**ABSTRACT**

This presentation is an attempt to briefly expain the terminologies used in Code and Standard. It is quite interesting and important to understand what is Code, Standard, Specification, Procedure, and Review? Without knowing the proper meaning and application of the terminologies used in Code and Standards, both the Written Practice and Written Procedure, and the subsequent implementation becomes meaningless.

The prime purpose and goal of doing NDT is to save human lives and prevent any industrial accident and disaster due to material product’s pre-mature failures. The broad areas and topics of NDT confined into two, one the equipments, test methods and the test results are related to Codes and Standards and the other part, the NDT personnel related to Training and Certification. NDT Training and Certifications are not a kind of any art of money making but more important to impart technical informations to the respective Level of qualification.

NDT is nothing but a Single Dimensional Measurement. For any measurement we need essential two things, one is the men - who involves in the measurements and the other is the instrument - using with the measurements have been made. The written document that governs the NDT personnel training and Qualification is ‘Written Practice’ and the those deals with the instruments and the test methods known as ‘Written Procedure.’ For NDT personnel, initial and periodic Vision and General written examination administered and for equipment part, initial and periodic calibrations are carried out.

**Keywords**: Codes and Standards, Written Practice, Written Procedure, Calibrations

**INTRODUCTION**

This paper comprises four sections. They are 1. Standard Developers (ASME); 2. Standards Guidelines (ASTM); 3. A forum for exchange of NDT technical information and qualification and certification of NDT personnel (ASNT) and 4. Standard Providers – the Accreditation body (ANSI).

**THEORY**

1. **AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)**

**Birth of codes, standards & safety**

A coal-burning furnace and boiler could heat the water; handmade items were replaced with manufactured items; human strength and horsepower were being replaced by machinery driven by STEAM POWER – steam engines, boilers.

**Because it’s a catastrophe when a screw doesn’t fit**

A consumer couldn’t buy a bolt in California and use it on a nut acquired in New Jersey because the threading didn’t match. So the 19th century engineers was facing several exploding boilers. Americans could not ignore the 50,000 dead and 2 million injured annually by such accidents, so ASME was founded in 1880.

**Objective of BPVC rules improving safety…**

To assure reasonably certain protection of life and property and to provide a margin for deterioration in service. Manufacturing in accordance with ASME BPVC provides with Sure Flow products of the highest QUALITY, RELIABILITY and INTEGRITY.

A Code is a ‘rule of law.’ and a standard, that has been adopted by one or more government bodies. BPVC is the largest ASME standard, both in size and in the number of volunteers involved in its preparation. At any one time there are more than 800
volunteers serving on one or more committees. ASME Coded
Designed vessels are heavier than all other Coded Designed
vessels, so no individual has the right to alter or violates its
content.

**ASME 1915 to 2011**

The first edition of the ASME BPVC, published in 1915; it
was ONE BOOK, 114 PAGES LONG. Now there are 32 books,
ASME SEC-I to SEC-XII runs into more than 16,000 PAGES.

A code comprises Sections; each Section contains Articles and
Articles contains Mandatory and Non Mandatory appendices.

**Mandatory means**

A set of rules formulated by the government that must be
incorporated into the codes and standards.

**CODE CASES**

Provide rules that permit the use of materials and alternative
methods of construction that are not covered by existing BPVC
rules.

2. **AMERICAN SOCIETY FOR TESTING AND
MATERIALS (ASTM):**

“Standards are a vehicle of communication for producers and
users,” runs from a few paragraphs to hundreds of pages, are
written by experts. Considered voluntary because they serve
as GUIDELINE, not having the force of law. Standards
establish size or shape or capacity of a product, process or
system. Ensure that a light bulb fit a socket and plugs for
electrical appliances fit outlets.

Proper usage of shall, should, may and will in ASTM
documents:

**SHALL:** indicates a provision is mandatory. **SHOULD:**
indicates a provision is not mandatory. **MAY:** indicates a
provision is optional. **WILL:** expresses futurity, but never
to indicate any degree of requirement.

Definition for terminologies used in ASTM standards:

**Standard GUIDE:** A guide is a document discuss without
technical background.

A series of options does not recommend a specific course of
action.

**Standard PRACTICE:** A practice is document discuss with
technical background. A definitive set of instructions for
performing one or more specific operations that **does not
produce a test result.**

**Standard SPECIFICATION:** In explicit set of requirements
to be satisfied by a material product, system or service. Standard
**TEST METHOD:** A definitive procedure that produces a test
result.

The ASTM Standards for Radiographic Testing are as follows:

- **SPECIFICATION:** E1390
- **TEST METHODS:** E1030, E1032
- **PRACTICES:** E1079, E1742
- **GUIDES:** E94

**ASTM Standards Assigned Numbers**

The ASTM standards are assigned numbers in the order that
they are developed. That is, when a new standard is
developed, it is assigned the next higher number than the
previous standard regardless of the subject matter. For
example, in Magnetic Particle Testing, the earliest edition
found for E-709 (Guide) is 1980 and the earliest edition for
E-1444 (Practices) is 1991, in between the time 735 other
standards were developed.

**Specification and Procedures:** Specification is Customer’s
written document and the details can be taken from different
codes and standards.

**How a procedure should be?** Procedures are the written
instructions to the field technician on the application of a
specific technique. It not a demonstration of the writer’s
knowledge of big words and do not submit hard-to-read. Do
not use twenty words when two will accomplish the task. It
written to ensure that the operator performs an examination
in a manner that allows for the detection of discontinuities
determined to be detrimental to product.

