



NATIONAL BOARD INSPECTION CODE

INSPECTION

PART
2



DIAMOND

ANNIVERSARY

NATIONAL BOARD INSPECTION CODE

2021 EDITION

DATE OF ISSUE — JULY 1, 2021

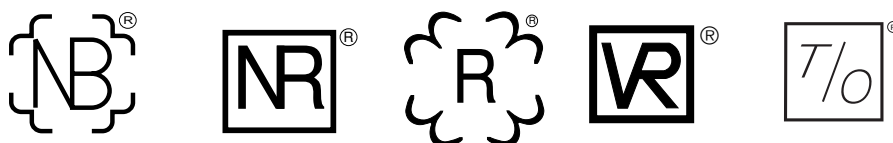
This code was developed under procedures accredited as meeting the criteria for American National Standards. The Consensus Committee that approved the code was balanced to ensure that individuals from competent and concerned interests had an opportunity to participate. The proposed code was made available for public review and comment, which provided an opportunity for additional public input from industry, academia, regulatory and Jurisdictional agencies, and the public-at-large.

The National Board does not “approve,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

The National Board does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable Letters Patent, nor assume any such liability. Users of a code are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code.

The National Board accepts responsibility for only those interpretations issued in accordance with governing National Board procedures and policies that preclude the issuance of interpretations by individual committee members.



The above National Board symbols are registered with the US Patent Office.

“National Board” is the abbreviation for The National Board of Boiler and Pressure Vessel Inspectors.

No part of this document may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

All charts, graphs, tables, and other criteria that have been reprinted from the *ASME Boiler and Pressure Vessel Code*, Sections I, IV, VIII, and X are used with the permission of the American Society of Mechanical Engineers. All Rights Reserved.

Library of Congress Catalog Card No. 52-44738
 Printed in the United States of America
 All Rights Reserved

www.NBBI.org

Copyright © 2021 by
 THE NATIONAL BOARD OF BOILER & PRESSURE VESSEL INSPECTORS
 All rights reserved
 Printed in U.S.A.

PART 2 — INSPECTION TABLE OF CONTENTS

Introduction		XIII
Foreword		XVII
Personnel		XIX
Section 1	General Requirements for Inservice Inspection of Pressure-Retaining Items	1
1.1	Scope	1
1.2	Administration	1
1.3	Reference to Other Codes and Standards	1
1.4	Personnel Safety	2
1.4.1	Personal Safety Requirements for Entering Confined Spaces	3
1.4.2	Equipment Operation	3
1.5	Inspection Activities	4
1.5.1	Inservice Inspection Activities	4
1.5.2	Pre-Inspection Activities	4
1.5.2.1	Inspection Planning	4
1.5.3	Preparation for Internal Inspection	5
1.5.4	Post-Inspection Activities	6
1.6	Change of Service	6
Section 2	Detailed Requirements for Inservice Inspection of Pressure-Retaining Items	7
2.1	Scope	7
2.2	Boilers	7
2.2.1	Scope	7
2.2.2	Service Conditions	7
2.2.3	Pre-Inspection Activities	7
2.2.4	Condition of Boiler Room or Boiler Location	7
2.2.5	External Inspection	7
2.2.6	Internal Inspection	8
2.2.7	Evidence of Leakage	8
2.2.8	Boiler Corrosion Considerations	8
2.2.9	Waterside Deposits	9
2.2.10	Inspection of Boiler Piping, Parts, and Appurtenances	9
2.2.10.1	Boiler Piping	9
2.2.10.2	Flanged or Other Connections	9
2.2.10.3	Miscellaneous	10
2.2.10.4	Gages	10
2.2.10.5	Pressure Relief Devices	11
2.2.10.6	Controls	11
2.2.11	Records Review	12
2.2.12	Description and Concerns of Specific Types of Boilers	12
2.2.12.1	Cast-Iron Boilers	12
2.2.12.2	Firetube Boilers	13
2.2.12.3	Watertube Boilers	15
2.2.12.4	Electric Boilers	16
2.2.12.5	Fired Coil Water Heaters	16
2.2.12.6	Fired Storage Water Heaters	17
2.2.12.7	Thermal Fluid Heaters	17
2.2.12.8	Waste Heat Boilers	19
2.2.12.9	Kraft or Sulfate Black Liquor Recovery Boilers	20
2.3	Pressure Vessels	22
2.3.1	Scope	22
2.3.2	Service Conditions	22
2.3.3	External Inspection	22
2.3.4	Internal Inspection	23
2.3.5	Inspection of Pressure Vessel Parts and Appurtenances	24

