ECDA Process for Cased Transmission Pipelines



Pipeline Integrity Services

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mears

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Focus of the Presentation

- Technical Basis for ECDA Application to Cased Pipelines
- Results of Validation Efforts at the Mears Casing Test Facility
- Results of Field Indirect Inspections on Cased Pipelines
- Results of Direct Examinations

Principles of the ECDA Process NACE RP 0502

- A structured process intended to improve safety by assessing and reducing the impact of external corrosion
- A continuous improvement process which through successive applications can identify and address locations where corrosion activity has occurred, is occurring, or may occur.
- Can locate areas where defects could form in the future rather than only areas where defects have already formed.

Principles of the ECDA Process NACE RP 0502

ECDA applications include, but are not limited to, pipeline segments that

- Cannot be inspected using ILI or pressure testing,
- Have already been inspected by other methods to help manage future corrosion,

DOT Code Requirements

- Per DOT Part 192.921, DA can be used to assess the integrity of gas transmission pipelines for the external, internal, and SCC threats.
- Per DOT Part 192.921, DA must be performed in accordance with 192.923, 192.925, 192.927, and 192.929, and specifically ECDA in accordance with NACE RP0502.

Technical Basis

The ECDA process assesses if a corrosion cell could exist

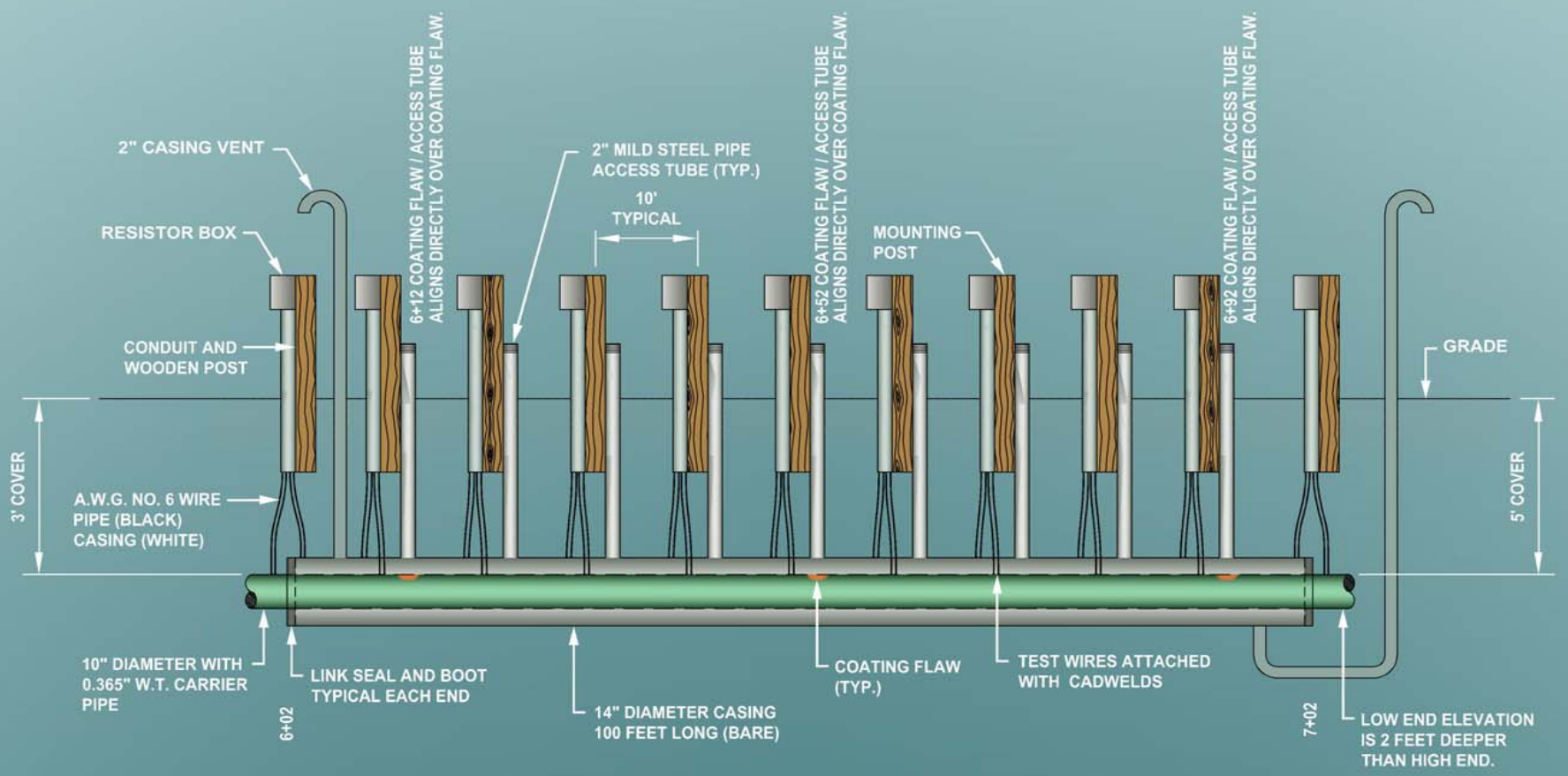
- Anode, Cathode, Metallic Path, Electrolytic Path

- If the coating is free of holidays, an external corrosion cell cannot occur (absent disbonded coating issues).
- If a holiday is present, the highest risk of external corrosion occurs with a metallic contact and electrolyte in the casing.
- If an electrolytic contact is present, a potentially corrosive environment exists, however Cathodic Protection may be able to polarize the pipeline.

