

SCHEDULE 5**THE INSPECTION PERFORMANCE SPECIFICATION****1. Introduction**

The Contractor's Inspection Vehicles have been specifically designed to ensure high resolution inspection of the full circumferential extent of the Pipeline and the detection of metal loss occurrences therein.

Inspection data obtained during the Inspection Vehicle run(s) in the Pipeline is subjected to a two stage processing and analysis procedure.

During Stage 1, preliminary processing and analysis is performed using the Contractor's automatic data analysis facilities. All Metal Loss Features detected by the Inspection System irrespective of depth or surface dimension are automatically sized and are reported together with Pipeline Anomalies and Pipeline Fittings, in the Pipeline Summary Report detailed in Schedule 5. The analysis systems employed during this stage are specifically designed such that all Metal Loss Features which may be of concern to the integrity of the Pipeline are highlighted and are selected for more detailed processing and analysis, subject to the maximum number of Features specified in Schedule 5.

During Stage 2, the most significant Metal Loss Features identified in Stage 1 are selected using the priority rules detailed in Schedule 5, for more detailed processing and analysis and reported on Individual Inspection Sheets. Those Metal Loss Features that have undergone such detailed processing and analysis shall be sized to the accuracy detailed in section 4 below.

The Contractor's Inspection Vehicles together with the aforementioned data processing and analysis comprise the Contractor's Inspection System.

2. Detection Capability

The capability of the Contractor's Inspection System, which applies irrespective of the type of pipeline construction (i.e. seamless, seamwelded, spiral etc.), is such that the following types of feature present in the pipeline can be detected:

- (a) Metal loss
 - (i) associated with corrosion, including
 - such metal loss in the vicinity of girth welds
 - such metal loss associated with dents
 - such metal loss situated beneath casings
 - (ii) associated with gouging

All such metal loss of depth and surface dimension greater than the minimum required for accurate sizing as detailed in Table 1 shall be detected. Metal loss below such depth and surface dimension can be detected. However, the probability of detection is reduced as the depth and surface dimension of the feature is reduced.

- (b) Metal loss situated beneath repair clamps
- (c) Metal loss associated with manufacturing faults
- (d) Welds - girth, seam and spiral
- (e) Girth weld anomalies including circumferential cracks within girth welds

- (f) Dents
- (g) Manufacturing/mill type defects
- (h) Construction damage
- (i) Changes in nominal pipe wall thickness
- (j) Pipeline fixtures and fittings including:
 - (i) Tees
 - (ii) Offtakes
 - (iii) Valves
 - (iv) Bends
 - (v) Anodes
 - (vi) Buckle Arrestors
 - (vii) External Supports
 - (viii) Ground Anchors
 - (ix) Repair Shells
 - (x) CP Connections - ferro-magnetic type
- (k) Ferrous metal objects in close proximity to the pipeline considered likely to affect the carrier protective coating or cathodic protection system.
- (l) Casings, including eccentric casings where the degree of eccentricity is considered likely to affect the carrier protective coating or cathodic protection system.
- (m) Reference marker magnets

3. Location Accuracy

- 3.1 All those features detailed in section 2 detected by the Inspection System shall be located to the accuracy detailed in Table 1.

4. Sizing Accuracy

- 4.1 Those Metal Loss Features as detailed in section 2.(a) detected by the Inspection System and which have been selected for reporting on Individual Inspection Sheets shall subject to section 4.2, be sized to the accuracy detailed in Table 1 attached hereto.
- 4.2 It should be noted that the sizing accuracy is dependent upon several factors such as pipeline cleanliness, pipe construction methods, product flow conditions etc. These factors have been taken into account by the Contractor when designing the Inspection System. However it has been found impractical to compensate fully for the extremes which have been noticed in practice and as a result the accuracy with which Metal Loss Features can be detected and sized can vary from point to point along a pipeline. The Contractor's experience of operating on-line Inspection Systems show that the sizing accuracy detailed in Table 1 is attained for greater than 80% of Metal Loss Features reported.

TABLE 1 DETECTION, SIZING AND LOCATION ACCURACY (10/20)

	METAL LOSS CATEGORY		
	PITTING <(3t X 3t)*	GENERAL >(3t x 3t)*	GOUGING
Minimum Depth for Accurate Sizing	If surface dimension is > 0.275" x 0.275" <u>or</u> 0.4t x 0.4t (whichever greater): 0.2t	0.1t	If width > 0.5t or 0.275" (whichever greater): 0.2t If width > 3t: 0.1t
Sizing Accuracy (Depth)	±0.1t	±0.1t	±0.1t
Sizing Accuracy (Length)	±0.4"	±0.8"	±0.8"
Sizing Accuracy (Width)	±0.8"	±0.8"	±0.8"
Location Accuracy (Axial)	±8" between the feature and the reference girth weld and ±1% of stated distance between reference girth weld and identified location reference		
Location Accuracy (Circumferential)	±7.5 degrees which for ease of reference is stated to the nearest half hour clock position		

t = nominal wall thickness

* Metal loss is characterized by the minimum rectangle of dimensions, circumferential width (W) and axial length (L) that contains the surface area of pipe affected by metal loss.