2.3.5.1	Gages	24
2.3.5.2	Safety Devices	25
2.3.5.3	Controls/Devices	25
2.3.5.4	Records Review	25
2.3.6	Description and Concerns of Specific Types of Pressure Vessels	26
2.3.6.1	Deaerators	26
2.3.6.2	Compressed Air Vessels	26
2.3.6.3	Expansion Tanks	27
2.3.6.4	Liquid Ammonia Vessels	28
2.3.6.5	Inspection of Pressure Vessels with Quick-Actuating Closures	31
2.3.6.6	Transport Tanks	33
2.3.6.7	Anhydrous Ammonia Nurse Tanks	33
2.3.6.8	Inspection of Pressure Vessels for Human Occupancy (PVHO'S)	34
2.3.6.9	Inspection of Static Vacuum Insulated Cryogenic Vessels	38
2.3.6.10	Inspection of Wire Wound Pressure Vessels	39
2.4	Piping and Piping Systems	41
2.4.1	Scope	41
2.4.2	Service Conditions	41
2.4.3	Assessment of Piping Design	41
2.4.4	External Inspection of Piping	41
2.4.5	Internal Inspection of Piping	42
2.4.6	Evidence of Leakage	42
2.4.7	Provisions for Expansion and Support	42
2.4.8	Inspection of Gages, Safety Devices, and Controls	43
2.4.8.1	Gages	43
2.4.8.2	Safety Devices	43
2.4.8.3	Quick-Disconnect Coupling	43
2.4.9	Covered Piping Systems	43
2.5	Pressure Relief Devices	43
2.5.1	Scope	43
2.5.2	Pressure Relief Device Data	44
2.5.3	Inservice Inspection Requirements for Pressure Relief Device Conditions	44
2.5.4	Inservice Inspection Requirements for Pressure Relief Devices Installation Condition	45
2.5.5	Additional Inspection Requirements	45
2.5.5.1	Boilers	45
2.5.5.2	Hot Water Supply Boilers, and Potable Water Heaters	45
2.5.5.3	Pressure Vessels and Piping	46
2.5.5.4	Rupture Disks	46
2.5.6	Packaging, Shipping, and Transportation	47
2.5.7	Testing and Operational Inspection of Pressure Relief Devices	48
2.5.7.1	Corrective Action	49
2.5.7.2	Valve Adjustments	49
2.5.8	Recommended Inspection and Test Frequencies for Pressure Relief Devices	49
2.5.8.1	Establishment of Inspection and Test Intervals	50
2.5.8.2	Establishment of Service Intervals	51
Section 3	Corrosion and Failure Mechanisms	52
3.1	Scope	52
3.2	General	52
3.3	Corrosion	52
3.3.1	Macroscopic Corrosion Environments	52
3.3.2	Microscopic Corrosion Environments	54
3.3.3	Control of Corrosion	54
3.3.3.1	Process Variables	54
3.3.3.2	Protection	55
3.3.3.3	Material Selection	55
3.3.3.4	Coatings	55
3.3.3.5	Engineering Design	56
3.3.3.6	Conclusion	56
3.4	Failure Mechanisms	56

