

Project Greenley Crescent II AFE/Work Order No. 5000136  
 Pipeline OSU 24/27 PW pipeline (Name) (Location)

Testing Contractor Wood (Name) (Contract No.) N/A  
 (Address) (Phone No.) N/A

Construction Contractor Wood (Name) (Contract No.) N/A  
 (Address) (Phone No.) N/A

Pipe O.D. 9.117" Wall thickness 0.746" Grade 2.2 MFG'R: FlexSteel  
 Test Fluid Water w/ Biocide (Type) Frac Tank (Source) (Temperature)

Additive \_\_\_\_\_ (Type) (Quantity)

Section Tested No. \_\_\_\_\_ From: 0+00 To: 79+07 Volume: \_\_\_\_\_  
 Pump Location: Combined West Tie in 0+00 Pump No. \_\_\_\_\_ Gal./Stroke \_\_\_\_\_  
 Deadweight Tester Location: 0+00 MFG'R: \_\_\_\_\_ S/N \_\_\_\_\_

Time	Pressure PSIG	Ambient Temp.
5:45	1038	63.5
6:00	1036	62.4
6:15	1035	62.0
6:30	1034	62.0
6:45	1032	63.3
7:00	1031	63.6
7:30	1029	64.5
8:00	1027	64.0
8:30	1026	64.3
9:00	1024	64.6
9:30	1023	63.7

Time	Pressure PSIG	Ambient Temp.
10:00	1072	63
10:30	1020	62.4
11:00	1019	61.7
11:30	1018	61.6
12:00	1017	61.0
12:30	1016	60.7
1:00	1016	60.08
1:30	1015	59.3
2:00	1014	59.6
2:30	1013	59.1
3:00	1013	58.8

Time	Pressure PSIG	Ambient Temp.
3:30	1012	58.2
4:00	1011	54.3
4:11	1011	53.4
4:40	781	53.2
5:06	783	50.5
5:46	520	50.7
6:10	526	49.3
6:54	260	48.2
7:15	269	43
7:48	0	47.2

Strokes per 10 PSIG: First 100 PSIG N/A Last 100 PSIG N/A  
 Test Started 5:45 PM (Time) (Date) 10/25/18 Test Ended 7:48 (Time) (Date) 10/26/18

Section Accepted: \_\_\_\_\_ Section Leaking: N/A Section Ruptured: N/A  
 Location and Type of Failure: \_\_\_\_\_

Remarks: Began Walkdown @ 4:11 AM (Line Pressure 1011 PSI) 4:40 AM @ 781 PSI (Hold for 20 mins.) Began 2nd Walkdown @ 5:06 AM) 6:10 AM Began 3rd Walkdown, line @ 526 PSI.) 7:15 AM Began final walkdown from 269 PSI.

Weather: Partly Cloudy / Overcast, Clear Early Am

Testing Contractor's Representative KIRT HAIC (Name) Tester (Title) [Signature] (Signature) 10-26-18 (Date)

Constr. Contractor's Representative KIRT HAIC (Name) Tester (Title) [Signature] (Signature) 10-26-18 (Date)

Company Representative William Hartline (Name) Utility Inspector (Title) [Signature] (Signature) 10/26/18 (Date)

Construction Superintendent David B. Bender (Name) Superintendent (Title) [Signature] (Signature) 10/26/18 (Date)

Title: Pipe Testing Report

Effective Date: 09-07-2006

Work Order Number:

FACILITY DESCRIPTION

Facility Name <b>Greenley Crescent II</b> <b>8" FlexSteel</b>	Location	Area	District	County	State	
		Section	Township	Range	<b>CO</b>	
Facility Type <input type="checkbox"/> Gathering <input checked="" type="checkbox"/> Transmission		Pipe Manufacturer <b>FlexSteel</b>				
<input checked="" type="checkbox"/> Line Pipe <input type="checkbox"/> Plant/Station <input type="checkbox"/> Vessel <input type="checkbox"/> Hot Tap <input type="checkbox"/> Line Junction <input type="checkbox"/> Well Setting <input type="checkbox"/> Fabrication <input type="checkbox"/> Other		Pipe Data	Diameter <b>8"</b>	Wall Thickness <b>0.746</b>		
Description of Portion Tested (From-To):		Spec. & Grade <b>2.2</b>	Length of Test Section <b>790'</b>			

TEST SPECIFICATIONS

Type of Test <input type="checkbox"/> Strength <input checked="" type="checkbox"/> Both <input type="checkbox"/> Leak	Test Stations and Elevation	Begin Location <b>0+00</b>	End Location <b>79+07</b>	Dead Weight
Reason for Test <input checked="" type="checkbox"/> New Facility <input type="checkbox"/> Pre-Test <input type="checkbox"/> Retest <input type="checkbox"/> Repair		High Point	Low Point	Pressure Pump
Test Method <input checked="" type="checkbox"/> Hydrostatic <input type="checkbox"/> Pneumatic <input type="checkbox"/> Service	Applicable Code	Design Pressure		<input checked="" type="checkbox"/> Above Ground <input checked="" type="checkbox"/> Underground
Pressure Data	Preliminary Leak Pressure	Begin Station Minimum Pressure	End Station Minimum Pressure	
	Required Test Pressure <b>997/1050</b>	High Point Minimum Pressure	Low Point Maximum Pressure	
	Required Test Duration <b>8 Hour</b>	Test Limitations (Valves, Fittings, etc.)	Test Medium <b>Water</b>	

