Non-proprietary

Attachment 2

Equipment Specifications 676413, Revision 1, "General Reactor Vessel Specification," and 953069, Revision 0, "Addendum to Equipment Specification 676433, Rev 1, North Anna Station,"

Virginia Electric and Power Company
(Dominion)
North Anna Unit 2

DESIGN SPECIFICATION SHEET

WESTINGHOUSE FORM 54064G

WESTINGHOUSE ELECTRIC CORPORATION
Nuclear Energy Systems
P.O Box 355
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DESIGN SPECIFICATION	DATED	REVISION NO	DATED	ORIGINAL ISSUE	SUPERSEDES PREVIOUS REVISIONS
676413	10/28/66	1	10/25/67	☐	☒

PROJECT: GENERAL REACTOR VESSEL SPECIFICATION

EQUIPMENT: Reactor Vessel

SHOP ORDER: 105

SYSTEM: Reactor Coolant System

ATTACHMENTS

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FOR SUPPLIER'S CONVENIENCE

REV NO	REVISION ENTERED BY & DATE

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Revision 1 of this document complies with Paragraph N-141, ASME Boiler and Pressure Vessel Code, Section III.

L. Katz PE 8/12/71
P.E. Date

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1.0 SCOPE

This Equipment Specification covers the general design, fabrication, examination, testing, cleaning and packaging of a reactor vessel, closure head and associated equipment by a reactor vessel constructor (hereafter referred to as the Supplier).

The reactor vessel shall be designed, fabricated, examined, and tested in accordance with this Equipment Specification and the ASME Boiler and Pressure Vessel Code, Section III, Rules for the Construction of Nuclear Vessels and all applicable Code Cases and Addenda for Class A vessels in effect at the date of the purchase order (hereafter referred to as Section III). Code Cases, Addenda or editions of Section III published after the purchase order date may be used if agreed upon by WAPD and the Supplier.

This Equipment Specification shall be used in conjunction with an Addendum which will indicate the specific dimensions, design parameters, design details, design criteria, scope of supply and references.

2.0 ASSIGNMENT OF RESPONSIBILITY

2.1 EQUIPMENT TO BE FURNISHED BY THE SUPPLIER

2.1.1 One (1) reactor vessel made up of the parts described below.

2.1.1.1 One (1) bottom head, including:

a. Internal cladding
b. External paint
c. Instrumentation tubes (See Addendum)

2.1.1.2 One (1) cylindrical shell, including:

a. Internal cladding
b. External reactor vessel supports
c. Reactor coolant inlet nozzles (See Addendum)
d. Reactor coolant outlet nozzles (See Addendum)
e. External paint
f. Core support pads (See Addendum)
g. Safety injection nozzles (See Addendum)

2.1.1.3 One (1) bolting flange, including:

a. Internal cladding
b. A number of threaded holes for closure studs
c. One (1) internal ledge for supporting the core, including four (4) keyways
d. One (1) refueling seal ledge
e. Two (2) closure gasket scaling areas
f. Two (2) monitoring tubes for closure gaskets
g. External paint
h. Flange cutouts for the irradiation sample tubes (See Addendum)

2.1.2 One (1) closure head made up of the parts described below.

2.1.2.1 One (1) center disc including:

a. Internal cladding
b. External thermal insulation

c. Control rod drive mechanism housings (See Addendum)
d. Three (3) closure head lifting lugs
e. External paint
f. A ventilation shroud support structure
g. One (1) vent pipe

2.1.2.2 One (1) bolting flange, including:

a. Internal cladding
b. A number of through holes for closure studs
c. Two (2) closure gasket grooves
d. Four (4) keyways
e. External paint

2.1.3 A set of closure studs

2.1.4 A set of closure stud lifting eyes

2.1.5 A set of closure nuts

2.1.6 A set of closure washers

2.1.7 A set of closure nut and closure washer fasteners

2.1.8 One (1) closure nut wrench

2.1.9 One (1) closure stud wrench

2.1.10 One (1) closure stud depth micrometer

2.1.11 Four (4) closure stud elongation measuring rods

2.1.12 Three (3) closure head and internals installation guide studs and sleeves.

2.1.13 One (1) guide stud sleeve handling too].

2.1.14 Sample pieces from core and nozzle region shell course plates and forgings and from core region weldments. The material shall be used for surveillance tests by the Purchaser.

2.1.15 Operating supplies consisting of the following:

2.1.15.1 Two (2) closure studs

2.1.15.2 Two (2) closure nuts

2.1.15.3 Two (2) closure washers

2.1.15.4 Three (3) sets of unused closure gaskets

2.1.15.5 Two (2) sets of closure gasket clips

2.1.15.6 Five (5) gallons of reactor vessel external paint

2.1.15.7 A sufficient amount of closure stud thread lubricant for four (4) closure head installations after the vessel is delivered to the plant site.

2.1.16 Spare Parts (See Addendum)

2.2 SERVICES TO BE FURNISHED BY THE SUPPLIER

The following services shall be furnished by the Supplier. Nothing in this Equipment Specification shall relieve the Supplier of the responsibility for performing in addition to the requirements of this Equipment Specification such tests, examinations, and other activities which the Supplier considers necessary to insure that the material and workmanship are satisfactory for the service intended, or as may be required by common usage or good practice.

2.2.1 Design and analysis of the equipment

2.2.2 Procurement of material for the equipment

2.2.3 Fabrication of the equipment

2.2.4 Testing and examination of the equipment

2.2.5 The obtainment and attachment of the ASME Code Stamp, Section III

2.2.6 Final shop cleaning of the equipment

2.2.7 Packing for shipment of the equipment

3.0 REFERENCES

Where compliance with particular portions of a reference are desired, this is specified in the body of the Equipment Specification. Any process, test or examination specification may be replaced by the Supplier's own specification after review and approval by WAPD.

3.1 REFERENCES NOT ATTACHED

3.1.1 ASME Boiler and Pressure Vessel Code, Section III Rules for Construction of Nuclear Vessels and applicable Code Cases and Addenda.

3.1.2 USASI Y14.5– 1966 "Dimensions and Tolerancing of Engineering Drawings".

3.2 ATTACHED REFERENCES

3.2.1 WAPD Reactor Vessel Proposal Drawing (See Addendum)

3.2.2 WAPD Drawing 882D800 "Form and Tolerance Design Profile–Vessel Upper Region"

3.2.3 WAPD Drawing 882D801 "Form and Tolerance Design Profile–Vessel Head"

3.2.4 WAPD Drawing 882D802 "Form and Tolerance Design Profile–Vessel Lower Region"

3.2.5 WAPD Drawing 500B466 "Vessel Design Profile-Acceptance Requirement of Bottom Mounted Instrumentation Tube"

3.2.6 WAPD Dimensional Profile Document (See Addendum)

3.2.7 Westinghouse Process Specification 292722 "Cleaning and Packaging Requirements of Equipment for Use in Nuclear Steam Supply System".

3.2.8 [

]^{a,c}

3.2.9 [ ]a,c

3.2.10 [ ]a,c

3.2.11 QCS-1 Manufacturers Quality Control Systems Requirements. The Supplier's quality control system shall meet the requirements of this specification.

4.0 DESIGN REQUIREMENTS

4.1 DESIGN INFORMATION

4.1.1 Vessel Assembly

4.1.1.1 Design pressure 2485 psig

4.1.1.2 Normal operating pressure (See Addendum)

4.1.1.3 Design temperature 650°F

4.1.1.4 No load temperature (See Addendum)

4.1.1.5 Normal operating inlet water temperature (See Addendum)

4.1.1.6 Normal operating outlet water temperature (See Addendum)

4.1.1.7 Design life (See Addendum)

4.1.1.8 Transients (See Addendum)

4.1.1.9 The reactor vessel and closure head internal surfaces shall be in contact with the inlet water except for the outlet nozzles which shall be in contact with the outlet water.

4.1.1.10 A complete fatigue analysis in accordance with Section III shall be performed on the entire vessel without consideration of the results of Paragraph N-415.1.

4.1.1.11 The reactor vessel shall be designed in accordance with the requirements of the WAPD drawing referenced in Paragraph 3.2.1.

4.1.1.12 The reactor vessel and closure head dimensional and geometric tolerances shall conform to the requirements of the WAPD drawings referenced in Paragraph 3.2.2 through 3.2.5. The definitions and interpretation of the symbols used on these drawings are in accordance with the document referenced in Paragraph 3.1.2.

4.1.1.13 Means shall be provided on the head and vessel flanges, respectively, to limit translational movements of the head on the vessel. The clearance shall be large enough to prevent damaging interference during heatup and cooldown cycles.

4.1.1.14 The exterior paint shall be resistant to heat and [ ]^{a,c}. One (1) coat of paint shall be used. (See Paragraph 4.3.13)

4.1.2 Reactor Vessel

4.1.2.1 Radiation heating in the vessel shell at the vertical midplane of the core is given by the expression,

$P_x = P_o e^{-Bx}$

where

P_o = Heating at inner surface of vessel, Btu/hr ft^3 (Kg-cal/hr m^3)

P_x = Heating at any local point displaced X in. (m) from the inner surface of vessel shell, Btu/hr ft^3 (kg-cal/hr m^3)

[ ]^{a,c}

Maximum value of P_o = (See Addendum)

4.1.2.2 Radiation heating in the flange and nozzle areas may be considered as negligible.

4.1.2.3 The core region* shall be free of wall thickness changes, vessel supports, lifting lugs or other geometric discontinuities.

4.1.2.4 The internal ledge for supporting the core shall be designed for the following vertical loads:

a. Weight of core and core support structure (See Addendum)
b. Dynamic load of tripped control rods (See Addendum)
c. Core clamping load (See Addendum)**
d. Seismic load (See Addendum)

4.1.2.5 Operational Loading Requirements

The reactor vessel, reactor coolant nozzles and reactor vessel supports shall be designed to resist simultaneously, the following operational loadings:

a. Weight and center of gravity*** of core and core support structure (See Addendum)

* The core region is defined on the WAPD drawing referenced in Paragraph 3.2.1.
** This load will also be imposed on the portion of the closure head directly above the core support ledge.
*** The reactor coolant nozzle centerline shall be the base for center of gravity dimensions.

b. Dynamic load of tripped control rods (See Addendum)
c. Weight and center of gravity of water contained within the reactor vessel and head (See Addendum)
d. Weight and center of gravity of reactor vessel closure head and closure head dome insulation – by Supplier
e. Weight and center of gravity of external thermal insulation (See Addendum)
f. Weight and center of gravity of closure head lifting rig and ventilation shroud (See Addendum)
g. Weight and center of gravity of control rod drive mechanisms (See Addendum)
h. Partial weight and center of gravity of reactor coolant piping (See Addendum)
i. Thermal expansion loads exerted by reactor coolant piping (See Addendum)

4.1.2.6 Seismic Loading Requirements

The reactor vessel, reactor coolant nozzles and reactor vessel supports shall be designed to resist the following seismic loadings:

Design (DES) and no-loss-of-function (NLF) seismic loads in the horizontal and vertical directions equal to (See Addendum), acting simultaneously and applied at the center of gravity.

Design (DES) and no-loss-of-function (NLF) seismic loadings exerted by the reactor coolant piping (See Addendum).

The stress intensity limits associated with the seismic loadings are as follows:

DES Seismic	$Pm \leq Sm$
plus operational loads	$P1 + Pb \leq 1.5Sm$
NLF Seismic	$Pm \leq 1.2Sm$
plus operational loads	$P1 + Pb \leq 1.8Sm$

4.1.2.7 Pipe Break Loading Requirements

The reactor vessel, reactor coolant nozzles and reactor vessel supports shall be designed to resist the following pipe break loadings: (See Addendum)

The stress intensity limits associated with the pipe break loads, when combined with the operational loads, shall be the same as those given for the NLF Seismic loads plus operational loads in Paragraph 4.1.2.6.

4.1.2.8 [

]^{a,c}

4.1.2.9 Core support pad loadings (See Addendum)

4.1.2.10 The reactor vessel supports shall permit the vessel to expand axially and radially during normal operation and transients.

4.1.2.11 [

]^{a,c}

4.1.2.12 The reactor vessel support system shall consist of (See Addendum).

4.1.2.13 [

]^{a,c}

4.1.2.14 The monitoring tubes shall not exit from the vessel flange in the high stressed region.

4.1.2.15 The refueling seal ledge shall contain two (2) machined gasket grooves.

4.1.2.16 The reactor vessel shall have orientation markings to facilitate setting in place at the site and to position vessel internals properly. All orientation marking and numbers in this and succeeding paragraphs shall be put on in such a manner that they are not points of stress concentration.

4.1.2.17 Each stud hole in the reactor vessel flange shall be numbered and the number shall be marked on the flange.

4.1.2.18 The stud holes in the vessel flange shall be counterbored at the top to provide a sealing surface for an O-ring. The O-ring will be part of the stud hole plugs, supplied by WAPD, which will be used to prevent the refueling water from entering the stud holes.

4.1.3 Closure Head

4.1.3.1 The ventilation shroud support structure shall consist of a cylindrical ring which surrounds the control rod drive mechanism adapters and terminates in a flange which contains (See Addendum) through bolt holes.

4.1.3.2 The closure head shall have an orientation marking.

4.1.3.3 [ ]^{a,c}

4.1.3.4 Each stud hole in the head flange shall be numbered and the number marked on the flange.

4.1.4 Thermal Insulation for Closure Head Dome (See Paragraph 4.3.1.4)

4.1.4.1 The thermal insulation shall contain no organic binder.

4.1.4.2 [ ]^{a,c}

4.1.4.3 [ ]^{a,c}

4.1.4.4 The thermal insulation must not sag, settle or disintegrate during the life of the reactor vessel.

4.1.4.5 The thermal insulation must not be harmed by moisture, and it must have a low water retention after wetting.

4.1.5 Closure Studs

4.1.5.1 Each stud shall have a center hole to receive a stud elongation measuring rod.

4.1.5.2 [

]^{a,c}

4.1.5.3 The studs shall be suitable for a minimum of (See Addendum) tightenings. The Supplier shall give in the Instruction Manual any maintenance procedures and/or inspections required for the studs after a period of operating time or number of tightening cycles.

4.1.5.4 A number shall be marked on the top of each stud. Each stud shall initially be interchangeable in all tapped holes in the vessel flange.

