

ASME Nuclear Codes and Standards

Supporting New Build and Nuclear Manufacturing in South Africa

Sandton, South Africa, October 7-8, 2008

Session 3

Section III - Component Design and Construction

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Today's Agenda

1. Small Advertisement for the ASME Code
2. Structure and Use of Section III
3. Code Interpretations and Code Cases
4. Basic Terms & Important Concepts
5. Subsections of Section III
6. Appendices

ASME Code Usage

60 Countries – ASME B&PV Code

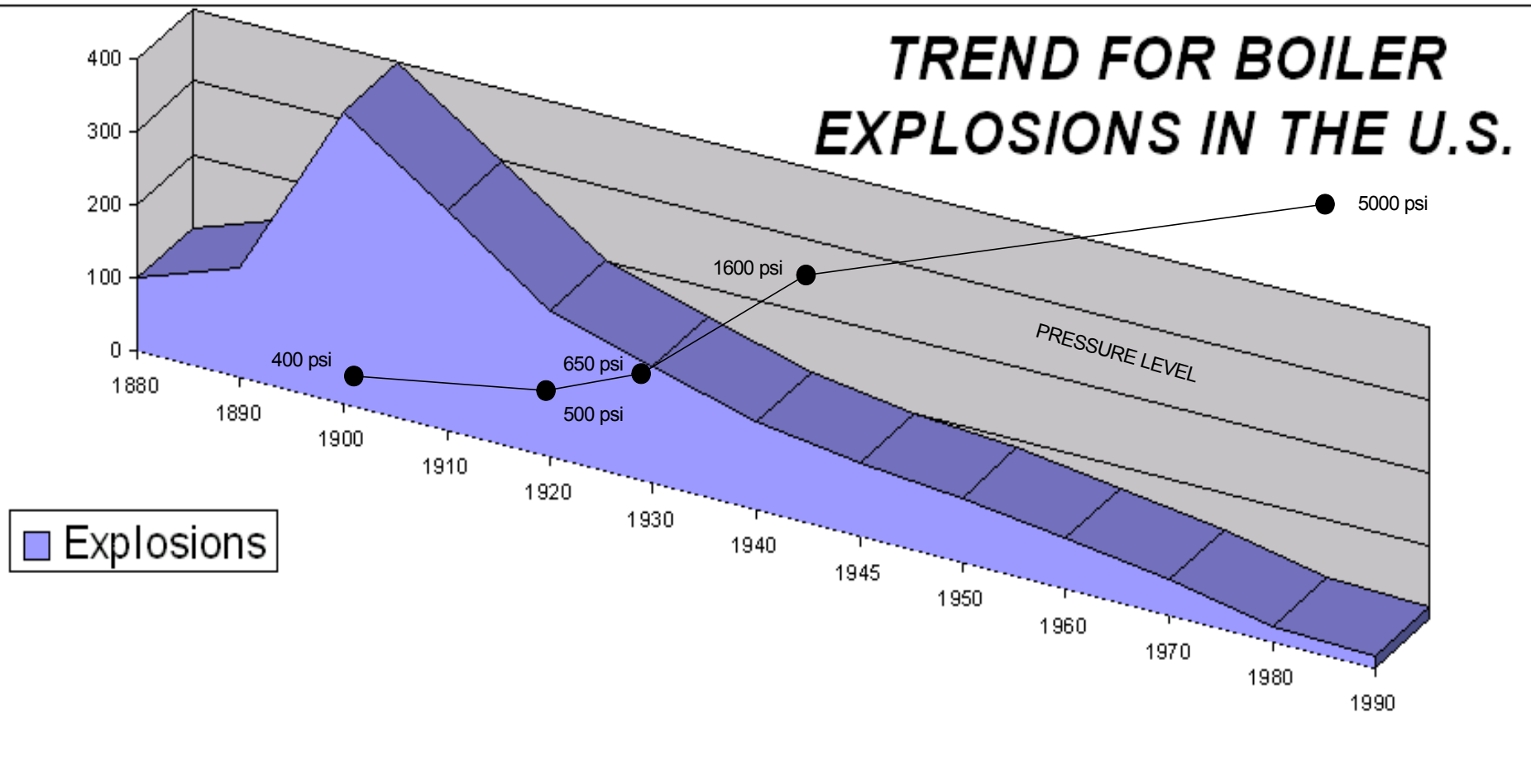
15 Countries – Section III/XI Nuclear Code

20 Countries – Section III Certificate Holders

30 Countries purchase items to Section III/XI

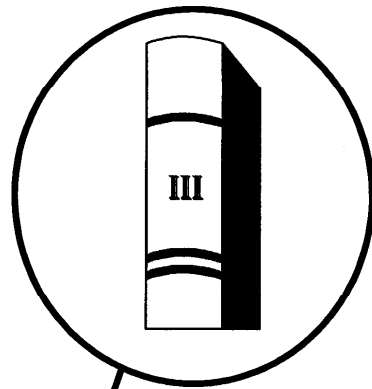
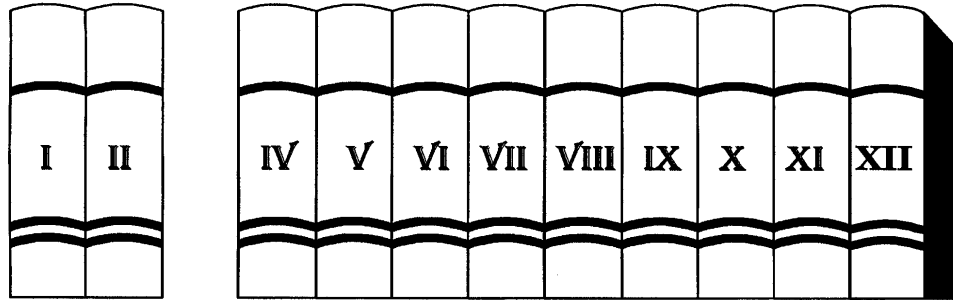
Trend for Boiler Explosions in the U.S.

TREND FOR BOILER EXPLOSIONS IN THE U.S.