CALIBRATION DATA

Chart Recorder ID <b>PSE / pipetemp 265-4840</b>	Date of Calibration <b>4-26-18</b>	Static Range <b>0-3000/0-1500</b>
Test Gauge ID <b>PST 790655</b>	Date of Calibration <b>06-18</b>	Gauge Range <b>0-1000</b>
Test Gauge ID <b>Ambtemp 748687</b>	Date of Calibration <b>6-7-18</b>	Gauge Range <b>0-500</b>
Dead Weight ID <b>GroundTemp 265-3801</b>	Date of Calibration <b>1-12-18</b>	Range <b>0-1500</b>

TEST RESULTS

Test Start Date <b>10-25-18</b> Hour <b>5:45 PM</b>	Test Completed Date <b>10-26-18</b> Hour <b>4:00 AM</b>	Weather <b>Sunny Cloudy Cool</b>
Comments:		

Time	D.W. Pressure	Amb. Temp. °F	Pipe Temp. °F	Remarks
1025	261	63		25%
1040	240	67		Pressure Back up
1048	260	67		Let Set at 25%
1103	254	66		drop 6lb
1106	258	66		25% Hold 15 min
1121	259	66		Pressure Back up to the 25%
1135	257	69		pressure up to 50% 520 PSF
1142	520	68		50%
1203	520	70		pressured Back up to 50%
1	514	69		pressure Back up to 520
1219	520	69		50%
1235	520	69		516 pressured Back up to 50% 520
1252	517	72		pressure up to 75%
100	780	73		75%
116	762	73		pressure Back up
118	780	73		75%
134	772	73		pressure Back up
136	780	71		75%
151	775	70		pressure Back up
153	781	71		75%

Elkhorn Holdings, Inc.

Effective Date: 09-07-2006

Title: Pipe Testing Report

TEST RESULTS (CONT.)

Time	D.W. Pressure	Amb. Temp. °F	Pipe Temp. °F	Remarks
209	777	70		Pressure BACK UP
210	780	70		750
226	779	73		START one Hour Hold
242	775	70		cloudy cool
256	774	70		cloud cool
312	772	71		going to Test PSI
327	771	70		
342	1040	72		Pressure BACK UP
358	1026	75		
402	1040	76		Pressure BACK UP
415	1035	77		
417	1040	74		Pressure BACK UP
431	1035	68		BACK TO 1045
434	1040	68		
447	1037	67		
507	1034	65		pressure BACK UP TO 1040
531	1030	63		
535	1041	63		
545	1038	63.5		cloudy
600 pm	1036	62.4		SUN DOWN.
615	1035	62.0		
630	1034	62.0		
645	1032	63.3		

SKETCH

APPROVALS

Performed By:	Date:
Superintendent Approval:	Date:
Client / AI Approval:	Date:
Witnessed By:	Date:

Work Order Number:

FACILITY DESCRIPTION

Facility Name	Location	Area	District	County	State
		Section	Township	Range	
Facility Type <input type="checkbox"/> Gathering <input type="checkbox"/> Transmission  <input type="checkbox"/> Line Pipe <input type="checkbox"/> Plant/Station <input type="checkbox"/> Vessel <input type="checkbox"/> Hot Tap <input type="checkbox"/> Line Junction <input type="checkbox"/> Well Setting <input type="checkbox"/> Fabrication <input type="checkbox"/> Other _____		Pipe Manufacturer			
Pipe Data		Diameter	Wall Thickness		
		Spec. & Grade	Length of Test Section		

Description of Portion Tested (From-To):

TEST SPECIFICATIONS

Type of Test <input type="checkbox"/> Strength	<input type="checkbox"/> Both <input type="checkbox"/> Leak	Test Stations and Elevation	Begin Location	End Location	Dead Weight
Reason for Test <input type="checkbox"/> New Facility <input type="checkbox"/> Repair	<input type="checkbox"/> Pre-Test <input type="checkbox"/> Retest		High Point	Low Point	Pressure Pump
Test Method <input type="checkbox"/> Hydrostatic <input type="checkbox"/> Pneumatic <input type="checkbox"/> Service		Applicable Code	Design Pressure		<input type="checkbox"/> Above Ground <input type="checkbox"/> Underground
Pressure Data	Preliminary Leak Pressure	Begin Station Minimum Pressure		End Station Minimum Pressure	
	Required Test Pressure	High Point Minimum Pressure		Low Point Maximum Pressure	
	Required Test Duration	Test Limitations (Valves, Fittings, etc.)			Test Medium

CALIBRATION DATA

Chart Recorder ID	Date of Calibration	Static Range
Test Gauge ID	Date of Calibration	Gauge Range
Test Gauge ID	Date of Calibration	Gauge Range
Dead Weight ID	Date of Calibration	Range

TEST RESULTS

Test Start Date	Hour	Test Completed Date	Hour	Weather
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Comments:

Time	D.W. Pressure	Amb. Temp. °F	Pipe Temp. °F	Remarks
700	1031	63.6		
715	1030	63.6		
730	1029	64.5		
745	1029	64.0		
800	1027	64.0		
815	1026	64.1		
830	1026	64.3		
845	1025	64.7		
900	1024	64.6		
915	1023	63.6		
930	1023	63.7		
945	1022	63.4		
1000	1022	63.0		
1015	1022	62.4		
1030	1020	62.4		
1045	1020	62.1		
1100	1019	61.7		
1115	1019	61.6		
1130	1018	61.6		
1145	1018	61.6		

Elkhorn Holdings, Inc.