Procedures are essential for obtaining “Consistency” and
quality in “Repetitive Inspection” applications.

3. **AMERICAN SOCIETY FOR NON-
DESTRUCTIVE TESTING (ASNT)**

**ASNT SNT-TC-1A and its requirements:** SNT-TC-1A is
most widely used certification scheme in US than CP 189, that
is seldom used and most restrictive.

SNT-TC-1A, is a Recommended Practice. It contains guidelines
which the employer uses to create a Written Practice. The First
edition was published in 1966, in which only 3 terms were
defined & 5 methods. The 12th edition published in 2006, in
which 15 terms were defined & 13 methods. Each edition is
reviewed by a committee of volunteers of ASNT and is revised
as is seen necessary at the time. It is the only certification
document which has different NDT training times depending
on educational qualification.

A Written Practice is the Control and Administration of NDT
personnel. Written specifically for a company needs, it typically
consists of 10-25 pages. The facility to meet employer
requirements is **often abused.** This results certification
programs being lower in achievement than the intent.
For NDT personnel

Near vision Acuity (vision of objects nearby, generally within arm’s length.)

It is an important issue if you are viewing X-ray film or looking for a crack in a part held in your hands. Because eye cannot sharply focus an object if its nearer than 250 mm. Near vision – Jaeger # 1 (for VT & welding inspectors) / # 2 (for other NDT methods), test with a chart at not less than 12 inches or equivalent. The eye has a visual acuity threshold, it vary person to person, below which an object will go undetected.

Two eyes required for stereoscopic vision (depth perception), but NDT is a single dimensional measurement and the Jaeger Number 1 letters having a height of 1.6mm, so that the eye can detect the least detectable defect size 2mm without any vision aids as set by a standard, with at least one eye, either corrected or uncorrected.

For Measuring Instruments:

Calibration: The calibration of the equipment to ensure the accuracy and repeatability of the test. This is Initial and Periodic Calibration.

Basic definitions used in ASNT are defied as follows:

Quality It is “Conformance to specification.

Examination: Performs a Quality Control Function, then the Examiner physically perform and record the NDT results.

Inspection: Performs a Quality Assurance Function then an inspector has the right to audit any examination.

NDT ‘method’ - An overall concept of inspection, such as, Radiography Testing, Ultrasonic Testing and Liquid Penetrant Testing

NDT ‘Technique’ Defined as a “specific way of utilizing a particular NDT method”, such as - water washable and Fluorescent.

Each NDT method comprises a set of 5 basic elements. They are

1. BASIC PRINCIPLE
2. ARTIFICIAL DEFECT
3. PROBING MEDIA
4. TESTING MEDIA
5. RECORDING MEDIA

The artificial defect for Magnetic Particle Testing is Field Indicator; for Liquid Penetrant Testing is Aluminum Comparator Block; for Radiographic Testing is Penetrometer and for Ultrasonic Testing is V1 Block.

In NDT nothing to detect new, all are expected defects, that’s why from the known artificial defects to detect the unknown natural defects in parts under test.

ASNT NDT Level III certification

PSYCHOMETRICS: All ASNT examinations are developed using psychometric principles. It is the field of study concerned with the theory and technique of educational and psychological measurement. Which includes the measurements of knowledge, abilities, attitudes and personality traits.

CUT SCORE: Defined as the minimum score required to pass an exam. Cut score accurately distinguishes between adequate and inadequate performance. Must be high enough to protect the public but not so high as to unnecessarily screen out qualified examiners. An exam with more difficult questions should have a lower cut score than an exam with easier questions.

Angoff Procedure: In order to set an objective, criterion based passing score (a cut score) the Angoff procedure is followed in ASNT conducted exams. ASNT is accredited by the American National Standards Institute (ANSI) in accordance with the ISO 17024.

ASNT exams are standardized: The ASNT exams are standardized, i.e., all drawn from the same databanks, so that clients and customers know that ASNT certificate holders have taken exams that are much more equal in difficulty and content than exams given by employers.

ASNT certification an option: The SNT-TC-1A guidelines give Level III's a lot of responsibility and people wanted someone to offer standardized examinations since each employer’s tests were different from other employers’ tests. However, the volunteers that wrote SNT-TC-1A chose to make ASNT certification an option rather than requiring it.

All NDT Level III's must be certified under an employer’s written practice regardless of whether or not they hold an ASNT Level III certificate, in order to be compliant with the SNT-TC-1A guidelines.

ASNT LIII Requirement: Regarding the need for ASNT Level III certification, unless you are working to the ANSI/ASNT American National Standard CP-189 or to another code or standard that specifically requires an ASNT certificate, holding an ASNT Level III certificate is not required (CP-189 requires it).

CORPORATE vs. ASNT LIII: SNT-TC-1A guidelines give Level III's a lot of responsibility and people wanted someone to offer standardized examinations since each employer’s tests were different from other employers’ tests. However, the volunteers that wrote SNT-TC-1A chose to make ASNT certification an option rather than requiring it.

NDT Level III’s not ASNT Level III: A corporate NDT Level III can’t do is call himself an ASNT Level III if he has not passed ASNT examinations. Because some people mistakenly think that when they get certified in accordance with SNT-TC-1A they are “ASNT certified,” which is not the case.
4. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

Finally ANSI accredits ASME, ASTM and ASNT. In that way ANSI is a Standard Providers in order to managing the consensus standards development process in a fair and open manner. It does not develop standards; not a government agency.

ACKREDITATION:

‘The procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks.’

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