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III Subsection NCA – General Requirements for Division 1 and Division 2

III Division 1

Subsection NB – Class 1 Components

Subsection NC – Class 2 Components

Subsection ND – Class 3 Components

Subsection NE – Class MC Components

Subsection NF – Component Supports

Subsection NG – Core Support Structures

Subsection NH – Class 1 Components - Elevated Temperature Service

Appendices

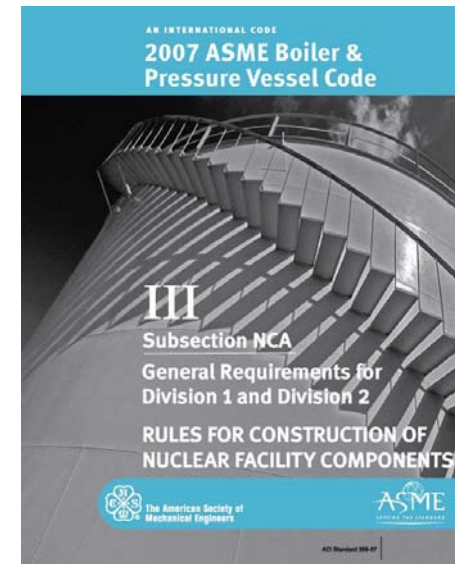
ASME Section III, Div. 1

– 8 Subsections

- NCA: General Requirements
- NB: Class 1 Components
- NC: Class 2 Components
- ND: Class 3 Components
- NE: Class MC Components
- NF: Supports
- NG: Core Support Structures
- NH: Class 1 Components in Elevated Temp. Service

– Appendices

– Code Cases Nuclear Components



Component Classification

Class 1

Components (III, Subsection NB)

Those components that are part of the primary core cooling system

Components (III, Subsection NH)

Those components that are used in elevated temperature service

Class 2

Components (III, Subsection NC)

Those components that are part of various important-to-safety emergency core cooling systems

Class 3

Components (III, Subsection ND)

Those components that are part of the various systems needed for plant operation

Section III Subsection Organization

“construction” =

- materials
- design
- fabrication
- examination
- inspection
- testing
- overpressure protection
- certification

organization =

NX-2000

NX-3000

NX-4000

NX-5000

NX-5000

NX-6000

NX-7000

NX-8000

NCA-1140 Use of Code Editions and Addenda

(a)(1) Under the rules of Section III, the Owner or his designee shall establish the Code Edition and Addenda to be included in the Design Specifications. All items of a nuclear power plant may be constructed to a single Code Edition and Addenda, or each item may be constructed to individually specified Code Editions and Addenda.

NCA-1140 Use of Code Editions and Addenda

(a)(2) In no case shall the Code Edition and Addenda dates established in the Design Specifications be earlier than:

(a) 3 years prior to the date that the nuclear power plant construction permit application is docketed; or

(b) The latest edition and addenda endorsed by the regulatory authority having jurisdiction at the plant site at the time the construction permit application is docketed.

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Code Interpretations

- Provide answers to questions about the Code
- Anyone can request
 - Appendix XX provides instructions
- Are published in the Code so answers are available to everyone

Inquiry on Code Edition and Addenda

10CFR52 Design Certification Process

- Regulator may have approved Edition and Addenda earlier than latest endorsed by regulator at time Combined License Application is docketed
- Regulator may have approved Edition and Addenda from the Design Certification Document at time Combined License Application is docketed

Inquiry on Code Edition and Addenda

Inquiry: As described in NCA-1140(a)(2)(b), does “the endorsement of the latest Code Edition and Addenda by the regulatory authority at the time the construction permit is docketed” include the Code Edition and Addenda endorsed by the regulator through the design certification process and included in the combined operating license (COL) at the time the COL is docketed?

Proposed Reply: Yes.

2007 SECTION III, DIVISION 1 — NCA

NCA-1140 Accompanying Code Change

NCA-1140 USE OF CODE EDITIONS, ADDENDA, AND CASES

(a) (1) Under the rules of this Section, the Owner or his designee shall establish the Code Edition and Addenda to be included in the Design Specifications. All items of a nuclear power plant may be constructed to a single Code Edition and Addenda, or each item may be constructed to individually specified Code Editions and Addenda.

(2) In no case shall the Code Edition and Addenda dates established in the Design Specifications be earlier than:

(a) 3 years prior to the date that the nuclear power plant construction permit application is docketed; or

(b) the latest edition and addenda endorsed by the regulatory authority having jurisdiction at the plant site at the time the construction permit application is docketed.

; or

(c) the edition and addenda endorsed for a design certified or licensed by the regulatory authority.

Code Cases

Provide:

- Relief from an existing Code requirement
- Treatment of topics not currently addressed

Are:

- Permissive, not mandatory
- Issued periodically by Code Committee

Code Case N-XXX

Use of Code Editions, Addenda, and Cases
Section III, Division 1

NCA-1140 Code Case

Inquiry:

What Code Editions, Addenda, and Cases may be used as an alternative to NCA-1140(a)(2)(a) and NCA-1140(a)(2)(b)?

Reply:

It is the opinion of the Committee that as an alternative to NCA-1140(a)(2)(a) and NCA-1140(a)(2)(b), the following requirements may be used:

1. The Edition and Addenda endorsed for a design certified or licensed by the regulatory authority.
2. This code case number shall be recorded on the documentation for the item.

Regulatory Approval of Code Cases



U.S. NUCLEAR REGULATORY COMMISSION

October 2007
Revision 34

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.84

(Draft was issued as DG-1133, dated October 2006)

**DESIGN, FABRICATION, AND MATERIALS CODE CASE
ACCEPTABILITY, ASME SECTION III**

Other Code Case Regulatory Guides

- Regulatory Guide 1.147 lists Code Case Acceptability for Section XI, In-Service Inspection
- Regulatory. Guide 1.192 lists the Operation and Maintenance Code Case Acceptability.
- Unendorsed Code Cases are listed in Regulatory Guide 1.193

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4. Subsections of Section III
5. Appendices
6. Code Cases

Basic Definitions

- **Material**
- **Component**

Section III Material Requirements

- Material Specification
 - Section II: Parts A, B, C, & D
- Control of Material
 - Section III: NCA-3800
- Special Material Requirements
 - Section III: NX- 2000

Important Concepts/Requirements

TRACEABILITY

- **Identification**

- NCA-3856 Identification, Marking, and Material Control
- NB-4122 Material Identification