Title: Pipe Testing Report

TEST RESULTS (CONT.)

Time	D.W. Pressure	Amb. Temp. °F	Pipe Temp. °F	Remarks	
12:00	1017	61.08		DARK. 10-26-18 PIPE COVERED	
12:15	1017	61.7			
12:30	1016	60.74			
12:45	1016	60.57			
1:00	1016	60.08			
1:15	1015	60.2			
1:30	1015	59.3			
1:45	1014	59.16			
2:00	1014	59.66			
2:15	1014	59.2			
2:30	1013	59.6			
2:45	1013	59.24			
3:00	1013	58.86			
3:15	1012	58.35			CLEAR.
3:30	1012	58.27			
3:45	1011	56.48			
4:00	1011	54.30		BLOW DOWN FIRST STEP	
4:11	1011	53.4		HOLD FOR 20 MINUTES.	
4:40	780	52.3		BLOW DOWN 2ND STEP.	
5:08	783	50.53		HOLD FOR 20 MINUTES.	
5:45	520	50.72			
6:00	525	49		BLOW DOWN	
6:10	526	49			

SKETCH

APPROVALS

Performed By:	Date:
Superintendent Approval:	Date:
Client / AI Approval:	Date:
Witnessed By:	Date:



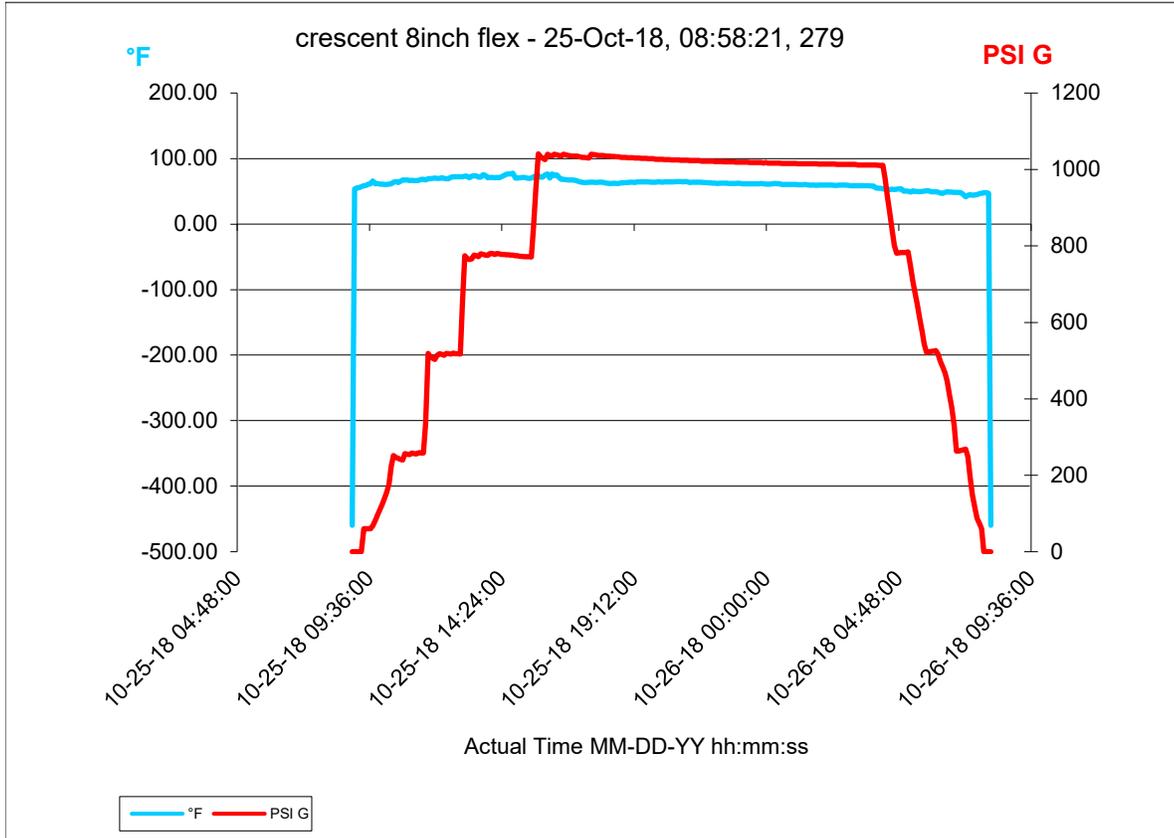


# Data Collection Report

	Chassis	Left Scale	Right Scale
Serial Number	790072	788687	790655
Datatype		Upper	Lower
Units		°F	PSI G

Upper

Lower



	<b>Chassis</b>	<b>Lower Module</b>	<b>Upper Module</b>	<b>BARO Module</b>	<b>Left Scale</b>	<b>Right Scale</b>
<b>Serial Number</b>	790072	790655	788687		788687	790655
<b>Model</b>	NV	10KPSI	RTD100			
<b>Message Store</b>						
<b>Userspan</b>		0.99982	1.00021			
<b>Offset</b>						
<b>Datatype</b>					Upper	Lower
<b>Units</b>		PSI G	°F		°F	PSI G
<b>Tare</b>						
<b>Average</b>						
<b>User Factor</b>						
<b>User Offset</b>						
<b>User Resolution</b>						
<b>Firmware Version</b>	<b>R080016</b>	<b>R090009</b>	<b>R100006</b>			
<b>Calibration Due</b>		6-Jun-19	7-Jun-19			
<b>Run Index</b>	7					
<b>Run Start Time</b>			25-Oct-18/08:58:21			
<b>Run Duration</b>			23 hours 10 minutes			
<b>Run Tag</b>			crescent 8inch flex			
<b>Logging Interval</b>	300.0					

