

Measurements, Fasteners & NDE

Five-Day Course Outline
(WEST DEC Facility, Brookshire, Texas)

Note: A Job Safety Analysis (JSA) will be presented before each lab exercise.

Section I - Introduction

A. Shop Safety

1. Fire awareness
2. Toolbox meetings (JSAs)
3. Awareness of potentially hazardous activities of other groups
4. Personal protective equipment
5. Trapped pressure
6. Compressed air
7. Security of equipment being worked on or mounted on work benches
8. Working under suspended loads
9. Load rating of lifting equipment
10. Rotating machinery
11. Hand tools and electric power tools
12. Chemical storage and identification
13. Tool care and maintenance
14. Housekeeping

B. Safety equipment required in the shop

1. Steel toed work boots
2. Safety glasses with side shields
3. Work gloves
4. Coveralls

Section II - Introduction to NDE

A. Liquid penetrant (PT) often referred to as dye penetrant or LPI

1. Color contrast using visible dye penetrants
 - a. Water washable
 - b. Solvent
2. Fluorescent penetrants with ultraviolet (UV) illumination

B. Magnetic Particle Inspection (MT) often referred to as MPI

1. Dry powder
2. Wet fluorescent with ultraviolet (UV) illumination
3. Color contrast

C. Ultrasonic (UT)

1. Flaw detection
2. Wall thickness

- D. Radiography, (RT) often referred to as X-ray
1. Gama ray
 2. X-ray
 3. Interpreting results
 4. Demonstration will include film
- E. Material Hardness
1. Brinell
 2. Rockwell
 3. Shore
 4. Durometer
- F. **Lab**
1. Students will perform a PT inspection using drilling hardware
 2. Students will perform a Magnetic Particle Inspection on drilling hardware
 3. Students will perform a UT inspection and measure wall thickness of drilling hardware
 4. Students will interpret information on X-Ray film of drilling hardware
 5. Students will perform and interpret both metal hardness and rubber hardness inspections.

Section III - Critical Measurements and Inspection Points

- A. Tools and techniques for measuring ram cavities and ram blocks
1. Measurement points
 2. How to use micrometers and calipers
 3. How to quantify the depth of scores and pits
 4. How to inspect for surface damage, flatness and wear
 5. How to generate an inspection report stating condition and acceptance criteria
- B. How to measure drilling riser choke and kill line piping
1. Measurement points – pin and box, wall thickness
 2. Surface finish
 3. Visual inspection, seals and seal grooves
 4. Wall thickness
 5. Tools and techniques
 6. How to generate an inspection report stating condition and acceptance criteria
- C. **Lab**
1. Students will perform a ram cavity and ram block visual and dimensional inspection and create a report.
 2. Student will perform a visual and dimensional inspection of kill and choke pin and box. Surface finish will be emphasized.



Instructor Ray Marek demonstrates a baseline ram cavity inspection on a ram BOP

Section IV - Fastener Selection and Maintenance

- A. Definitions and Terminology – The definitions of bolts, studs, screws, and other types of fasteners will be reviewed.
- B. Threads and Thread Measurement – The various types of threads, both English and metric, will be evaluated.
- C. Thread Repair – Various techniques for thread repair will be described.
- D. Torque – The concept of torque and the calculations associated with torque will be introduced.
- E. Torque Wrenches – The various types of torque wrenches will be evaluated.
- F. Bolt Failures – The various failure modes and fracture surface “signatures” will be described.
- G. Torquing Bolt Patterns – The proper technique for torquing bolts in a bolted pattern such as a flange joint will be described. The use of a hydraulic torque wrench to torque large, high strength bolts in a pattern will be evaluated in detail.
- H. **Lab**
 - 1. Students will be given a fastener and asked to identify it by type, grade, thread, and length.
 - 2. Students will be given a damaged fastener and asked to repair it (both internal and external threads)
 - 3. Students will be given a bolt and asked to look up the torque specification for it. They will then torque the bolt using the various types of torque wrenches discussed in class.
 - 4. Each student will place a bolt in a Skidmore-Wilhelm Torque Tester and observe the relationship of bolt torque to bolt preload as the bolt is torqued. They will do this for both lubricated and non-lubricated bolts.
 - 5. Using the Skidmore-Wilhelm Torque Tester, students will observe the effects on bolt pre-load as a bolt is torqued beyond its yield strength.
 - 6. Students will torque bolts to preset values on a bolted flange to understand the importance of bolt torquing patterns. A hydraulic torque wrench and riser flange will be used for this exercise.