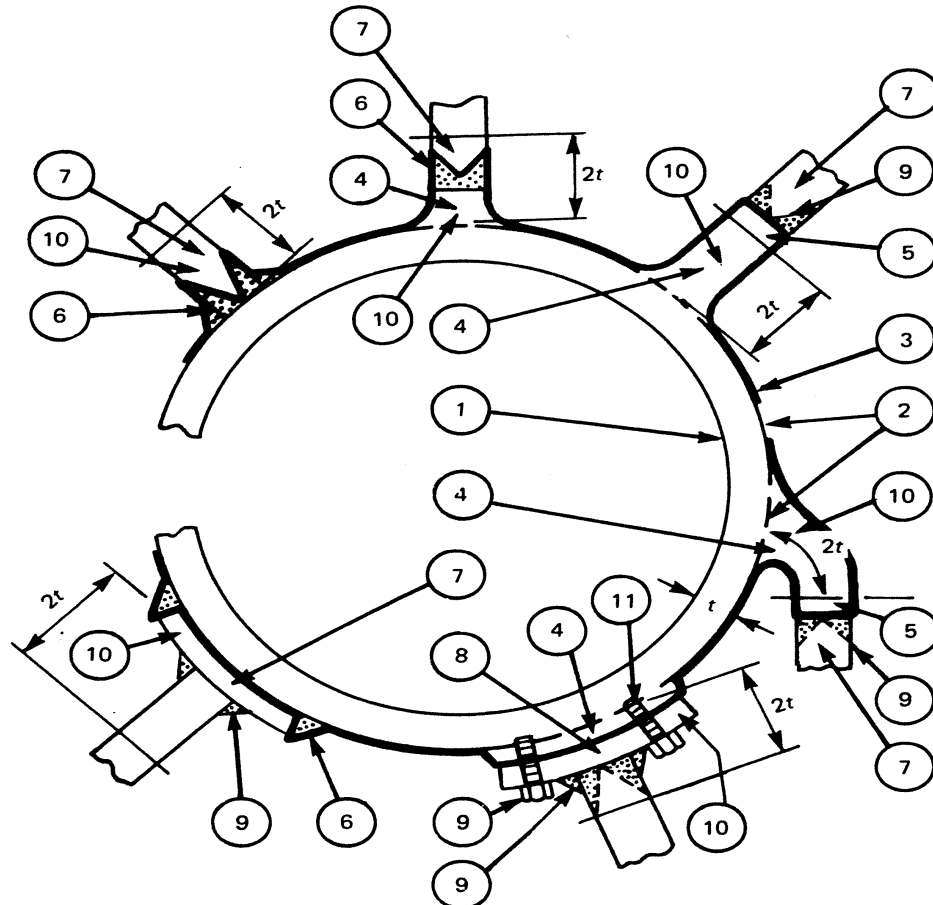
- **Certification of Material**

- NCA-3861 Certification Requirements for Material Organizations
- NCA-3862 Certification of Material
- NCA-3862.1 Material Certification
- NCA-3862.2 Quality System Program Statement

Important Concepts/Requirements

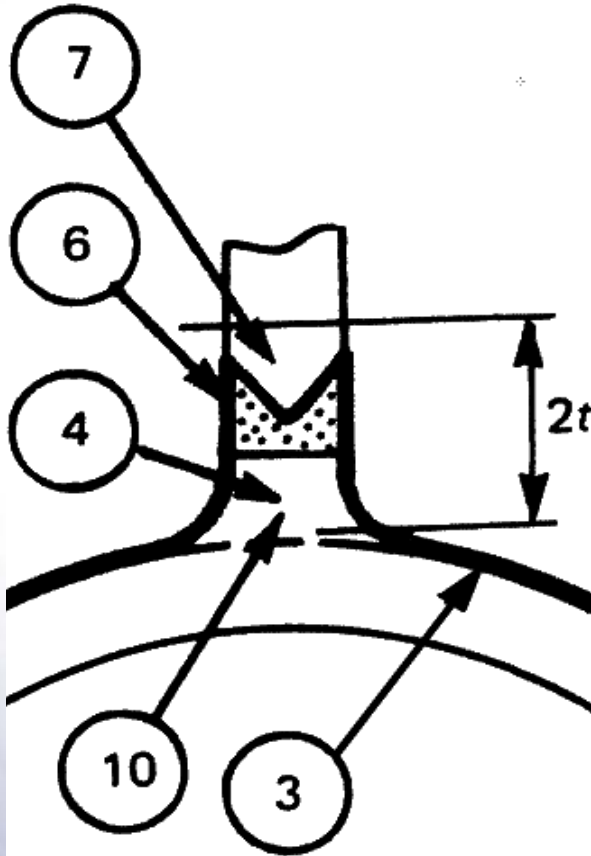
- Thermal stresses explicitly considered
- Basis for stress limits shifted from maximum principal stress theory to more accurate maximum shear stress theory
- Fatigue recognized as possible failure mode
- Brittle fracture specifically treated
- Plastic limit analysis established as a reliable predictor of ductile failure after some plastic action

Jurisdictional Boundaries



- ① Component shall conform to Subsection NB.
- ② Pressure retaining portion of the component.
- ③ Jurisdictional boundary (heavy line).
- ④ Cast or forged attachment or weld buildup shall conform to Subsection NB.
- ⑤ Beyond $2t$ from the pressure retaining portion of the component, the design rules of NF-3000 may be used as a substitute for the design rules of NB-3000.
- ⑥ At or within $2t$ from the pressure retaining portion of the component, the first connecting weld shall conform to Subsection NB.
- ⑦ Beyond $2t$ from the pressure retaining portion of the component or beyond the first connecting weld, the attachment shall conform to Subsection NF [see Note (1)].
- ⑧ Bearing, clamped, or fastened attachment shall conform to Subsection NF [see Note (1)].
- ⑨ Attachment connection shall conform to Subsection NF [see Note (1)].
- ⑩ At or within $2t$ from the pressure retaining portion of the component, the interaction effects of the attachment shall be considered in accordance with NB-3135.
- ⑪ Drilled holes shall conform to Subsection NB.