<b>Data Points</b>			
<b>Point #</b>	<b>Time</b>	<b>Left - °F</b>	<b>Right - PSI G</b>
1	10-25-18 8:58:21	-459.67	0
2	10-25-18 9:03:21	53.71	0
3	10-25-18 9:08:21	55.35	0
4	10-25-18 9:13:21	55.78	0
5	10-25-18 9:18:21	57.10	0
6	10-25-18 9:23:21	58.49	60
7	10-25-18 9:28:21	59.28	60
8	10-25-18 9:33:21	60.93	60
9	10-25-18 9:38:21	61.47	60
10	10-25-18 9:43:21	65.90	68

11	10-25-18 9:48:21	61.38	82
12	10-25-18 9:53:21	61.76	96
13	10-25-18 9:58:21	61.09	109
14	10-25-18 10:03:21	60.86	123
15	10-25-18 10:08:21	60.39	138
16	10-25-18 10:13:21	60.48	156
17	10-25-18 10:18:21	60.91	177
18	10-25-18 10:23:21	61.67	223
19	10-25-18 10:28:21	63.84	252
20	10-25-18 10:33:21	64.73	247
21	10-25-18 10:38:21	63.43	244
22	10-25-18 10:43:21	65.39	242
23	10-25-18 10:48:21	67.50	240
24	10-25-18 10:53:21	67.40	257
25	10-25-18 10:58:21	67.47	255
26	10-25-18 11:03:21	66.24	254
27	10-25-18 11:08:21	66.77	258
28	10-25-18 11:13:21	66.38	257
29	10-25-18 11:18:21	66.17	256
30	10-25-18 11:23:21	66.73	259
31	10-25-18 11:28:21	68.21	258
32	10-25-18 11:33:21	68.03	258
33	10-25-18 11:38:21	67.22	335
34	10-25-18 11:43:21	69.27	519
35	10-25-18 11:48:21	69.06	510
36	10-25-18 11:53:21	69.69	506
37	10-25-18 11:58:21	70.41	503
38	10-25-18 12:03:21	69.95	514
39	10-25-18 12:08:21	69.79	518
40	10-25-18 12:13:21	70.55	516
41	10-25-18 12:18:21	69.93	514
42	10-25-18 12:23:21	69.08	519
43	10-25-18 12:28:21	69.30	518
44	10-25-18 12:33:21	71.67	517
45	10-25-18 12:38:21	72.39	520
46	10-25-18 12:43:21	71.99	518
47	10-25-18 12:48:21	72.29	518

48	10-25-18 12:53:21	72.19	517
49	10-25-18 12:58:21	72.19	656
50	10-25-18 13:03:21	73.23	774
51	10-25-18 13:08:21	73.00	768
52	10-25-18 13:13:21	70.84	764
53	10-25-18 13:18:21	73.09	766
54	10-25-18 13:23:21	73.78	776
55	10-25-18 13:28:21	73.52	774
56	10-25-18 13:33:21	71.44	772
57	10-25-18 13:38:21	71.88	779
58	10-25-18 13:43:21	75.36	778
59	10-25-18 13:48:21	73.91	776
60	10-25-18 13:53:21	70.60	775
61	10-25-18 13:58:21	71.26	780
62	10-25-18 14:03:21	71.36	780
63	10-25-18 14:08:21	70.79	778
64	10-25-18 14:13:21	70.99	780
65	10-25-18 14:18:21	70.48	779
66	10-25-18 14:23:21	72.21	778
67	10-25-18 14:28:21	74.08	778
68	10-25-18 14:33:21	76.14	777
69	10-25-18 14:38:21	76.28	777
70	10-25-18 14:43:21	76.34	776
71	10-25-18 14:48:21	77.69	776
72	10-25-18 14:53:21	70.01	774
73	10-25-18 14:58:21	70.16	774
74	10-25-18 15:03:21	70.46	773
75	10-25-18 15:08:21	71.36	773
76	10-25-18 15:13:21	71.01	772
77	10-25-18 15:18:21	70.03	772
78	10-25-18 15:23:21	69.91	772
79	10-25-18 15:28:21	70.15	771
80	10-25-18 15:33:21	71.99	852
81	10-25-18 15:38:21	73.23	959
82	10-25-18 15:43:21	73.98	1041
83	10-25-18 15:48:21	71.60	1033
84	10-25-18 15:53:21	71.53	1029

