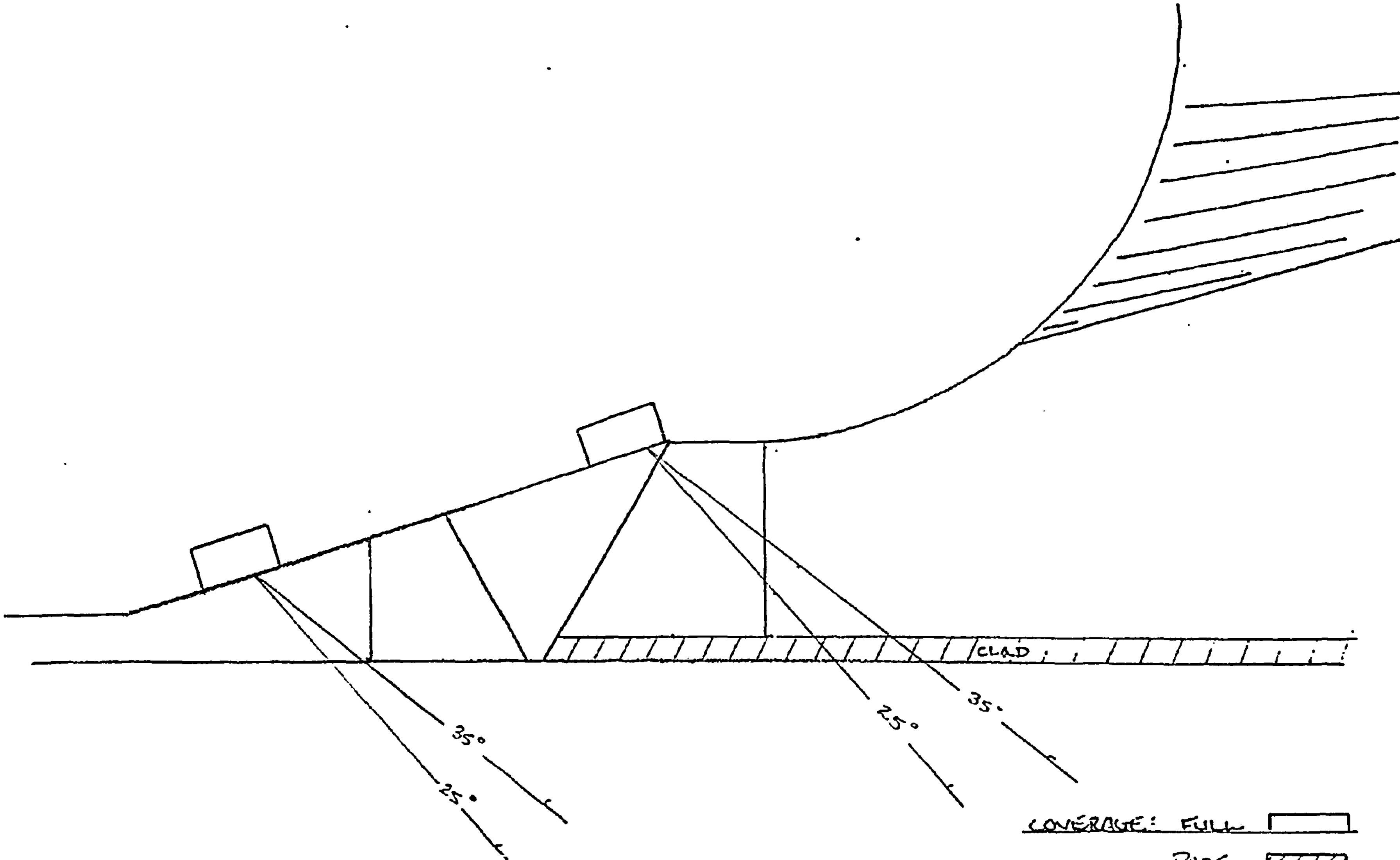
18° - 78° INCLUSIVE LONGITUDINAL WAVE



COVERAGE: FULL
PART.
NONE

SCALE: FULL

DIC DTD LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATIO



SCALE : FULL

[illegible] LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATION

AXIAL PERCENT TOWARDS NOZZLE - FULL COVERAGE

