

•TABLE OF CONTENTS

VOL I (CHAPTERS 1-5)

1.0 INTRODUCTION 1

Learning Objectives

1.1_ Overview of Course..... 1

1.2 Human Factors.....2

1.2.1 Examiner Errors.....2

1.2.1.1 Technique Errors 2

1.2.1.2 Inadvertent Errors 3

1.2.1.3 Procedural Errors 4

1.2.1.4 Conscious Errors..... 4

1.2.2 Environmental5

2.0 PERSONNEL QUALIFICATION AND CERTIFICATION 1

Learning Objectives

2.1 Qualification vs. Certification 1

2.2 Employer-Based Certification vs. Centralized Certification..... 1

2.3 Employer-Based Certification 2

2.3.1 SNT-TC-1A..... 2

2.3.1.1 Benefits of SNT-TC-1A 3

2.3.1.2 Limitations of SNT-TC-1A 4

2.3.1.3 Terminology 6

2.3.2 ASNT Certification Standard (ANSI/ASNT CP-189)..... 7

2.3.3 Qualification of Personnel for Visual Examination 8

2.3.4 Qualification Requirements for Ultrasonic Examination Personnel 9

2.4 ISO 9712 Central Certification..... 9

2.4.1 Term of Certification 10

2.4.2 Renewal 11

2.4.3 Recertification 11

2.5 ASNT Central Certification Program (ACCP)..... 11

2.6 AWS Certification of Welding Inspectors (CWI) 11

2.7 Supplemental Qualification Requirements 12

3.0 CLASSIFICATION AND INTERPRETATION OF INDICATIONS 1

Learning Objectives

3.1 Indications 1

3.2 False Indications 1

3.2.1 Penetrant Examination..... 1

3.2.2 Magnetic Particle Examination2

3.2.3 Radiographic Examination2

3.2.4 Ultrasonic/Eddy Current Examination2

3.2.5 Summary of False Indications2

3.3 Nonrelevant Indications.....2

 3.3.1 Penetrant Examination.....3

 3.3.2 Magnetic Particle Examination3

 3.3.3 Radiographic Examination4

 3.3.4 Ultrasonic Examination4

 3.3.5 Eddy Current Examination4

 3.3.6 Summary of Nonrelevant Indications.....5

3.4 True Discontinuities5

 3.4.1 Inherent Discontinuities..... 5

 3.4.1.1 Inclusions..... 5

 3.4.1.2 Laminations 5

 3.4.1.3 Pipe 5

 3.4.1.4 Seams..... 5

 3.4.2 Primary Processing Discontinuities..... 5

 3.4.2.1 Casting..... 6

3.4.2.1.1	Casting Processes	6
3.4.2.1.2	Casting Discontinuities.....	7
3.4.2.2	Forging.....	9
3.4.2.2.1	Forging Processes	9
3.4.2.2.2	Forging Discontinuities	9
3.4.2.3	Rolling	10
3.4.2.3.1	Rolling Process	10
3.4.2.3.2	Rolling Discontinuities	10
3.4.2.4	Extruding	10
3.4.3	Secondary Processing Discontinuities.....	10
3.4.3.1	Tears (Machining)	11
3.4.3.2	Heat Treating Cracks	11
3.4.3.3	Grinding Cracks.....	11
3.4.3.4	Forming Cracks	11
3.4.4	Service Discontinuities	11
3.4.4.1	Corrosion	11
3.4.4.2	Stress Corrosion.....	11
3.4.4.3	Microbiological Corrosion	12
3.4.4.4	Intergranular Corrosion	12
3.4.4.5	Fatigue	12
3.4.4.6	Wear.....	12
3.4.5	Weld Discontinuities	13
3.4.5.1	Cracks	13
3.4.5.2	Longitudinal Cracks	13
3.4.5.3	Transverse Cracks.....	14
3.4.5.4	Crater Cracks	14
3.4.5.5	Porosity.....	14
3.4.5.6	Inclusions.....	14
3.4.5.7	Undercut	15

