Pulsed Eddy Current (PEC)

Corrosion Under Insulation (CUI) And Fireproofing (CUF)

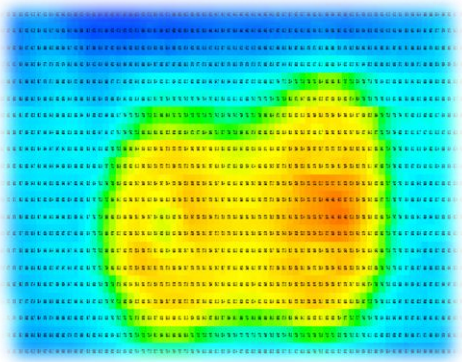
PULSED EDDY CURRENT (PEC) INSPECTION

IRISNDT uses state-of-the-art high-performance Pulsed Eddy Current (PEC) systems to inspect for corrosion under insulation (CUI). We use this fast and cost effective electromagnetic inspection technique (along with guided wave testing, real time radiography and digital radiography) for honing in on CUI suspect areas without stripping insulation. Our portable high-performance fast data acquisition PEC system has dynamic scanning modes and real-time C-scan imaging. The grid maps obtained facilitate data presentation and long cables give us flexibility during our set-up.

Pulsed Eddy Current system at work

IRISNDT APPLIES PEC TO

- Identify CUI on piping (≥ 2” diameter), vessel and tanks
- Inspect sphere legs above concrete fireproofing
- Inspect vessel skirts above concrete fireproofing
- Inspect I-beams, piping above concrete fireproofing
- Inspect underneath corrosion scale to determine remaining thickness



PEC C Scan representation of 6”, 0.28” thick pipe

FEATURES

- Serves to test carbon steel of thickness values up to 1.5”
- Serves to test at temperatures from -238°F to 932°F
- Serves to test through up to 6” thick insulation (liftoff)
- Serves to inspect piping of diameter greater than 2”
- Acquires data at up to 15 points/second
- Performs dynamic scans at up to 3”/second
- Develops instant grid mapping in less than 1 second
- Is a volumetric technique (covers ID and OD)
- Has a sizing accuracy of ±10% when defects are larger than the probe footprint (check limitation section)
- Can be used with the following weather jackets: stainless steel up to 0.06”; aluminum up to 0.04”; galvanized steel up to 0.02”

6” line representing the PEC C Scan Above

INSPECTION PREPARATION

- Access to the inspection location if rope access cannot be utilized

LIMITATIONS

- Can only be used to inspect carbon steel material
- The detection sensitivity is dependent on the footprint of the probe (liftoff / insulation thickness) and the thickness of the material (isolated pitting can be difficult to detect)
- Cannot differentiate between internal or external defects
- Variation in measurements when close to edges (i.e. nozzles, flanges or the end of structure)
- Scanning speed depends upon the thickness of the material

5311 86th Street NW, Edmonton, Alberta T6E 5T8 Phone: (780) 437-2022 fax: (780) 436-4873

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Lloydminster	(780) 875-6455	Fort McMurray	(780) 743-1536	Engineering, Edmonton	(780) 437-2022
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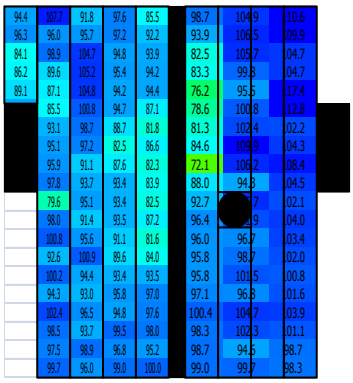
PULSED EDDY CURRENT – HOW INSPECTIONS ARE OPTIMIZED BASED ON THE PROBE FOOTPRINT

Pec Probe Footprint

The footprint (FP) of a probe is used to determine the best grid resolution for proper detection. FP is defined as the full width at half maximum (FWHM) of the response detected by the probe. With this a 50% signal overlap is used between each point on the grid map.