Jurisdictional Boundaries (Detail)



- ③ Jurisdictional boundary (heavy line).
- ④ Cast or forged attachment or weld buildup shall conform to Subsection NB.
- ⑥ At or within $2t$ from the pressure retaining portion of the component, the first connecting weld shall conform to Subsection NB.
- ⑦ Beyond $2t$ from the pressure retaining portion of the component or beyond the first connecting weld, the attachment shall conform to Subsection NF [see Note (1)].
- ⑩ At or within $2t$ from the pressure retaining portion of the component, the interaction effects of the attachment shall be considered in accordance with NB-3135.

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Structure of Section III Subsections

| | |
|-----------------|--------------------------------|
| Article NX-1000 | Introduction |
| Article NX-2000 | Material |
| Article NX-3000 | Design |
| Article NX-4000 | Fabrication and Installation |
| Article NX-5000 | Examination (NDE) |
| Article NX-6000 | Pressure Testing |
| Article NX-7000 | Overpressure Protection |
| Article NX-8000 | Nameplates, Stamping & Reports |

Subsection NB Class 1 Components

| | |
|-----------------|--------------------------------|
| Article NB-1000 | Introduction |
| Article NB-2000 | Material |
| Article NB-3000 | Design |
| Article NB-4000 | Fabrication and Installation |
| Article NB-5000 | Examination (NDE) |
| Article NB-6000 | Pressure Testing |
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Article NB-2000 Materials

- NB-2100 General Requirements for Material
- NB-2200 Material Test Coupons and Specimens for Ferritic Steel Material
- NB-2300 Fracture Toughness Requirements
- NB-2400 Welding and Brazing Material

Article NB-2000 Materials (cont.)

- NB-2500 Examination and Repair of Pressure Retaining Material
- Plate — Forgings and Bars
 - Seamless and Welded Tubular Products and Fittings
 - Tubular Products and Fittings with Filler Metal
 - Statically & Centrifugally Cast Products
 - Bolts, Studs and Nuts

Article NB-2000 Materials (cont.)

- NB-2600 Material Manufacturers' Quality System Program
- NB-2700 Dimensional Standards
-

- NB-2160 Deterioration of Material
- Outside scope of Section III
 - Covered in Design Specification

Design NB-3000

| | |
|---------|--------------------|
| NB-3100 | General Design |
| NB-3200 | Design by Analysis |
| NB-3300 | Vessel Design |
| NB-3400 | Pump Design |
| NB-3500 | Valve Design |
| NB-3600 | Piping Design |

NB-3100 General Design

- Loading Criteria
 - Loading conditions (pressure, impact loads, weight, reaction, etc.)
 - Design loadings (design pressure, design temperature and design mechanical loadings)
- Special Considerations
 - Corrosion
 - Cladding stresses
 - Welding (dissimilar welds, fillet weld attachments)
- External Pressure Analysis

NB-3200 Design by Analysis

- Design Criteria
 - Basis for determining stresses (maximum shear stress theory)
 - Terms relating to stress analysis
 - Stress classification
 - Derivation of stress intensities

NB-3200 Design By Analysis (cont.)

| Stress Limit | Failure Mode |
|-----------------------------------|--|
| Primary (P_m , P_b & P_L) | Plastic deformation and provide nominal factor of safety on ductile burst pressure |
| Primary plus secondary (P+Q) | Excessive plastic deformation leading to incremental collapse and validate fatigue evaluation elastic analysis |
| Peak (S_a) | Fatigue failure as a result of cyclic loadings |
| Special | Elastic and inelastic instability |

NB-3200 Design By Analysis (cont.)

- Stress Limits for Components
 - Design Condition Limits
 - Level A Service Condition Limits (Normal)
 - Level B Service Condition Limits (Upset)
 - Level C Service Condition Limits (Emergency)
 - Level D Service Condition Limits (Faulted)
 - Test Condition Limits
- Fatigue Analysis Procedure
- Thermal Stress Ratchetting
- Plastic Analysis
- Limit Analysis
- Simplified Elastic Plastic Analysis