Pipeline Anomalies (i.e. Dents, Weld Anomalies, Eccentric Casings, and Metal Objects) and Pipeline Fittings (i.e. Valves, Offtakes, etc.) shall also be located to the accuracy stated above.

Exhibit "E"

Performance and Operating Specifications

GE
Oil & Gas
PII Pipeline Solutions

Tool Data Sheet

30" UltraScan WM



Tool Configuration 24" -1, 1.5D

ILI Tool Dimensions	
Total Length	approx. 4850 mm
Weight	approx. 955 kg
Number of Modules	3

Capabilities of the Measurement System	
Number of Ultrasonic Sensors	304 (evenly distributed on the circumference)
Circumferential Sensor Spacing	7.8 mm (value refers to the nominal pipe diameter)
Longitudinal Sampling Distance	3.3 mm at 1 m/s
Defect Location Accuracy - Axial	±1% of distance to nearest marker; minimum value: ±1 m ±0.2 m to nearest girth weld
Defect Location Accuracy - Circumferential	±10°
Active Range	up to 210 km at 1 m/s; value depends on tool settings and refers to pipes with moderate surface roughness; idle times are not considered; battery life time: 272 hrs
Nominal Survey Speed Range	0 to 1 m/s for wall thickness up to 24 mm (for higher speed and/or thicker wall, changes of the tool's defect detection capabilities must be considered)

Necessary Pipeline Conditions	
Maximum Pressure	100 bar
Temperature Range (Standard Tool)	-10 to +60 °C (higher temperature on request)
Possible Pipeline Media	Most of the liquids transported in pipelines. Limitations refer to two-phase liquids, sour contents and liquefied gas - feasibility approval requires expert verification.
Tolerable Signal Attenuation	16 dB (value reflects the influence of the medium according to PII Standard Medium Test; higher values require expert verification)
Minimum Bend Radius	1.5D for 90° bends (D = nom. outer pipeline diameter)
Minimum ID in Straight Pipe	650 mm in round pipe, 630 mm in oval pipe (dent passing ability)
Minimum ID in bend	680 mm; critical gauge plate diameter: 680 mm
Nominal Wall Thickness Range	4.5 to 12 mm at 0.1 mm resolution (only with AEP) 4.5 to 24 mm at 0.2 mm resolution 4.5 to 45 mm at 0.4 mm resolution

Relevant Launcher and Receiver Dimensions	
<p>Receiver [mm]</p> <p>access area min length: 8400 min width: 2800</p> <p>trap overbore min length: 1000</p> <p>trap nominal min length: 1000</p> <p>trap nominal min length: 1000</p> <p>trap overbore min length: 1000</p> <p>access area min length: 8400 min width: 2800</p>	<p>Launcher [mm]</p> <p>access area min length: 8400 min width: 2800</p>
<p>Note: The values given are default values. In the case of small deviations, please contact the responsible GE Project Manager for individual solutions! GE reserves the right to introduce technical changes and modifications without prior notice.</p>	

Exhibit "E"

Performance and Operating Specifications

UltraScan[®] WM
Defect Detection Capabilities

No. ka-ce0001-12


 GE
 Oil & Gas
 PII Pipeline Solutions

General Inspection in 4.5 to 24 mm Wall Thickness Pipeline

(Depth Resolution: 0.2 mm)

	Cer- tainty	Pitting with diameter ≥10 mm (all pipe types)	Pitting with diameter ≥20 mm (all pipe types)	Extended Metal Loss	Axial Grooving	Circum- ferential Grooving	Lamination, manufacturing related or caused by HIC
Min. Depth at 90% POD		1.5 mm	1 mm	1 mm	1 mm	1 mm	1 mm
Depth Sizing Accuracy	80% 90%	Detection only	±0.4 mm ±0.5 mm	±0.4 mm ±0.5 mm	±0.4 mm ±0.5 mm	±0.4 mm ±0.5 mm	±0.4 mm ±0.5 mm
Width Sizing Accuracy	80% 90%	±10 mm ±12 mm	±10 mm ±12 mm	±10 mm ±12 mm	±10 mm ±12 mm	±10 mm ±12 mm	±10 mm ±12 mm
Length Sizing Accuracy	80% 90%	±5 mm ±6 mm	±5 mm ±6 mm	±5 mm or ±5% of length ±6 mm or ±6% of length	±5 mm or ±5% of length ±6 mm or ±6% of length	±5 mm ±6 mm	±5 mm or ±5% of length ±6 mm or ±6% of length

Note: POD = Probability of detection; POI = Probability of identification; all accuracies are only valid for nominal tool speeds.