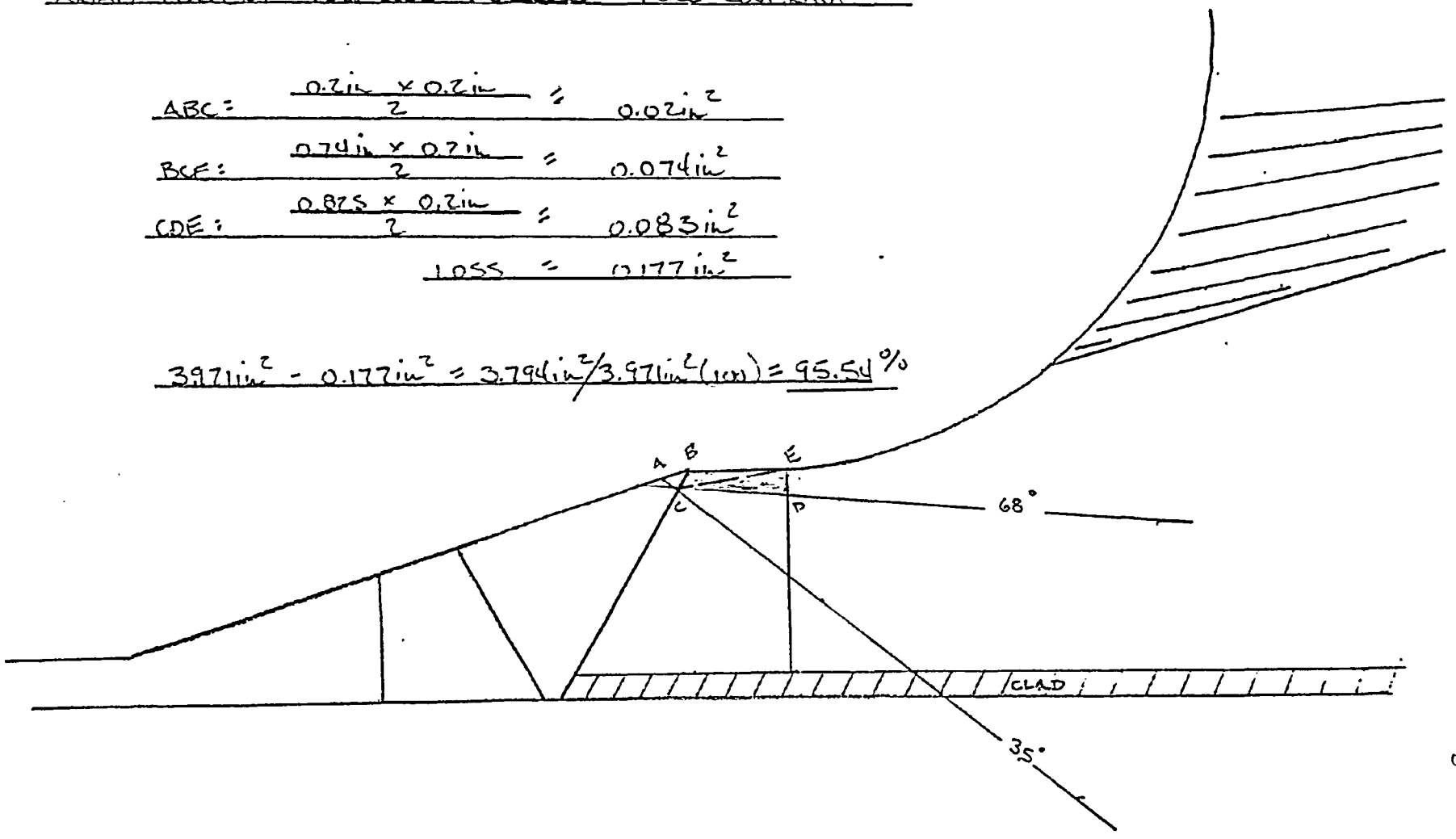
ABC: $\frac{0.2in \times 0.2in}{2} = 0.02in^2$

BCE: $\frac{0.74in \times 0.2in}{2} = 0.074in^2$

CDE: $\frac{0.825 \times 0.2in}{2} = 0.083in^2$

LOSS = $0.177in^2$

$3.971in^2 - 0.177in^2 = 3.794in^2/3.971in^2(100) = 95.54\%$



COVERAGE: FULL

PART.