3.4.1	Fatigue	56
3.4.2	Creep	57
3.4.3	Temperature Effects	57
3.4.4	Hydrogen Embrittlement	57
3.4.5	High-Temperature Hydrogen Attack	58
3.4.6	Hydrogen Damage	58
3.4.7	Bulges and Blisters	59
3.4.8	Overheating	59
3.4.9	Cracks	59
Section 4	Examinations, Test Methods, and Evaluations	60
4.1	Scope	60
4.2	Nondestructive Examination Methods (NDE)	60
4.2.1	Visual	60
4.2.2	Magnetic Particle	61
4.2.3	Liquid Penetrant	61
4.2.4	Ultrasonic	61
4.2.5	Radiography	62
4.2.6	Eddy Current	62
4.2.7	Metallographic	62
4.2.8	Acoustic Emission	62
4.3	Testing Methods	62
4.3.1	Pressure Testing	63
4.3.1.1	All Pressure Testing	63
4.3.1.2	Liquid Pressure Testing	63
4.3.1.3	Pneumatic Pressure Testing	64
4.4	Methods to Assess Damage Mechanisms and Inspection Frequency for Pressure-Retaining Items	64
4.4.1	Scope	64
4.4.2	General Requirements	65
4.4.3	Responsibilities	65
4.4.4	Remaining Service Life Assessment Methodology	65
4.4.5	Data Requirements for Remaining Service Life Assessments	66
4.4.6	Identification of Damage Mechanisms	67
4.4.7	Determining Inspection Intervals	67
4.4.7.1	Method for Estimating Inspection Intervals for Pressure-Retaining Items Subject to Erosion or Corrosion	68
4.4.7.2	Method for Estimating Inspection Intervals for Exposure to Corrosion	68
4.4.7.3	Estimating Inspection Intervals for Pressure-Retaining Items Where Corrosion Is Not a Factor	71
4.4.8	Evaluating Inspection Intervals of Pressure-Retaining Items Exposed to Inservice Failure Mechanisms	71
4.4.8.1	Exposure to Elevated Temperature (Creep)	71
4.4.8.2	Exposure to Brittle Fracture	72
4.4.8.3	Evaluating Conditions That Cause Bulges/Blisters/Laminations	72
4.4.8.4	Evaluating Crack-Like Indications in Pressure-Retaining Items	72
4.4.8.5	Evaluating Exposure of a Pressure-Retaining Item to Fire Damage	73
4.4.8.6	Evaluating Exposure of Pressure-Retaining Items to Cyclic Fatigue	74
4.4.8.7	Evaluating Pressure-Retaining Items Containing Local Thin Areas	74
4.5	Risk-Based Inspection Assessment Programs	75
4.5.1	Scope	75
4.5.2	Definitions	75
4.5.3	General	76
4.5.4	Considerations	76
4.5.5	Key Elements of an RBI Assessment Program	77
4.5.6	RBI Assessment	77
4.5.6.1	Probability of Failure	78
4.5.6.2	Consequence of Failure	78
4.5.6.3	Risk Evaluation	78

4.5.6.4	Risk Management	78
4.5.7	Jurisdictional Relationships	79
4.6	Quantitative Engineering Assessments Including Finite Element Analysis (FEA)	79
4.6.1	Calculations	79
4.6.2	Engineer Experience	79
4.6.3	Finite Element Analysis (FEA) Engineer Experience	79
Section 5	Stamping, Documentation, and Forms	80
5.1	Scope	80
5.2	Replacement of Stamping or Nameplate	80
5.2.1	Indistinct Stamping or Nameplate is Lost, Illegible, or Detached	80
5.2.2	Reporting	80
5.2.3	Replacement of Duplicate Nameplates	81
5.3	National Board Inspection Forms	81
5.3.1	Scope	81
5.3.2	Forms	81
5.3.3	Instructions for Completing the Form NB-136, Replacement of Stamped Data Form	81
5.3.4	Guide for Completing Fitness for Service Assessment Reports	82
Section 6	Supplements	95
Supplement 1	Steam Locomotive Firetube Boiler Inspection and Storage	95
S1.1	Scope	95
S1.2	Special Jurisdictional Requirements	96
S1.3	Federal Railroad Administration (FRA)	96
S1.4	Locomotive Firetube Boiler Inspection	96
S1.4.1	Inspection Methods	96
S1.4.2	Inspection Zones	97
S1.4.2.1	Riveted Seams and Rivet Heads	97
S1.4.2.2	Welded and Riveted Repairs	98
S1.4.2.3	Boiler Shell Course	99
S1.4.2.4	Dome and Dome Lid	99
S1.4.2.5	Mudring	99
S1.4.2.6	Flue Sheets	100
S1.4.2.7	Flanged Sheets	100
S1.4.2.8	Stayed Sheets	100
S1.4.2.8.1	Bulged Stayed Sheets	101
S1.4.2.9	Staybolts	101
S1.4.2.10	Flexible Staybolts and Sleeves	102
S1.4.2.11	Girder Stay and Crown Bars	103
S1.4.2.12	Sling Stays	103
S1.4.2.13	Crown Stays and Expansion Stays	104
S1.4.2.14	Diagonal and Gusset Braces	105
S1.4.2.15	Flues	105
S1.4.2.16	Superheater Units and Header	105
S1.4.2.17	Arch Tubes, Water Bar Tubes, and Circulators	106
S1.4.2.18	Thermic Syphons	106
S1.4.2.19	Firebox Refractory	107
S1.4.2.20	Dry Pipe	107
S1.4.2.21	Throttle and Throttle Valve	107
S1.4.2.22	Screw-Type Washout Plugs, Holes, and Sleeves	107
S1.4.2.23	Handhole Washout Doors	108
S1.4.2.24	Threaded and Welded Attachment Studs	108
S1.4.2.25	Fusible Plugs	109
S1.4.2.26	Water Glass, Water Column, and Gage Cocks	109
S1.4.2.27	Steam Pressure Gage	109
S1.4.2.28	Boiler Fittings and Piping	110
S1.4.2.29	Boiler Attachment Brackets	110
S1.4.2.30	Fire Door	110