4.1.5.5 A lifting eye shall be provided for each stud.

4.1.5.6 [

]^{a,c}

4.1.5.7 [ ]^{a,c}

4.1.5.8 The Supplier shall use three (3) stud tensioners, supplied by WAPD, to tighten and loosen the studs for the shop hydrotest.

4.1.6 Closure Nuts

4.1.6.1 The closure nuts shall be of the through-type to permit the use of stud tensioners.

4.1.6.2 Each closure nut shall have a provision so that it can be turned by a hand wrench.

4.1.6.3 [ ]a,c

4.1.6.4 The nut and washer shall be joined by means of a mechanical fastener to facilitate field handling.

4.1.7 Closure Washers

4.1.7.1 [ ]a,c

4.1.7.2 [ ]a,c

4.1.8 Closure Gaskets

4.1.8.1 [ ]a,c

4.1.8.2 The gaskets shall be fastened to the closure head by means of a mechanical connection. Each gasket shall be designed so that it remains affixed to the closure head during the removal of the closure head from the vessel. The closure head would then be moved to a pad which permits access to the closure head mating surface. Gasket replacement must then be possible.

4.1.8.3 [ ]a,c

4.1.9 Guide Studs and Sleeves

4.1.9.1 The guide studs shall have sufficient length to be engaged in the head flange when the plane of the head flange face is within approximately (See Addendum) from the face of the vessel flange.

4.1.9.2 [ ]a,c

4.1.9.3 [ ]a,c

4.1.9.4 The guide studs shall be inserted into the sleeves which shall be threaded into the tapped holes in the vessel flange prior to installation of the guide studs. Provisions shall be made for locking the guide studs to the guide stud sleeves. The guide stud and guide stud sleeve shall have provisions preventing the refueling water from entering the stud holes. The guide stud sleeves shall be final machined while installed in the vessel flange tapped holes.

4.1.10 Stud Elongation Measuring Rods

4.1.10.1 One (1) of the measuring rods shall be marked "Master". This measuring rod shall be supplied with a separate wooden box.

4.1.10.2 Three (3) of the measuring rods shall be marked "1", "2" and "3".

4.2 FABRICATION INFORMATION

4.2.1 All welding procedure specifications to be used in the fabrication of this equipment shall contain at least the following information.

4.2.1.1 Specification for electrode or filler metal and flux.

4.2.1.2 Welding positions covered by the procedure specification.

4.2.1.3 Preparation of base material for welding.

4.2.1.4 Welding current characteristics; polarity, amperage, voltage.

4.2.1.5 Welding technique: This is to include welding sequence in bead deposition, type of travel, whether string or weave.

4.2.1.6 Cleaning

4.2.1.7 Appearance of weld bead. This should cover convexity, fusion to adjacent bead, undercutting, etc.

4.2.1.8 Treatment of root side of weld joint.

4.2.1.9 Preheat temperature.

4.2.1.10 Interpass temperature

4.2.1.11 Postheating procedure

4.2.1.12 Inspection procedure and acceptance standards.

4.2.1.13 Reference to the applicable weld procedure qualification.

4.2.2 For welding P_3 materials, preheat temperature of 250°F minimum is required. The preheat must be maintained until either an intermediate or partial post weld heat treatment or a full post weld heat treatment is completed.

4.2.3 [ ]^{a,c}

4.2.4 [ ]^{a,c}

4.2.5 The internal cladding shall be attached by the weld deposited overlay method or high energy methods.

4.2.6 [ ]^{a,c}

4.2.6.1 [ ]^{a,c}

4.2.6.2 [ ]^{a,c}

4.2.6.3 [ ]a,c

4.2.7 [ ]a,c

4.2.7.1 [ ]a,c

4.2.7.2 [ ]a,c

4.2.8 [ ]a,c

4.2.9 [ ]a,c

4.2.10 [ ]a,c

4.2.11 [ ]a,c

4.2.12 [ ]a,c

4.2.13 [ ]a,c

4.2.14 [ ]a,c

4.3 MATERIAL INFORMATION

The following materials are preferred for this equipment. Use of these materials shall not relieve the Supplier of conforming to the requirements of this Equipment Specification. Substitute materials may be used after review and approval by WAPD.

4.3.1 Reactor Vessel and Closure Head

4.3.1.1 [ ]a,c

4.3.1.2 [ ]a,c

[ ]a,c

4.3.2 Surfaces in Contact with Reactor Coolant.

4.3.2.1 [ ]a,c

4.3.2.2 Clad surfaces shall be:

4.3.2.2a [ ]a,c

The expected and acceptable chemical content for each layer of cladding shall be in accordance with the following table:

TABLE I

[

]a,c

4.3.2.2b [ ]a,c

4.3.3 [

]a,c

4.3.4 Control Rod Drive Mechanism Housings

[

]a,c

4.3.5 Instrumentation Tubes

[

]a,c

4.3.6 [ ]a,c

4.3.7 [ ]a,c

4.3.8 [ ]a,c

4.3.9 [ ]a,c

4.3.10 [ ]a,c

4.3.11 [ ]a,c

4.3.12 [ ]a,c

4.3.13 Vent Pipe

[

]a,c

4.3.14 [

]a,c

4.3.15 [

]a,c

[

]a,c

4.3.16 [

]a,c

4.3.17 The Supplier may substitute other ASME approved material than specified in Paragraphs 4.3.1 through 4.3.15 after review and approval by WAPD. If the Supplier elects to use other ASME approved material than specified in Paragraph 4.3.1 for the core region, the Supplier's request for approval shall contain the following information.

[

]a,c

4.3.18 Reactor Vessel Surveillance Material

The reactor vessel surveillance material shall be supplied in accordance with the following.

4.3.18.1 Sample Location

4.3.18.1a All material samples shall be located at a minimum distance of 1T from the quenched edges.

4.3.18.1b [ ]^{a,c}

4.3.18.1c [ ]^{a,c}

4.3.18.2 Sample Size

4.3.18.2a Core region plates* –

[ ]^{a,c}

4.3.18.2b Core region forgings* –

[ ]^{a,c}

* – Balance of core region plates or forgings shall be shipped to WAPD.

4.3.18.2c Nozzle shell course plates – All nozzle cutouts from one (1) heat of material

4.3.18.2d Nozzle shell course forgings – Two (2) nozzle cutouts

4.3.18.2e Core region weldments

[ ]^{a,c}

[

]^{a,c}

4.3.18.3 Processing

4.3.18.3a The material supplied in accordance with Paragraphs 4.3.18.2a, b, c, d and e (Sample A) shall have a similar thermal and fabrication history (preliminary heat treatments, quench and tempering, postweld heat treatment and forming must be included) to the final vessel material condition.

4.3.18.3b The material supplied in accordance with Paragraph 4.3.18.2e (Sample B) shall be processed with the vessel so that both will have the identical thermal and fabrication history.

4.3.19 Pressure containing forgings shall be contour shaped or machined essentially to the finished product configuration prior to heat treatment except for test and surveillance material areas.

5.0 TEST REQUIREMENTS

5.1 IMPACT TESTS

The impact test requirements below are in addition to the impact test requirements in Paragraph N-330 of Section III.

5.1.1 General Requirements

5.1.1.1 The test procedures and test specimen location shall be in accordance with Article 3 of Section III.

5.1.1.2 Core region weld metal and base metal heat affected zone test specimens shall be obtained from a full thickness weld sample using core region weld metal and base metal. The test specimens shall be obtained at the 1/4T depth.

5.1.1.3 All test specimens for vessel shell forgings* shall be located in accordance with Paragraph N-313.4d(1) of Section III.

5.1.2 Charpy V-Notch Testing

5.1.2.1 Fully Charpy V-Notch curves (upper and lower plateaus included) shall be furnished for:

5.1.2.1a Each pressure containing plate, shell forging and contoured forging.**

* – Shell forgings are defined as ring forgings used in the cylindrical region of the vessel shell. These include nozzle shell course, core region shell course and bottom head transition forgings.

** – Contoured forgings are defined as vessel flange, closure head flange, reactor coolant nozzle and safety injection nozzle (where applicable) forgings.

5.1.2.1b Core region weld metal and base metal heat affected zone.

5.1.2.1c Closure stud material.

5.1.2.2 [

]a,c

5.1.3 Drop Weight Testing

5.1.3.1 Drop weight test data shall be furnished for:

5.1.3.1a Each pressure containing plate, shell forging and contoured forging.

5.1.3.1b Core region weld metal and base metal heat affected zone.

5.1.3.2 [

]a,c

5.2 CLADDING TESTS

5.2.1 Production Tests

5.2.1.1 The Supplier shall prepare and submit to WAPD for approval, a procedure for testing the production cladding to assure compliance with the chemistry and ferrite requirements of Paragraph 4.3.1.2.

5.2.1.2a The production cladding test procedure shall include at least the following, if Type 308 or Type 308L electrodes are used singly or in combination with other austenitic stainless steel electrodes for the first layer.

5.2.1.2a The Supplier shall perform one (1) test for each change in physical set up.

5.2.1.2b The Supplier shall perform one (1) test for each heat of filler wire (or combination of filler wires) and each batch of flux.

5.2.1.2c The Supplier shall perform one (1) test per welding working shift. If the chemical analysis and ferrite content does not meet the expected values given in Paragraph 4.3.1.2a, every bead for that welding working shift period shall be sampled on the component being clad.

5.2.2 Qualification Tests

Separate material certification test plates shall be required for each heat of filler wire and batch of flux that will be used in production cladding. These tests shall be performed in accordance with Article 5 of Section III. The percentage of ferrite present before and after a simulated postweld heat treatment shall be determined for the certification test plates and the cladding procedure qualification test plates.

5.3 HYDROSTATIC TEST

5.3.1 The minimum hydrostatic test temperature for the vessel shall be established by the Supplier based on the tests performed in accordance with Paragraph 5.1.

5.3.2 The water used for the hydrostatic test shall meet the following requirements:

[

]^{a,c}

5.3.3 The hydrostatic test shall be followed immediately by a flush of water which meets the requirements specified in paragraph 7.1.2.

6.0 EXAMINATION REQUIREMENTS

6.1 ULTRASONIC EXAMINATION

The ultrasonic examination requirements below are in addition to the ultrasonic examination requirements in Paragraph N-320 of Section III.

6.1.1 General Requirements

6.1.1.1 The Supplier shall submit for approval, ultrasonic examination procedures outlining the essential variables of the examination including equipment calibration and acceptance standards. The following parameters shall be detailed in the procedure.

a. The stages(s) of fabrication at which the examination(s) will be conducted.
b. The degree of surface preparation, the types(s) of couplants(s) which will be used.
c. The direction in which the waves are introduced.

6.1.1.2 [

]^{a,c}

6.1.1.3 Scanning shall provide one hundred percent (100%) volumetric coverage of all material being examined.

6.1.2 Plate Material

[

]^{a,c} The acceptance standard shall be as follows:

Indications whose amplitude equals or exceeds the calibration standard shall be rejected.

6.1.3 Stud Material

[

]^{a,c} The acceptance standards shall be equivalent to that in Article 3 of Section III for the circumferential longitudinal wave testing of stud material.

6.1.4 Cladding

6.1.4.1 [

]^{a,c} The acceptance standard shall be as follows:

Indications whose amplitude equals or exceeds that from the reference hole shall be rejected.

6.1.4.2 [

]^{a,c} The acceptance standards shall be as follows:

Indications whose amplitude equals or exceeds that from the reference hole shall be rejected.

6.1.5 Reactor Vessel or Reactor Vessel Sub Assemblies.

6.1.5.1 Examination schedule

This ultrasonic examination shall be performed after the hydrostatic test. Preparation of the clad surfaces may be done at any time during the fabrication sequence.

6.1.5.2 Areas to be examined

An ultrasonic examination of the following areas of the reactor vessel and closure head shall be performed.

6.1.5.2a Lower vessel flange radius or taper.

6.1.5.2b Reactor coolant and safety injection nozzles (if required).

6.1.5.2c Nozzle shell course (all areas which are 4' (1219mm) or more below the reactor coolant nozzle centerline including longitudinal weldments).

6.1.5.2d Middle shell course (including longitudinal weldments).

6.1.5.2e Lower shell course above the lower core support pads (including longitudinal weldments).

6.1.5.2f Vessel flange to nozzle shell course weldment.

6.1.5.2g Reactor coolant nozzle and safety injection nozzle (if required) to nozzle shell course weldments.

6.1.5.2h Nozzle shell course to middle shell course weldment.

6.1.5.2i Middle shell course to lower shell course weldment.

6.1.5.2j Reactor coolant nozzle and safety injection nozzle (if required) bimetallic weld.

6.1.5.2k Closure head from flange knuckle to ventilation shroud support outside diameter (including all weldments).

6.1.5.3 Surface finish requirements

The ultrasonic examination shall be performed through the clad surface for all areas indicated in Paragraph 6.1.5.2, except area "k" which shall be examined from the exterior surface.

The clad surface shall be prepared so that a meaningful ultrasonic examination can be performed. The crown of the weld overlay beads shall be flattened but discernible "valleys" may be left between the beads or equivalent preparation.

The Supplier shall submit a sample of the clad surface finish with their quotation which he considers as acceptable for performing a meaningful ultrasonic examination.

6.1.5.4 Examination requirements

[

]a,c

6.1.6 Reportable Indications

The Supplier shall submit ultrasonic examination reports showing "reportable" indications. The locations of the "reportable" indications shall be shown on a chart or plan drawing of the material. For the reactor vessel examination (Paragraph 6.1.5), the "reportable" indications shall be located relative to vessel assembly reference surfaces and axes. Information relative to the magnitude and depth of the "reportable" indications shall be included. The definition of the "reportable" indications is given below.

6.1.6.1 Plate Material

6.1.6.1a Longitudinal Wave Examination

[

]a,c

6.1.6.1b Shear Wave Examination

[

]a,c

6.1.6.2 Forgings

The indications in Article 3 of Section III classified as "Reported for Information".

6.1.6.3 Cladding

Indications whose amplitude equals or exceeds fifty percent (50%) of that from the 3/4" diameter reference hole.

6.1.6.4 Reactor Vessel or Reactor Vessel Sub-Assemblies

6.1.6.4a Longitudinal Wave Testing (Back Reflection)

[

]a,c

6.1.6.4b Longitudinal Wave Testing (Discontinuity Indication)

[

]a,c

6.1.6.4c Shear Wave Testing

[

]a,c

6.2 DYE PENETRANT EXAMINATION

The dye penetrant examination requirements below are in addition to the dye penetrant examination requirements in Section III.

