

MSS GUIDED WAVE TESTING REPORT

Client: Husky Energy

Glycol Heater 5.5 O.D. coil, S.N. 99160



Job No. 18-393

June 20, 2018

Issued By:

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1 INTRODUCTION

The MsS technology is designed to inspect a structure by using ultrasonic guided waves that are generated with Magnetostrictive Sensor (MsS) probe. The Magnetostrictive Sensor (MsS) generates and detects ultrasonic guided waves electromagnetically in the material being tested. It utilizes the magnetostrictive effect to generate ultrasonic waves. This effect is the small change in the physical dimensions of ferromagnetic material when an external magnetic field is applied to it. The MsS utilizes the inverse magnetostrictive effect to detect the generated waves. This effect is the change in the magnetic induction of ferromagnetic material caused by propagating ultrasonic waves. Since the sensor relies on the magnetostrictive effect, it is called a Magnetostrictive Sensor (MsS).

Guided waves are structure-borne elastic waves propagating along the length of pipe. They are guided by and confined within the inner or outer diameter of pipe. Since the wave is guided by the pipe boundary, the propagating wave should satisfy the boundary condition of pipe. These unique features make guided waves a very capable tool in long-range piping inspection from a single test location.

The pipeline has three wave modes: torsional (T), longitudinal (L), and flexural (F). The velocities of the L- and F-waves vary significantly with wave frequency and therefore the waves are dispersive. The velocity of the T(0,1) wave, however, is constant (that is, equal to the shear wave velocity of the pipe material) and therefore independent of frequency. The fundamental T-wave is superior to the L- and F-waves in application of long-range pipeline inspection because of the following reasons:

- 1) The T-wave is dispersion-free; therefore, any wave frequency can be used for long-range pipe inspection
- 2) The T- wave does not interact with water or liquid due to its shear particle motion
- 3) The T-wave has a lower velocity than that of the L-wave so the T-wave has better sensitivity in defect detection at the same operating frequency

Even though MsS probe can operate L-wave in non-dispersive region, we utilize the fundamental T-wave for pipeline inspection and monitoring with these merits of operation.

MsS guided wave is intended to inspect for and detect volumetric wall loss within piping structures. It is not intended, nor can it, detect weld defects. Guided wave testing cannot distinguish internal from external wall loss. It simply detects overall volumetric cross sectional wall loss. Follow up visual and UT inspection are carried out on all suspect areas as accessible to determine the nature, location, and extent of all detected indications.

All calibrations are conducted after scans have been collected. Distance calibration is completed by entering known location of or known distances between major reflectors / MsS probe install locations. Distance amplitude correction and calibration is completed using reflectors of known signal amplitude (welds). Weld signal amplitude is a function of weld size and height correlated to probe center frequency.

A system calibration of this Guided Wave Unit S/N E10C was conducted by MsS Guided Wave Analysis on January, 2018. The expiration date is January, 2019..

2 INSPECTION SCOPE

A Guided Wave inspection was conducted on the Glycol Heater coil as directed by the client. The coil tested was a bended 5.5 O.D. pipe in the glycol heater.

The piping examined is above ground steel lines on steel pipe support pads. This piping is not internally coated. The pipe was bare metal and was found to be in acceptable condition at the sensor location. A Zero Degree UT scan was conducted at the MsS probe install location to inspect pipe condition at attachment points / probe dead zone. A total of 1 Guided Wave test locations were inspected covering approximately 60 feet.

Note: The symbols x and y on the attached Mss Guide wave reports represent directionality. The nominal pipe thickness was assumed through Zero Degree UT thickness readings.

SUMMARY OF RESULTS:

- Glycol Heater coil, S.N. 99160

No indication of wall loss found within the Guided wave scan. The scan shows one indication "Q1" which is assumed to be a pipe support wear pad.