S1.4.2.31	Grates and Grate Operating Mechanism	111
S1.4.2.32	Smokebox	111
S1.4.2.33	Smokebox Steam Pipes	111
S1.4.2.34	Ash Pan and Fire Pan	112
S1.4.3	Method of Checking Height of Water Gage Glass	112
S1.4.3.1	Water Height Measurement Method.....	112
S1.4.3.2	Flexible Spirit Level Method	113
S1.5	Guidelines for Steam Locomotive Storage	114
S1.5.1	Storage Methods	115
S1.5.2	Wet Storage Method	115
S1.5.3	Dry Storage Method	115
S1.5.4	Recommended General Preservation Procedures	116
S1.5.5	Use of Compressed Air to Drain Locomotive Components	119
S1.5.6	Return to Service	119
S1.6	Safety Valves	120
S1.7	Tables and Figures	120
Supplement 2 Historical Boilers		121
S2.1	Scope	121
S2.2	Introduction.....	121
S2.3	Responsibilities	121
S2.4	General Inspection Requirements	121
S2.4.1	Pre-Inspection Requirements	121
S2.4.2	Post-Inspection Activities	122
S2.4.3	Boiler Operators	122
S2.4.4	Examinations and Tests	123
S2.4.4.1	Nondestructive Examination Methods.....	123
S2.4.4.2	Testing Methods	123
S2.5	Specific Examination and Test Methods	123
S2.5.1	Specific Examination Methods	123
S2.5.2	Visual Examination	124
S2.5.2.1	Preparation for Visual Inspection	124
S2.5.2.2	Visual Examination Requirements	124
S2.5.3	Ultrasonic Examination.....	124
S2.5.4	Liquid Penetrant Examination	124
S2.5.5	Magnetic Particle Examination	125
S2.6	Specific Testing Methods	125
S2.6.1	Hydrostatic Pressure Testing.....	125
S2.6.2	Ultrasonic Thickness Testing.....	125
S2.6.3	Evaluation of Corrosion	126
S2.6.3.1	Line and Crevice Corrosion.....	126
S2.6.3.2	Randomly Scattered Pits.....	126
S2.6.3.3	Locally Thinned Areas	126
S2.6.3.4	Generalized Thinned Areas.....	127
S2.7	Inspections	127
S2.7.1	Inservice Inspections.....	127
S2.7.2	Inservice Inspection Documentation	128
S2.7.3	Inspection Intervals	128
S2.7.3.1	Initial Inspection.....	128
S2.7.3.2	Subsequent Inspections.....	129
S2.8	Safety Devices — General Requirements.....	129
S2.8.1	Safety Valves.....	129
S2.8.2	Gage Glass	130
S2.8.3	Try-Cocks	131
S2.8.4	Fusible Plug.....	131
S2.8.5	Pressure Gage	131
S2.9	Appurtenances – Piping, Fittings, and Valves	132
S2.9.1	Piping, Fittings, and Valve Replacements.....	132
S2.10	Maximum Allowable Working Pressure (MAWP).....	132