85	10-25-18 15:58:21	74.90	1026
86	10-25-18 16:03:21	76.66	1040
87	10-25-18 16:08:21	70.12	1037
88	10-25-18 16:13:21	76.74	1035
89	10-25-18 16:18:21	74.08	1040
90	10-25-18 16:23:21	74.84	1038
91	10-25-18 16:28:21	71.35	1037
92	10-25-18 16:33:21	68.41	1035
93	10-25-18 16:38:21	68.11	1040
94	10-25-18 16:43:21	67.93	1038
95	10-25-18 16:48:21	67.17	1037
96	10-25-18 16:53:21	67.11	1036
97	10-25-18 16:58:21	67.08	1035
98	10-25-18 17:03:21	66.90	1035
99	10-25-18 17:08:21	65.91	1035
100	10-25-18 17:13:21	64.50	1033
101	10-25-18 17:18:21	63.96	1032
102	10-25-18 17:23:21	63.60	1032
103	10-25-18 17:28:21	63.49	1031
104	10-25-18 17:33:21	63.69	1030
105	10-25-18 17:38:21	64.01	1040
106	10-25-18 17:43:21	63.86	1039
107	10-25-18 17:48:21	63.62	1038
108	10-25-18 17:53:21	63.88	1037
109	10-25-18 17:58:21	63.97	1037
110	10-25-18 18:03:21	63.69	1037
111	10-25-18 18:08:21	62.91	1036
112	10-25-18 18:13:21	62.45	1035
113	10-25-18 18:18:21	62.07	1035
114	10-25-18 18:23:21	61.92	1034
115	10-25-18 18:28:21	62.27	1034
116	10-25-18 18:33:21	62.04	1033
117	10-25-18 18:38:21	62.16	1033
118	10-25-18 18:43:21	62.79	1032
119	10-25-18 18:48:21	62.97	1032
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121	10-25-18 18:58:21	63.53	1031

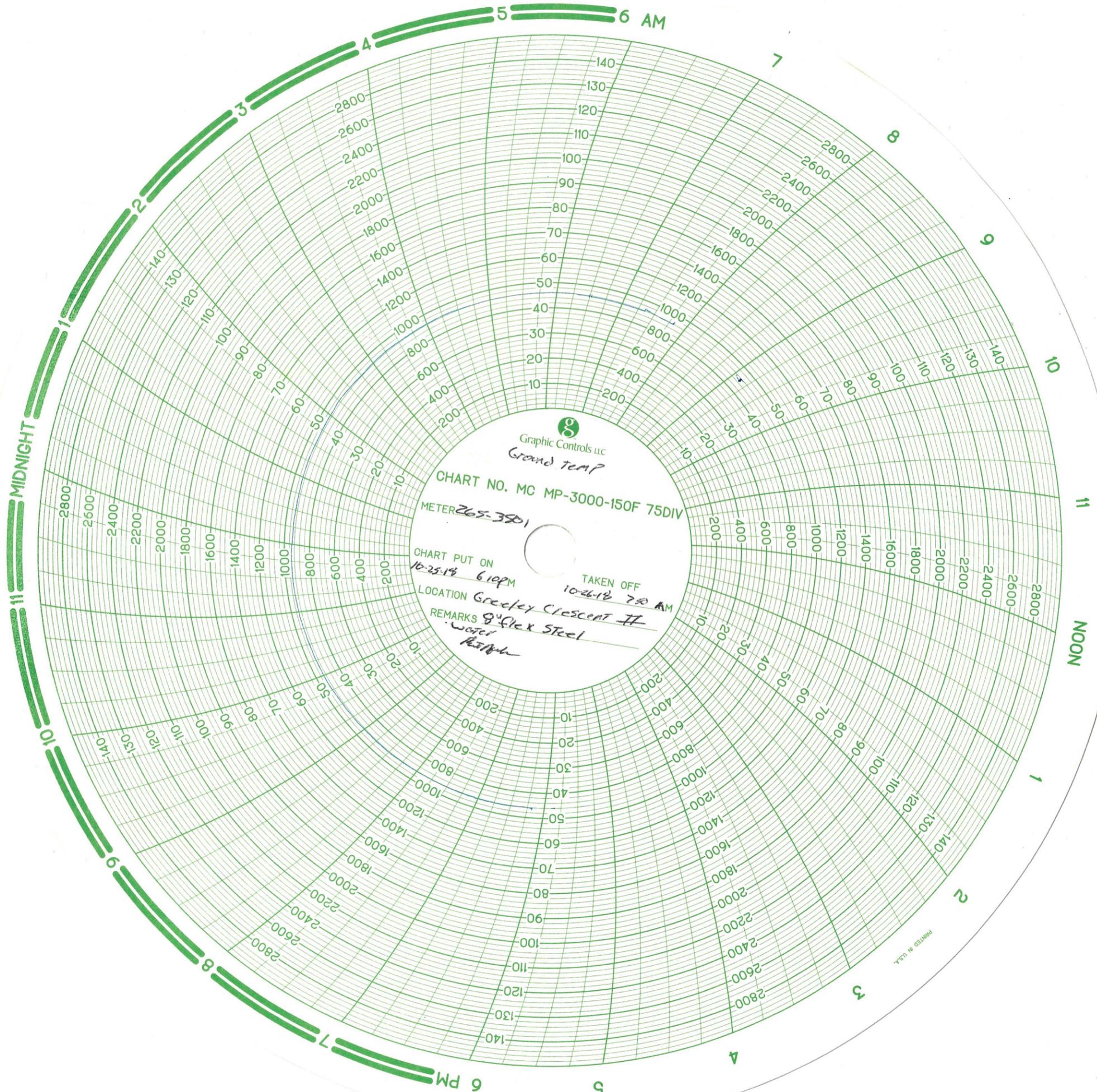
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123	10-25-18 19:08:21	63.91	1031
124	10-25-18 19:13:21	63.46	1030
125	10-25-18 19:18:21	64.26	1030
126	10-25-18 19:23:21	64.51	1030
127	10-25-18 19:28:21	64.57	1029
128	10-25-18 19:33:21	64.49	1029
129	10-25-18 19:38:21	64.32	1029
130	10-25-18 19:43:21	64.33	1028
131	10-25-18 19:48:21	63.95	1028
132	10-25-18 19:53:21	64.00	1028
133	10-25-18 19:58:21	64.06	1027
134	10-25-18 20:03:21	64.14	1027
135	10-25-18 20:08:21	64.16	1027
136	10-25-18 20:13:21	64.01	1027
137	10-25-18 20:18:21	64.25	1026
138	10-25-18 20:23:21	64.21	1026
139	10-25-18 20:28:21	64.36	1026
140	10-25-18 20:33:21	64.48	1025
141	10-25-18 20:38:21	64.54	1025
142	10-25-18 20:43:21	64.90	1025
143	10-25-18 20:48:21	64.93	1025
144	10-25-18 20:53:21	64.92	1024
145	10-25-18 20:58:21	64.46	1024
146	10-25-18 21:03:21	64.64	1024
147	10-25-18 21:08:21	64.36	1024
148	10-25-18 21:13:21	63.42	1023
149	10-25-18 21:18:21	63.80	1023
150	10-25-18 21:23:21	63.97	1023
151	10-25-18 21:28:21	63.98	1023
152	10-25-18 21:33:21	63.74	1023
153	10-25-18 21:38:21	63.70	1022
154	10-25-18 21:43:21	63.48	1022
155	10-25-18 21:48:21	63.42	1022
156	10-25-18 21:53:21	63.14	1022
157	10-25-18 21:58:21	63.04	1022
158	10-25-18 22:03:21	62.62	1022