Technical Basis
Atmospheric Corrosion

- Pre-Assessment Considerations
  - Corrugated and/or Nestable Casings
  - Humid Environments
  - Discharge Temperatures
  - Coatings
  - Age
  - Construction Methods (i.e. Wood spacers)
  - Seasonal Variations
- Effectiveness Digs
- Guided Wave During Direct Examinations

Validating the Process - Casing Test Facility



CASING DETAIL

Results of Validation Efforts
at Mears Casing Test Facility

- Metallic shorts are found by all Indirect Inspection methods. *Protocols need refinement.*
- Electrolytic contacts easily found by numerous methods, especially when coating resistance is low (i.e. significantly degraded)
- A-Frame most sensitive to electrolytic contacts, even when small, single holidays are present. Protocols for “one-side-only” indications need further evaluation.

Can CP Polarize the Pipeline Inside a Casing if it is Electrolytically Contacted?

- **Polarization (>100 mV) achieved at 3 very small isolated coating holidays when casing filled with water and after 24 hours with adequate cathodic protection.**

2 cm	5 cm	10 cm
In Tube On = -1.158 V	In Tube On = -1.150 V	In Tube On = -1.135 V
In Tube Off = -0.857 V	In Tube Off = -0.815 V	In Tube Off = -0.831 V
In Tube Native = -0.501 V	In Tube Native = -0.566 V	In Tube Native = -0.580 V
Polarization = 356 mV	***Polarization = 240 mV***	***Polarization = 251 mV***
At Ground On = -1.547 V	At Ground On = -1.537 V	At Ground On = -1.526 V
AT Ground Off = -1.231 V	At Ground Off = -1.226 V	At Ground Off = -1.221 V

Field Indirect Inspection Statistics

CASING EVALUATION RESULTS				
OPERATOR	NO. OF CASINGS EVALUATED	IDENTIFIED AS POSSIBLE METALLIC	IDENTIFIED AS POSSIBLE ELECTROLYTIC	IDENTIFIED AS CLEAR
A	20	3	16	4
B	6	0	5	1
C	78	22	62	2
D	95	7	65	23
E	14	2	10	2
F	125	48	64	13
TOTALS	338	82	222	45

*Operators in diverse geographical locations (west coast, east coast, central)

Field Indirect Inspection Statistics

RESULTS BY TOOL TYPE				
	POSSIBLE METALLIC			
	82	A-Frame	65	**79%**
		PCM	22	**27%**
		P/S & C/S Shifts	6	**7%**
		P/S & C/S ON	1	**1%**
	POSSIBLE ELECTROLYTIC			
	222	A-Frame	197	**89%**
		PCM	111	**50%**
		P/S & C/S Shifts	21	**9%**
		P/S & C/S ON	4	**2%**

Technical Basis

Indirect Inspection Methods

Indirect Method	Type of Method	Metallic Short	Electrolytic Contact
P/S & C/S Potentials	Electrical Potential	✓	Low probability
P/S & C/S Shift	Electrical Potential	✓	✓
Pipe Current Mapper	AC Current Attenuation	✓	✓
PCM A-Frame	AC Voltage Gradient	✓	✓
Internal Resistance	Electrical Resistance	✓	Low probability
Panhandle Eastern	Reverse Current Applied to Casing	✓	Low probability
Pipe/Cable Locator	Radio Signal	✓	Low probability
Tinker & Rasor Model CE-IT	Casing/Pipe Capacitance	✓	Low probability
Guided Wave		✓	✓ Providing Corrosion is Present

Direct Examination - Field Results

Operator	IIT Results	DE Results	Comments
A	12 Electrolytics	8 Confirmed (water and/or mud) 1 Dry, seasonal water 1 Dry, end locations inaccurate 2 ends not accessible for excavation	**- Good correlation** - Repeat testing just prior to excavation - Caused wrong interpretation
	2 Metallics	Found only to be electrolytic contacts	PCM Severe, internal resistance would have added value
	2 Clear (Monitored)	1 - a trickle of water 1 contained 30 gallons of water	**Good correlation**
B	Excavations in Progress on 6 casings	5 electrolytics - scheduled 1 clear - monitored	2 regions set up for these casings
C	Excavations planned		
D	Excavations completed		**Good correlation**, Data being assessed by SWRI
E	Excavations completed		Data being assessed
F	Indirects completed.		
G	4 Electrolytics	All confirmed Electrolytics	**Good correlation**
	2 Metallics	Both confirmed Electrolytics	PCM Severe, internal resistance would have added value

Summary

- **Testing and field results have validated that the ECDA process and NACE RP 0502 are applicable to cased pipelines**
  - **Indirect Tests Find Metallic and Electrolytic Conditions**
  - **Process Elements and Guided Wave Assess for Atmospheric Corrosion**
- **The process improves the safety of cased pipelines by**
  - **identifying when potentially corrosive situations exist**
  - **mitigating the conditions**
  - **and examining the integrity of the pipeline.**
- **The process will continue to improve, as the tools and the process are continually improved**

Comments/Discussion

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