S2.10.1	Strength	133
S2.10.2	Rivets and Rivet Heads	133
S2.10.2.1	Rivet Head Types	133
S2.10.2.2	Inspection of Corroded Rivets	134
S2.10.3	Cylindrical Components	135
S2.10.3.1	Cylindrical Components Under External Pressure	135
S2.10.4	Stayed Surfaces	154
S2.10.4.1	Staybolts	154
S2.10.4.2	Bulging	154
S2.10.5	Construction Code	163
S2.10.6	Nomenclature	163
S2.10.7	Limitations	164
S2.10.8	Boiler Insulation and Jacketing	164
S2.11	Boiler Inspection Guideline	164
S2.12	Initial Boiler Certification Report Form	169
S2.13	Guidelines for Historical Boiler Storage	169
S2.13.1	Storage Methods	169
S2.13.1.1	Wet Storage Method	170
S2.13.1.2	Dry Storage Method	170
S2.13.2	Recommended General Preservation Procedures	171
S2.13.3	Use of Compressed Air to Drain Historical Boiler Components	173
S2.13.4	Return to Service	173
S2.14	Safety Procedures	174
S2.14.1	Experience	174
S2.14.2	Stopping Engine in an Emergency	175
S2.14.3	Water Glass Breakage	175
S2.14.4	Runaway Engine and Governor Over Speed	176
S2.14.5	Killing a Fire	176
S2.14.6	Injector Problems	176
S2.14.7	Foaming or Priming Boiler	178
S2.14.8	Handhole Gasket Blows Out	178
S2.14.9	Tube Burst	178
S2.14.10	Leaking Valves	179
S2.14.11	Broken Pipes	179
S2.14.12	Safety Valve Problems	179
S2.14.13	Safety Valve Opens But Will Not Close	179
S2.14.14	Leaking Pipe Plugs	179
S2.14.15	Melted Grates	179
S2.14.16	Firing of Historical Boilers with Liquid or Gaseous Fuels	180
S2.15	Tables and Figures	180
Supplement 3	Inspection of Graphite Pressure Equipment	185
S3.1	Scope	185
S3.2	Application	185
S3.3	Operations	185
S3.4	Inservice Inspection	185
Supplement 4	Inspection of Fiber-Reinforced Thermosetting Plastic Pressure Equipment	187
S4.1	Scope	187
S4.2	Inservice Inspection	187
S4.3	General	187
S4.4	Visual Examination	188
S4.5	Inspector Qualifications	189
S4.6	Assessment of Installation	189
S4.6.1	Preparation	190
S4.6.2	Leakage	190
S4.6.3	Tools	190
S4.7	External Inspection	190
S4.7.1	Insulation or Other Coverings	190

S4.7.2	Exposed Surfaces	190
S4.7.3	Structural Attachments	191
S4.8	Internal Inspection	191
S4.8.1	General	191
S4.8.2	Specific Areas of Concern	192
S4.9	Inspection Frequency	192
S4.9.1	Newly Installed Equipment	192
S4.9.2	Previously Repaired or Altered Equipment	193
S4.10	Photographs of Typical Conditions	194
S4.11	Tables and Figures	209

Supplement 5 Inspection of Yankee Dryers (Rotating Cast-Iron Pressure Vessels) with Finished Shell Outer Surfaces

S5.1	Scope	210
S5.2	Assessment of Installation	210
S5.2.1	Determination of Allowable Operating Parameters	212
S5.2.2	Adjusting the Maximum Allowable Operating Parameters of the Yankee Dryer Due to a Reduction in Shell Thickness from Grinding or Machining	213
S5.2.3	Documentation of Shell Thickness and Adjusted Maximum Allowable Operating Parameters	213
S5.3	Causes of Deterioration and Damage	213
S5.3.1	Local Thinning	214
S5.3.2	Cracking	214
S5.3.2.1	Through Joints and Bolted Connections	215
S5.3.2.2	Through-Wall Leakage	215
S5.3.2.3	Impact From Objects Passing Through the Yankee/Pressure Roll Nip	215
S5.3.2.4	Stress Magnification Around Drilled Holes	215
S5.3.2.5	Thermal Stress and/or Micro-Structural Change From Excessive Local Heating and Cooling	216
S5.3.2.6	Joint Interface Corrosion	216
S5.3.2.7	Stress-Corrosion Cracking of Structural Bolts	216
S5.3.3	Corrosion	216
S5.4	Inspections	216
S5.5	Nondestructive Examination	217
S5.6	Pressure Testing	217
S5.7	Tables and Figures	218