Identification of Features:

YES POI > 90%	<ul style="list-style-type: none"> - int./ext. discrimination; - metal loss/corrosion; metal loss/corrosion cluster; artificial metal loss; manufacturing related metal loss (pipe mill anomaly); gouging; grinding; metal loss at/in welds and dents - thickness measurement of sound wall (a wall thickness reference value for each pipe joint is provided); wall thickness change (between two pipe joints); wall thickness variation (within a pipe joint) - dent/buckle/wrinkle (with local "steep" contour and 2 mm min. height) - lamination; inclusions; blister (with local "steep" contour and 2 mm min. height); spalling - debris (only its presence) - external support; ground anchor; pipeline fixture; crack arrestor; sleeve repair; patch (all if welded) - tee; valve; off-take/fitting (size ≥2"); anode/cp connection (size ≥2") - bend (≤5D, cold/field bends are reported on best endeavor) - diameter change; adjacent tapering 	<p>Metal Loss Feature Type Definition</p> <p>If nom. wt < 10 mm then A = 10 mm, else A = nom. wt.</p>
NO POI < 50%	<ul style="list-style-type: none"> - eccentric pipeline casing; composite sleeve repair (not welded); presence of touching metal to metal - SCC; arc strike; crack in base material or weld; anomaly in weld (if crack-like) - ovality - presence of weld deposit; presence of external coating - reference magnet 	
MAYBE POI ≤ 90% POI ≥ 50%	<ul style="list-style-type: none"> - anomaly in weld if with metal loss - off-take/fitting (size <2") - anode/cp connection (size <2") 	

Limitations:

This specification is generally valid for clean pipeline without internal coating and can be impacted by the attenuation of the media the ILI tool will be run in. For the determination of the required line cleanliness and the assessment of how the ILI tool's inspection capabilities are affected by the attenuation of the media or the presence of internal coating or a rough surface, please refer to the responsible project manager.

The data gathered by the UltraScan tool may not correctly reflect the true defect dimensions in the following cases:

- Depth sizing accuracy**
For the accurate depth sizing of internal and external metal loss features a minimum remaining wall thickness between 1 and 1.5 mm is required. This minimum remaining wall thickness increases to a value between 2.5 and 4.0 mm if an ILI tool without AEP electronics is used.
- Screened defects**
External defects behind laminations are not detected.
- Type of defect**
The following defects may not be detected or sized properly:
 - Pinhole corrosion
 - Internal sponge-like corrosion
 - Radial cracks
- Defects within deformations**
Reduced detection and sizing capabilities
- Overlaying defects**
If internal and external corrosion occur at the same location the external and internal parts cannot always be distinguished. However, the remaining wall thickness in between is measured with the regular accuracy.
- Metal loss detection at welds**
The specification above is valid for any metal loss in the weld area, except for manufacturing related weld defects.

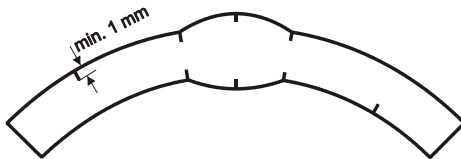
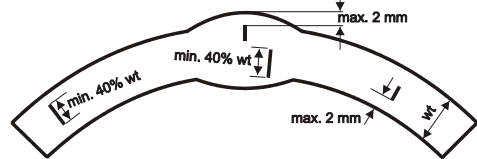
UltraScan® CD Defect Detection Capabilities

No. ka-ce1001-30



PII Pipeline Solutions
a GE Oil & Gas and
Al Shaheen joint venture

General Inspection on Longitudinal Cracks in 16" to 34" Pipelines

	Crack fields (like SCC)	Isolated radial cracks with longitudinal orientation			Longitudinal gouging
		In the plate material	In the longitudinal weld area	Non surface breaking	
		Minimum length 30 mm			
Minimum depth extension at POD = 90%	1 mm		40 % of wt (max. 2 mm from surface)	1 mm	
					
