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Nondestructive Testing Technical Writing and NDT Procedure Development

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ASNT/NAS 410 Level III: IRRSP, RT, UT, ET, PT, MT & Nital Etch

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- Bob Conklin – ASNT Learn's Webinar Series Organizer
- Marybeth Miceli – Host Management of NDT Series Co-Sponsored by NDTMA
- Flynn Spears – Host for the ASNT Innovation in NDT Series

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How do we bridge the Gap between Tribal knowledge and Documented Written Knowledge

Problem: Quality Assurance Professionals and Level IIIs are retiring and taking "Tribal knowledge" with them. We have an education Gap!

1. **Presentation Purpose:** To define and teach requirements for:
   a. NDT Procedures
   b. NDT Work Instructions
   c. NDT Technique sheets

2. **Ultimate Goal:** To teach NDT quality control requirements and improve company procedure implementation skills to the next generation of QA and NDT professionals

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Why do you need to learn "HOW" to develop your own technical documents?

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COPYRIGHT LAWS

Copyright is a form of intellectual property law, protects original works of authorship including NDT authored documents,

It is important to develop your own work and shall not duplicate other work

If you use other resources: CITE the source

The difference between Forgery & Plagiarism?

Answer: Quality Assurance and NDT Personnel signatures / stamps are required on company and industry documents. Authenticity is imperative.

Preventing Forgery: To protect your signature

Definition: the action of forging or producing a copy of a document or signature. Also, the crime of falsely and fraudulently making or altering a document

Preventing Plagiarism: To Protect intellectual Property.

Definition: the practice of taking someone else's work or ideas (i.e. technical documents) and passing them off as one's own.

Discussion #1: NDT PROCEDURES

What are NDT Procedures and Why are they Important

Process vs Procedure: ISO 9001

A process is "something going on." It is a continuing natural or biological activity or function.

A process is a series of actions or operations. It is a continuous operation or treatment, especially in manufacturing – Example performing UT

A procedure is a particular way of accomplishing something.

This is also defined as a series of steps in a regular definite order; a traditional or established way of doing things. Basically, procedures are used for REPEATABILITY from one NDT Technician to the next!

https://asqasktheexperts.com/2012/03/19/iso-9001-procedure-vs-process-9/

General Requirements for Technical Procedures

Excerpt from www.asq.org: Writing ISO 9001:2015 Procedures

- In general, a procedure: should be structured to define its purpose or scope. If the procedure is intended to address an identified risk or opportunity, it should be stated.
- If appropriate, identify who, what, when, and how these activities will be conducted.
- Likewise, consider including specific references to customer, industry standards, and internal requirements that are being addressed in the procedure.
- References to any required specification should be included to ensure conformance and should also be a part of the procedure. For example, NDT procedures often reference acceptance criteria requirements in procedures

Why is implementing an approved written procedure important to you and to your company?

Writing ISO 9001:2015 Procedures

Discussion #2:

Implementing Standards, Codes & Specifications

History of NDT Standards and Codes

- NDT was born out of the Military world to assess Quality Control in Aerospace, due to NDT's ability to check metal alloys and non-metals.
  Mil-Specs / Mil-Stds evolved into "ASTM" requirements
- NDT was quickly adopted in other transport sectors such as ship building, submarine, and automotive for both in the military and private sectors.
- For structures such as buildings, bridges, petrochemical, power plants, etc.
  Mil-Specs evolved into "CODE" requirements and are related to ASTMs

http://focusonndt.com/about-us/history/

Designation: E2033 – 17

Snip from: www.astm.org

Standard Practice for Radiographic Examination Using Computed Radiography (Photostimulable Luminescence Method)[1]

This standard is issued under the fixed designation E2033; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice establishes the minimum requirements for computed radiographic (CR) examination for metallic and nonmetallic materials using X-ray or gamma radiation.

1.2 *Applicability*—The requirements in this practice are intended to control the quality of computed radiographic examinations and are not intended to establish acceptance criteria for parts or materials.

Additionally, the user shall develop part specific inspection procedures (see subsections 5.5 and 7.5).