6.2.1 The following surfaces and welds shall be examined by dye penetrant methods. The acceptance standards shall be in accordance with Section III.

6.2.1.1 Surface Examinations

6.2.1.1a Dye penetrant examination of all clad surfaces and other vessel and head internal surfaces after the hydrostatic test.

6.2.1.1b [

]a,c

6.2.1.2 Weld Examinations

[

]a,c

6.3 MAGNETIC PARTICLE EXAMINATION

The magnetic particle examination requirements below are in addition to the magnetic particle examination requirements of Section III.

6.3.1 [ ]a,c

6.3.2 [ ]a,c

6.3.3 The following surfaces and welds shall be examined by magnetic particle methods. The acceptance standards shall be in accordance with Section III.

6.3.3.1 Surface Examinations

6.3.3.1a [ ]a,c

6.3.3.1b [ ]a,c

6.3.3.2 Weld Examination

[ ]a,c

6.4 DIMENSIONAL INSPECTIONS

The Supplier shall inspect and record reactor vessel and closure head as-built dimensions in accordance with the document referenced in Paragraph 3.2.6. This shall not relieve the Supplier of inspecting the dimensions of reactor vessel closure head and associated equipment to assure compliance with the Supplier drawings and Section III.

6.5 WAPD INSPECTIONS

The Supplier shall notify WAPD five (5) days in advance of the start of the events listed below. Verification shall be given twenty-four (24) hours prior to the start of the event.

6.5.1 Ultrasonic testing of plates, forgings, studs, cladding, pipes, tubes and reactor vessel.

6.5.2 All major base metal repairs.*

6.5.3 Fit up for main seam welding.

6.5.4 Welding of the main seams.

6.5.5 Completion of X-ray inspection of the main scams.

6.5.6 Penetrant testing of cladding.

6.5.7 Hydrostatic testing.

6.5.8 Optical alignment checks.

6.5.9 Equipment ready for shipment.

[

]^{a,c}

7.0 CLEANING, IDENTIFICATION AND PACKING

7.1 CLEANING

The reactor vessel surfaces shall be cleaned in accordance with the requirements of Westinghouse PS-292722.

The following additional requirements apply:

7.1.1 [ ]a,c

7.1.2 The final water contacting reactor vessel and head internal surfaces shall meet the following requirements:

[

]a,c

7.2 IDENTIFICATION

The Supplier shall provide his standard nameplate, including the WAPD Standard Plant Item Number (SPIN) on the reactor vessel and head assembly and indicate the location of the nameplate on a drawing.

7.3 PACKING

The interior of the vessel and head shall be protected during shipment by (See Addendum)

8.0 DOCUMENTATION

8.1 SPECIFICATIONS

8.1.1 Three (3) copies of all procedures (including the processing of surveillance material) for the evaluation of the fabrication process and sequence shall be submitted for approval prior to fabrication.

8.1.2 Three (3) copies of all process (including heat treatment, weld and weld repair procedures), test (including cladding chemistry test procedures), examination, hydrotest, cleaning and packing specifications shall be submitted for approval prior to fabrication.

8.2 CALCULATIONS

8.2.1 Three (3) copies of all basic vessel thickness calculations shall be submitted for approval prior to fabrication. Initial fabrication of critical material may commence, at the Supplier's risk, prior to submission of these calculations.

8.2.2 Three (3) copies of all structural and thermal discontinuity calculations required to prove the adequacy of the vessel shall be submitted for approval within six (6) months after the date of the purchase order.

8.2.3 Evidence that the calculations have been submitted to the proper authorities (insurance, state, etc.) shall be made available to WAPD prior to start of fabrication. Initial fabrication of critical material may commence, at the Supplier's risk, prior to submission of these documents.

8.2.4 Three (3) copies of all calculations required to show that the reactor vessel can withstand the thermal and pressure transients shall be submitted for approval within one (1) year after the date of the purchase order.

8.2.5 Twelve (12) copies of the final stress report summarizing all calculations for the reactor vessel shall be submitted for approval at least six (6) months prior to shipment of the vessel.

8.3 DRAWINGS

8.3.1 One (1) reproducible of the general arrangement drawing(s) shall be submitted for approval within three (3) months after the date of the purchase order. These drawings shall show only the general configurations of the reactor vessel and head with overall dimensions shall contain no machining details.

8.3.2 One (1) reproducible of each forging drawing shall be submitted for approval prior to the start of procurement of these forgings. These drawings shall include the following information:

8.3.2.1 Location of test specimens

8.3.2.2 Dimensions of forging prior to quenching

8.3.2.3 Dimensions of forging prior to ultrasonic testing (preliminary and final)

8.3.2.4 Location and size of ultrasonic reference holes or notches

8.3.2.5 Ultrasonic scanning surfaces

8.3.2.6 Location of high stressed areas

8.3.2.7 Location of surveillance material

8.3.3 One (1) reproducible of each assembly and detail drawing shall be submitted for approval prior to start of material procurement of the items covered by the drawing. These drawings shall, wherever possible, separate the welding operations from the machining operations. Long lead item material may be procured at the Supplier's risk prior to completion of detail drawings.

8.3.4 One (1) reproducible of drawings showing the following information shall be submitted for approval one (1) year prior to shipment of the reactor vessel.

8.3.4.1 Reactor vessel mounted on the shipping skid with the shipping covers and lifting beam attached to the vessel. All pertinent dimensions, weights and centers of gravity should be indicated.

8.3.4.2 Closure head mounted on the shipping rig with shipping covers attached to the closure head. All pertinent dimensions, weights and centers of gravity should be indicated.

8.3.4.3 Reactor vessel and closure head loaded and fixed to the barge or rail car.

8.4 MATERIAL CERTIFICATION

8.4.1 Three (3) copies of all material ordering specifications (including heat treatment and base metal repair procedures) for the evaluation of materials shall be submitted for approval prior to material procurement.

8.4.2 Three (3) copies of each chemical analysis, physical and mechanical mill test data sheets, Supplier test data sheets and inspection reports for materials required by this Equipment Specification and applicable references shall be submitted for information. The records and reports shall be submitted promptly after the completion of each test or inspection, and in all cases shall be furnished to WAPD prior to fabrication.

8.4.3 One (1) signed original and five (5) copies of the Supplier's certification that all material requirements specified by this Equipment Specification and applicable references have been met, shall be furnished to WAPD prior to shipment.

8.5 TEST AND EXAMINATION RECORDS

8.5.1 Three (3) copies of Supplier's certification that the final cleaning water met the requirements of Paragraph 7.1.2 shall be submitted for record.

8.5.2 Three (3) copies of each ultrasonic examination report required by this Equipment Specification and applicable references should be submitted for approval promptly after the completion of each examination.

8.5.3 Three (3) copies of each record and report for all tests and examinations required by this Equipment Specification and applicable references which do not meet the acceptance standards shall be submitted for approval. WAPD should be notified promptly should an unacceptable test or examination require rework which will affect the vessel delivery schedule.

8.5.4 One (1) signed original and five (5) copies of the Supplier's certification that all test and examination requirements of this Equipment Specification and applicable references have been met shall be furnished to WAPD prior to shipment of each item.

8.5.5 One (1) reproducible of the completed dimensional profile document used to record reactor vessel and head as-built dimensions shall be submitted for record prior to shipment.

8.5.6 The Supplier shall maintain the test and examination records required by this Equipment Specification and the applicable references for a period of one year in the active files and then placed in retrievable storage for the life of the power plant.* These records shall be kept up-to-date and should be available for review by WAPD in the Supplier's shop during the vessel fabrication cycle.

8.6 INSTRUCTION MANUAL

8.6.1 The instruction manual shall contain detailed instructions for the maintenance and operation of the equipment to be furnished by the Supplier.

* – The Supplier may request after a period of five (5) years that the records be transferred to WAPD.

8.6.2 The instruction manual shall contain a list of all the equipment, complete with drawing part numbers to be furnished by the Supplier.

8.6.3 The instruction manual shall contain suitable descriptive photographs and drawings required for the complete understanding of the manual.

8.6.4 The instruction manual shall include a description of the stud tightening and loosening procedures for the operational and hydrostatic testing conditions using stud tensioners. This shall include the amount of overtensioning of the initial sets of three (3) studs in order to assure adequate loading of the studs when the tensioning is completed, taking into account the movement of the flange during the tensioning operations. Nominal loadings with tolerance ranges for the end conditions should be included.

8.6.5 Three (3) draft copies of the instruction manual shall be submitted for approval at least four (4) months prior to shipment of the vessel.

8.6.6 (See Addendum) final copies of the instruction manual shall be submitted for approval prior to shipment of the reactor vessel.

EQUIPMENT SPECIFICATION SHEET

WESTINGHOUSE FORM 54064D

WESTINGHOUSE ELECTRIC CORPORATION
Nuclear Energy Systems
P O. Box 355
Pittsburgh, Pennsylvania 15230

EQUIPMENT SPECIFICATION	DATED	REVISION NO	DATED	ORIGINAL ISSUE	SUPERSEDES PREVIOUS REVISIONS
953069	5/16/75	0		☒	☐

PROJECT: ADDENDUM TO EQUIPMENT SPECIFICATION 676413, REV. 1
NORTH ANNA STATION

EQUIPMENT: REACTOR VESSEL

SHOP ORDER: VRA/VGB-105

SYSTEM: REACTOR COOLANT

SPIN NO. VRA/VGB RCPCRV-1

Revision 0 of this document complies With Paragraph N-141, ASME Boiler and Pressure Vessel Code, Section III.

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
RICHARD EARLE TOME
10334-E

Richard Earle Tome P.E. 1/4/77 Date

ATTACHMENTS

[

]a,c

FOR SUPPLIER'S CONVENIENCE

REV. NO	REVISION ENTERED BY & DATE

APPROVALS

	ORIGINAL ISSUE	REV. 1	REV. 2	REV 3	REV. 4	REV. 5	REV. 6
AUTHOR	C. G. Skillern 3/21/77						
SHOP ORDER HOLDER	R. Tome R.E. Tome 4/4/77						
MANAGER, Pnm Eq	J. A. Krul 4-5-77						
PROJECT MANAGER	J. L. Vota 4/5/77						

TABLE OF CONTENTS

1.0	Add "The 1968 edition of ASME Section III including all addenda through the 1968 Winter Addendum is applicable.
2.1.1.1(c)	[ ]a,c
2.1.1.2(c)	[ ]a,c
2.1.1.2(d)	[ ]a,c
2.1.1.2(f)	[ ]a,c
2.1.1.2(g)	[ ]a,c
2.1.1.3(h)	[ ]a,c
2.1.2.1b	Omit.
2.1.2.1c	[ ]a,c
2.1.7	Omit.
2.1.15	Change to "Erection spares consisting of . . . ."
2.1.15.8	Non-reuseable shipping skids for both vessel and head.
2.1.16	Spare Parts:
2.1.16.1	[ ]a,c
2.1.16.2	[ ]a,c
2.1.16.3	[ ]a,c
2.1.16.4	[ ]a,c
2.1.16.5	[ ]a,c
2.1.16.6	[ ]a,c
2.1.16.7	[ ]a,c
2.2.5	[ ]a,c
3.1.3	New Paragraph – W NES Drawing EDSK 342276 dated 6-29-71, "North Anna Vessel Support Hole Pattern."

3.1.4 New Paragraph –

W NES Drawing 5655D14, Sheets 1 – 9, VRA As-Builts.

3.2.1 W NES Drawing EDSK 334699J, Sub 2 "157 Inch I.D. – Three Loop Reactor Vessel", as modified by Paragraph 9.0 of this specification.

3.2.6 See Paragraph 3.1.4.

3.2.12 New Paragraph –

W PSPWR – 597755 "Application of Protective Coatings to Reactor Containment and System Components in the Reactor Containment."

3.2.13 New Paragraph –

W NES Drawing EDSK 341549, "Typical Refueling Seal Ledge Arrangement for Thermal Analysis Only."

3.2.14 New Paragraph –

W NES, Drawing EDSK 341550, "Typical Internals Support Arrangement for Thermal Analysis Only."

3.2.15 New Paragraph –

W NES Drawing EDSK 341551, "Typical Outlet Nozzle Arrangement for Thermal Analysis Only."

4.1.1.2 Normal operating pressure is [ ]^{a,c}.

4.1.1.4 The no load temperature is [ ]^{a,c}.

4.1.1.5 The normal inlet water temperature is [ ]^{a,c}.

4.1.1.6 The normal operating outlet water temperature is [ ]^{a,c}.

4.1.1.7 The design life is [ ]^{a,c}.

4.1.1.8 The reactor vessel shall be capable of withstanding the following representative thermal and pressure transients without impairing its ability to function in accordance with the requirements of this Equipment Specification.

OPERATING CYCLE	OCCURRENCES	OPERATING CONDITION	FIGURE
[			

]a,c

4.1.1.14 Change to "Exterior paint – See para. 4.3.15."

4.1.2.1 The maximum value of P_o is [ ]^{a,c}.
Change to "[ ]^{a,c}."

4.1.2.4(a) The weight is [ ]^{a,c}.

4.1.2.4(b) The load is [ ]^{a,c}.

4.1.2.4(c) The load is [ ]^{a,c}.

4.1.2.4(d) The load is [ ]^{a,c}.

4.1.2.5(a) The weight is [ ]^{a,c}.
The c.g. is [ ]^{a,c}.

4.1.2.5(b) The load is [ ]^{a,c}.

4.1.2.5(c) The weight is [ ]^{a,c}.
The c.g. is [ ]^{a,c}.

4.1.2.5(e) The weight is [ ]^{a,c}.
The c.g. is [ ]^{a,c}.

4.1.2.5(f) The weight is [ ]^{a,c}.
The e.g. is [ ]^{a,c}.

4.1.2.5(g) The weight is [ ]^{a,c}.
The c.g. is [ ]^{a,c}.