Depth grouping in 3 classes at 80% certainty with ±0.4 mm tolerance or at 90 % certainty with ±0.5 mm tolerance	alternative classes available: 12.5 - 25 % of wt 25 - 40 % of wt above 40 % of wt			1 - 2 mm 2 - 3 mm > 3 mm n/a	
Length sizing accuracy at 80% certainty	±7.5 mm or ±7.5% of length				
Length sizing accuracy at 90% certainty	±10 mm or ±10% of length				
Acceptable tolerances for crack orientation	Maximum deviation from longitudinal orientation: ±10° Maximum deviation from radial orientation: ±10°				
Internal/external discrimination	yes		n/a	yes	
Types of crack-like features	The ILI tool will detect (and identify as crack-like with 90% POI) all types of radial, longitudinal cracks which terminate in the internal or external wall surface, including the weld bead, as indicated in the sketch above left. Typical crack types are single, isolated cracks like toe cracks or fatigue cracks, crack fields, like SCC colonies or crack-like defects in the weld bead like lack of fusion, undercuts and welding defects. Non surface breaking cracks will be found when their depth extension is at least 40 % of wall thickness and the distance between the crack tip and either surface is less than 2 mm, as indicated in the sketch above right. In most cases, a distinction between midwall cracks and surface breaking cracks is not made.				
Crack fields (like SCC)	Clusters of cracks are detected (and identified as crack fields with 90% POI) when the cluster is longer than 30 mm. Depth estimation is only carried out if at least one individual crack of at least 1 mm depth and 20 mm length is present in the crack field. Note: if the distances between any two neighbouring, individual cracks is shorter than 5 mm, these two are treated as one individual crack.				
Laminations	Only surface breaking laminations are reported.				
ERW welds	Sizing accuracy of cracks can be deteriorated by overlaying echoes from planing marks.				
Seam welds with roofing	Crack detection at seam welds with roofing (pipe out-of-roundness due to incomplete bending during manufacturing process) is carried out with same PODs as in regular inspections, if this defect is known to be present and the necessary tool modifications are applied!				
Nominal tool speed range	The Defect Detection Capabilities refer to the nominal tool speed range stated in the Tool Data Sheet. If the speed increases beyond this nominal tool speed range the minimum detectable crack length increases linearly with speed, i. e. increases to double the length if the actual tool speed is twice as high as the max. nominal speed.				
Nominal wt range	The Defect Detection Capabilities refer to the nominal wall thickness range stated in the Tool Data Sheet.				
Wall thickness measurement	The ILI tool features a number of perpendicular sensors to measure wall thickness. They provide information on the actual wall thickness of the pipe joint. But they are not designed to determine corrosion.				
Other features	The following features are identified by the UltraScan CD, with 90% POI: - welds (longitudinal, spiral, girth welds), longit. weld anomalies (the same depth grouping as with crack features applied) - fittings (with 50 mm minimum diameter)				
Defects within deformations	Reduced detection and sizing capabilities.				
Liquid gas	For propane as coupling liquid, a separate Defect Detection Capabilities sheet is available.				
This specification is generally valid for clean pipeline without internal coating and can be impacted by the attenuation of the media the ILI tool will be run in. For the determination of the required line cleanliness and the assessment of how the ILI tool's inspection capabilities are affected by the attenuation of the media or the presence of internal coating or a rough surface, please refer to the responsible project manager.					

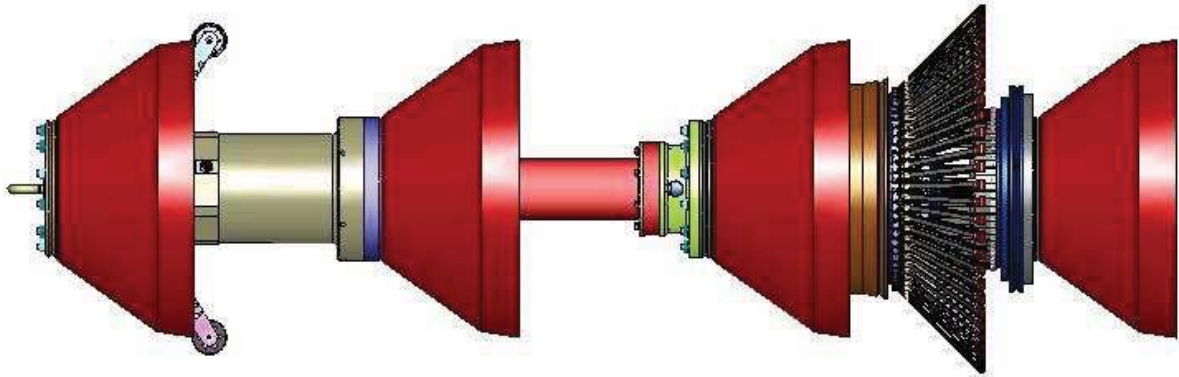
Note: POD = Probability of detection; POI = Probability of identification; all accuracies are only valid for nominal tool speeds.