159	10-25-18 22:08:21	62.64	1021
160	10-25-18 22:13:21	62.06	1021
161	10-25-18 22:18:21	62.65	1021
162	10-25-18 22:23:21	62.61	1021
163	10-25-18 22:28:21	62.47	1020
164	10-25-18 22:33:21	62.50	1020
165	10-25-18 22:38:21	62.18	1020
166	10-25-18 22:43:21	62.12	1020
167	10-25-18 22:48:21	62.15	1020
168	10-25-18 22:53:21	62.00	1019
169	10-25-18 22:58:21	62.24	1019
170	10-25-18 23:03:21	61.77	1019
171	10-25-18 23:08:21	61.66	1019
172	10-25-18 23:13:21	61.67	1019
173	10-25-18 23:18:21	61.55	1019
174	10-25-18 23:23:21	61.65	1018
175	10-25-18 23:28:21	61.40	1018
176	10-25-18 23:33:21	61.32	1018
177	10-25-18 23:38:21	61.54	1018
178	10-25-18 23:43:21	61.47	1018
179	10-25-18 23:48:21	61.83	1018
180	10-25-18 23:53:21	61.65	1017
181	10-25-18 23:58:21	60.78	1018
182	10-26-18 0:03:21	61.10	1017
183	10-26-18 0:08:21	61.08	1017
184	10-26-18 0:13:21	61.53	1017
185	10-26-18 0:18:21	61.74	1017
186	10-26-18 0:23:21	61.68	1017
187	10-26-18 0:28:21	61.64	1017
188	10-26-18 0:33:21	60.70	1016
189	10-26-18 0:38:21	60.31	1016
190	10-26-18 0:43:21	60.54	1016
191	10-26-18 0:48:21	60.72	1016
192	10-26-18 0:53:21	60.59	1016
193	10-26-18 0:58:21	60.54	1016
194	10-26-18 1:03:21	60.55	1016
195	10-26-18 1:08:21	60.19	1015

196	10-26-18 1:13:21	60.12	1015
197	10-26-18 1:18:21	60.25	1015
198	10-26-18 1:23:21	60.45	1015
199	10-26-18 1:28:21	60.02	1015
200	10-26-18 1:33:21	59.34	1015
201	10-26-18 1:38:21	59.39	1015
202	10-26-18 1:43:21	59.63	1015
203	10-26-18 1:48:21	58.85	1015
204	10-26-18 1:53:21	59.48	1014
205	10-26-18 1:58:21	59.57	1014
206	10-26-18 2:03:21	59.71	1014
207	10-26-18 2:08:21	59.59	1014
208	10-26-18 2:13:21	59.70	1014
209	10-26-18 2:18:21	59.66	1014
210	10-26-18 2:23:21	59.32	1014
211	10-26-18 2:28:21	58.96	1014
212	10-26-18 2:33:21	58.96	1013
213	10-26-18 2:38:21	59.37	1013
214	10-26-18 2:43:21	59.64	1013
215	10-26-18 2:48:21	59.35	1013
216	10-26-18 2:53:21	59.32	1013
217	10-26-18 2:58:21	59.26	1013
218	10-26-18 3:03:21	58.41	1013
219	10-26-18 3:08:21	58.47	1013
220	10-26-18 3:13:21	58.61	1013
221	10-26-18 3:18:21	58.64	1012
222	10-26-18 3:23:21	58.66	1012
223	10-26-18 3:28:21	58.59	1012
224	10-26-18 3:33:21	58.34	1012
225	10-26-18 3:38:21	58.45	1012
226	10-26-18 3:43:21	58.41	1012
227	10-26-18 3:48:21	58.23	1012
228	10-26-18 3:53:21	58.07	1012
229	10-26-18 3:58:21	55.36	1012
230	10-26-18 4:03:21	54.85	1011
231	10-26-18 4:08:21	54.77	1011
232	10-26-18 4:13:21	53.83	1011