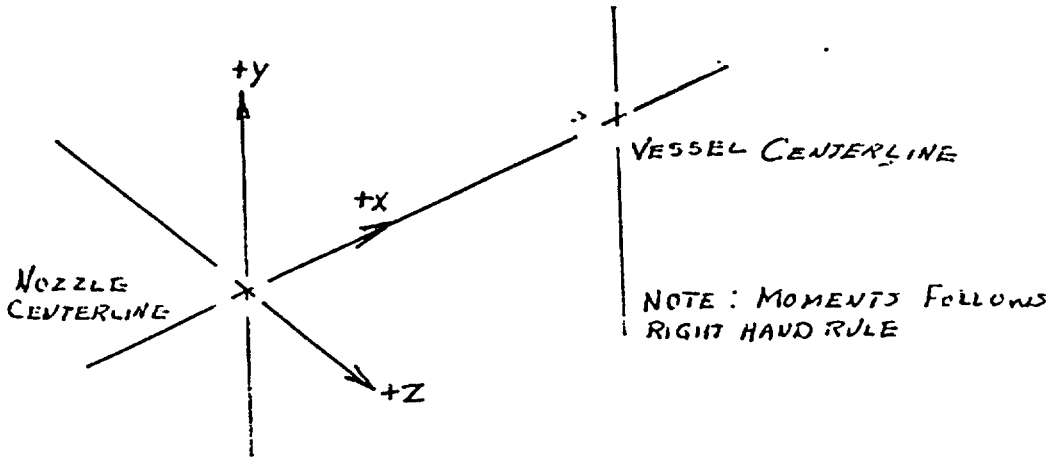
4.1.2.5(h) The weight is [ ]^{a,c}.
The c.g. is [ ]^{a,c}.

4.1.2.5(i) The thermal expansion loads exerted by the reactor coolant piping are as follows:

[

]^{a,c}

All loads are oriented as given on the following page:



4.1.2.5(j) New Paragraph

The following loads should be considered as acting on the reactor coolant outlet nozzles inside the reactor vessel due to the reaction of the core barrel nozzles.

[

]^{a,c}

4.1.2.6 [

]^{a,c}

All loads are oriented Eks given in Paragraph 4.1.2.5(i).

The worst combination of load orientation (±) for each nozzle should be used for evaluating the individual nozzles. These loads should be combined for all nozzles in the worst orientation (±) for evaluating the vessel supports. The seismic loads should be assumed such as to result in the maximum loading condition on the vessel supports considering the translation of the vessel in the plan view, rotation of the vessel in the plan view, overturning of the vessel in the vertical plane, and the maximum upward and/or downward thrust on the supports.

4.1.2.7 The pipe break loadings are as follows:

Seven (7) cases for various pipe break loading conditions are shown below. The Supplier shall show that the stress intensity limits associated with the pipe break loadings are met for each case.

The combination of operating loads (4.1.2.5) plus the design loads (4.1.2.6) plus the pipe break load should not exceed the stress limits of Paragraph N-417.11 (Faulted Condition; Summer, 1968 Addenda; Section III ASME Code, Class A Vessels).

The combination of loads in the above paragraphs and the pipe break accident load should not be considered in the fatigue analysis of the reactor vessel.

The pipe break loads are as follows:

1	2	3
[		

]^{a,c}

The loads are oriented as given in Paragraph 4.1.2.5(i).

Since the reactor coolant pipe has been severed, axial loads should not be considered as acting on the nozzles but they must be reacted by the reactor vessel supports. The other forces and moments are considered to act at the weld between the reactor coolant pipe and the reactor coolant nozzle and must be reacted by the nozzle as well as the supports. It is not necessary to evaluate the thin portion of the nozzle beyond the vessel supports for this loading condition.

4.1.2.9 The core support pad loadings are as follows:

[

]^{a,c}

The possible loading combinations are as follows:

a. Loadings 1 and 2.
b. Loadings 1, 2, and 3.
c. Loadings 2 and 4.
d. Loadings 5.

4.1.2.11 Change 5000 psi to 7500 psi.

4.1.2.12 The vessel support system, shall consist of [ ]^{a,c} supports. These supports shall be in the form of weld metal buildups located on the underside of the reactor coolant nozzles. Support pads shall be drilled per W NES sketch EDSK 342276 dated 6-29-71, see Para. 3.1.3.

4.1.2.13 [ ]^{a,c}

4.1.2.15 Delete.

4.1.3.1 [ ]^{a,c}

4.1.4 Delete.

4.1.5.3 [ ]^{a,c}

4.1.6.4 Delete.

4.1.9.1 The guide studs shall have sufficient length to be engaged in the head flange when the plane of the head flange face is within approximately [ ]^{a,c} from the face of the vessel flange.

4.2.2.1 New Paragraph

For cladding and welding of temporary attachments only, preheat may be dropped before stress relief provided that as an intermediate step the preheat temperature is raised to [ ]^{a,c}.

Stress raisers shall be removed before dropping the preheat and where temporary attachments are removed the areas shall be magnetic particle or dye penetrant examined.

Buttering on J-groove, core support pad build-ups and other primary boundary butterings or welds are not considered cladding. Specifically J-groove buttering, core support pad build-ups and primary nozzle safe end weld deposits require preheat until stress relief.

4.2.4 [ ]^{a,c}

4.2.6 Change to "The internal vessel machined and head ...."

4.2.10 [ ]^{a,c}

4.2.15 New Paragraph

Deviation Reports

Deviation reports shall be prepared for all conditions which do not meet the requirements of this Equipment Specification, Section III, or W NES, approved, supplier procedures and drawings. Raw material and fabrication deviations shall be reported. The report shall contain the following:

4.2.15.1 A sketch showing the location of the deviation.

4.2.15.2 A description of the deviation.

4.2.15.3 The method by which the deviation was detected.

4.2.15.4 The supplier's recommendation for disposition including the repair procedure, if applicable.

4.2.16 New Paragraph

Major Base Metal Weld Repairs

[

]^{a,c}

The deviation notices covering major weld repairs must include a detailed description (1) and disposition (2).

1. Written description and sketch, showing –

   a. size and shape of cavities (three dimensions).

   b. Location and orientation (three dimensions) with respect to wall thickness and vessel axes (keyways) marking or temporary marking which can later be oriented with the vessel axes (keyways).

2. Detailed repair procedure, including –

   a. Base metal preparation prior to repair - non destructive tests etc. (reference specifications with revisions).

   b. Method of weld repair (note weld specification including revision and any particular requirements applicable).

   c. Post welding requirements, e.g., post heat – stress relief – examinations of repaired areas (reference specifications with revision numbers).

The accuracy in locating major weld repairs in base metal with respect to the wall thickness, vessel or closure head axes (keyways or other scribe marks near the mating surfaces), is

extremely important. At the completion of the fabrication vendor shall supply a complete record (mapped locations) of these repairs. This record will serve as a map for periodic in-service inspection of base metal repaired areas.

4.2.17 New Paragraph

The core support blocks shall be welded to the vessel base metal and not to the stainless steel cladding.

4.3.1.1 Change to "[ ]^{a,c}."

4.3.1.2 Change to "[ ]^{a,c}."

4.3.3 Delete.

4.3.5 Change to:

[ ]^{a,c}

4.3.6 [ ]^{a,c}

4.3.7 [ ]^{a,c}

4.3.8 [ ]^{a,c}

4.3.12 [ ]^{a,c}

4.3.13 [ ]^{a,c}

4.3.15 Delete and replace with "[ ]^{a,c}."

5.1.1.3 Change to ".....Paragraph N-313.4(d)(2) of Section III."

5.2.1.1 Change to "... ferrite requirements of Paragraph 4.3.2.2(a)."

5.2.1.2(a) The paragraph beginning with the words "The production" should be renumbered as 5.2.1.2.

5.2.1.2(c) Change to "... values given in Paragraph 4.3.2.2(a)."

5.3.2 Revise to read:

The water used for the hydrostatic test shall meet the following requirements:

a) Grade of water according to W PS 292722 Rev. 5 shall be used.

[

]^{a,c}

These conditions shall be reached prior to hydrotest. It is preferable that these additives be added continuously to the filling water. However, if this is not possible a progressive batch type addition is acceptable.

6.1.5 & 6.1.6 Delete and replace with the following:

6.1.5.1 Examination Schedule – This ultrasonic examination shall be performed after the hydrostatic test. Preparation of the clad surfaces may be done at any time during the fabrication sequence.

6.1.5.2 Areas to be Examined - An ultrasonic Examination of the following areas of the reactor vessel and closure head shall be performed in accordance with the ASME Code for Inservice Inspection of Nuclear Reactor Coolant Systems. All vessel areas shall be examined through the I.D. clad surface and all closure head areas shall be examined through the outside surface.

a. All longitudinal shell and transition ring welds and at least two (2) plate thicknesses of adjacent base metal on both sides of the weld.

b. All circumferential shell, flange and transition ring welds and at least 2 plate thicknesses of adjacent base metal on both sides of the weld.

c. All primary nozzle to shell welds and all integral nozzle extensions inside the vessel.

d. All primary nozzle to safe end welds.

e. Closure studs and nuts.

f. Ligaments between threaded closure stud holes.

6.1.5.3 Surface Finish Requirements.

[

]a,c

6.1.5.4 Examination Requirements

[

]a,c

[

]a,c

6.1.6 Reportable Indications

The supplier shall submit ultrasonic examination reports showing "reportable" indications. The location of the reportable" indications shall be shown on a chart or plan drawing of the material. For the reactor vessel examination (Paragraph 6.1.5), the "reportable" indications shall be located relative to vessel assembly reference surfaces and axes. Information relative to the magnitude and depth of the "reportable" indications shall be included. The definition of the "reportable" indications is given below.

6.1.6.1 Plate Material

A. Longitudinal Wave Examination

[

]a,c

B. Shear Wave Examination

[

]a,c

6.1.6.2 Forgings

The indications in Article 3 of Section III and ASTM-A388 Sec. 7., 1969 edition as "Reported for Information" and "Recording" respectively.

6.1.6.3 Cladding

[

]a,c

6.1.6.4 Reactor Vessel or Reactor Vessel Sub-Assemblies

[

]^{a,c}

6.1.7 New Paragraph

Forgings

The method and acceptable standards for forgings shall be equivalent to the criteria of Code Case 1359-1.

6.2.1.1(a) Add "... and head internal. surfaces including CRDM. welds, vent pipe weld, instrumentation tube welds and all primary nozzle safe ends after the hydrostatic test."

The primary nozzle stainless steel safe ends examination shall be carried out based on the following:

[

]^{a,c}

6. This examination is a mandatory witness point for W NES quality control representative.

6.2.1.2(b) Change to "... control rod drive mechanism housings, vent pipe, and the closure head after ..."

6.4 Change to "...referenced in Paragraph 3.1.4. This shall not ..."

6.5 Omit and replace with the following:

W NES INSPECTIONS

The following list of fabrication procedures, tests and inspections are defined as "hold points" which require witnessing by a W NES representative. A minimum of seventy-two (72) hours advance notice is required for W NES witnessing.

6.5.1 Ultrasonic testing of all raw materials (plates, forgings, tubes, studs, etc.)

6.5.2 Ultrasonic testing of cladding for bond. (This applies to testing of the first component only.)

6.5.3 Ultrasonic testing of reactor vessel and reactor vessel sub-assemblies. (This applies to testing of the first component and testing of the areas indicated in Paragraphs 6.1.5.2(d), (e) , and (i).

6.5.4 The following fit-up and welding operations.

a. Reactor coolant nozzle to vessel shell.
b. Core support pad to vessel shell.
c. Instrumentation tube to bottom head.
d. Mechanism housing to closure head.

Since the above operations involve more than one component, the "hold point" is defined as the first time these operations are performed.

6.5.5 Inspection and recording of all as-built dimensional data.

6.5.6 Hydrostatic test.

6.5.7 Application of main shipping cover for the reactor vessel and closure head.

7.2 Add "... his standard nameplate (in English), ..."

7.3 The vessel and head interior surfaces shall be protected during shipment in a manner which will assure that the surface cleanliness meets the requirements of W PS 292722 when the vessel and head arrive at the plant site.

8.2.1 Change to "...submitted for approval prior to vessel shipment. Initial fabrication of critical material may commence, at the supplier's risk, prior to approval of these calculations."

8.2.2 Change to "... submitted for approval prior to shipment."

8.2.3 Omit and replace with:

Three (3) copies of all correspondence which prove that the calculations, procedures, and all other documentation required by the authorities (insurance, state, etc.) have been submitted and accepted by the authorities shall be submitted to W NES prior to shipment.

8.2.5 Change to "... submitted for approval prior to shipment vessel."

8.3.1 Change to "... with overall dimensions and shall contain no machining details."

6.3.3 Change to "... risk, prior to approval of detail drawings."

6.3.4 Change to "... be submitted for approval prior to shipment of the reactor vessel."

8.5.3 Omit and replace with:

"Three (3) copies of each deviation report shall be submitted to W NES for approval. (See Paragraph 4.2.1.5)."

8.5.7 New Paragraph

Three (3) copies of the weld repair list shall be submitted to W NES for information each month. (See Paragraph 4.2.16).

8.6.6 Thirty-five (35) copies in English of the final instruction manual shall be submitted for approval prior to shipment of the reactor vessel.