NONE

SCALE: FULL

OIS BTP LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATIONS

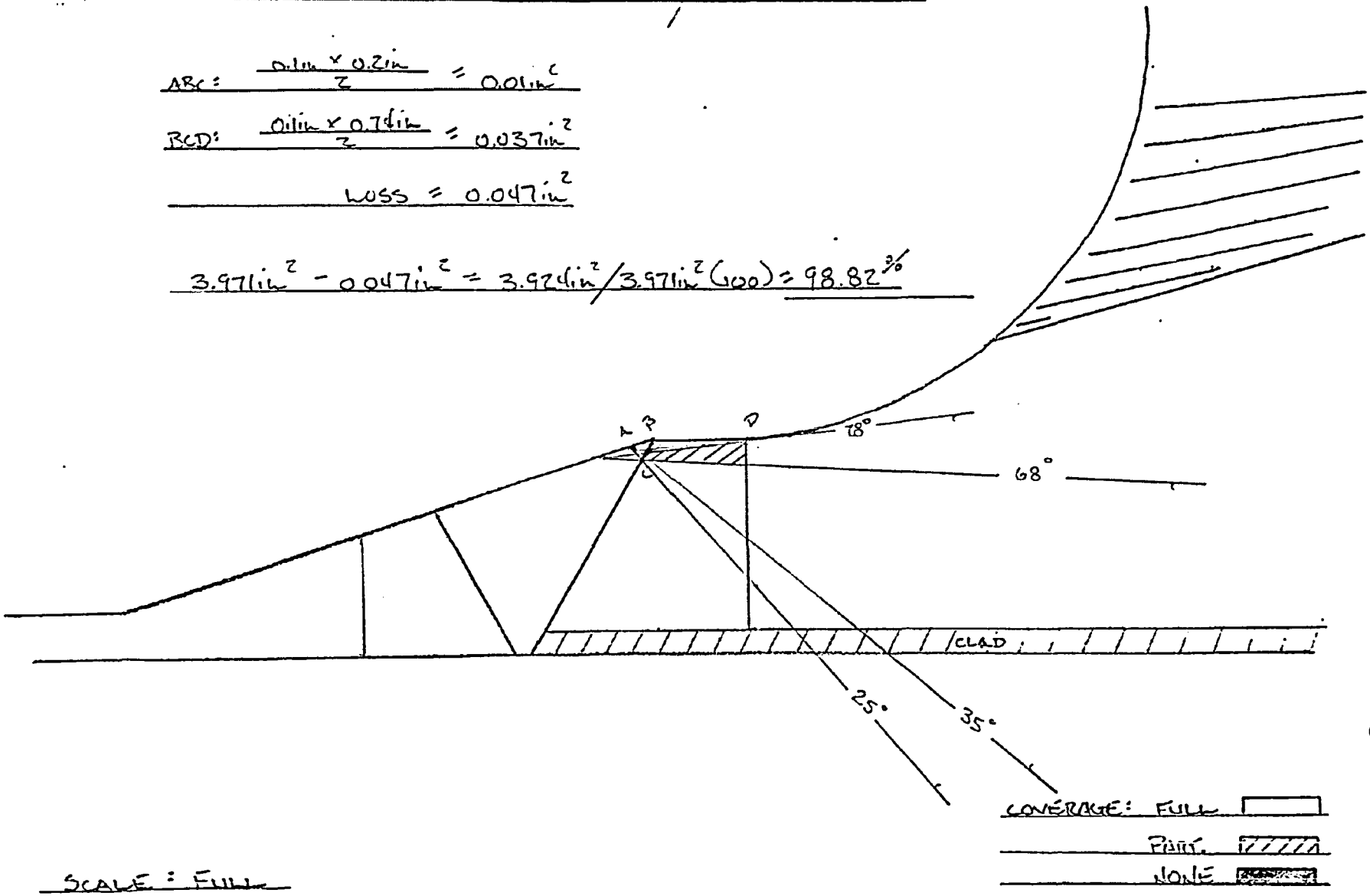
AXIAL PERCENT TOWARDS DATTIE - FULL/PARTIAL COVERAGE

ABC: $\frac{0.1in \times 0.2in}{2} = 0.01in^2$

BCD: $\frac{0.1in \times 0.74in}{2} = 0.037in^2$

LOSS = $0.047in^2$

$3.971in^2 - 0.047in^2 = 3.924in^2 / 3.971in^2 (100) = 98.82\%$



SCALE: FULL

OIC RTP LEVEL SAFE END PRELIMINARY SCAN PLAN - AREA & PERCENT OF COVERAGE CALCULATIONS