Supplement 6 Continued Service and Inspection of DOT Transport Tanks

S6.1	Scope	219
S6.2	Terminology	219
S6.3	Administration	219
S6.4	Inspection	219
S6.4.1	Scope	219
S6.4.2	General Requirements for Inspectors	219
S6.4.3	Registration of Inspectors	220
S6.4.4	Qualifications of Inspectors	220
S6.4.5	Codes of Construction	221
S6.4.6	Inspector Duties for Continued Service Inspections	221
S6.4.6.1	Inspector Duties for Continued Service Inspection of Cargo Tanks	221
S6.4.6.2	Inspector Duties for Continued Service Inspection of Portable Tanks	222
S6.4.6.3	Inspector Duties for Continued Service Inspections of Ton Tanks	222
S6.4.7	Continued Service, Inspection for DOT Transport Tanks Scope	222
S6.4.7.1	Administration	222
S6.4.7.2	Inspection and Test Required Frequencies	223
S6.4.7.3	External Visual and Pressure Tests	223
S6.4.7.4	Leak Tightness Testing of Transport Tanks	223
S6.4.7.4.1	Cargo Tanks	223
S6.4.7.4.2	Portable Tanks	223
S6.4.7.4.3	Ton Tanks	223

S6.4.7.4.4	Leak Tightness Testing of Valves	224
S6.4.7.4.4.1	Cargo Tanks	224
S6.4.7.4.4.2	Portable Tanks.....	224
S6.4.7.4.4.3	Ton Tanks	224
S6.4.7.5	Leak Tightness Testing of Safety Relief Devices.....	224
S6.4.7.5.1	Cargo Tanks	224
S6.4.7.5.2	Portable Tanks.....	225
S6.4.7.5.3	Ton Tanks	225
S6.4.7.6	Testing of Miscellaneous Pressure Parts	225
S6.4.7.6.1	Cargo Tanks	225
S6.4.7.6.2	Portable Tanks.....	226
S6.4.7.6.3	Ton Tanks	226
S6.4.7.7	Acceptance Criteria	226
S6.4.7.8	Inspection Report	226
S6.4.7.8.1	Cargo Tanks	226
S6.4.7.8.2	Portable Tanks.....	226
S6.4.7.8.3	Ton Tanks	226
S6.5	Stamping and Record Requirements for DOT Transport Tanks in Continued Service	227
S6.5.1	General.....	227
S6.5.2	Stamping	227
S6.5.3	Owner or User Required Records For Cargo Tanks	228
S6.5.3.1	Reporting Requirements by the Owner or User of Tests and Inspections of DOT Specification Cargo Tanks.....	229
S6.5.3.2	DOT Marking Requirements for Tests and Inspections of DOT Specification Cargo Tanks	229
S6.5.4	Owner or User Required Records for Portable Tanks	230
S6.5.4.1	Reporting of Periodic and Intermediate Periodic Inspection and Tests of DOT Specification Portable Tanks.....	230
S6.5.4.2	Marking Requirements for Periodic and Intermediate Inspection and Tests for IM or UN Portable Tanks	230
S6.5.4.3	DOT Marking Requirements for Periodic and Intermediate Inspection and Tests of DOT Specification 51, 56, 57, or 60 Portable Tanks	231
S6.5.5	Owner or User Required Reports for DOT Specification 106A and DOT 110A Ton Tanks.....	231
S6.5.5.1	Reporting of Inspection and Tests for DOT Specification 106A and DOT 110A Ton Tanks	231
S6.5.5.2	DOT Marking Requirements for Tests and Inspection of DOT Specification 106A and 110A Ton Tanks	232
S6.6	Corrosion and Failure Mechanisms in Transport Tanks	232
S6.6.1	Scope	232
S6.6.2	General.....	232
S6.6.3	Internal and/or External Corrosion	233
S6.6.3.1	Types of Corrosion	233
S6.6.4	Failure Mechanisms	235
S6.7	Classification Boundaries	236
S6.8	Pressure, Temperature, and Capacity Requirements for Transport Tanks	236
S6.9	References to Other Codes and Standards	237
S6.10	Conclusion	238
S6.11	Personnel Safety and Inspection Activities	238
S6.12	Transport Tank Entry Requirements.....	238
S6.12.1	Pre-Inspection Activities	239
S6.12.2	Preparation for Internal Inspection	239
S6.12.3	Post-Inspection Activities	240
S6.13	Inspection and Tests of Cargo Tanks	240
S6.13.1	Visual External Inspection	242
S6.13.2	Inspection of Piping, Valves, and Manholes	244
S6.13.3	Inspection of Appurtenances and Structural Attachments	245
S6.13.4	Visual Internal Inspection	246