9.0 The following comments apply to [ ]a,c Sub 2.

9.1 [

]a,c

9.2 [

]a,c

9.3 [

]a,c

9.4 [

]a,c

9.5 [

]a,c

9.6 [

]a,c

9.7 [

]a,c

9.8 [

]a,c

9.9 [

]a,c

FIGURE 1

PLANT HEAT UP AND COOL DOWN

a,c

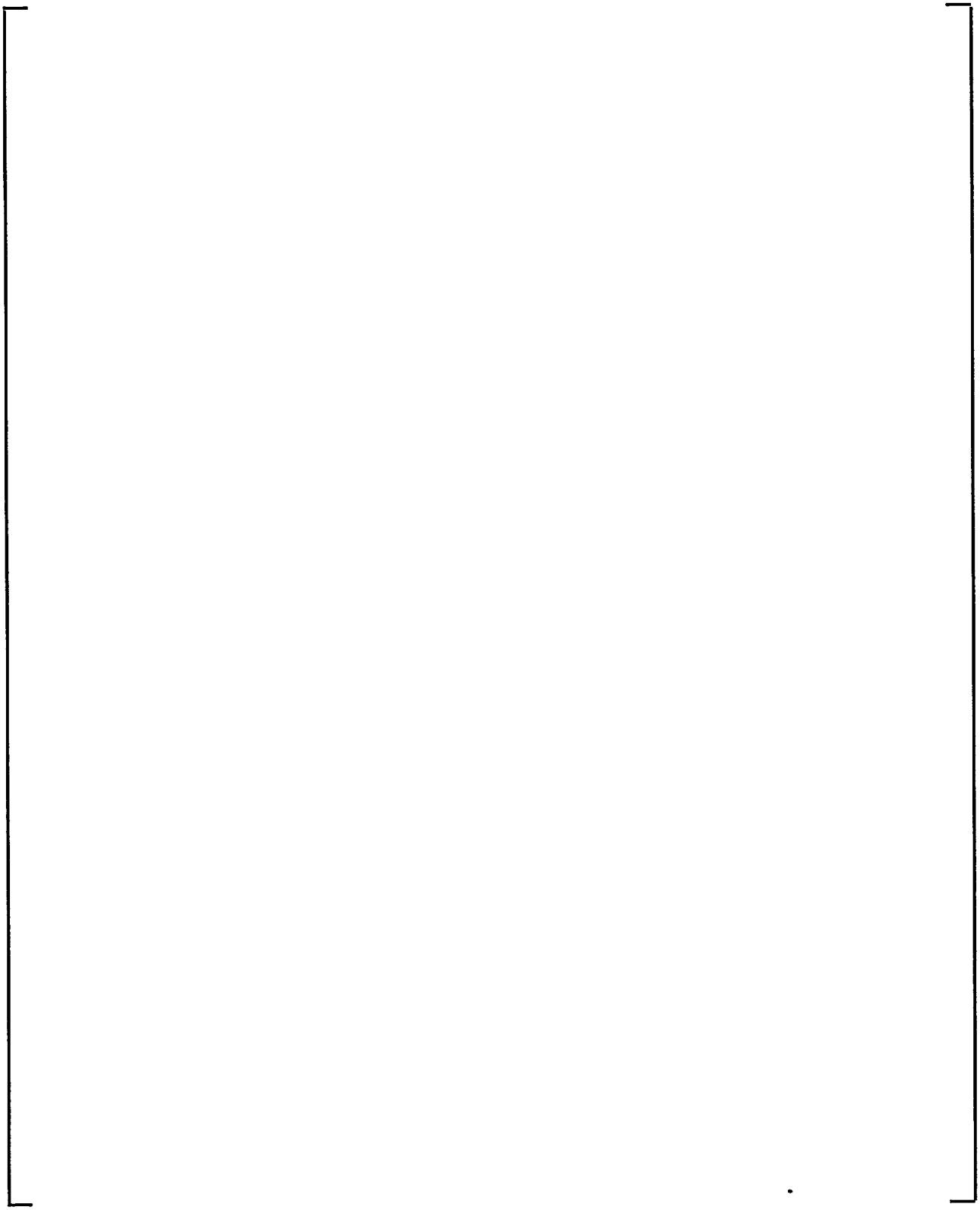


FIGURE 2

PLANT LOADING AND UNLOADING

a,c

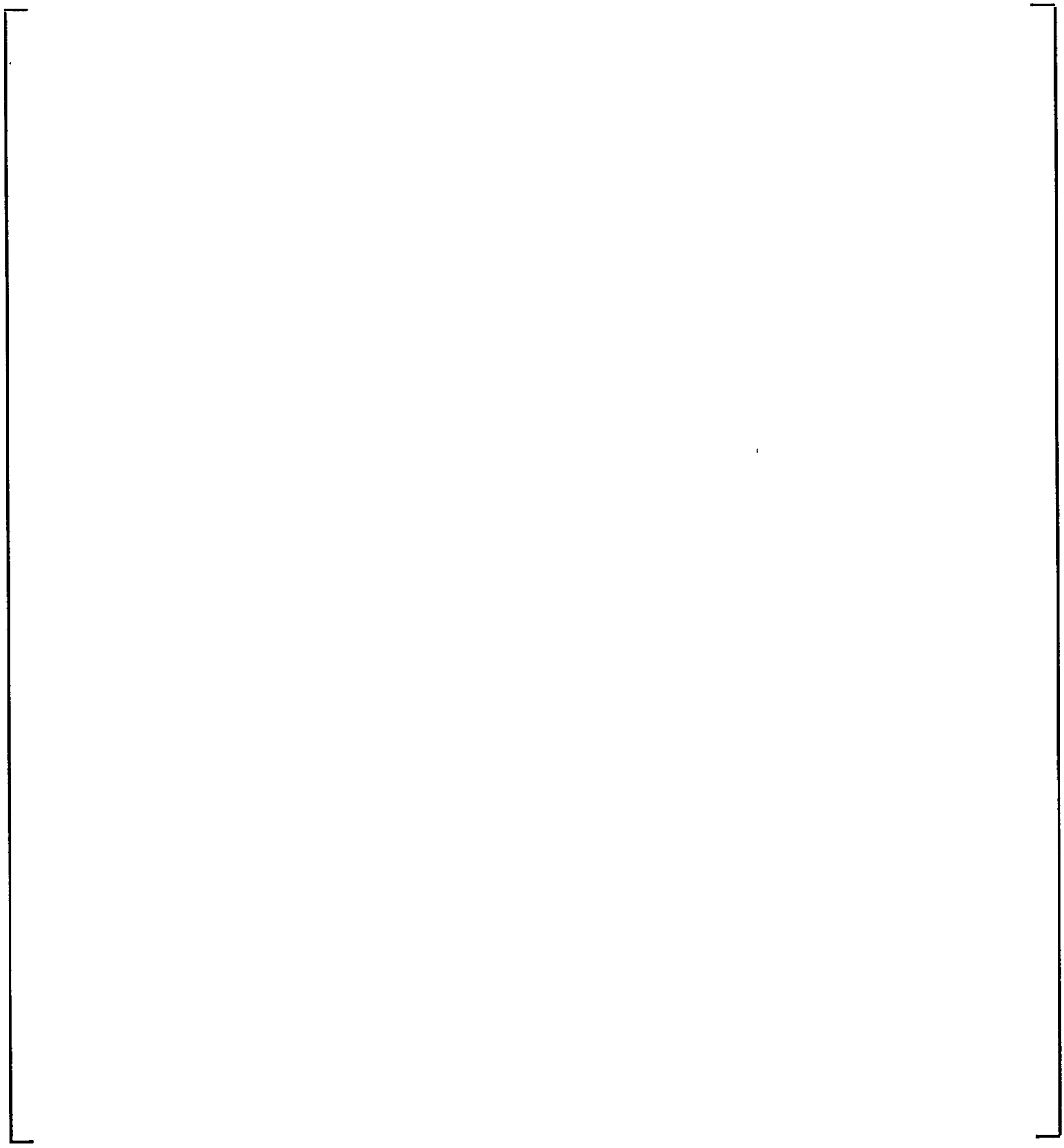


FIGURE 3

10 PERCENT STEP LOAD
INCREASE AND DECREASE

a,c

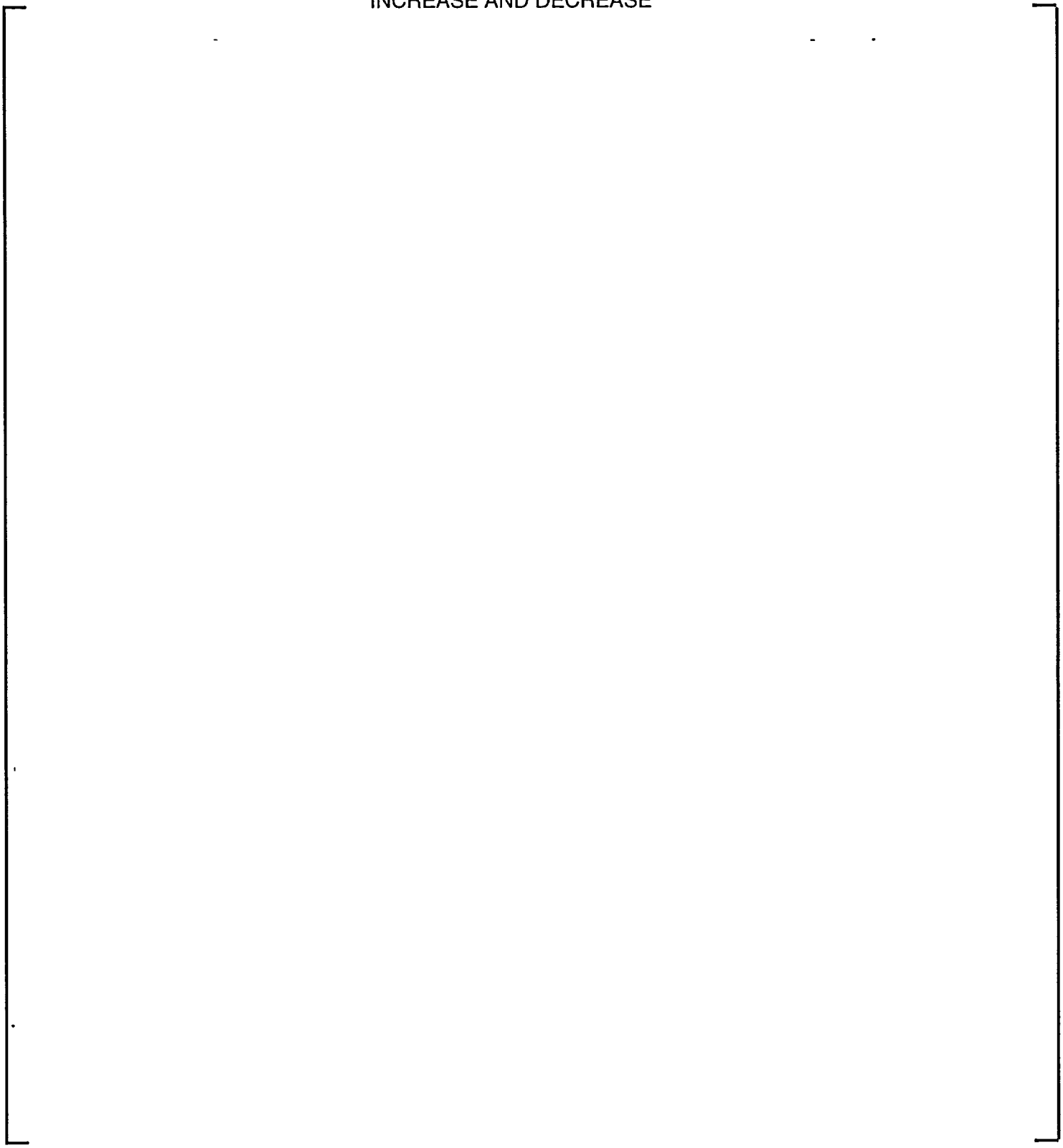


FIGURE 4A

LARGE STEP DECREASE (TEMP.)