3.4.5.8	Burn Through	15
3.4.5.9	Concavity.....	15
3.5	Summary of True Discontinuities.....	15
3.5.1	Defects	15
3.5.2	Repair Considerations.....	15
3.6	Interpretation Summary.....	16
4.0	INTRODUCTION TO VISUAL EXAMINATION.....	1
Learning Objectives		
4.1	History	1
4.2	Personnel Qualification and Certification	1
4.2.1	Visual Acuity.....	2
4.2.2	Equipment.....	2
4.2.3	Experience and Training.....	2
4.2.4	Procedures.....	3
4.2.5	Certification	3
4.3	Principles of Visual Testing	4
4.3.1	Applications	4

4.3.2	Visual Factors.....	5
4.3.3	Human Eye	5
4.3.3.1	Refractivity	6
4.3.3.2	Distance Judgment.....	6
4.3.3.3	Mechanism of Vision.....	7
4.3.3.4	Light Receptors.....	7
4.3.4	Color and Color Vision.....	7
4.3.4.1	Color Characteristics	7
4.3.4.2	Brightness Characteristics	8
4.3.4.3	Spectrum Limits of Visibility	8
4.3.4.4	Color Changes	8
4.3.5	Observer Differences	9
4.3.6	Lighting	9
4.3.7	Specific Lighting Devices	10
4.4	Imaging Equipment	10
4.4.1	Mirrors	10
4.4.2	Magnification.....	10
4.4.2.1	Focal Length.....	11
4.4.2.2	Magnifying Devices	11
4.4.3	Borescopes and Fiberscopes.....	12
4.4.3.1	Borescopes.....	12
4.4.3.2	Fiberscopes	13

4.4.4	Electronic Imaging	13
4.4.4.1	Closed Circuit Television	13
4.4.4.2	Cathode-ray Tube (Viewing).....	13
4.4.4.3	Digital Imaging.....	14
4.4.5	Photographic Techniques	15
4.4.5.1	Depth of Field.....	15
4.4.5.2	Lighting	16
4.4.5.3	Film.....	16
4.5 Measuring Equipment 16		
4.5.1	Linear Scales.....	17
4.5.2	Steel Rules	16
4.5.3	The Vernier Scale	17
4.5.4	Vernier Calipers.....	17
4.5.5	Dial Calipers	18
4.5.6	Micrometer	18
4.5.7	Micrometer Depth Gages.....	18
4.5.8	Dial Indicator	18
4.5.9	Balanced Dials	18
4.5.10	Combination Square Set	19
4.5.11	Thread Pitch Gages.....	19

4.5.12 Thickness Gages	19
4.5.13 Levels	19
4.6 Visual Examination of Welds.....	19
4.6.1 Prior to Welding	19
4.6.2 During Welding	20
4.6.3 After Welding.....	20
4.6.4 Weld Examination Gages	20
4.6.4.1 Fillet Weld Gage.....	20
4.6.4.2 Multipurpose Gage	21
4.6.4.3 Taper Gage	21
4.6.4.4 Hi-Lo Gage	21
4.6.4.5 Ferrite Gages.....	21
4.7 Remote Visual Inspection (RVI)	21
4.7.1 Fiberoptic Borescopes, Fiberscopes, and Videoimagescopes	21
4.7.2 Liquid Penetrant Examinations Combined with RVI.....	22
4.7.3 Magnetic Particle Examinations Combined with RVI	23
4.7.4 Ultrasonic Examinations Combined with RVI.....	23
4.7.5 Eddy Current Examinations Combined with RVI.....	23

