

CP TESTING & COMMISSIONING REPORT

Prepared for:

Vermont Gas Systems, Inc.
Addison Natural Gas Project
(first 11 miles)

Prepared By:



Report Issued: February 18, 2016

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1 INTRODUCTION

On January 28 and 29, 2016, cathodic protection commissioning and system balance was performed on the 12" Addison Natural Gas Project pipeline from Milepost 0.00 to Milepost 10.43. There was only one impressed current system involved located at Milepost 6.7519. The total project is over 43 miles of pipe. The portion passed MP 10.43 was not installed yet. CP balancing was performed before the new pipeline was tied into the existing gas supply at MP 0.00.

2 SUMMARY

The CP system was very easy to balance. In fact, output was so low that current measurements at the individual shunts were almost too small to measure.

- Test Station #0: Had no access first day due to hydrostatic testing. No access the second day due to tie in work. There were supposed to be isolation flanges at the tie-in site. It appears that the piping was installed without them. They were indicated on the drawings.
- Test Station #1 had a broken black wire. This is a 4 wire test station.
- Test Station #3 had no post.
- Test Station #5, #6, #7, #8, #10, #11, #12 and #13 were not terminated properly into the screws of the test station.

3 SURVEY DATA

Rectifier:

- Manufacturer: JA Electronics
- Model: CSA
- Serial Number: 2150057
- 120/240 Single Phase
- Rated Output: 40 VDC / 20 ADC

- Operating Output: 7.32 VDC and 0.10 Amps (0.2 mV x 0.5 {25A-50mV shunt})
 - o Setting A/D Course and 4/6 Fine
 - o 5 Circuit Junction Box to Anodes
 - 1: 0.2 mV with a 0.01 ohm shunt = 0.02 Amps or 20 mA
 - 2: 0.2 mV with a 0.01 ohm shunt = 0.02 Amps or 20 mA
 - 3: 0.2 mV with a 0.01 ohm shunt = 0.02 Amps or 20 mA
 - 4: 0.2 mV with a 0.01 ohm shunt = 0.02 Amps or 20 mA
 - 5: 0.2 mV with a 0.01 ohm shunt = 0.02 Amps or 20 mA
 - Total Current = 0.10 Amps

4 TESTING PROCEDURE

Each test station was visited. Observations about the test stations were made. Native pipe-to-soil potentials were taken. The rectifier was not energized yet. There were some magnesium anodes left in the ground directly connected to the pipeline that were installed during construction to protect the pipe until the impressed current system could be energized. This was done on 1/28/2016.

The rectifier was energized later on 1/28/2016 to allow the pipeline to polarize overnight.

On 1/29/2016, the rectifier was interrupted at 8 seconds ON and 2 seconds Off.

Test stations were reread noting the ON and Instant OFF potential measurements.

Calibrated spans were also read where white to black was stationing. White was meter positive and black was meter negative.

5 CP COMMISSIONING DATA

12" Addison Natural Gas Project – CP Commissioning							
Box #	Approx MP	Station Type	Location Description	Native 1/28/2016	ON 1/29/2016	Inst OFF 1/29/2016	Comments
0	0.0000	2 Wire	Colchester Launcher	No Access Hydro Test	No Access Tie-In		
1	0.4924	4 Wire	Mill Pond Road	Gr (-) 0.705 Wh (-) 0.705 Bk (-) 0.041 Bl (-) 0.673 I = 0 mV	(-) 1.411 3.297 VAC I = 0 mV (used Blue)	(-) 1.349 I = 0 mV (used Blue)	Black is Broken. Blue is Suspect.
2	1.2689	CPN Bison 1	Access Road "C" Gauthier Drive	S#1 (-) 0.735 S#2 (-) 0.735	(-) 1.331 3.311 VAC	(-) 1.297	See Note 1 Below
3	2.0644	2 Wire	Route 2A	#1 (-) 0.842 #2 (-) 0.842	(-) 1.451 4.96 VAC	(-) 1.349	No Post – Wires Coiled On Ground