a,c

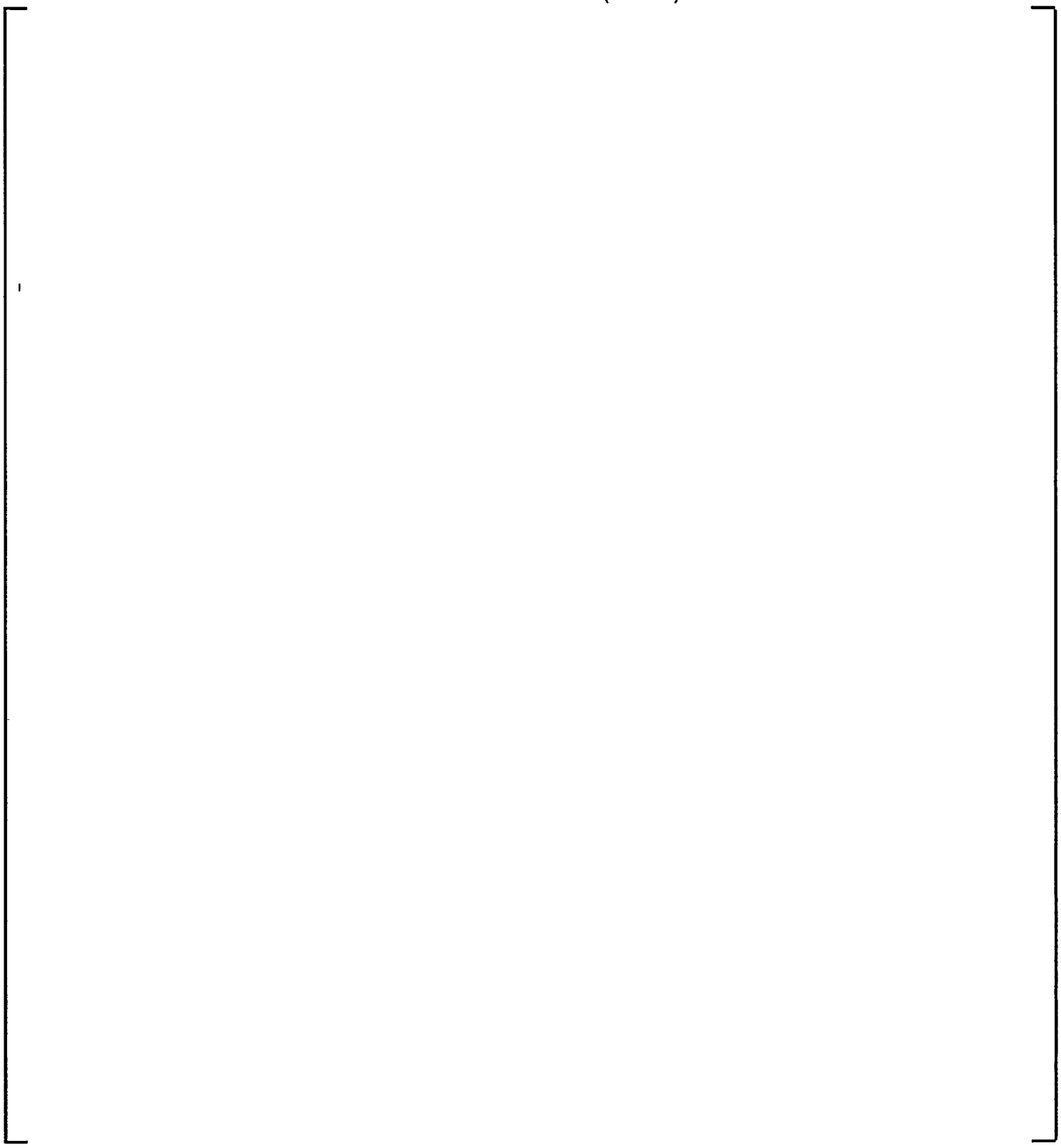


FIGURE 4B

LARGE STEP DECREASE (PRESS.) a,c

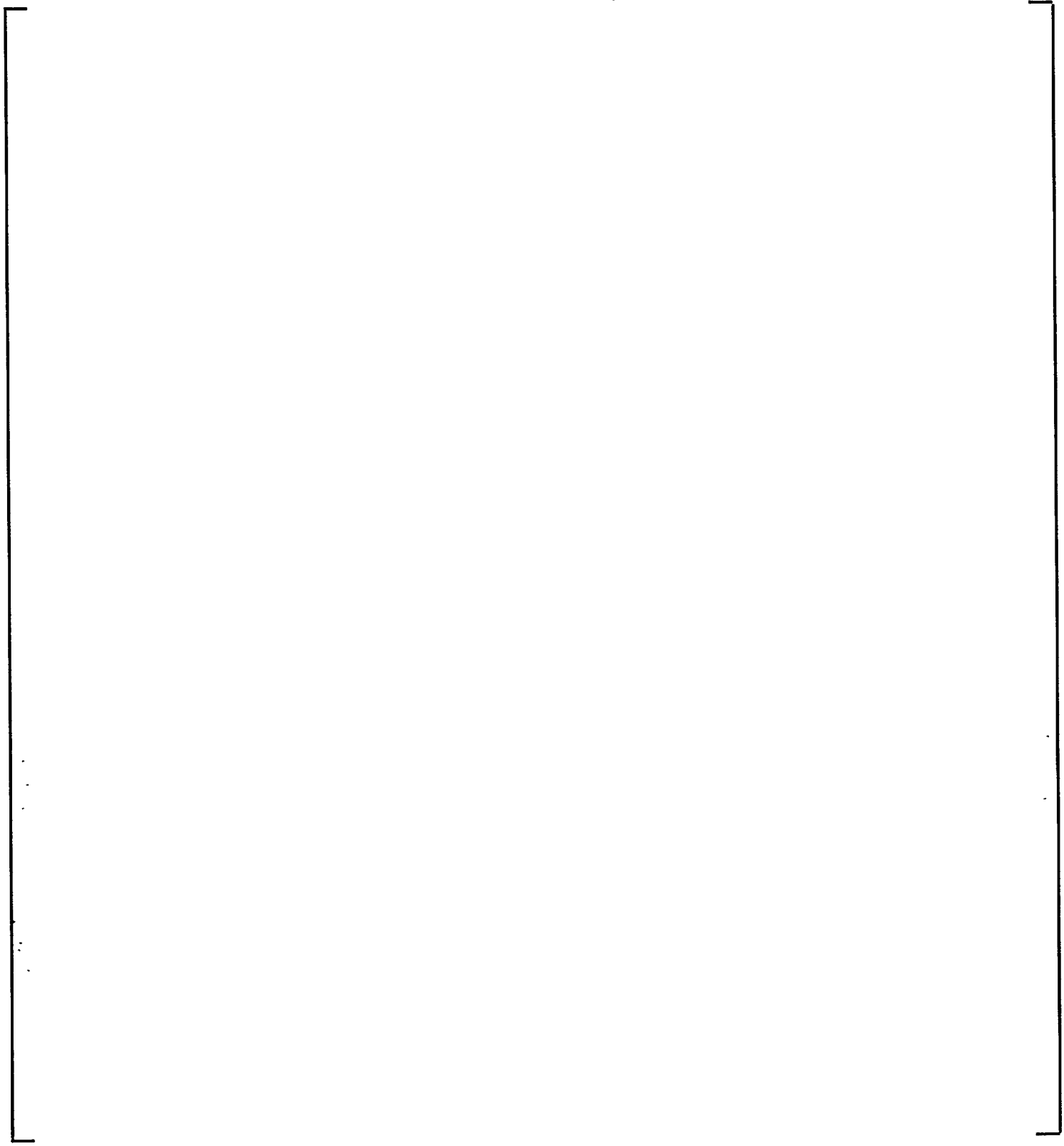


FIGURE 5

LOSS OF LOAD FROM FULL POWER

a,c

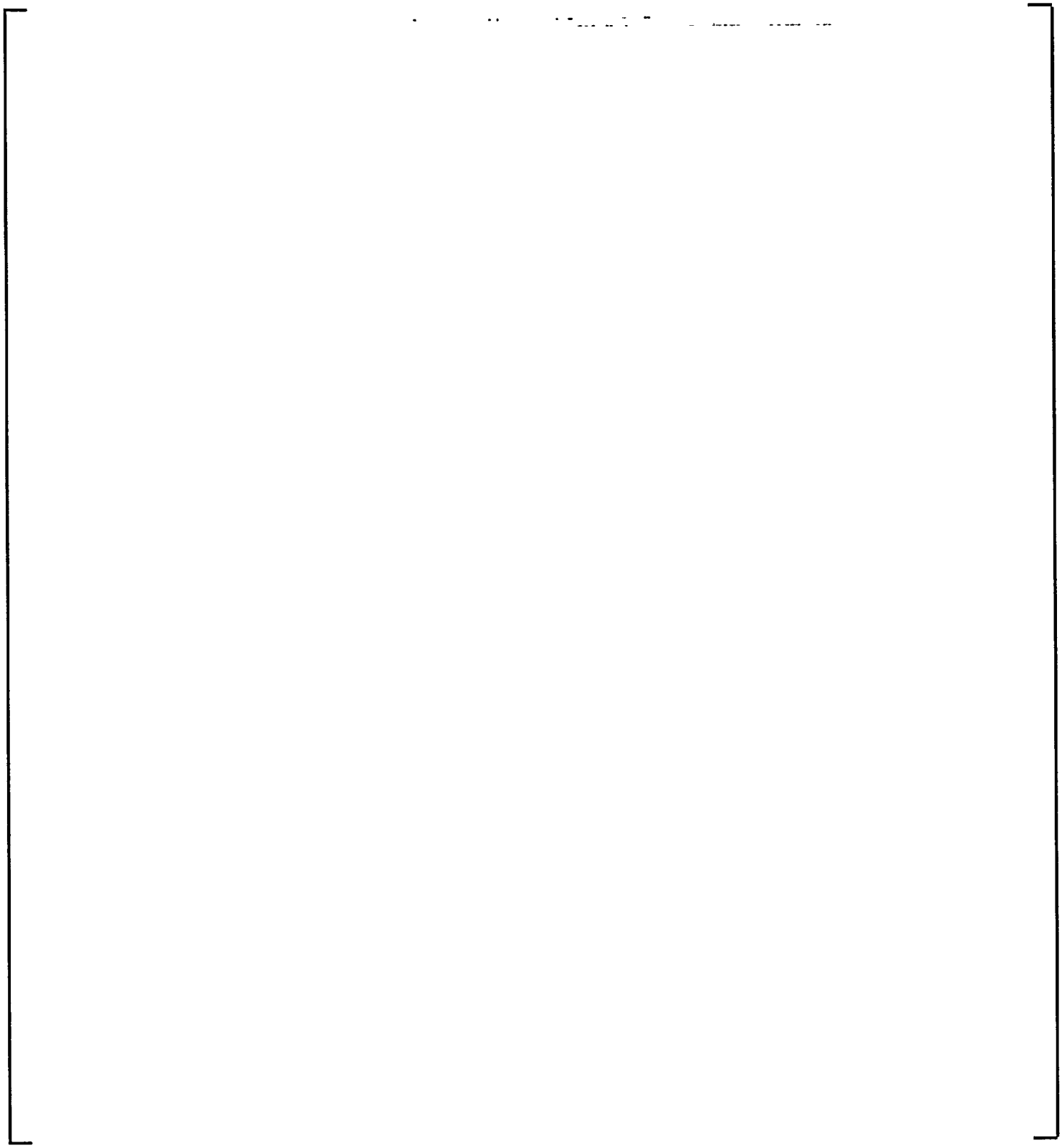


FIGURE 6

LOSS OF POWER

a,c

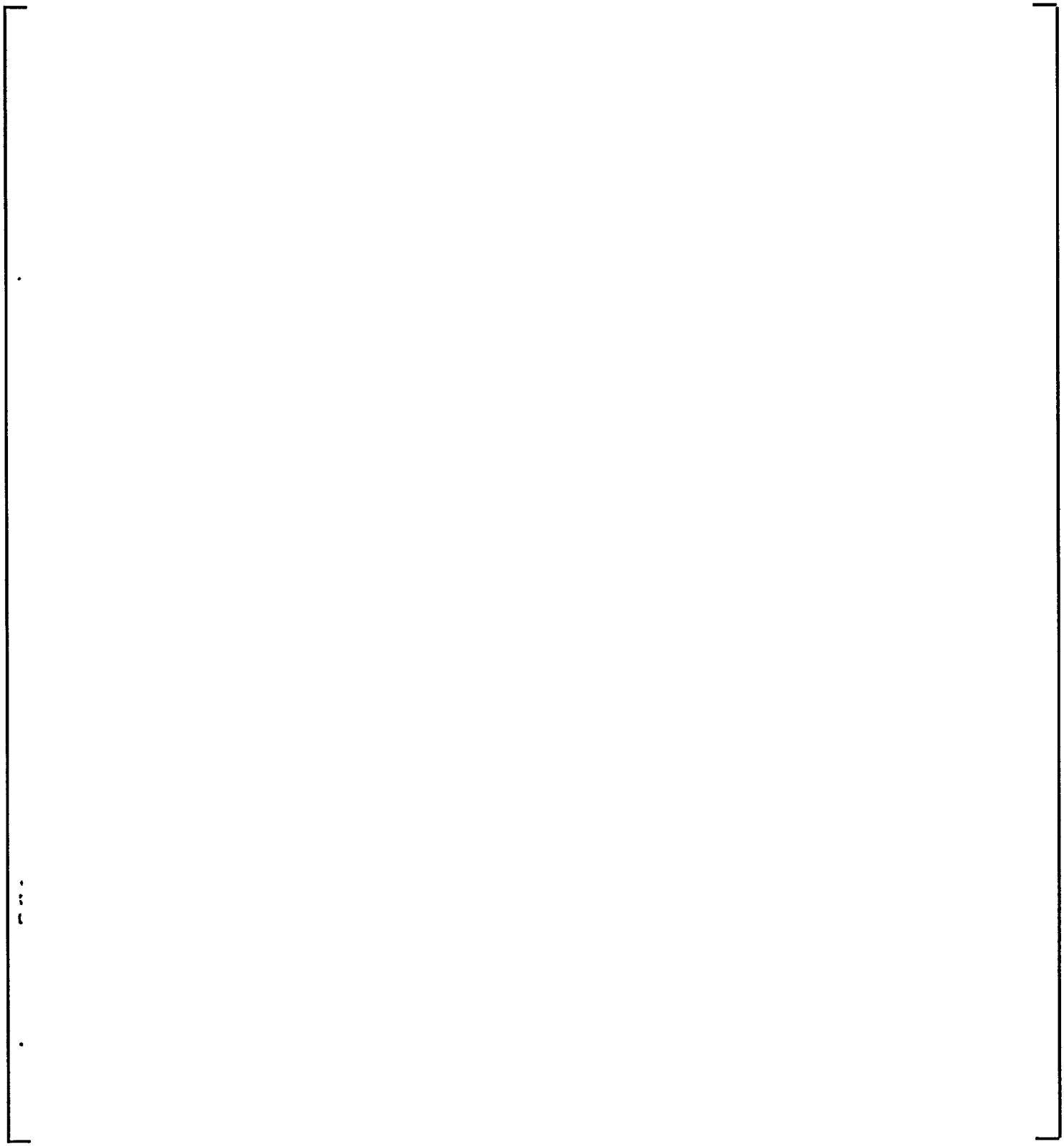


FIGURE 7

LOSS OF FLOW IN ONE LOOP