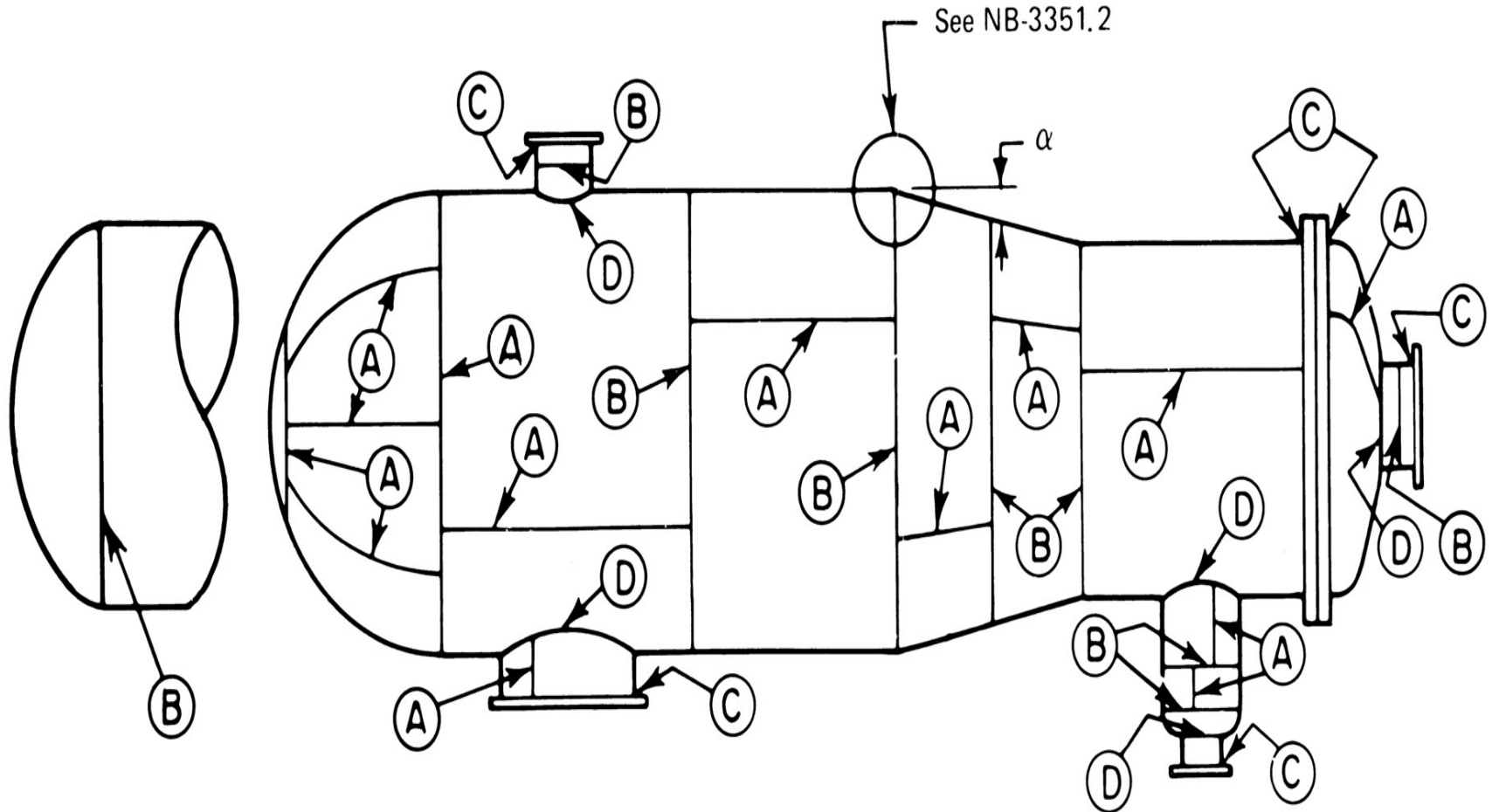
Section III Design by Rule

- Uses simple equations
- Sets rules on geometry of construction
- Uses conservative design values for pressure and temperature
- Justification is based on allowing only low stresses combined with “over-design”

NB-3300 Vessel Design

- General Requirements
- Design Considerations
 - Minimum Pressure Thickness Calculations
- Openings and Reinforcement
- Design of Welded Construction

NB-3300 Vessel Design



Design, Fabrication & Examination Integration

NB-3352.1 Joints of Category A

All welded joints of Category A as defined in NB-3351 shall meet the fabrication requirements of NB-4241 and shall be capable of being examined in accordance with NB-5210.

Design NC/ND-3000

| | |
|------------|---|
| NC/ND-3100 | General Design |
| NC/ND-3200 | Alternate Design Rules for Vessels |
| NC/ND-3300 | Vessel Design |
| NC/ND-3400 | Pump Design |
| NC/ND-3500 | Valve Design |
| NC/ND-3600 | Piping Design |
| NC/ND-3700 | Electrical and Mechanical Penetration Assemblies |
| NC/ND-3800 | Atmospheric Storage Tanks |
| NC/ND-3900 | Storage Tanks 0-15 psig (0-103 kPa) |

Fabrication and Installation NB-4000

NB-4100 General Requirements

NB-4200 Forming, Fitting and Aligning

NB-4300 Welding Qualifications

NB-4400 Making, Examining and Repairing Welds

NB-4500 Brazing

NB-4600 Heat Treatment

NB-4700 Mechanical Joints

NB-4100 General Requirements

- Certification of materials
- Fabrication by certificate holder
- Repair of materials

NB-4200 Forming Fitting and Aligning

- Cutting
 - Material may be cut to shape and sized by mechanical means, such as:
 - Machining
 - Shearing
 - Chipping
 - Grinding
 - Thermal cutting
- Recommendations for preheating prior to thermal cutting in Appendix D Preheat Procedures

NB-4200 Forming Fitting and Aligning

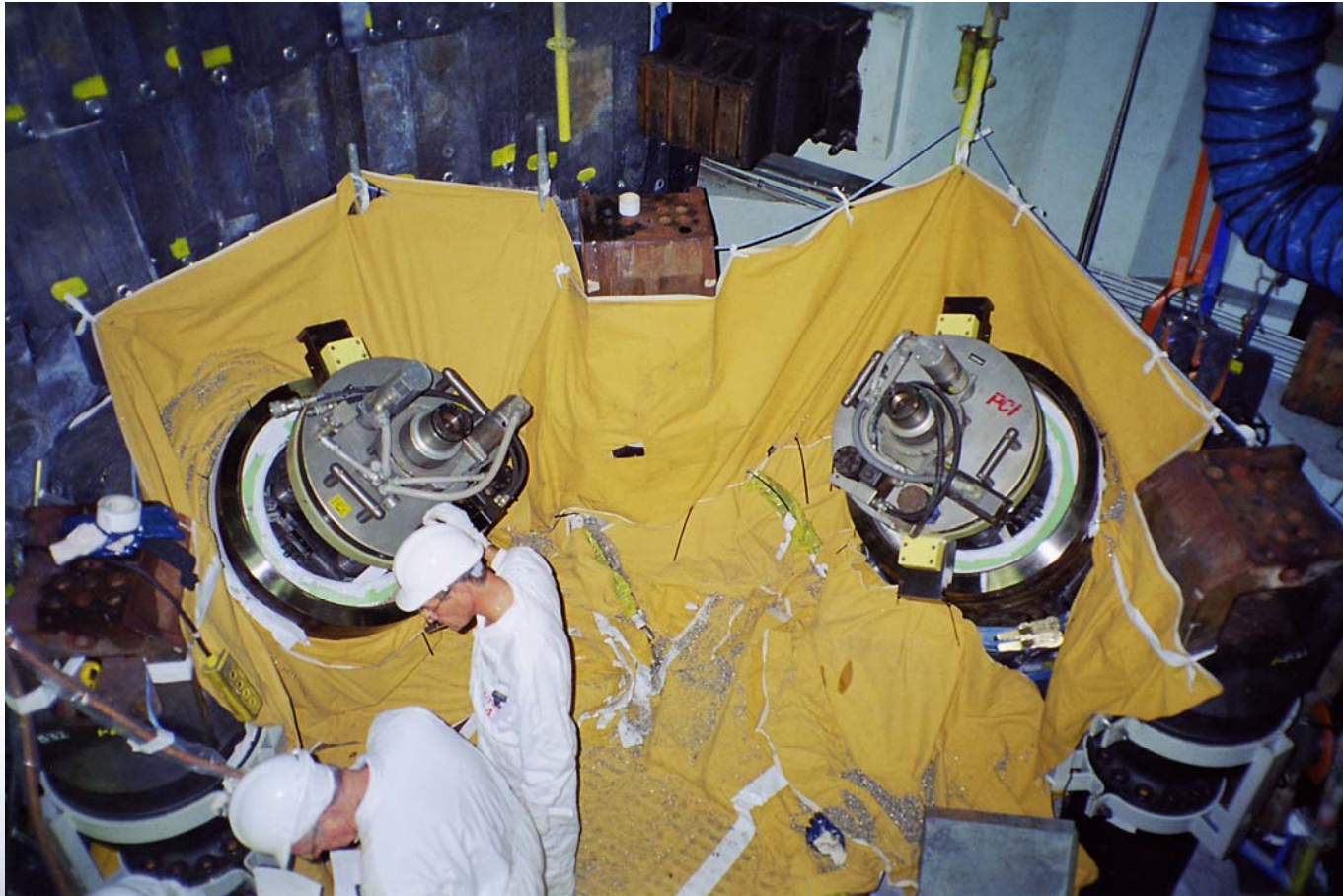
(cont.)