4.8 Specific Applications for Power Generation 24

 4.8.1 Steam Turbines 24

 4.8.2 Surface Condensers and Heat Exchangers 24

4.9 Visual Examination Code Requirements..... 25

 4.9.1 ASME-Section V 25

 4.9.2 ASME-Section XI..... 25

 4.9.2.1 Supplemental Qualifications of
 Examination Personnel 26

 4.9.3 AWS Certified Welding Inspector 27

4.10 Records27

4.11 Advantages and Limitations of Visual Testing 27

 4.11.1 Advantages 27

 4.11.2 Limitations..... 28

5.0 INTRODUCTION TO RADIOGRAPHIC EXAMINATION 1

Learning Objectives

 5.1 History 1

 5.2 Personnel Qualification and Certification 2

5.3 Principles	3
5.3.1 Characteristics of Matter	4
5.3.1.1 Atomic Weight	4
5.3.1.2 Atomic Number	5
5.3.1.3 Electron Configuration	5
5.3.2 Radiation Theory	5
5.3.2.1 Radiation Characteristics	5
5.3.2.2 Interaction with Matter	6
5.3.2.3 Radiation Measurement	9
5.3.3 Radioactive Isotopes	10
5.3.3.1 Characteristics of an Isotope	10
5.3.3.2 Production of Radioactive Isotopes	11
5.3.3.3 Radioactive Decay	11
5.3.4 Generation of X-rays	12
5.3.4.1 Theory of Generation	12
5.3.4.2 X-ray Spectrum	12
5.3.4.3 Milliamperes-Time or Exposure	13
5.3.4.4 Effective vs. Actual Focal Spot Size	13
5.3.5 Geometric Factors	13
5.3.5.1 Definition	14
5.3.5.2 Contrast	15
5.3.6 Exposure Considerations	16
5.3.6.1 Inverse Square Law	17
5.3.6.2 Reciprocity Law	18
5.3.6.3 Film Density	18

5.3.6.4 Film Characteristic Curves 18

5.3.6.5 Exposure vs. Density 19

5.3.6.6 Gamma Ray Exposure 19

5.4 Equipment 19

5.4.1 X-ray Machines 19

5.4.2 Isotope Exposure Devices 20

5.4.3 Radiographic Film 21

5.4.3.1 Composition..... 21

5.4.3.2 Lead Screens..... 21

5.4.4 Film Processing 21

5.4.4.1 Manual System 22

5.4.4.2 Automatic System..... 22

5.5 Techniques..... 22

5.5.1 Single Wall Exposure/Single Wall Viewing 22

5.5.2 Double Wall Exposure/Double Wall Viewing 23

5.5.3 Double Wall Exposure/Single Wall Viewing..... 23

5.5.4 Multiple Film Techniques 23

5.5.5 Coverage..... 23

5.5.6 Use of Blocks and Step Wedges..... 23

5.5.7 Penetrameter Placement 23

5.5.8	Structural Welds	24
5.6	Radiographic Quality.	24
5.6.1	Image Quality Indicators	24
5.6.1.1	.....Hole Type IQIs	24
5.6.1.2	..... Wire IQIs	24
5.6.1.3	.....Penetrameter Requirements.....	24
5.6.2	Density.....	25
5.6.3	Improper Use of Penetrameters	25
5.6.4	Radiographic Film Identification.....	25
5.7	Film Viewing Considerations	26
5.7.1	High Intensity Illuminators.....	26
5.7.1.1	..... Heat.....	27
5.7.1.2	..... Diffusion.....	27
5.7.1.3	..... Intensity Control	27
5.7.1.4	..... Masks.....	27
5.7.1.5	..... Precautions.....	27
5.7.1.6	..... Magnifiers.....	28
5.7.1.7	..... Other Viewing Accessories	28
5.8	Interpretation of Radiographs	28
5.8.1	False Indications (Artifacts)	28
5.8.2	Radiographic Image of Discontinuities	30

5.8.2.1	Weld Discontinuities	30
5.8.2.2	Casting Discontinuities.....	30
5.9	Code Considerations..	31
5.10	Safety Concerns...	32
5.11	Advantages and Limitations of Radiographic Examination.....	32
5.11.1	Advantages	32
5.11.2	Limitations.....	33