a,c

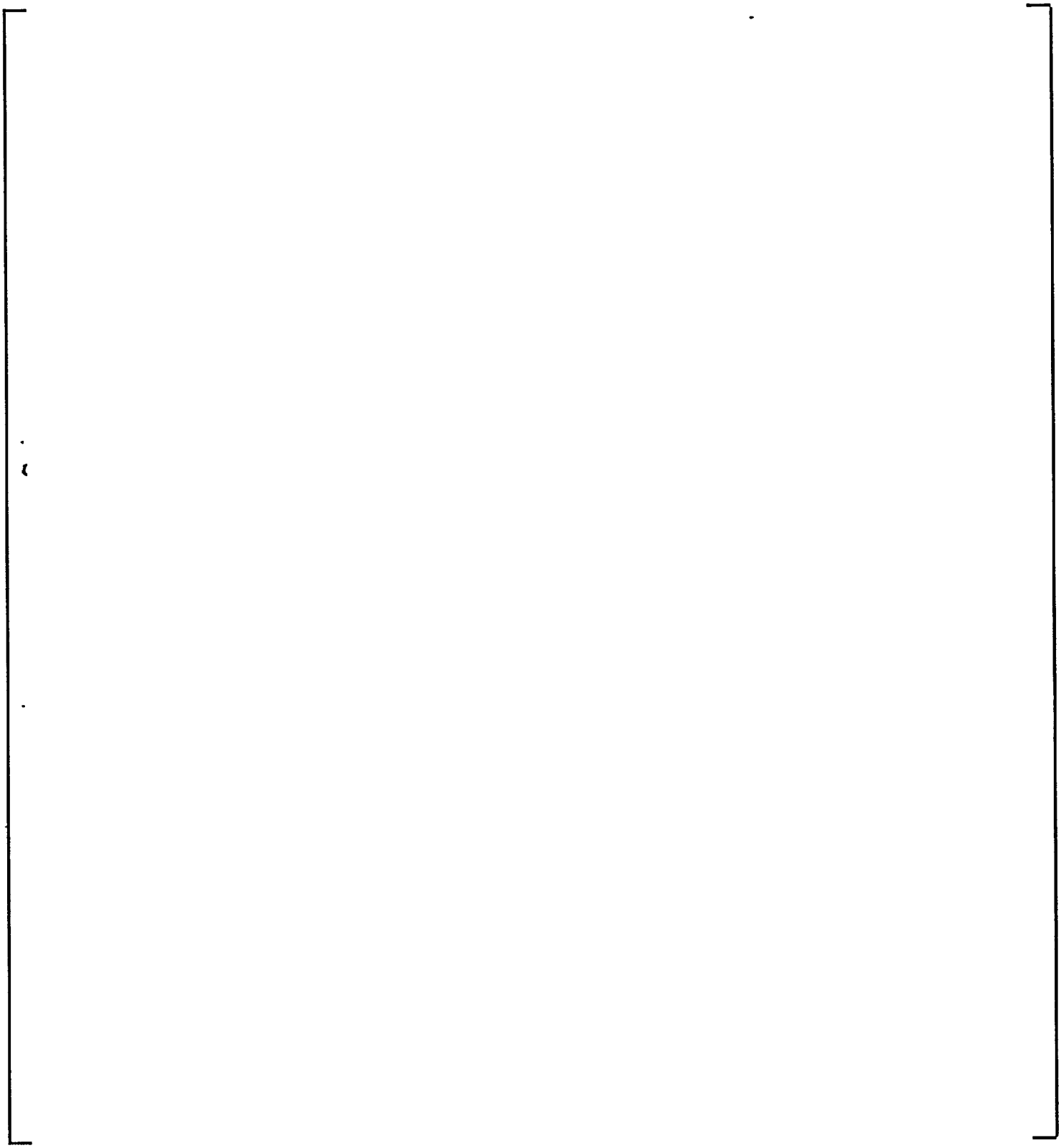


FIGURE 8

LOSS OF FLOW IN ONE LOOP

a,c

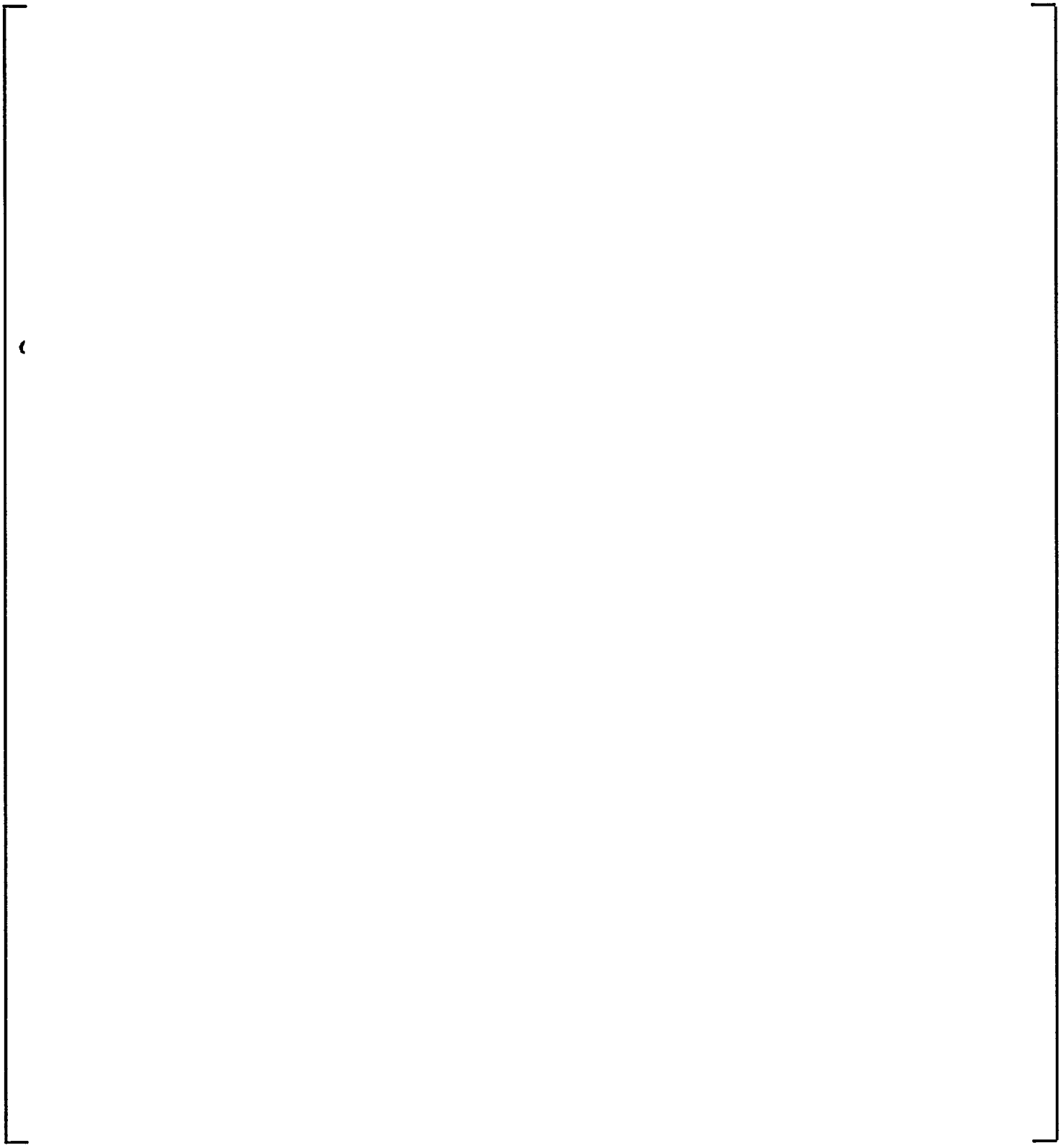


FIGURE 9

LOSS OF FLOW IN ONE LOOP

a,c

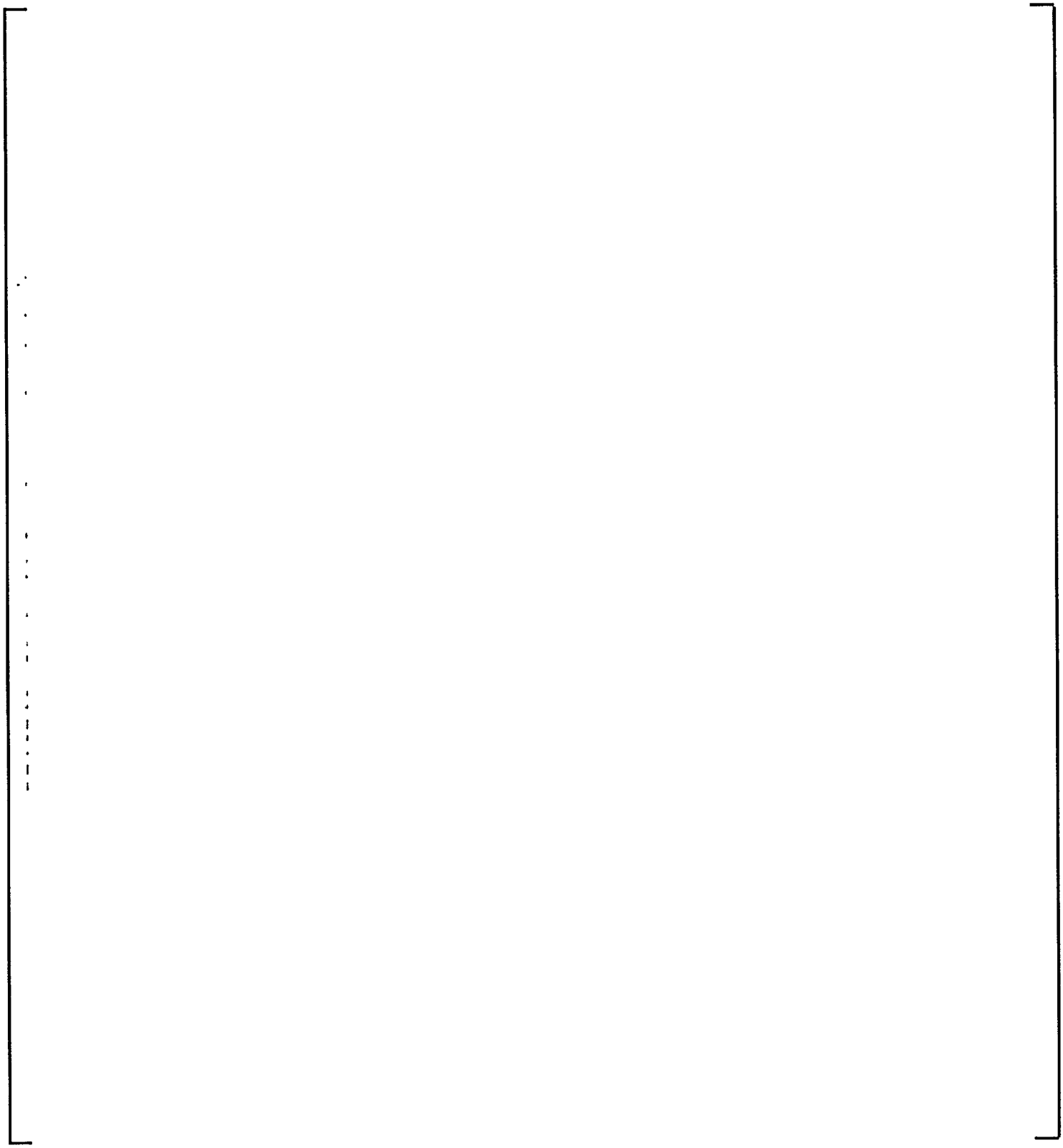


FIGURE 10

REACTOR TRIP FROM FULL POWER

a,c

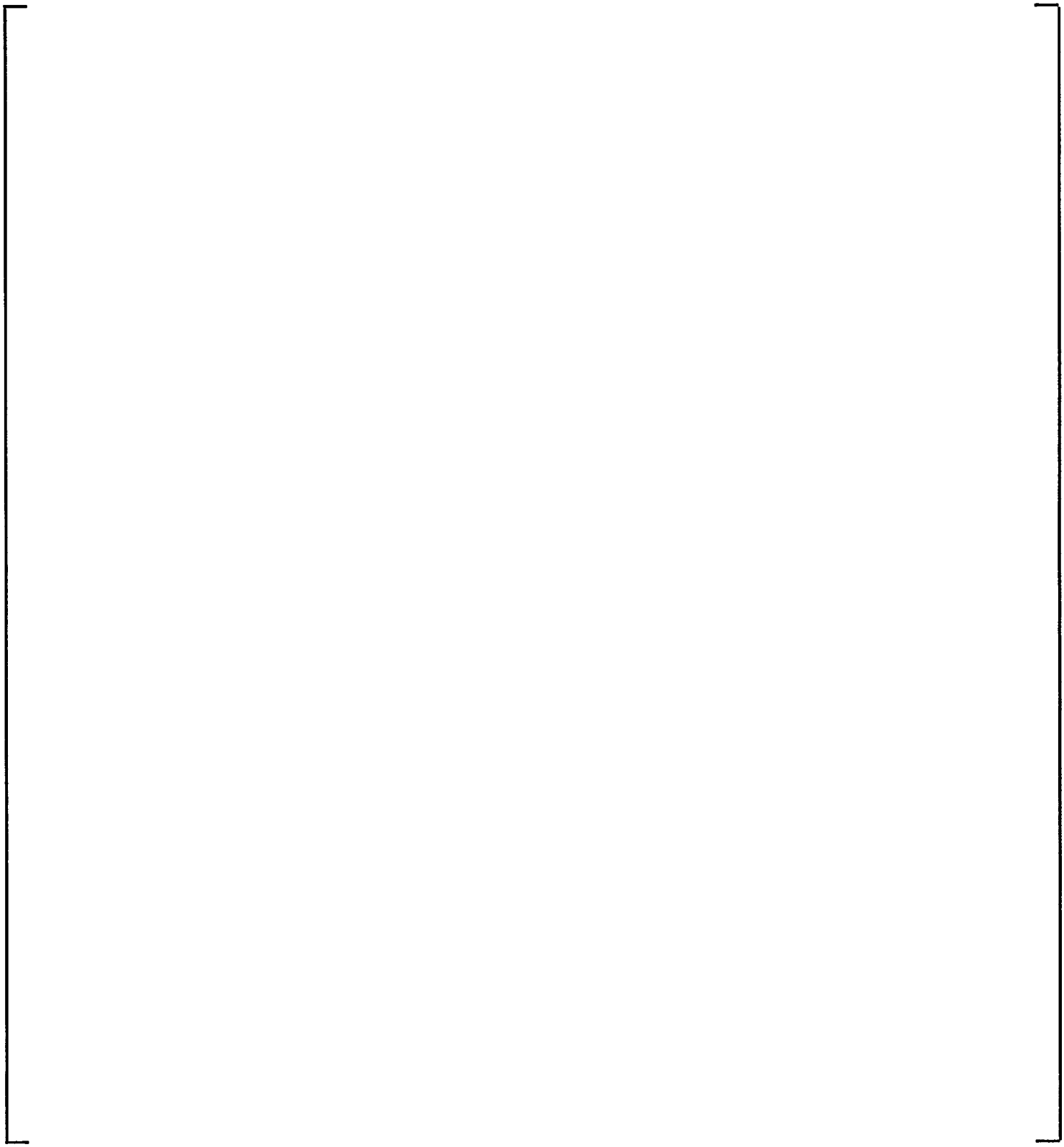


FIGURE 11

REACTOR COOLANT PIPE BREAK