- **Forming and Bending Processes**
 - May be hot or cold provided impact properties are not reduced below specified values
 - Heat treatment may be used to restore properties
- **Qualification of Forming Processes for Impact Property Requirements**
 - Procedure qualification test required
 - Acceptance standard based on impact properties

NB-4200 Forming Fitting and Aligning



NB-4200 Forming Fitting and Aligning



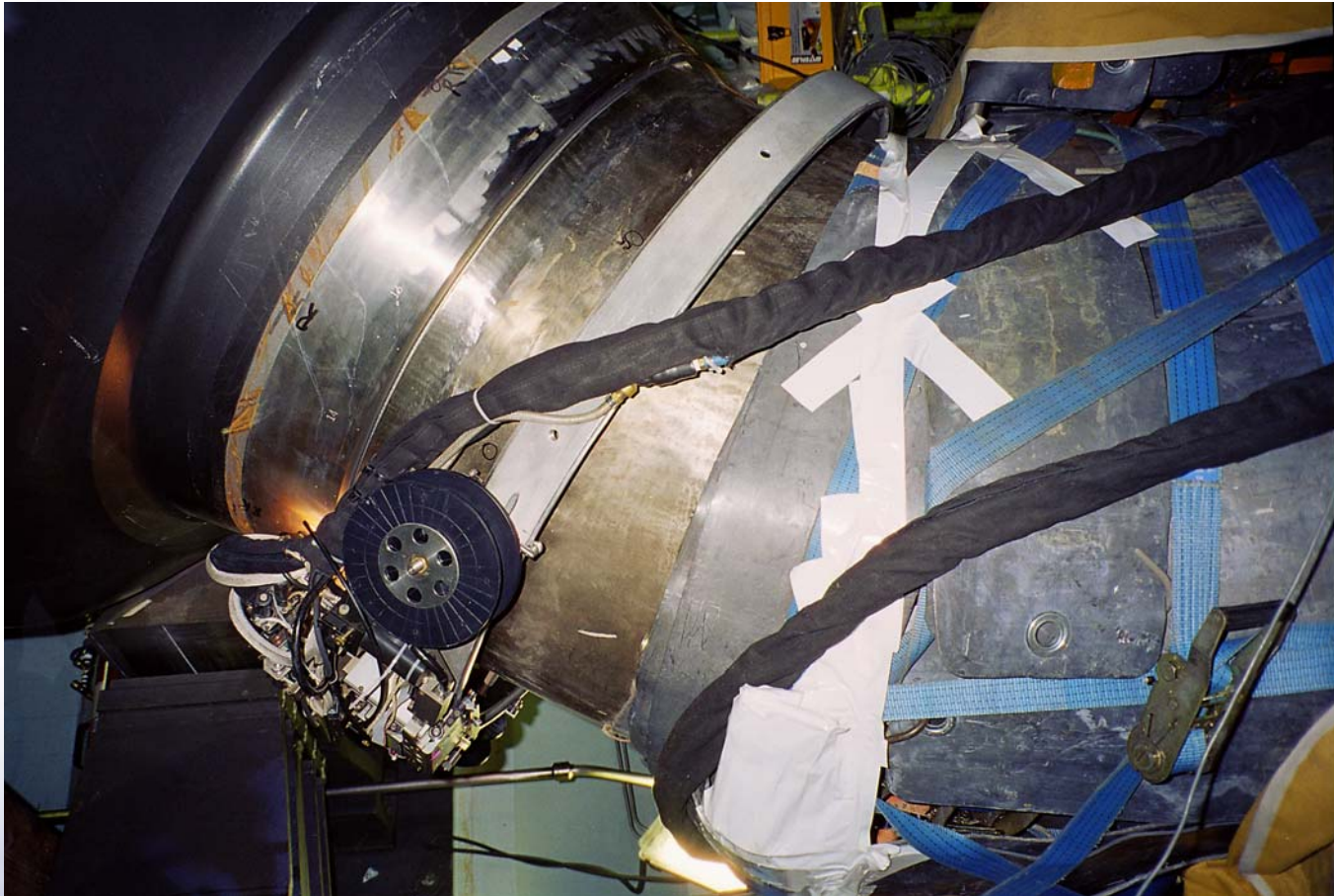
NB-4200 Forming Fitting and Aligning



NB-4200 Forming Fitting and Aligning



NB-4200 Forming Fitting and Aligning



NB-4300 Welding Qualifications

- Types of processes permitted
- Required qualifications
- Requirements for welding procedure qualification tests
- Special qualification requirements for tube-to-tubesheet welds
- Qualification requirements for welding specially designed welded seals

NB-4400 Rules Governing Making, Examining and Repairing Welds

- Precautions before welding
- Rules for making welded joints
- Welding of attachments
- Repair of weld metal defects

NB-4500 thru NB-4700

NB-4500 Brazing

- Rules for brazing
- Qualification requirements
- Fitting and aligning
- Examination

NB-4600 Heat Treatment

- Welding preheat requirements
- Post-weld heat treatment requirements
- Intermediate post-weld heat treatment
- Heat treatment after bending or forming for pipes, pumps and valves
- Heat treatment of electroslag welds