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Quality Record; Title: 30" DEF Tool Specification			Page 1 of 3
Number: D1073	Rev. A	Date:	
Written by:	Date:	Approved By:	Date:

Standard 30" (762 mm) Deformation Tool Specification



General

All tools feature inertial navigation sensors, high resolution odometers and a highly reliable design that minimizes exposed components. Tools can be easily started and stopped using a Palm™ PDA. The system is supported with GPS and Bluetooth™ Above Ground Markers, making the entire inspection process simpler, more reliable and less expensive for our customers. Tools can detect seamless pipe variations, stopples, flanges, and valves. Tool configuration includes:

- INS data details bends and clock position.
- Variations less than 0.020 inch (0.5mm) are visible with the smaller tools.
- Like all of our specifications, the 1% or 0.100 inch accuracy is conservative compared to what the tool can actually do.
- Based on the same system as our MFL tools for proven reliability and efficiency.
- Quick scan software allows for MFL tool clearance go/no-go calls within hours.
- Can be configured with our MFL tools for one pass MFL/deformation surveys.


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Quality Record; Title: 30" DEF Tool Specification			Page 2 of 3
Number: D1073	Rev. A	Date:	
Written by:	Date:	Approved By:	Date:

DEF Tool Specifications

Deformation sensor type	Low mass, direct measuring arms
Deformation reporting threshold	0.125 in (3.2 mm)
Deformation depth accuracy	±1% of pipe OD or ±0.10 in, whichever is greater
Deformation axial accuracy	±1 in (25 mm)
Def. circumferential accuracy	±1 in (25 mm)
Sample frequency	Up to 500 samples per second
Data discarded by filtering	None
Data storage	Solid state flash memory
Tool transmitter	Pulsed low frequency
Inertial navigation sensors	Solid state INS
Operating pressure range ¹	300 to 2000 psi (21 to 137.8 bar)
In-line temperature range	14 to 131 °F (–10 to 55 °C)
Maximum tool speed ²	15 ft/s (4.6 m/s)
Minimum bend radius	1.5D
Minimum bore in 1.5D bend	27 in (686 mm)
Minimum bore for straight pipe	22.5 in (572 mm)
Defect location aids	GPS equipped AGMs, on board INS and pipeline features
Odometer resolution	0.118 in (2.99 mm)
Number of odometers	2

Def Arms	Length	Weight	Standard Run Time ³
65 arms	100 in (2.54 m)	960 lb (435 kg)	375 hr

¹ Optimal pressure range to minimize surging in gas. Consult Magpie for operation at other pressures.

² For full reporting accuracy.

³ With one alkaline battery pack. Consult Magpie for special configurations yielding longer run times.


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Quality Record; Title: 30" DEF Tool Specification			Page 3 of 3
Number: D1073	Rev. A	Date:	
Written by:	Date:	Approved By:	Date:

Pipeline Features Detected:

- Valves, Flanges, Fittings
- Bends and Elbows
- Girth Welds
- Lateral and Vertical direction changes and upheaval buckling
- ID changes

Pipe Anomalies Identified:

- Seamless pipe variations
- Misalignment
- Weld variations
- Ovality, buckles, dents and wrinkles.

Defect Characterization Performance:

- Bend radius $\pm 0.25D$
- Bend angle $\pm 10^\circ$
- Location from closest weld girth weld $\pm 0.5\%$
- Circumferential orientation $\pm 10^\circ$

Stated performance is dependent upon:

- Nominal tool speed maintenance and acceleration/deceleration.
- Product Compressibility
- Pipeline Length



3.3 Axial Flaw Detection Performance Specifications (AFD)

The Performance Specifications for the Axial Flaw Detection (AFD) inspection, version 3.2, are provided below.