a,c

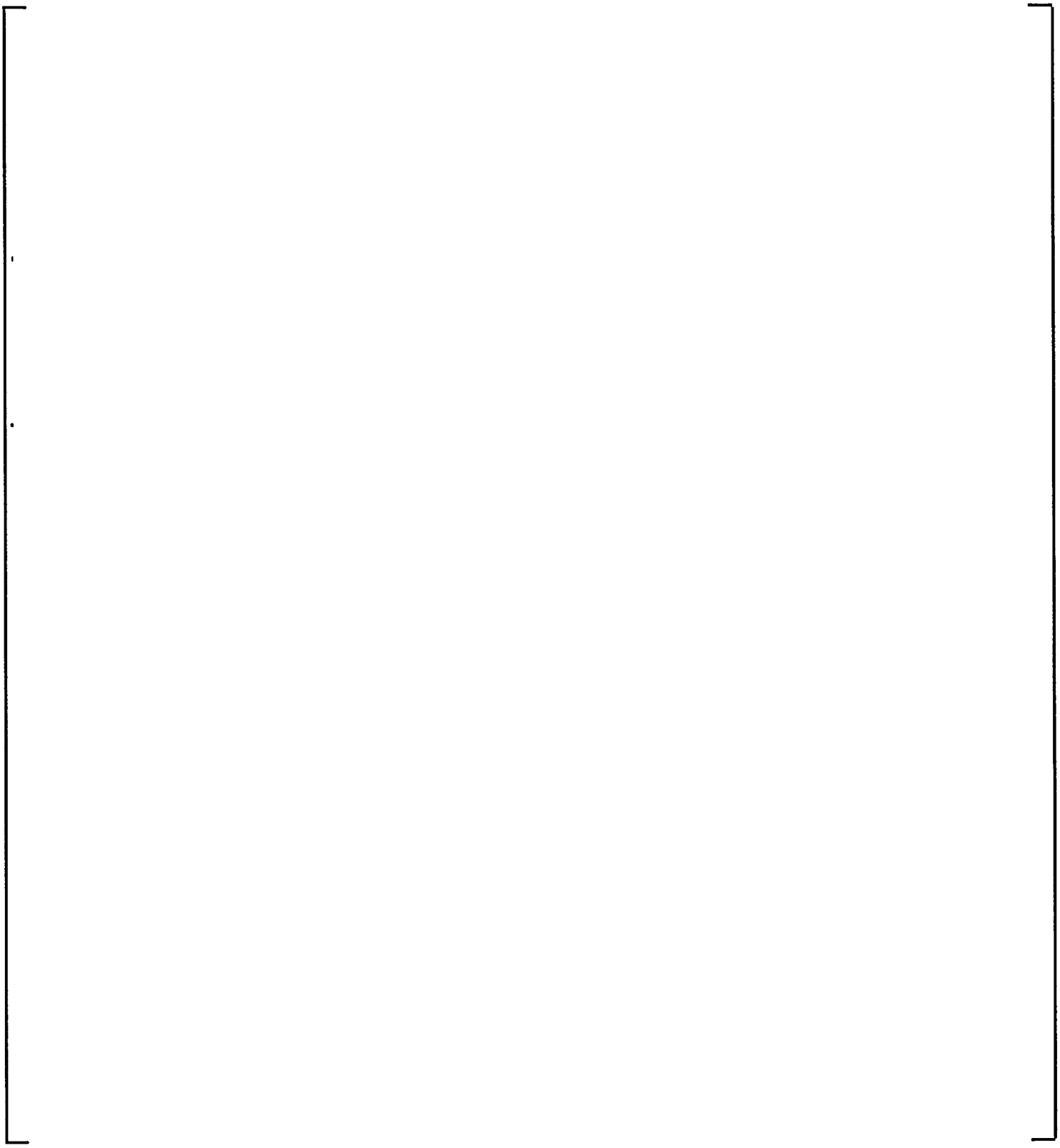


FIGURE 12

STEAM LINE BREAK FROM NO LOAD

a,c

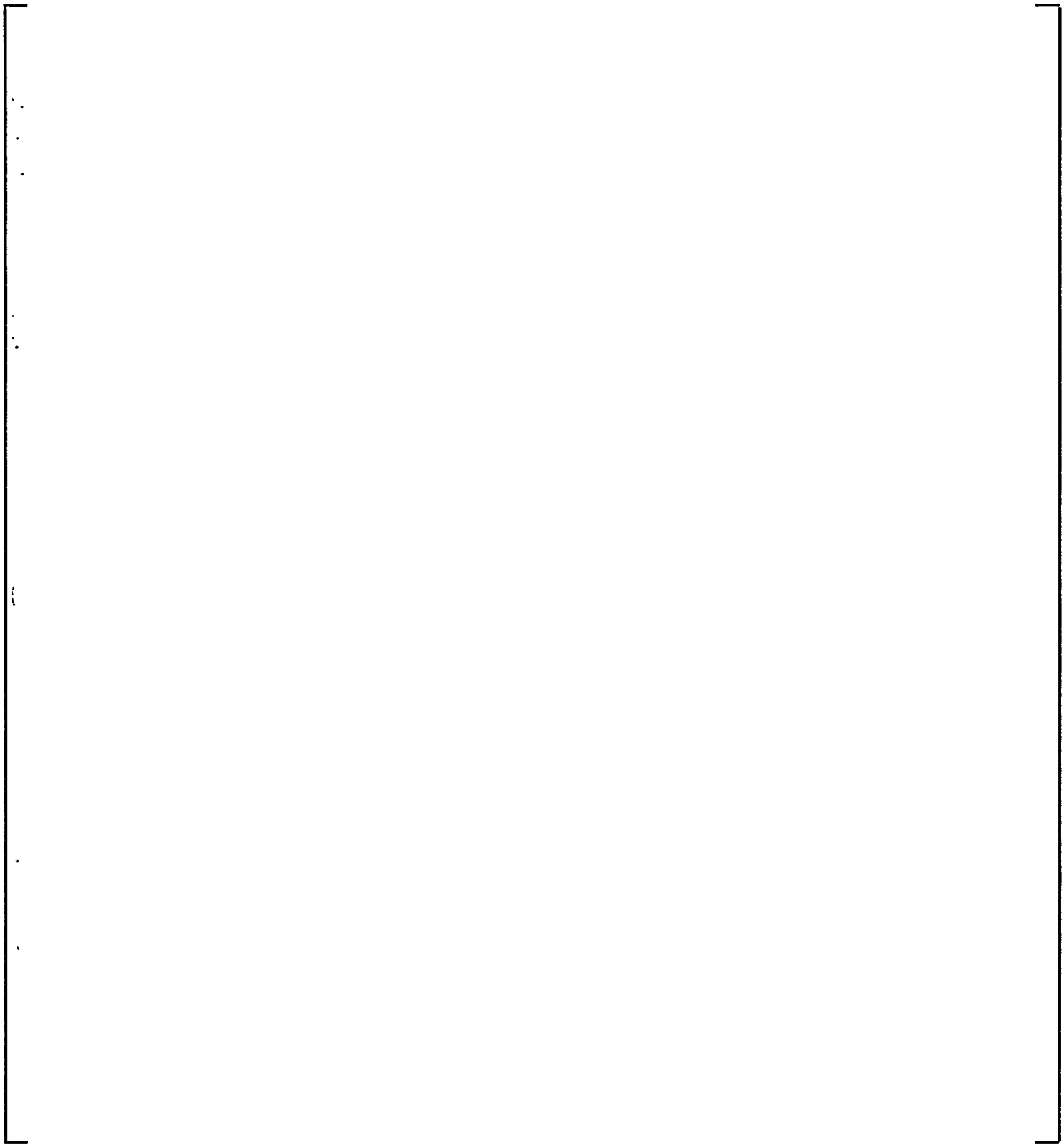


FIGURE 13

TURBINE ROLL TEST

a,c

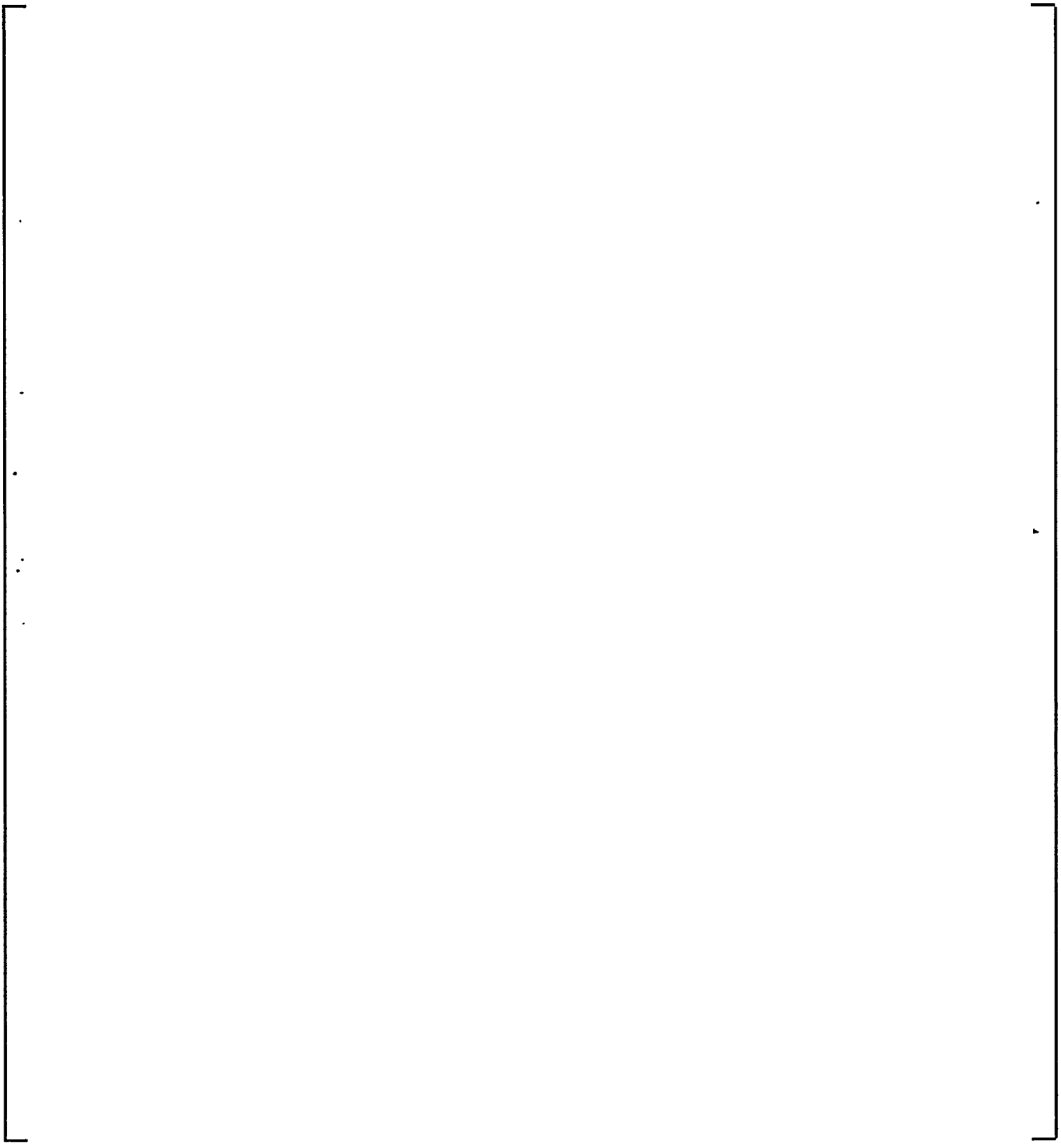


FIGURE 14

HYDROSTATIC TEST

a,c

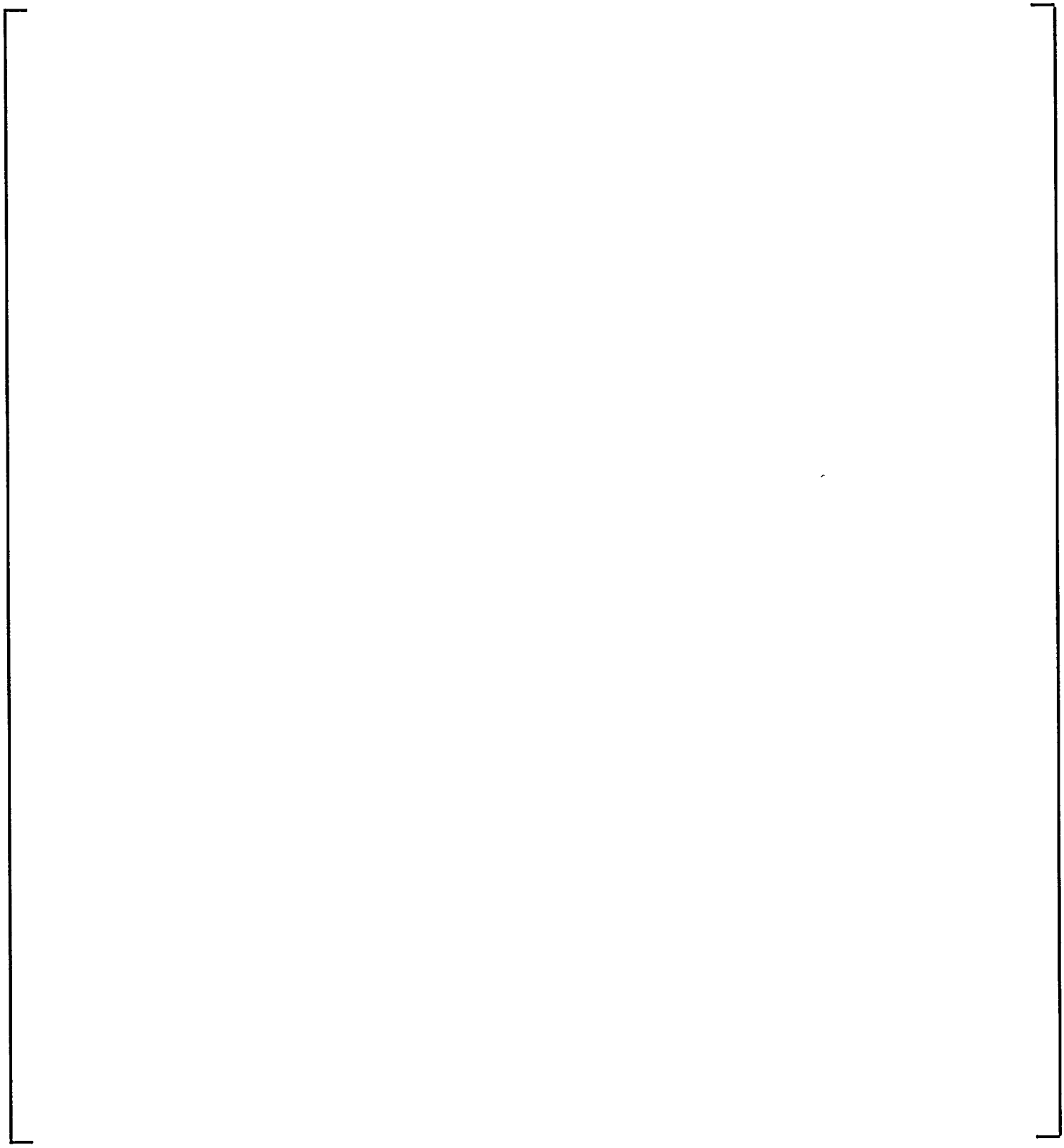


FIGURE 15

HYDROSTATIC TEST

a,c