TABLE OF CONTENTS**VOL II (CHAPTERS 6-9)****6.0 INTRODUCTION TO LIQUID PENETRANT EXAMINATION 1**

Learning Objectives

6.1 History. 1

6.2 Personnel Qualification and Certification 1

6.3 Principles. 3

6.3.1 Capillary Action 3

6.3.2 Contact Angle 3

6.3.3 Contrast Ratio 3

6.4 Prerequisites. 4

6.5 Penetrant Materials 4

6.5.1 Precleaners 4

6.5.1.1 Selection of Cleaning Technique 4

6.5.1.2 Typical Cleaning Techniques 4

6.5.1.3 Cleaning Precautions 5

6.5.1.4 Drying Process 5

6.5.2 Penetrants 6

6.5.2.1 Penetrant Family 6

6.5.2.2 Technique Selection 6

6.5.3	Developers	6
6.5.3.1	..... Properties	6
6.5.3.2	Developer Types.....	7
6.6	Penetrant Techniques	7
6.6.1	Water Washable.....	7
6.6.1.1	Water Washable (Fluorescent)	8
6.6.1.2	Water Washable (Visible).....	8
6.6.2	Post Emulsifiable.....	9
6.6.2.1	Post Emulsifiable (Fluorescent).....	9
6.6.2.2	Post Emulsifiable (Visible).....	9
6.6.3	Solvent Removable.....	10
6.6.3.1	Solvent Removable (Fluorescent).....	10
6.6.3.2	Solvent Removable (Visible).....	11
6.6.4	Compatibility.....	11
6.7	Procedures	11
6.7.1	Penetrant Application	12
6.7.2	Penetrant Dwell Time.....	12
6.7.3	Removal of Excess Surface Penetrant.....	12
6.7.3.1	Method A (Water Washable).....	12
6.7.3.2	Method B (Lipophilic Emulsifier).....	12
6.7.3.3	Method D (Hydrophilic Emulsifier)	13
6.7.3.4	Method C (Solvents).....	13

6.7.4	Drying.....	14
6.7.5	Development.....	14
6.7.5.1	Dry Developer	14
6.7.5.2	Aqueous Wet Developer	14
6.7.5.3	Nonaqueous Wet Developer	14
6.7.6	Evaluation	15
6.7.7	Post Cleaning.....	15
6.8	Procedure Qualification.....	15
6.9	Nonstandard Temperatures.....	15
6.10	Control Panels.....	16
6.10.1	Limitation of Test Panels.....	16
6.11	Penetrant Systems.....	16
6.11.1	Precleaning Station.....	16
6.11.2	Penetrant Application Station.....	16
6.11.3	Penetrant Draining Station.....	16
6.11.4	Emulsifier Application Station.....	17
6.11.5	Washing or Rinsing Station.....	17

6.11.6	Developer Application Station	17
6.11.7	Drying Station.....	17
6.11.8	Examination Station	17
6.11.9	Post-cleaning Station	17
6.12	Portable Systems.. ..	17
6.12.1	Black Lights.....	18
6.13	Examination Procedure.....	18
6.13.1	Procedure Revision.....	18
6.14	Applications.....	19
6.14.1	Welds	19
6.14.2	Castings	19
6.14.3	Through Leaks	19
6.15	Unacceptable Techniques	19
6.16	Variables	19
6.17	Evaluation.....	20
6.17.1	Indications.	20
6.17.1.1	False Indications	20
6.17.1.2	Nonrelevant Indications.....	20
6.17.1.3	True Indications	20

6.17.2 Interpretation 21

 6.17.2.1 Visible Daylight Dye Penetrants..... 21

 6.17.2.2 Fluorescent Penetrants 21

6.17.3 Specific Types of Discontinuities..... 22

6.17.4 Discontinuity Indication Categories 22

6.18 Advantages and Limitations of Penetrant Examination 23

 6.18.1 Advantages 23

 6.18.2 Limitations..... 23

7.0 INTRODUCTION TO MAGNETIC PARTICLE EXAMINATION. 1

Learning Objectives

7.1 History. 1

7.2 Personnel Qualification and Certification 1

7.3 Principles. 2

 7.3.1 Key Terms..... 3

 7.3.2 Theory of Magnetism 4

 7.3.2.1 Horseshoe Magnet..... 4

 7.3.2.2 Bar Magnet 5

 7.3.2.3 Flux Line Characteristics..... 5

 7.3.2.4 Classification of Materials..... 5

 7.3.2.5 Molecular Theory 6

7.3.2.6	Leakage Fields	6
7.3.2.7	Hysteresis Loop	6
7.4	Producing Magnetic Fields	7
7.4.1	Induced Magnetic Fields	7
7.4.1.1	Permanent Magnets	7
7.4.1.2	Electromagnets	7
7.4.2	Circular Magnetization	7
7.4.2.1	Direct Magnetization	8
7.4.2.2	Indirect Magnetization	9
7.4.2.3	Equipment	9
7.4.2.4	Field Strength Calculations	9
7.4.2.5	Code Requirements - Circular	10
7.4.2.5.1	Direct Contact Technique (Head Shot)	10
7.4.2.5.2	Central Conductor	10
7.4.2.5.3	Prods	11
7.4.3	Longitudinal Magnetization	11
7.4.3.1	Coil Shot	12
7.4.3.2	Cable Wrap	12
7.4.3.3	Quick Break Technique	12
7.4.3.4	Equipment	13
7.4.3.5	Coil Field Strength Calculations	13
7.4.3.6	Code Requirements - Longitudinal	13
7.4.4	Field Direction	14
7.4.5	Multidirectional Magnetic Fields	14
7.4.6	Magnetizing Current	14