S6.13.5	Lining Inspections	247
S6.13.6	Pressure Tests	248
S6.13.6.1	Hydrostatic or Pneumatic Test Method	249
S6.13.6.2	Pressure Testing Insulated Cargo Tanks	250
S6.13.6.3	Pressure Testing Cargo Tanks Constructed of Quenched and Tempered Steels	250
S6.13.6.4	Pressure Testing Cargo Tanks Equipped with a Heating System	250
S6.13.6.5	Exceptions to Pressure Testing	251
S6.13.6.6	Acceptance Criteria	251
S6.13.6.7	Inspection Report	251
S6.13.7	Additional Requirements for MC 330 and MC 331 Cargo Tanks	252
S6.13.8	Certificates and Reports	253
S6.13.9	Leakage Test	253
S6.13.10	New or Replaced Delivery Hose Assemblies	256
S6.13.10.1	Thickness Testing	256
S6.13.10.2	Testing Criteria	256
S6.13.10.3	Thickness Requirements	257
S6.13.11	Cargo Tanks That No Longer Conform to the Minimum Thickness Requirements in NBIC Part 2, Tables S6.13.1-a and S6.13.1-b	257
S6.13.11.1	Minimum Thickness for 400 - Series Cargo Tanks	258
S6.13.11.2	DOT 406 Cargo Tanks	258
S6.13.11.3	DOT 407 Cargo Tanks	259
S6.13.11.4	DOT 412 Cargo Tanks	260
S6.14	Inspection and Tests of Portable Tanks	264
S6.14.1	Periodic Inspection and Test	265
S6.14.2	Intermediate Periodic Inspection and Test	265
S6.14.3	Internal and External Inspections	266
S6.14.4	Exceptional Inspection and Test	266
S6.14.5	Internal and External Inspection Procedure	267
S6.14.6	Pressure Test Procedures for Specification 51, 57, 60, IM or UN Portable Tanks	267
S6.14.6.1	Specification 57 Portable Tanks	268
S6.14.6.2	Specification 51 or 56 Portable Tanks	268
S6.14.6.3	Specification 60 Portable Tanks	269
S6.14.6.4	Specification IM or UN Portable Tanks	270
S6.14.7	Inspection and Test Markings for IM or UN Portable Tanks	271
S6.14.8	Inspection and Test Markings for Specification DOT 51, 56, 57, or 60	271
S6.14.9	Record Retention	272
S6.15	General Requirements for DOT Specification 106A and 110A Tank Cars (Ton Tanks)	272
S6.15.1	Special Provisions for Ton Tanks	272
S6.15.2	Visual Inspection of Ton Tanks	274
S6.15.3	Inspection and Tests of DOT Specification 106A and DOT Specification 110A Ton Tanks	275
S6.15.3.1	Air Tests	276
S6.15.3.2	Pressure Relief Device Testing	276
S6.15.3.3	Rupture Discs and Fusible Plugs	276
S6.15.3.4	Successful Completion of the Periodic Retesting	276
S6.15.3.5	Exemptions to Periodic Hydrostatic Retesting	276
S6.15.3.6	Record of Retest Inspection	277
S6.15.4	Stamping Requirements of DOT 106A and DOT 110A Ton Tanks	277
S6.16	Pressure Relief Devices	278
S6.16.1	Scope	278
S6.16.2	Safety Considerations	278
S6.16.3	Installation Provisions	278
S6.16.4	Pressure Relief Device Inspection	279
S6.16.5	Schedule of Inspections	279
S6.16.6	External Visual Inspection of Pressure Relief Devices	279
S6.16.7	Pressure Testing of Pressure Relief Valves	280
S6.16.8	Correction of Defects	280
S6.16.9	Inspection of Rupture Disks and Non-Reclosing Devices	281