FIGURE 1 MSS SCAN LOCATION(GUIDED WAVE SHOTS 1)



2.1 MSS GUIDED WAVE – SHOT 1



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5.5 coil tube ; glycol heater

MsS Guided Wave Testing Report

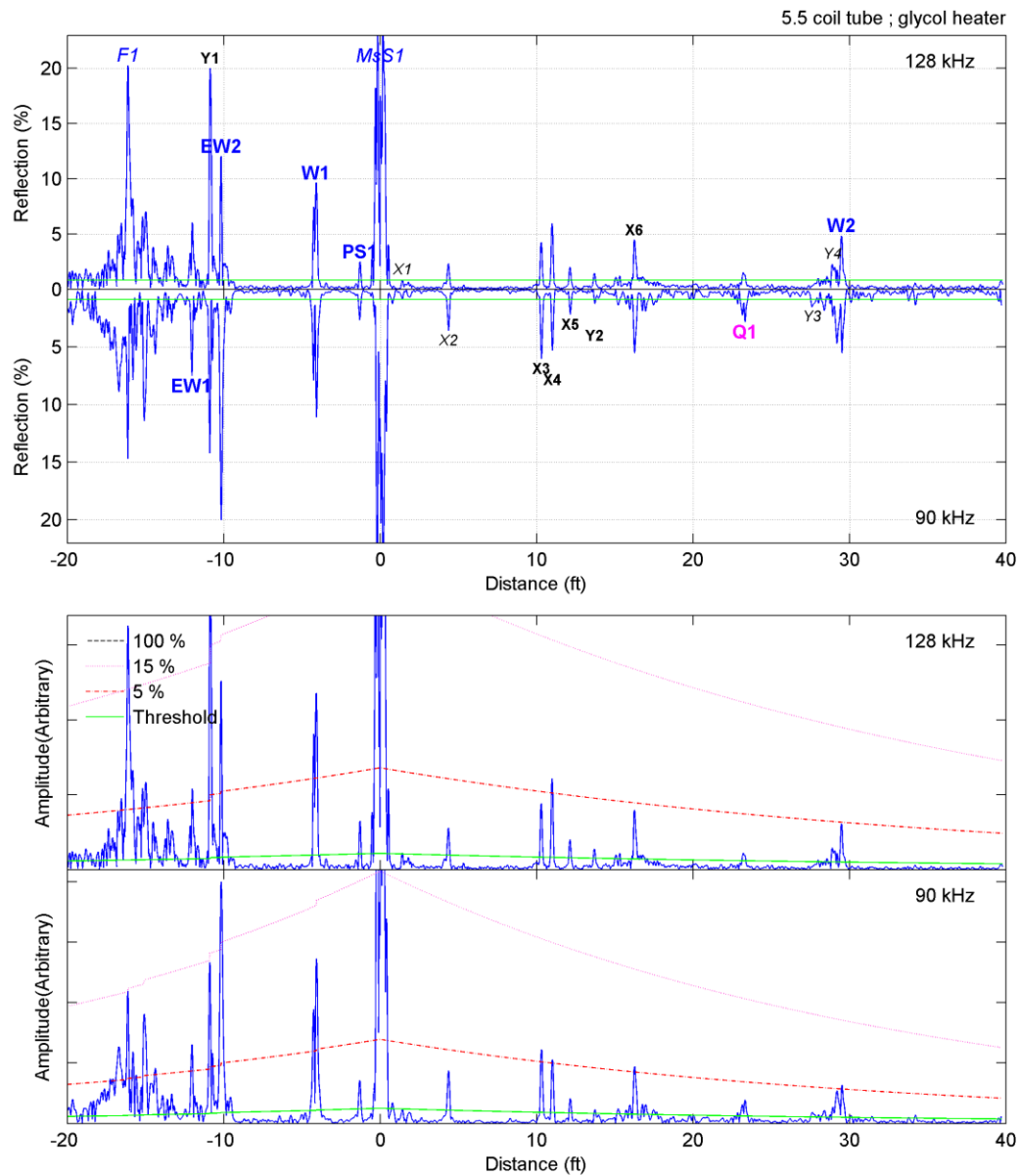
Site: ansel; Main Plant	Date: 18-Apr-2018
Pipe ID/Location: 5.5 coil tube ; glycol heater	GWT System: MsSR3030R E100
Pipe Size: 5.50-inch-OD, 0.300-inch-wall	Analysis S/W: MsSPipe-V3.00
Inspector: etienne legare	Wave Mode: Torsional Mode
Analyzer: etienne legare	Velocity: 128.00 inch/msec
Client: Husky	Refl. % Ref.: 1) Y1, 20.0%; 2) EW2, 20.0%
Procedure: GWA 1.01	Attenuation: 1) 0.113 dB/ft
Inspection Range: -20.0 to 40.0 ft	2) 0.131 dB/ft
Threshold Level: 1) 0.8%(-39.8 ~ 39.8)	
2) 0.9%(-39.7 ~ 39.7)	
Test Pipe: Aboveground; Bare; 20 C glycol-carrying pipe; 0.300, 0.300, 0.310, 0.305-inch wall; Supported with wear pads	
Note: this is a 5.5 coil tube in the glycol heater.	
Summary: No indication of wall loss found within the Guided Wave scan. Q1 could not be verified and is assumed to be a pipe support.	