7.5 Techniques..... 16

 7.5.1 Continuous 16

 7.5.2 Residual 16

7.6 Magnetic Particles16

 7.6.1 Visible Particles - Wet..... 16

 7.6.2 Fluorescent Particles - Wet..... 16

 7.6.3 Advantages of Wet Particles..... 17

 7.6.4 Limitations of Wet Particles 17

 7.6.5 Dry Particles 17

 7.6.6 Advantages of Dry Particles 18

 7.6.7 Limitations of Dry Particles 18

 7.6.8 Particle Characteristics 18

 7.6.8.1 Wet Particle Concentration..... 18

 7.6.8.2 Particle Size 18

 7.6.8.3 Particles for Wet Suspension..... 18

 7.6.8.4 Particle Shape 19

 7.6.8.5 Magnetic Particle Properties..... 19

 7.6.8.6 Particle Mobility 19

7.7 Stationary Equipment	20
7.8 Portable Equipment	21
7.8.1 Yokes	21
7.8.1.1 Electro-Magnet Yoke	21
7.8.1.2 Permanent Magnet Yoke	21
7.8.2 Prods	21
7.8.2.1 Contact Prods.	21
7.8.2.2 Contact Clamps.	22
7.8.3 Coils	22
7.8.3.1 Hand-Held Coil.	22
7.8.3.2 Cable Wrap	22
7.9 Applications.	22
7.9.1 Solid Cylindrical Parts.	22
7.9.2 Hollow Cylindrical Parts	22
7.9.3 Welds	23
7.9.4 Castings	23
7.10 Demagnetization.	23
7.10.1 Principles of Demagnetization.	23
7.10.2 Measuring Residual Fields	25
7.11 Procedure Requirements.	25

7.12 Calibration.....25

 7.12.1 Frequency 25

 7.12.2 Tolerance 25

 7.12.3 Procedure 25

 7.12.4 Yoke Calibration..... 26

7.13 Surface Preparation 26

7.14 Magnetic Field Verification..... 26

7.15 Evaluation26

 7.15.1 Evaluation Terms..... 26

 7.15.1.1 Indications 26

 7.15.1.2 Nonrelevant Indications..... 27

 7.15.1.3 Interpretation of Nonrelevant Indications..... 28

 7.15.1.4 True Discontinuity Indications 28

 7.15.2 Evaluation Guide 28

7.16 Recording..... 29

7.17 Advantages and Limitations of Magnetic Particle Testing 29

 7.17.1 Advantages 29

 7.17.2 Limitations 29

8.0 INTRODUCTION TO ULTRASONIC EXAMINATION 1

Learning Objectives

8.1 History 1

8.2 Personnel Qualification and Certification 1

8.2.1 ASME Section V 1

8.2.2 ASME Section XI 2

8.3 Principles 4

8.3.1 Frequency 4

8.3.2 Velocity 4

8.3.3 Wavelength 5

8.3.4 Transmission/Reflection 5

8.3.5 Attenuation 6

8.3.6 Instrumentation and Control 6

8.3.7 Ultrasonic Wave Propagation 6

8.3.7.1 Acoustic Impedance 7

8.3.7.2 Reflection at Interfaces 8

8.3.7.3 Fresnel Zone 8

8.3.7.4 Fraunhofer Zone (Far Field) 9

8.3.7.5 Dead Zone 9

8.3.8	Refraction	9
8.3.8.1	Snell's Law	9
8.3.8.2	First and Second Critical Angles	10
8.3.9	Ultrasonic Examination Variables	11
8.3.9.1	Equipment	11
8.3.9.2	Transducers	12
8.3.9.3	Couplant	13
8.3.9.4	Scanning Techniques	13
8.3.9.5	Part Structure	13
8.3.9.6	Surface Condition	13
8.3.9.7	Part Geometry and Size	13
8.3.9.8	Discontinuity Type, Shape, and Orientation	14
8.4	Equipment	14
8.4.1	Ultrasonic Transducers	14
8.4.1.1	Types	14
8.4.1.2	Care of Transducers	14
8.4.2	Base Pulse-Echo Instrumentation	15
8.4.2.1	Time base	15
8.4.2.2	Clock	16
8.4.2.3	Pulse Repetition Rate	16
8.4.2.4	Pulser-Receiver	16
8.4.2.5	Basic Controls	16
8.4.2.6	Gates	17
8.5	Procedures	17
8.5.1	Application of the Various Wave Modes	18
8.5.1.1	Compressional Wave Applications	18