3.3.1 Anomaly Detection

Pipe Wall Anomalies	Pitting and general corrosion Gouges Cracks Hard spots
Weld Anomalies	Anomalies in the heat affected zone
Manufacturing Anomalies	Laminations Inclusions
Deformations	Dents Buckles Wrinkles
Wall Thickness Changes specified below (4.3)	
Installations	Girth Welds Tees Taps Bends Anodes Valves
Repairs	Patches Sleeves
Pipe Casings	Locations Eccentricities
Ferrous Metal	Inside the pipe/outside if in contact



3.3.2 Detection and Sizing Capabilities

3.3.2.1 Detection and sizing accuracy for anomalies in body of pipe

	General Metal Loss		Pitting		Axial Grooving		Axial Slotting	
POD= 90% [Fraction of t]	0.20		0.20		0.20		0.20	
	80%	90%	80%	90%	80%	90%	80%	90%
Depth sizing accuracy at 80% and 90% confidence	± 0.15	±0.20	±0.20	±0.25	±0.15	±0.20	±0.20	±0.25
Width sizing accuracy at 80% and 90% confidence	± 0.59 inches or 15mm	± 0.79 inches or 20mm	± 0.59 inches or 15mm	±0.79 inches or 20mm	± 0.59 inches or 15mm	± 0.79 inches or 20mm	± 0.39 inches or 10mm	± 0.39 inches or 10mm
Length sizing at accuracy at 80% and 90% confidence	± 0.59 inches or 15mm	± 0.79 inches or 20mm	± 0.39 inches or 10mm	±0.59 inches or 15mm	± 0.59 inches or 15mm	± 0.79 inches or 20mm	± 0.59 inches or 15mm	± 0.79 inches or 20mm

* valid for axial slotting anomaly width \geq .01 inch or 1mm

Note: POF category 'circumferential grooving' and 'circumferential slotting' not specified

For Definitions, requirements and notes please refer Section 7.



3.3.2.2 Detection and sizing accuracy for anomalies in girth weld at heat affected zone

Within $\pm 3A$ of the weld ($A = \text{Max}(wt, 10\text{mm})$) detection and sizing are affected by the weld. The extent of this effect depends on weld quality and the weld impact on the tool dynamics. During passage of the magnetic yoke over a weld sizing accuracy might be affected slightly.

	General Metal Loss	Pitting	Axial Grooving	Axial Slotting
POD= 90% [Fraction of t]	0.30	0.30	0.30	0.30
Depth sizing accuracy at 80% confidence	± 0.25	± 0.25	± 0.25	± 0.25
Length sizing accuracy at 80% confidence	± 0.96 inches or 25mm	± 0.79 inches or 20mm	± 0.96 inches or 25mm	± 0.96 inches or 25mm
Width sizing at 80% confidence	± 0.96 inches or 25mm	± 0.96 inches or 25mm	± 0.96 inches or 25mm	± 0.79 inches or 20mm

* valid for axial slotting anomaly width $\geq .01$ inch or 1mm

3.3.2.3 Detection and sizing accuracy for crack or crack-like anomalies

	Axial Slotting	Axial Crack
POD= 90% [Fraction of t]	$0.20 \cdot t$	$0.20 \cdot t$
Minimum crack opening	.03 inches or 1 mm	.01 inches or 0.20 mm
Depth sizing accuracy at 80% confidence	$\pm 0.2 \cdot t$	n/a
Width (circumferential) sizing accuracy at 80% confidence	± 0.59 inches or 15mm	n/a

* provided that the S/N ratio of the MFL amplitude is ≥ 5



3.3.2.4 Detection of Long Seam Weld (detection and determination of position)

	Type
POD \geq 90%	ERW
POD \geq 90%	EFW
POD \geq 90%	other, (magnetic irregularity provided)

3.3.2.5 Wallthickness Measurement ± 0.04 or 1 mm or $\pm 0.1t$, whichever value is greater, at 80 % confidence

3.3.2.6 Location and Orientation Capabilities

The below specifications are based on a maximum distance between reference points of 6561 feet, or 2000 meters. It can be expected that the axial position accuracy will increase as the distance between the reference points decreases.

axial position accuracy from reference marker	± 3.28 feet or 1 meter
axial position from closest weld	± 3.94 inches or 100mm
circumferential position accuracy	$\pm 10^\circ$

The axial positioning accuracy specified is based on following conditions:

- The distance between u/s and d/s marker/reference point < 6561.68 feet or 2000 meters.
- The actual above ground distance to both u/s and d/s markers/reference points is measured and correlated to the recorded tool log distance.
- There is a negligible difference between pipeline and soil contour (flat terrain).

3.3.3 Notes Concerning Performance Specifications

3.3.3.1 Anomaly Detection and Sizing Capabilities

The given accuracy values were derived from statistical analysis of sizing results originated by straightforward, standard procedures. The sizing results were compared with a large number of known anomaly events.

3.3.3.2 Definitions

Where the wall thickness is ≥ 0.196 inches, then t = wall thickness. Where wall thickness is < 0.196 inches, then t = 0.196 inches. It should be noted that the depth calculation for metal loss and the wall thickness calculation for the pipe wall are independent. Therefore, the reported depth percentage is based on actual wall thickness.