1.4 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Where applicable, SI units are shown in brackets [xx].

ASTM's for a Computed Radiography Procedure

ASTM E 1742

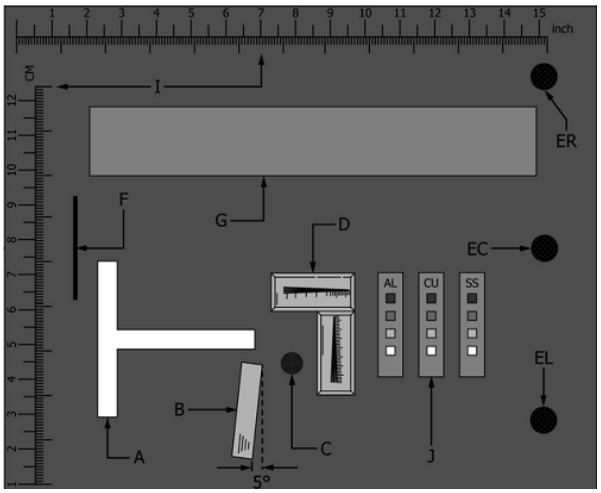
ASTM E 2033

ASTM E 2007

ASTM E 2445

ASTM E 2446

ASTM E 2339



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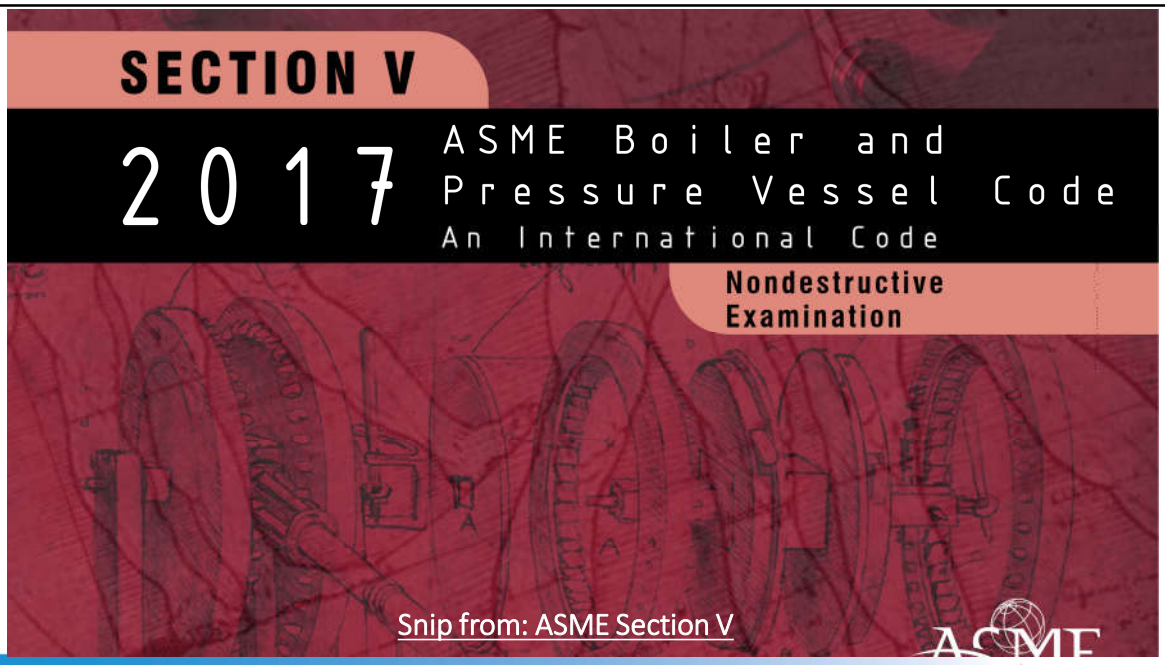