8.5.1.2	Shear Waves	18
8.5.1.3	Surface Waves	18
8.5.1.4	Lamb Waves	18
8.5.2	Immersion Testing.....	18
8.5.2.1	Immersion Tanks and System Components	18
8.5.2.2	Immersion Transducers	19
8.5.3	Data Display	20
8.5.3.1	A-Scan.....	20
8.5.3.2	B-Scan.....	20
8.5.3.3	C-Scan.....	20
8.5.4	Calibration Techniques.....	21
8.5.4.1	Linearity.....	21
8.5.4.2	Distance Amplitude	22
8.5.4.3	Resolution.....	23
8.5.4.4	Beam Profile	23
8.5.4.5	Test Block Parameters	23
8.5.5	Unacceptable Techniques	23
8.5.5.1	Scanning Problems	23
8.5.5.2	Interpretation Shortcomings	23
8.5.5.3	Report Format Problems.....	23
8.6	Interpretation and Code Requirements	24
8.6.1	Weld Calibration Standards.....	24
8.6.2	Evaluation.....	25
8.6.2.1	False Indications	25
8.6.2.2	Nonrelevant Indications.....	25
8.6.2.3	Relevant Discontinuity Indications	25

8.6.3	Recording.....	26
8.6.3.1	Use of Examination Forms	26
8.6.3.2	Recording Techniques	26
8.7	Advantages and Limitations of Ultrasonic Examination.....	26
8.7.1	Advantages	26
8.7.2	Limitations.....	26
9.0	INTRODUCTION TO EDDY CURRENT TESTING EXAMINATION.	1
Learning Objectives		
9.1	History.	1
9.2	Personnel Qualification and Certification.	2
9.3	Principles	3
9.3.1	Electromagnetic Induction	4
9.3.2	Eddy Current Characteristics	4
9.3.2.1	Material Properties	5
9.3.2.1.1	Conductivity	5
9.3.2.1.2	Permeability.....	6
9.3.2.1.3	Test Display of Material Property Variations.....	6
9.3.2.2	Frequency	6
9.3.2.3	Test Specimen Geometry.....	7
9.3.2.4	Coil Design.....	7
9.3.2.4.1	Coil Coupling (Lift-Off).....	7
9.3.2.4.2	Edge Effect	8

9.4 Equipment	8
9.4.1 System Components	8
9.4.2 Data/Displays	10
9.4.2.1 Lift-Off Curves	10
9.4.2.2 Conductivity Curve.....	10
9.4.2.3 Thickness Curves.....	10
9.4.2.4 Discontinuity Signal Display.....	11
9.4.3 Basic Coils	12
9.4.3.1 Surface Coils.....	12
9.4.3.2 Encircling Coils	12
9.4.3.3 Internal Coils	13
9.5 Techniques	13
9.5.1 Impedance Plane Fundamentals	13
9.5.2 Impedance Plane Response to Conductivity Variations.....	13
9.5.3 Sorting.....	14
9.5.4 Discontinuities.....	14
9.5.4.1 Discontinuity Location in Installed Nonferrous Steam Generator Heat Exchanger Tubing.....	14
9.5.4.2 Calibration Procedure	15
9.5.4.3 Probe Speed	16
9.5.5 Thickness	16
9.5.5.1 Location of Secondary Layer Corrosion or Cracking	16

9.5.6	Coatings	17
9.5.6.1	Variations in Thickness of Plating or Cladding.....	17
9.6	Interpretation and Code Requirements	17
9.6.1	Written Procedure.....	17
9.6.2	Description of Method.....	17
9.6.3	Reference Specimen	18
9.6.4	Equipment Qualification.....	18
9.6.5	Procedure Requirements.....	18
9.7	Advantages and Limitations of ET Examinations.....	18
9.7.1	Advantages	18
9.7.2	Limitations	18

*Tables and figures are listed in separate Table of Contents that are available for each chapter.