3.3.3.3 Requirements

These specifications are applicable to longitudinally welded pipes, and where run conditions, pipe grade, pipe cleanliness, magnetization level, sensor operation, and data recorded are within the established parameters. Both the magnet yokes and sensors should be located in the same straight pipe body, and the magnetic field should not be affected by installations.



3.3.3.4 Anomalies in Seamless Pipe

In general, Anomaly Detection and Sizing capabilities in seamless pipe depends on the actual noise level of the pipe material concerned. Typically, the detection threshold and sizing accuracy will be as stated above plus up to an additional 0.1t. Dimension accuracy is typically as stated above plus up to an additional 0.39 inches.

3.3.4 Identification of Anomalies

POI (Probability of Identification)

Anomaly	POI >90%	POI <50%	50%≤POI ≤90%
Internal/ non-internal ¹⁾	x		
Ext./ midwall discrimination		x	
Additional metal/material:			
- debris	x		
- touching metal to metal	x		
Anode	x		
Anomaly:			
- arc strike			x
- artificial defect	x		
- buckle	x		
- corrosion	x		
- corrosion cluster	x		
- circumferential crack		x	
- axial crack	x		
- dent ²⁾	x		(x)
- dent with metal loss ²⁾	x		(x)
- gouging	x		
- grinding			x
- girth weld crack		x	
- girth weld anomaly			x
- HIC			x
- lamination			x
- longitudinal weld crack			x
- longitudinal weld anomaly	x		
- ovality	x		
- pipe manufacturing anomaly	x		
- SCC		x	
- spalling	x		
- spiral weld crack			x
- spiral weld anomaly	x		
- wrinkle	x		
Crack arrestor		x	



Eccentric pipeline casing			x
Change in wall thickness	x		
CP connection	x		
External support	x		
Ground anchor	x		
Off take	x		
Pipeline fixture	x		
Reference magnet	x		
Repair:			
- welded sleeve repair	x		
- composite sleeve repair		x	
- weld deposit	x		
- coating		x	
Tee	x		
Valve	x		
Weld:			
- bend	x		
- diameter change	x		
- wall thickness change (pipe/pipe connection)	x		
- adjacent tapering	x		

¹⁾ The internal / non internal discrimination may be reduced for anomalies smaller than 20 mm extent (width) and 20 % depth.

²⁾ POI greater 90% only reached in combination with geometry inspection. Without any geometry inspection, dents are only identified with a probability between 50% and 90%.



GE Oil & Gas
PII Pipeline Solutions

CalScan XR Operational Specification

Summary

		Tool Size						
		10	12	16	18	20	24	30
Number of Discrete Channels		20	25	35	40	45	55	70
Minimum Bend Radius		1.5D						
Odometer System		Two, direct measured pitch						
Sample Rate Resolution		3.3 mm						
Maximum Travel Distance*		250 km (155 mi) - Expandable			205 km (127 mi) - Expandable		150 km (93 mi) - Expandable	
Min/Max Tool Speed		Min 0.1 m/s to Max 5.0 m/s (0.33 - 16.4 ft/s)						
Optimal Tool Speed*		1.0 - 3.0 m/s (3.3 - 9.8 ft/s)						
Maximum Pressure		120 bar (1740 psi)						
Min/Max Temperature		Min 0 C to Max 60 C (Min 32 F to Max 140 F)						
Battery Range, Standard		85 hours			70 hours		60 hours	55 hours
Media		Liquids, petroleum base & water. Gas, acids & toxic materials require approval						
Minimum Clearance 75% of OD	mm	204.8	242.9	304.8	342.9	381.0	457.2	571.5
Minimum Clearance 75% of OD	in	8.1	9.6	12.0	13.5	15.0	18.0	22.5
Length, Standard	mm	1996	2044	2213	1963	1963	2548	2924
	in	78.6	80.5	87.1	77.3	77.3	100.3	115.1
Weight, Standard	kg	73	77	104	140	152	289	386
	lbs	161	170	229	309	335	637	851
*Important Notes	Speed Excursions outside the optimum range may result in degraded data.							
	Standard Configuration does not include extended battery or IMU capability.							
	Consultation with GE Applications Engineering is required under the following circumstances:							
	(i) If pipeline conditions are outside the range specified in this document.							
	(ii) Confirmation of Minimum Bend Radius and Minimum Clearance specifications for extended length XR tools.							
	(iii) Run Profiles with tool speeds > 1m/s (Specified Maximum Travel Distance is based on 1m/s tool speed).							
	(iv) Dual Diameter requirements.							