NB-4700 Mechanical Joints

NB-4600 Postweld Heat Treatment

TABLE NB-4622.1-1
MANDATORY REQUIREMENTS FOR POSTWELD HEAT TREATMENT OF WELDS

| P-No. (Section IX, QW-420) | Holding Temperature Range, °F (°C) [Note (1)] | Minimum Holding Time at Temperature for Weld Thickness (Nominal) | | | |
|---|---|--|-----------------------------------|--|---|
| | | ½ in. (13 mm) or less | Over ½ in. to 2 in. (13 to 50 mm) | Over 2 in. to 5 in. (50 to 125 mm) | Over 5 in. (125 mm) |
| 1, 3 | 1,100–1,250 (595–675) | 30 min | 1 hr/in. (2 min/mm) | 2 hr plus 15 min each additional inch (25 mm) over 2 in. (50 mm) | 2 hr plus 15 min each additional inch 2 hr plus 0.5 min/mm over 50 mm |
| 4 | 1,100–1,250 (595–675) | 30 min | 1 hr/in. (2 min/mm) | 1 hr/in. (2 min/mm) | 5 hr plus 15 min each additional inch 5 hr plus 0.5 min/mm over 125 mm |
| 5A, 5B, 5C, 6 except P-No. 5B Gr. 2 and P-No. 6 Gr. 4 | 1,250–1,400 (675–760) | 30 min | 1 hr/in. (2 min/mm) | 1 hr/in. (2 min/mm) | 5 hr plus 15 min each additional inch 5 hr plus 0.5 min/mm over 125 mm |
| 5B Gr. 2 | 1,350–1,425 (730–775) | | | | |
| 6 Gr. 4 | 1,050–1,150 (565–620) | | | | |

NC/ND-4000 Fabrication and Installation

NC/ND-4100 General Requirements

NC/ND-4200 Forming, Fitting and Aligning

NC/ND-4300 Welding Qualifications

NC/ND-4400 Making, Examining and Repairing Welds

NC/ND-4500 Brazing

NC/ND-4600 Heat Treatment

NC/ND-4700 Mechanical Joints

NC/ND-4800 Expansion Joints

Examination NB-5000

- NB-5100 General Requirements
- NB-5200 Examination of Welds
- NB-5300 Acceptance Standards
- NB-5400 Final Examination of Vessels
- NB-5500 Qualification and Certification
of NDE Personnel

NB-5000 Examination

NB-5100 General Requirements for Examination

- Fabrication (F) Preservice Base Line (PS)

NB-5200 Required Examination of Welds

- Category A Welded Joints (Longitudinal Welds)
- Category B Welded Joints (Circ Welds)
- Category C Welded Joints (Flange to Shell, etc.)
- Category D Welded Joints (Nozzle to vessel, etc.)
- Fillet, partial penetration and socket welds
- Structural attachment welds
- Special welds (e.g., Canopy Seal Welds)
- Preservice Examination

NB-5000 Examination (cont.)

NB-5300 Acceptance Standards

- Radiographic
- Ultrasonic
- Magnetic particle
- Liquid Penetrant
- Eddy Current
- Visual
- Gas and bubble formation testing

NB-5400 Final Examination of Vessels

NB-5500 Qualifications and Certification of Nondestructive Examination Personnel

NC/ND-5000 Examination

- NC/ND-5100 General Requirements
- NC/ND-5200 Examination of Welds
- NC/ND-5300 Acceptance Standards
- NC/ND-5400 Final Examination of Components
- NC/ND-5500 Qualification and Certification of NDE Personnel
- NC/ND-5700 Examination Requirements for Expansion Joints

Testing NB-6000

| | |
|---------|----------------------------------|
| NB-6100 | General Requirements |
| NB-6200 | Hydrostatic Tests |
| NB-6300 | Pneumatic Tests |
| NB-6400 | Pressure Test Gauge |
| NB-6600 | Special Test Pressure Situations |

NB-6000 Testing

NB-6220 HYDROSTATIC TEST PRESSURE REQUIREMENTS

NB-6221 Minimum Hydrostatic Test Pressure

(a) The installed system shall be hydrostatically tested at not less than 1.25 times the lowest Design Pressure of any component within the boundary protected by the overpressure protection devices which satisfy the requirements of NB-7000.

(b) Valves shall be hydrostatically tested in accordance with the rules of NB-3500.

(c) Components shall be hydrostatically tested at not less than 1.25 times their Design Pressure.

NC/ND-6000 Testing

- NC/ND-6100 General Requirements
- NC/ND-6200 Hydrostatic Tests
- NC/ND-6300 Pneumatic Tests
- NC/ND-6400 Pressure Test
- NC/ND-6600 Special Test Pressure Situations
- NC/ND-6500 Atmospheric & 0-15 psig Storage Tanks
- NC/ND-6900 Proof Tests to Establish Design Pressure

Overpressure Protection NB/NC/ND-7000

| | |
|---------|--|
| NB-7100 | General Requirements |
| NB-7200 | Overpressure Protection Report |
| NB-7300 | Relieving Capacity Requirements |
| NB-7400 | Set pressures of Pressure Relief Devices |
| NB-7500 | Operating and Design Requirements for Pressure Relief Valves |
| NB-7600 | Non-reclosing Pressure Relief Devices |
| NB-7700 | Certification |
| NB-7800 | Marking, Stamping & Data Reports |

NB-7300 Relieving Capacity Requirements

At least 2 relief devices are needed for a system

- Capacity of the smallest must exceed 50% of the largest
- At least 1 relief device needed for each isolatable component

NB-7500 Operating Design Requirements for Pressure Relief Valves

- Safety, safety relief and relief valves
- Pilot operated pressure relief valves
- Power actuated pressure relief valves
- Safety valves and pilot operated pressure relief valves with auxiliary actuating devices