Snip from: ASME Section V

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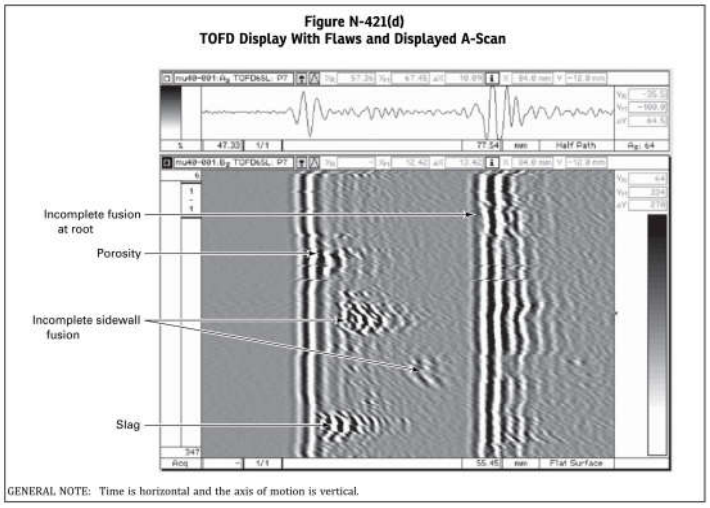
Example Section V - Articles for NDT

- Article 2 – RT
- Articles 4 to 5 – UT
- Article 6 – PT
- Articles 7 – MT
- Article 8 – ET
- Article 9 – VT
- Articles 10 to 33 – other methods & techniques



These Codes, Standards and Specifications require Procedures

Approved procedures are developed by the NDT Laboratory

Discussion #3: INTERPRETING REQUIREMNTS & DEVELOPING PROCEDURES

All Procedures are based on requirements

Internal Procedure Flow Down

Aerospace Industry

- Procedure: ASTM, Prime / Customer requirements and maybe acceptance criteria for the NDT method
- Work Instruction: component or process specific "how to" based on the NDT Procedure - Several pages
- Technique Sheet: part specific "how to" based on the NDT Procedure - one or two pages

Non-Aerospace – Code Industry

- Procedure: Applicable Code, manufacture / customer requirements and maybe acceptance criteria for the NDT method
- Work Instruction: component or process specific "how to" based on the NDT Procedure - Several pages
- Technique Sheet: part specific "how to" based on the NDT Procedure - one or two pages

Elements of a Procedure: Magnetic Particle

Basic Procedure: 20 to 40 pages

- Scope
- Reference Documents
- Qualification Requirements
- Materials and Equipment
- Magnetization Techniques
- Sequence and Inspection
- Accept / Reject
- Reporting and Records

Quality Control Requirements

- Formulas, Figures, Tables
- Forms: Technique Sheets
- Forms: Process Controls
- Equipment Calibration requirements

Example Procedure

Develop MT Procedure to meet ASTM & Customer requirements

TITLE: **NDT Procedure for Magnetic Particle Inspection, Stationary and Portable**			
EFFECTIVE: **December 1, 2013**	NO: **MP-03-MT**	REVISION: **0**	PAGE: **1 of 54**

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Elements of NDT Work Instructions

Prepared (Written) by a **Level II or III** in the Method and Approved by the company **Level III** in the method if required, by the customer or primary design authority.

The document is normally 4 to 12 pages and consists of:

Example, the ET Work Instructions describes ***component specific*** instructions outlining:

- This is a "How To": a mini-procedure with scope, references, qual & cert
- Part preparation, equipment and materials, calibration standards,
- Instrument settings, calibration parameters, screen responses,
- Inspection procedures, inspection area / part images, customer requirements,
- Evaluation, acceptance criteria, marking parts and inspection reports

- Example:
- NDT Company
- Component Specific
- Work Instruction

Company Logo
NDT Method
Work Instruction Number: Example ET -001

Company Information Here:

NDT Eddy Current Technique for

Prime / Customer

Component Part Number / Serial Number

Material Type

Stage of Manufacturing

Elements of NDT Technique Sheets

Prepared (Written) by a **Level II or III** in the Method and Approved by the company **Level III** in the method if required, by the customer or primary design authority.