Sym.	Dist.(ft)	% Refl.	Comment
F1	-16.12	20.3	Flange;
EW1	-12.04	7.5	Elbow Weld;
Y1	-10.86	20.0	Multiple Reflection; ;
EW2	-10.17	12.0	Elbow Weld;
W1	-4.09	9.6	Weld;
PS1	-1.29	2.5	Pipe Support;
MsS1	0.00	--	Initial Pulse;
X1	1.41	0.8	Directionality; ;
X2	4.37	3.6	Directionality; MsS-X =4.37; W1 (4.1, 1.41)
X3	10.32	6.0	Directionality; MsS-X =10.32; EW2 (10.2, 1.76)
X4	11.01	5.3	Directionality; MsS-X =11.01; Y1 (10.9, 2.23)
X5	12.15	2.2	Directionality; MsS-X =12.15; EW1 (12.0, 1.09)
Y2	13.73	1.2	Multiple Reflection; ;
X6	16.26	4.5	Directionality; ;
Q1	23.33	2.8	Indication;
Y3	27.61	1.5	Multiple Reflection; MsS-X =27.61; Q1-W1 (27.4, 0.22)
Y4	28.90	2.3	Multiple Reflection; ;
W2	29.49	4.8	Weld;



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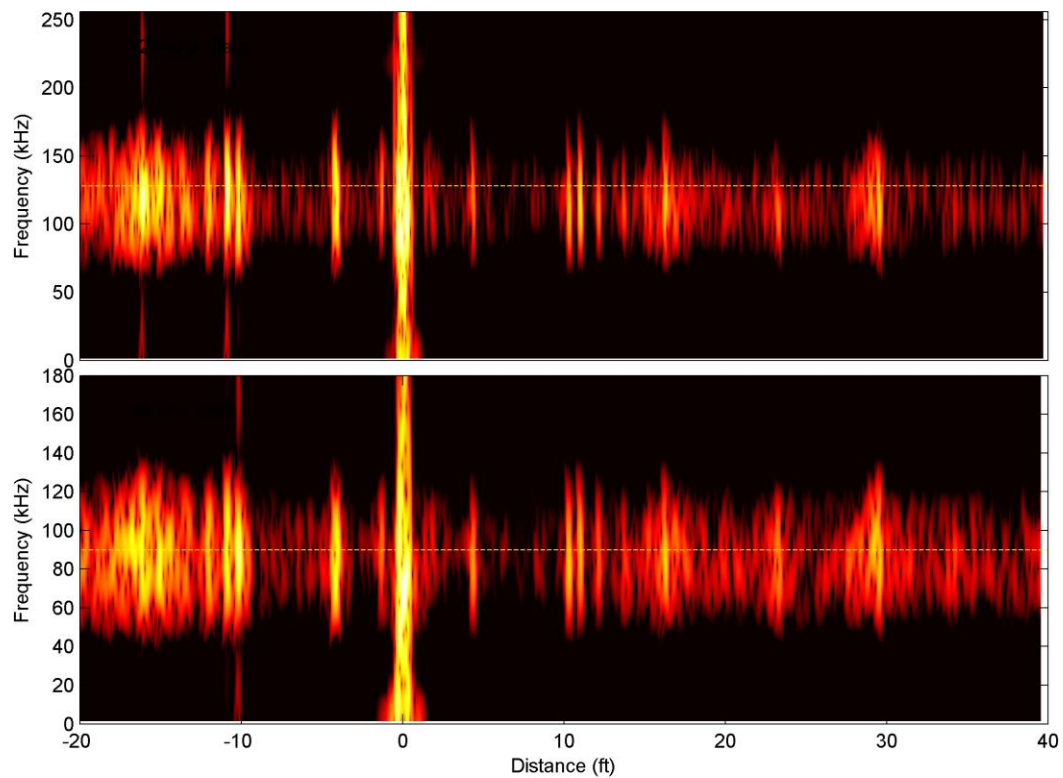
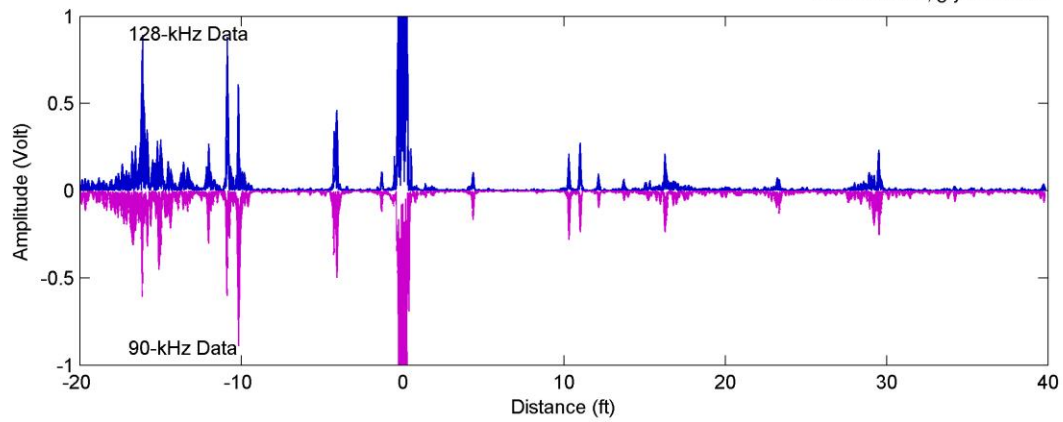




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5.5 coil tube ; glycol heater



2.2 –GUIDED WAVE CREW CERTIFICATIONS

	Name	Position	CGSB UT / MT / PT Certification	MsS Guided Wave Certification through SwRI	Signature
<input type="checkbox"/>	Curtis Graham	Senior Technician / Inspector	#6560 UTII/MTII/PTII/RTIII	11-133	<i>Curt</i>
<input type="checkbox"/>	Dave Skeard	Senior Technician / Inspector	#8101 UTII/MTII	29-126	<i>Dave Skeard</i>
<input checked="" type="checkbox"/>	Etienne Legare	NDE Technician	#22090 UTI		<i>Etienne Legare</i>
<input type="checkbox"/>			-		
<input type="checkbox"/>					
<input type="checkbox"/>					

UT Set: GE DMS Go SN 12116329. Cal Date 05-Jan-18

Cable: 6' Lemo to Micordot

Transducer: Dual, 0 deg, Longitudinal wave, 5MHz, 0.250", Stresstel, SN 14I0056H

Couplant: UTX

Cal. Block: 0.100" to 0.500" C/S Step SN 14-2022

Zero Degree UT Procedure: UT-1 Rev 0.0