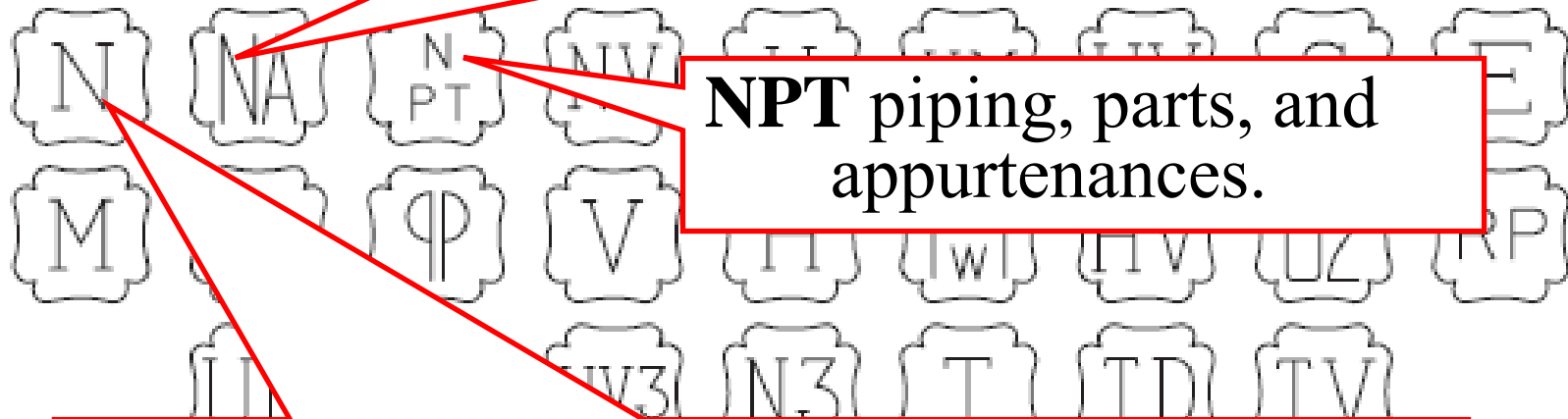
Article NB/NC/ND-8000

Nameplates, Stamping and Reports

NA components that are being installed in the power plant.

NPT piping, parts, and appurtenances.

N completed ASME Code component that the Certificate Holder supplies to a customer.



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Section III, Appendices

Mandatory

- Invoked within the text of a Code paragraph and are required.

Nonmandatory

- Invoked by a footnote to a Code paragraph and provide information or guidance.

Mandatory Appendix Example

NB-3680 Stress Indices and Flexibility Factors

NB-3681(d) For piping products not covered by NB-3680, stress indices and flexibility factors shall be established by experimental analysis (Appendix II) or theoretical analysis.

Nonmandatory Appendix Example

NB-3252 Contents of Design Specifications ³

- (a) The Design Specification shall contain sufficient detail to provide a complete basis for Division 1 construction ...

³ See Appendix B

Section III: Mandatory Appendices

| | |
|-----------------|---|
| Appendix I* | Design Stress Intensity Values, Allowable Stresses, Material Properties, and Fatigue Curves |
| Appendix II | Experimental Stress Analysis |
| Appendix III | Basis for Establishing Design Stress Intensity Values and Allowable Stress Values |
| Appendix IV | Approval of New Materials Under the ASME Boiler and Pressure Vessel Code |
| Appendix V | Certificate Holders' Data Report Forms, Instructions, and Application Forms |
| Appendix VI | Rounded Indications |
| Appendix VII | Charts and Tables for Determining Shell Thickness of Cylindrical and Spherical Components Under External Pressure |
| Appendix XI | Rules for Bolted Flange Connections for Class 2 and 3 Components and Class MC Vessels |
| Appendix XII | Design Considerations for Bolted Flange Connections |
| Appendix XIII | Design Based on Stress Analysis for Vessels Designed in Accordance With NC-3200 |
| Appendix XIV | Design Based on Fatigue Analysis for Vessels Designed in Accordance With NC-3200 |
| Appendix XVIII | Capacity Conversions for Pressure Relief Valves |
| Appendix XIX | Integral Flat Head With a Large Opening |
| Appendix XX* | Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee |
| Appendix XXI | Adhesive Attachment of Nameplates |
| Appendix XXII | Design of Reinforcement for Come-to-Cylinder Junction Under External Pressure |
| Appendix XXIII* | Qualifications and Duties of Specialized Professional Engineers |

Section III: Nonmandatory Appendices

| | |
|-------------|---|
| Appendix A | Stress Analysis Methods |
| Appendix B* | Owner's Design Specifications |
| Appendix C* | Certificate Holder's Design Report |
| Appendix D | Nonmandatory Preheat Procedures |
| Appendix E | Minimum Bolt Cross-Sectional Area |
| Appendix F* | Rules for Evaluation of Service Loadings With Level D Service Limits |
| Appendix G | Protection Against Nonductile Failure |
| Appendix J* | Owner's Design Specifications for Core Support Structures |
| Appendix K | Tolerances |
| Appendix L | Class FF Flange Design for Class 2 and 3 Components and Class MC Vessels |
| Appendix M | Control of Welding, Postweld Heat Treatment, and Nondestructive Examination of Welds |
| Appendix N | Dynamic Analysis Methods |
| Appendix O | Rules for Design of Safety Valve Installations |
| Appendix P | Contents of Certified Material Test Reports |
| Appendix Q | Design Rules for Clamp Connections |
| Appendix R | Permissible Lowest Service Metal Temperature From T_{NDT} for Classes 2 and MC Construction |
| Appendix S | Pump Shaft Design Methods |
| Appendix T | Recommended Tolerances for Reconciliation of Piping Systems |
| Appendix U | Rules for Pump Internals |
| Appendix V | Interruption of Code Work |
| Appendix W | Environmental Effects on Components |

Appendices of Interest

Mandatory Appendices

- I Material Properties (Fatigue curves and other properties in older Codes)
- XX Submittal of Technical Inquiries to the Boiler and Pressure Vessel Committee
- XXIII Qualifications and Duties of Specialized Professional Engineers

Non-Mandatory Appendices

- B Owner's Design Specification
- C Certificate Holder's Design Report
- E Minimum Bolt Cross Sectional Area
- F Rules for Faulted (Level D) Condition Analysis
- G Rules for Fracture Mechanics Analysis
- W Environmental Effects on Components

Overall Summary

ASME Code:

- Is Comprehensive - provides rules for materials, design, fabrication, examination, inspection, testing, certification, and pressure relief
- Is Integrated – materials, design, fabrication, inspection and testing rules are integrated – a change in one area may require a change in another
- Is Dynamic – evolves and changes to reflect new technology and industry needs

Thank You

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