The document is normally 1 to 2 pages and consists of:

Example, the Technique sheet describes ***part specific*** instructions outlining:

- Identification of the part, Part material/Alloy and the form/configuration, Part Condition (i.e.. Heat Treatment)
- Pre and Post part preparation
- A diagram including dimensions depicting the shot sequence and amperages
- Equipment used shot sequences, settings, materials, requirements
- Discontinuity Description, acceptance criteria, photos of parts

- Example 1:
- NDT Company
- Part Specific
- Technique Sheet

INPUT YOUR COMPANY INFORMATION Page 1 of 1

Part Number:		Process Spec:		Customer:		Tech No:	Rev
Part Name:		Acceptance Spec:		Prime:		Date:	
Material:		Dev. By:		Approved By:			
Material Cond:		Name:		Level III Name:			
Stage of Inspection:		Date Dev:		Date Approved:			

EQUIPMENT AND MATERIALS

Method:	☐	☐	☐ Fluorescent	☐
Current:	☐	☐	☐	
Machine Mfg & Model:		Demagnetizer Mfg & Model:		Demagnetizer Current:
Particle Type:		Vehicle:	Field Strength Verification:	Shot Duration:

DEVELOPMENT INFORMATION

Concentration:	Black Light Intensity:

PROCESS INFORMATION

Relevant Dim's:

Outside Diameters	Inside Diameters	Length	L/D Ratio
4.5"		31.5"	25 / 4.5 = 5.55

Pre-Clean Method:	Solvent	Post Clean Method:	Solvent

Seq	Head Shot Amperes	Field Direction	Central Conductor Amperes	Central Conductor Diameter	Conductor Rotations	Field Direction	Coil Shot Amps	Coil Shot Dia	Coil Shot Turns	Coil Locations	Field Direction	Gauss
1		↑ →			4 x 90°	↑ →					↑ →	37-51
2		↑ →		2"	4 x 90°	↑ →					↑ →	36-49
3		↑ →				↑ →					↑ →	39-52
4		↑ →				↑ →				bottom	↑ →	QQI

- Example 2:
- NDT Company
- Part Specific
- Technique Sheet

CR-001 COMPUTED RADIOGRAPHY TECHNIQUE SHEET
(Print on Letterhead)

Work Order Number / Router Number		Name of Item				Customer Name / Prime			Page: N/A of N/A		
X-ray Technique											
X-ray Mach. Mfg. & Number		Max. KV Rating			Material Type / Alloy	Customer Requirement / Specification/					
Eff. FS	IQI Type–	IQI Thick.	Number IQIs		Shims N/A	Specimen Thickness					
Quality Level N/A	Screen Front/Back N/A	PV (Pixel Value Range			Filter						
CR Acquisition Technique											
Scan Resolution (Microns)		Signal-to Noise Ratio:			Pixel Intensity	Gray Scale Pixel Value			Exp Room Recommended Ambient Temp		
Technique Parameters used for X-ray:											
SHOT No.	KV	M A	Exp. Time	Focal Spot (mm)	IP Type	IP Size	SDD (Inches)	Pre / Post Cu Filter	Angle	Remarks: See	
1										None	
2										None	

Level III Authority: the designated person who approves all NDT documents

Truly has the Power of the PEN!

Technical Writing Tips

Pare and Flourish: technical writing tips

Back to the Basics: Technical Writing Tips for Engineers (NDTers)

- Stay on Task – make an outline, note the headers, list main points
- Use Concise Wording – strike out *any* words that are not directly necessary
- Format Matters – bold section headers and sub-headers, use short paragraphs (4 sentences) and 1 FONT style, use bullets / numbers for lists,
- Always Edit – writing out loud to yourself or have others proofread

https://accendoreliability.com/technical-writing-tips-engineers/

Course Conclusion

Back to the Basics: Technical Writing Tips for Engineers (NDTers) cont'd

Summary: Even if you don't like to write documents, following these tips will make your documents look as professional as if you'd hired a writer.

- When you spend much of your time focused on your technical work, some communication skills may fall by the wayside.
- Improving your writing skills will make you an even more effective engineer, quality manager and NDT Level III.

https://accendoreliability.com/technical-writing-tips-engineers/

Questions and Answers Segment

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