12" Addison Natural Gas Project – CP Commissioning							
4	2.9924	2 Wire	VELCO 289	#1 (-) 0.714 #2 (-) 0.714	(-) 1.436 3.36 VAC	(-) 1.341	Not Terminated
5	4.0530	2 Wire	Route 15	#1 (-) 0.816 #2 (-) 0.816	(-) 1.427 3.01 VAC	(-) 1.341	Mag Anodes from Construction
6	4.5549	2 Wire	Essex Way	#1 (-) 0.709 #2 (-) 0.709	(-) 1.317 2.51 VAC	(-) 1.211	Not Terminated
7	5.7197	4 Wire	1-89 Jughandle	Gr (-) 0.623 Wh (-) 0.623 Bk (-) 0.628 Bl (-) 0.628 I = 0 mV	(-) 1.209 0.93 VAC I = 0 mV	(-) 1.081 I = 0 mV	Zap Guard Type Not Terminated
8	6.7424	2 Wire	Winooski River HDD (At Rectifier)	#1 (-) 0.683 #2 (-) 0.683	(-) 1.311 0.738 VAC	(-) 1.155	Not Terminated
9	7.0833	2 Wire	Railroad w/ Casing	Bk 1 (-) 0.571 Bk 2 (-) 0.571 Bl 1 (-) 0.641 Bl 2 (-) 0.641 Vent (-) 0.638	(-) 1.273 1.39 VAC Casing: (-) 0.714	(-) 1.154 Casing: (-) 0.635	Mainline Valve Near #9: (-) 1.084 ON (-) 0.996 I Off
10	7.5663	2 Wire	Redmond Road	#1 (-) 0.641 #2 (-) 0.642	(-) 1.189 1.413 VAC	(-) 1.047	Head Came Off Wires Not Stripped
11	8.3996	2 Wire	Redmond Road	#1 (-) 0.639 #2 (-) 0.639	(-) 2.011 1.035 VAC	(-) 1.099	Not Terminated
12	9.1098	2 Wire	Mountain View Road	#1 (-) 0.758 #2 (-) 0.758	(-) 1.403 0.095 VAC	(-) 1.285	Not Terminated
13	9.8201	2 Wire	West of Catamount CC Bike Path	#1 (-) 0.773 #2 (-) 0.773	(-) 1.365 1.25 VAC	(-) 1.281	Not Terminated
14	10.4356	4 Wire	Williston Station	Gr (-) 0.902 Wh (-) 0.902 Bk (-) 0.907 Bl (-) 0.907 I = 0 mV	(-) 1.519 0.087 VAC I = 0 mV	(-) 1.403 I = 0 mV	Mag Anodes From Construction

Note 1:

Coupon Test Station (#2) Details (was not a CS3100 – It was a Bison 1 by Bingham and Taylor)

- Protected Coupon P/S with Temp Cell: Native: (-) 0.769 ON: (-) 0.789 I-Off: (-) 0.789
- Protected Coupon P/S with Perm Cell: Native: (-) 0.759
- Passive Coupon P/S with Temp Cell: Native: (-) 0.767 ON: (-) 0.789 I-Off: (-) 0.789
- Passive Coupon P/S with Perm Cell: Native: (-) 0.759
- Structure #1 P/S with Temp Cell: Native (-) 0.735
- Structure #1 P/S with Perm Cell: Native: (-) 0.714
- Structure #2 P/S with Temp Cell: Native: (-) 0.735
- Structure #2 P/S with Perm Cell: Native (-) 0.714

Solid State Decouplers:

There were four SSD's tested during the commissioning:

1. SSD Between Test Site #12 and Test Site #11 (Closest to #12)
 - a. Serial #: 26743
 - b. Not Clicking
 - c. 0.3 Amps AC through device
 - d. 243 mVDC across lugs
 - e. 0.003 VAC across lugs

2. SSD Between Test Site #12 and Test Site #11 (Furthest from #12)
 - a. Serial #: 26740
 - b. Not Clicking
 - c. 0.29 Amps AC through device
 - d. 241 mVDC across lugs
 - e. 0.003 VAC across lugs

3. SSD Just Upstream of the Rectifier
 - a. Serial #: 26721
 - b. Not Clicking
 - c. 0.31 Amps AC through device
 - d. 165 mVDC across lugs
 - e. 0.002 VAC across lugs

4. SSD Just Other Side of AC Corridor
 - a. Serial #: 26729
 - b. Not Clicking
 - c. 0.26 Amps AC through device
 - d. 181 mVDC across lugs
 - e. 0.005 VAC across lugs

6 CONCLUSIONS

The new impressed current cathodic protection system is balanced. However, the missing isolation flanges on the older pipe will effect this balance once the pipe is tied in. As this commissioning survey was being completed, Vermont Gas in-house forces were looking into getting these flanges installed.

7 RECOMMENDATIONS

- 1) **Repair the Black and Blue wires in Test Station #1 (MP 0.4924).** The black wire is already broken. Since there is such a difference between the blue and the white/green wires, the blue wire is suspect too. The hole will be open to repair the black wire and the blue one is only 2 feet away.
- 2) **Connect the pipeline coupon to the structure lead inside the test station.** The pipeline coupon should be hooked up so it can receive cathodic protection current as if it is part of the pipeline. The coupons are usually left to normalize in the ground for a few months before this is done. The Bison 1 coupon test station has the pipeline and Passive coupons clearly marked. It is just a matter of connecting a short banana plug jumper from the structure to the pipeline coupon.
- 3) **Install the post for test station #3 and finish terminating all the wires.** The wires for test point #3 are just lying on the ground. These could be damaged very easily. Installing the post will protect them. The wires in the other test stations are either not connected at all or simply bent around the screw and tightened. Proper terminals (ring style or fork style) will allow excellent contact as well as keeping the wires from falling into the tubes.

Please contact the author if you have any questions or require additional information.

We look forward to completing this work on the rest of the Addison Natural Gas Project pipeline.