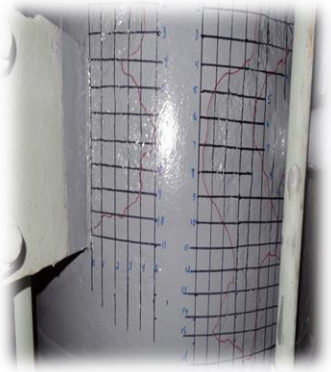
Calculating the Pec Probe Footprint

The table below shows the PEC Probe footprint of probes PEC-025, PEC-089 and PE-152 versus insulation thickness. For example, a 1.5” insulated pipe will have a 3.42” footprint when using PEC-089 probe.



PEC C Scan representation of 0.625” thick vessel with 1.5” insulation

		Insulation / Coating Thickness (Liftoff)												
		0.0 mm	6.4 mm	12.7 mm	19.1 mm	25.4 mm	38.1 mm	50.8 mm	63.5 mm	76.2 mm	88.9 mm	101.6 mm	127.0 mm	152.4 mm
		0.00 in	0.25 in	0.50 in	0.75 in	1.00 in	1.50 in	2.00 in	2.50 in	3.00 in	3.50 in	4.00 in	5.00 in	6.00 in
Footprint	PEC-025 mm	35.0	39.2	43.3	47.4	51.5	-	-	-	-	-	-	-	-
	PEC-025 in	1.38	1.54	1.70	1.87	2.03	-	-	-	-	-	-	-	-
	PEC-089 mm	62.0	66.2	70.3	74.4	78.5	86.8	95.0	103.3	111.5	119.8	-	-	-
	PEC-089 in	2.44	2.61	2.77	2.93	3.09	3.42	3.74	4.07	4.39	4.72	-	-	-
	PEC-152 mm	100.0	104.2	108.3	112.4	116.5	124.8	133.0	141.3	149.5	157.8	166.0	182.6	199.1
	PEC-152 in	3.94	4.10	4.26	4.43	4.59	4.91	5.24	5.56	5.89	6.21	6.54	7.19	7.84



Follow-up results of the vessel

Calculating the Size of Detectable Flaws with PEC

The table below lists the minimum defect depth detectable by comparing the footprint with the percentage of defect depth and with the defect size. For example, one can detect a 40% deep defect occupying a ~2.2” surface with a probe with a 3.42” footprint.

Minimum Defect Diameters at Specific Depths According to the Probe’s Footprint

		Minimum Defect Depth											
		10%		20%		30%		40%		50%		60%	
Footprint	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
	40	1.6	49	1.9	35	1.4	28	1.1	24	1.0	22	0.9	20	0.8
	50	2.0	61	2.4	43	1.7	35	1.4	31	1.2	27	1.1	25	1.0
	60	2.4	73	2.9	52	2.0	42	1.7	37	1.4	33	1.3	30	1.2
	70	2.8	86	3.4	61	2.4	49	1.9	43	1.7	38	1.5	35	1.4
	80	3.1	98	3.9	69	2.7	57	2.2	49	1.9	44	1.7	40	1.6
	90	3.5	110	4.3	78	3.1	64	2.5	55	2.2	49	1.9	45	1.8
	100	3.9	122	4.8	87	3.4	71	2.8	61	2.4	55	2.2	50	2.0
	110	4.3	135	5.3	95	3.8	78	3.1	67	2.7	60	2.4	55	2.2
	120	4.7	147	5.8	104	4.1	85	3.3	73	2.9	66	2.6	60	2.4
	130	5.1	159	6.3	113	4.4	92	3.6	80	3.1	71	2.8	65	2.6
	140	5.5	171	6.8	121	4.8	99	3.9	86	3.4	77	3.0	70	2.8
	150	5.9	184	7.2	130	5.1	106	4.2	92	3.6	82	3.2	75	3.0
	160	6.3	196	7.7	139	5.5	113	4.5	98	3.9	88	3.5	80	3.1
	170	6.7	208	8.2	147	5.8	120	4.7	104	4.1	93	3.7	85	3.3
	180	7.1	220	8.7	156	6.1	127	5.0	110	4.3	99	3.9	90	3.5
	190	7.5	233	9.2	165	6.5	134	5.3	116	4.6	104	4.1	95	3.7
	200	7.9	245	9.6	173	6.8	141	5.6	122	4.8	110	4.3	100	3.9

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