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GE Oil & Gas
PII Pipeline Solutions

CalScan XR Reporting Specification

Summary

Tool Size	Location	Orientation	Bends		Wall Thickness Changes		Dents / Buckles			Ovalities			
	Accuracy from Reference (+/-)	Accuracy Degrees (+/-)	Class	Angle Degrees (+/-)	Sensitivity @ 90% POD*	Accuracy @ 85% Confidence (+/-)	Sensitivity @ 90% POD*	Accuracy @ 85% Confidence (+/-)		Sensitivity @ 90% POD*	Accuracy @ 85% Confidence (+/-)		
								ID Red. < 10%	ID Red. > 10%		ID Red. < 5%	ID Red. 5 - 10%	ID Red. > 10%
10	1%	30.0	1.5D 3D 5D >5D	5.0	1.0%	0.4%	1.2%	0.8%	1.0%	1.0%	0.9%	1.4%	1.8%
12					0.5%	0.2%	0.8%	0.6%	0.8%	0.8%	0.6%	1.2%	1.6%
16													
18							0.7%						
20					0.4%	0.15%	0.6%	0.5%	0.7%	0.6%	0.5%	1.0%	1.4%
24													
30													

*POD, Probability of Detection

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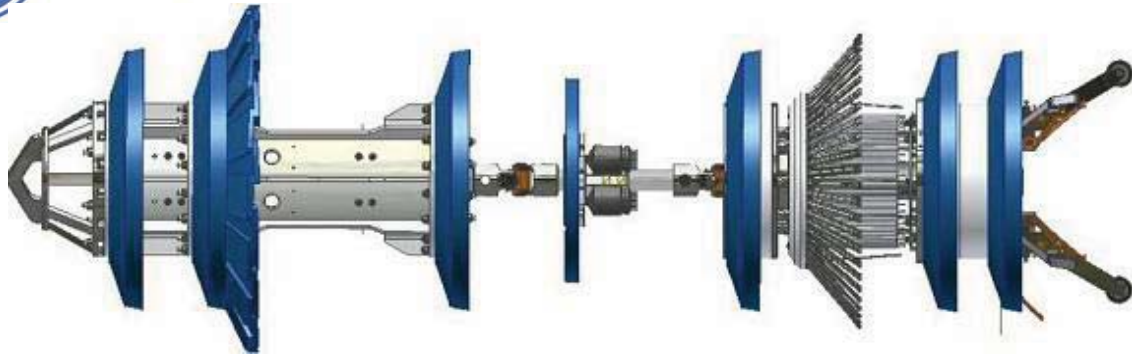
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GE Oil & Gas
PII Pipeline Solutions

CalScan XR Technical Specification (& Options)

30 Inch



Operational Parameters

Number of Discrete Channels	70		
Minimum Bend Radius	1.5D		
Odometer System	Two, direct measured pitch		
Sample Rate Resolution	3.3 mm		
Maximum Travel Distance*	150 km (93 mi) - Expandable		
Min/Max Tool Speed	Min 0.1 m/s to Max 5.0 m/s (0.33 - 16.4 ft/s)		
Optimal Tool Speed*	1.0 - 3.0 m/s (3.3 - 9.8 ft/s)		
Maximum Pressure	120 bar (1740 psi)		
Min/Max Temperature	Min 0 C to Max 60 C (Min 32 F to Max 140 F)		
Battery Range, Standard	55 hours		
Media	Liquids, petroleum base & water. Gas, acids & toxic materials require approval		
Minimum Clearance 75% of OD	571.5	mm	22.5 in
Length, Standard	2924	mm	115.1 in
Weight, Standard	386	kg	851 lbs

Reporting Specifications

Location Accuracy (+/-)	1%		
Orientation Accuracy (+/- degrees)	30		
Bend Radius Classification	1.5D, 3D, 5D, >5D		
Bend Angle (+/- degrees)	5		
		Sensitivity @ 90% POD ⁺⁺ (%)	Accuracy @ 85% Confidence (+/-%)
Wall Thickness Changes		0.4%	0.15%
Dents	ID Reduction < 10%	0.6%	0.5%
	ID Reduction > 10%	0.6%	0.7%
Ovalities	ID Reduction < 5%	0.6%	0.5%
	ID Reduction 5-10%	0.6%	1.0%
	ID Reduction > 10%	0.6%	1.4%

* Maximum Travel Distance is based on 1m/s tool speed. Consult Applications for confirmation on each run profile.

Speed outside the Optimum range may result in degraded data.

⁺⁺ POD, Probability of Detection

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