233	10-26-18 4:18:21	53.57	976
234	10-26-18 4:23:21	52.93	930
235	10-26-18 4:28:21	52.84	884
236	10-26-18 4:33:21	52.98	842
237	10-26-18 4:38:21	52.79	801
238	10-26-18 4:43:21	53.24	781
239	10-26-18 4:48:21	53.50	782
240	10-26-18 4:53:21	53.65	783
241	10-26-18 4:58:21	50.49	783
242	10-26-18 5:03:21	50.43	783
243	10-26-18 5:08:21	50.34	784
244	10-26-18 5:13:21	48.73	745
245	10-26-18 5:18:21	50.68	708
246	10-26-18 5:23:21	49.71	677
247	10-26-18 5:28:21	49.64	647
248	10-26-18 5:33:21	49.09	613
249	10-26-18 5:38:21	50.03	577
250	10-26-18 5:43:21	50.36	542
251	10-26-18 5:48:21	51.02	521
252	10-26-18 5:53:21	50.79	523
253	10-26-18 5:58:21	49.18	524
254	10-26-18 6:03:21	49.25	525
255	10-26-18 6:08:21	49.52	526
256	10-26-18 6:13:21	48.98	517
257	10-26-18 6:18:21	47.18	499
258	10-26-18 6:23:21	46.96	483
259	10-26-18 6:28:21	48.46	468
260	10-26-18 6:33:21	49.32	446
261	10-26-18 6:38:21	49.00	411
262	10-26-18 6:43:21	48.80	379
263	10-26-18 6:48:21	48.55	330
264	10-26-18 6:53:21	48.43	263
265	10-26-18 6:58:21	48.15	263
266	10-26-18 7:03:21	47.82	265
267	10-26-18 7:08:21	45.61	267
268	10-26-18 7:13:21	41.32	268
269	10-26-18 7:18:21	44.16	248

270	10-26-18 7:23:21	44.86	195
271	10-26-18 7:28:21	44.21	149
272	10-26-18 7:33:21	44.47	114
273	10-26-18 7:38:21	45.10	87
274	10-26-18 7:43:21	46.26	74
275	10-26-18 7:48:21	47.00	60
276	10-26-18 7:53:21	47.88	0
277	10-26-18 7:58:21	47.71	0
278	10-26-18 8:03:21	46.70	0
279	10-26-18 8:08:21	-459.67	0



Graphic Controls LLC  
Grand Temp

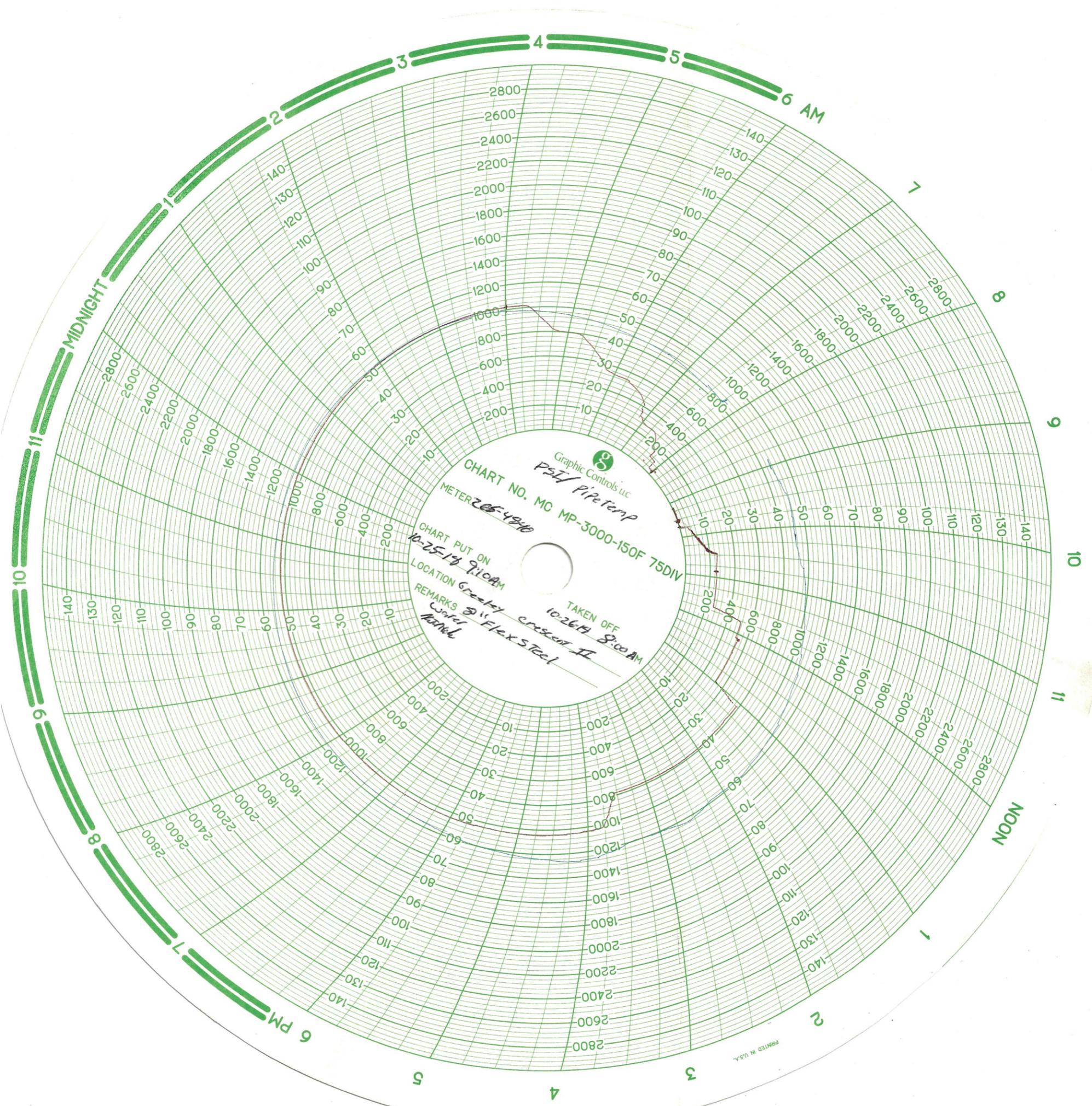
CHART NO. MC MP-3000-150F 75DIV  
METER 265-351

