NDT & QA IN PIPE MANUFACTURING

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ABSTRACT

• In every CANDU power station piping is an important part of the installation. In this presentation the welding and NDT methods to produce steel pipes will be reviewed.
• It will include ERW, spiral welded and LSAW welded manufacturing processes.
• The NDT using mostly ultrasonic methods start with plate inspection for laminations and defects, and then customized system applications for each of the above processes.
• These are multi-channel systems typically 160 to 400 channels for the plate UT and typically 8-20 channels for the ERW to spiral weld inspection.
• Sometimes the systems are combined to include a full body inspection of the manufactured pipe.
• In some cases X rays augment the UT testing.
PIPE MANUFACTURING

• Excluding seamless pipe, the process starts with plate or coil. Then, we have:

1. ERW (Electro Resistance Weld) Pipes;
2. Spiral Welded Pipes;
3. LSAW Pipes.
APPLICABLE STANDARDS

- ANSI/AWWA
- API 5L
- ASTM A 53
- DIN 2440
- BS 1387
- SEP 1916/1917/1925
- Company Specifications such as:
  - Shell
  - Aramco (Saudi)
160 CHANNEL PLATE UT SYSTEM
DETAIL OF EDGE FOLLOWING PROBES
ERW WELD AND FULL BODY TESTING
PROBE ARRANGEMENT
SAW PIPE UT SYSTEM
CALIBRATION DEFECT GEOMETRY

B (Buttress) Notch

V10 Notch

Area of each side: 0.006 sq. in. (3.57 mm²) max.
P (Parallel Sided) Notch

Drilled Hole

N5 and N10 Notch

N5 Depth
5% t ± 15%
With min. of 0.012 ± 0.002 in.
(0.3 ± 0.05 mm)

N10 Depth
10% t ± 15%
With min. of 0.012 ± 0.002 in.
(0.3 ± 0.05 mm)

Length
For Eddy Current: 1.5 in. (38 mm) max. Total length
For Diverted Flux: And Ultrasonic: 2 in. (50 mm) max. At full depth
REFERENCE STANDARD FOR ULTRASONIC TESTING OF SPIRAL WELD SEAM

1, 2 = Longitudinal inside notch at weld seam edge
3, 4 = Longitudinal outside notch at weld seam edge
5 = Transverse inside notch across weld
6 = Transverse outside notch across weld
7 = Longitudinal inside notch at weld seam center
8 = Longitudinal outside notch at weld seam center
9 = 1.6mm dia. hole through thickness.
TRANSDUCER CONFIGURATION

- Longitudinal Defect Detection
- Transverse Defect Detection
- Defect Detection in the HAZ
- Full Body Inspection (20% Coverage)
CABIN VIEW OF PROBE CLUSTER
LASER SEAM TRACKER CAMERA
SEAM TRACKER DISPLAY
STANDARDIZATION REPORT

Equipment: TSI Canada
Pipe Size: 273.10MMX6.40MM
Customer: H.P.C.L MUMBAI...
Pipe No.: 9130029
P.O. No., W.O.No.: 9000964-4Q-10902
Specification: API X-60-B
Date: 6/10/2009 15:24
Shift: A, 6/10/2009
Procedure No.: Procedure Num
Transducer: Angle: 60
Size: 1-100mm, 1-10mm
Sweep Range: Sweep Range 1-100mm, T.D.: W-Reverse B-Forward
Test Coverage: WELD HAZ 20% BODY (Min.)
Reference Standard: N10 Notch ([B&OD) AT WELD 6 35X1.2 BEH with side weld 3mm x 1/2 T PB3 circumferentially for body
Frequency: 4 MHz
Complaint: Water / Oil / Glycerin
Calibration Block: HWV2 Block & Step Block

REPORTING
CONCLUSION

• The automated UT systems are capital intense, but they perform reliable ultrasonic inspection for improved quality, reliability and environmental safety of pipelines.