CHART PUT ON  
10-25-18 6:10PM

TAKEN OFF  
10-26-18 7:00 AM

LOCATION Greeky Crescent II  
REMARKS water  
R574

PRINTED IN U.S.A.



Graphic Controls, Inc.  
*P&H Pipe Temp*  
CHART NO. MC MP-3000-150F 75DIV  
METER *205-4840*

CHART PUT ON  
*10-25-19 9:00 AM*

LOCATION *Greater Crescent II*

REMARKS *Water  
Crest  
Tank*

TAKEN OFF  
*10-26-19 9:00 AM*

Certificate Number: 185546

6/7/2018

Crystal nVision RTD100-w/Probe

Manual Template

Test Description	Nominal	Test Results	As Left	Tolerance (+/-)	UUT Error	Status	Pass
<b>Measure Resistance</b>							
5 Ohms	5.00 $\Omega$	5.00 $\Omega$		0.02 $\Omega$	0.00 $\Omega$	Pass	
100 Ohms	100.00 $\Omega$	100.01 $\Omega$		0.03 $\Omega$	0.01 $\Omega$	Pass	
200 Ohms	200.00 $\Omega$	200.01 $\Omega$		0.04 $\Omega$	0.01 $\Omega$	Pass	
300 Ohms	300.00 $\Omega$	299.99 $\Omega$		0.06 $\Omega$	-0.01 $\Omega$	Pass	
400 Ohms	400.00 $\Omega$	400.00 $\Omega$		0.08 $\Omega$	0.00 $\Omega$	Pass	

RTD Probe Verification

Class B / 3-Wire / PT100 Q.00365

Serial Number						788667-1
32 F	32.08 °F	32.16 °F	0.58 °F	0.08 °F		Pass
250 F	250.03 °F	250.58 °F	1.64 °F	0.55 °F		Pass

-- End of measurement results--



APX03751

Page 2/2

Apex Instruments Inc.

7200 E. Dry Creek Rd, STE C-102, Centennial, CO 80112  
Ph. 303-804-0867 Cal.Leh@Apex-Instruments.com

# Calibration Certificate

Certificate Number: 185547

**Customer:**Cross Country Pipeline Supply  
Aurora, CO**Manufacturer:** Crystal Engineering**Model Number:** nVision 10,000 psi**Serial Number:** 790655**Description:** Pressure Module**Procedure:** CRY\_P\_nVPM**Calibrated To:** Manufacturer's Specifications**Technician:** Steven Laupan**Calibration Date:** 6/6/2018**Due Date:** 6/6/2019**As Found:** In Tolerance**As Left:** As Found**Temperature:** 73 F**Humidity:** 34 %**Technician Notes:**

As Left Userspan: 0.99962

Approved Signature: 

Apex Instruments certifies that the instrument listed above meets the specifications of the manufacturer at the completion of its calibration. Standards used are traceable to the National Institute of Standards and Technology (NIST), or have been derived from accepted values, natural physical constants, or through the use of the ratio method of self-calibration techniques.

Methods used are in accordance with the procedure listed above. This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

This certificate does not guarantee the continued performance of the instrument listed above. Any modifications or services performed hereafter may void this certificate.

This certificate is not to be reproduced other than in full, except with prior written approval from Apex Instruments Inc.

## Standards Used

Description	Model Number	Serial Number	Calibration Date	Due Date	ID
Electronic Deadweight Tester	RPM4-E-DWT A100MA10M	1709	11/13/2017	11/13/2018	APX00024



APX03752

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Apex Instruments Inc.

# PSS-COMPANIES



9700 E. 104<sup>TH</sup> AVE, UNIT F- HENDERSON, CO 80640 - Phone (303)857-7986 - Fax (303)389-4945

## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER: CO

Details +/-: 1.0% ACCURACY

**DATE CALIBRATED:** 04/26/2018

**DUE DATE:** 04/26/2019

**INDICATED TEMPERATURE RANGE:** # 0 – 150°F

**INDICATED PRESSURE RANGE:** #0 – 3000 PSI

**SERIAL NO:** 265-4840

**MANUFACTURER:** BARTON/ 12" RECORDER

**TYPE OF INSTRUMENT CALIBRATED:** TEMPERATURE / PRESSURE RECORDER

**INSTRUMENT FINDINGS/STATUS:** UNIT IS IN TOLERANCE/ INSTRUMENT MEETS OR EXCEEDS SPECIFICATIONS.

**BASED ON INTERNATIONAL STANDARDS OF GRAVITY:** (980.665 cm./sq.).

**TYPE OF STANDARD USED TO CALIBRATE:** REFINERY DEADWEIGHT TEST UNIT SPT. (35225-3) SERIAL No. 5268; KESSLER TEST THERMOMETERS; SERIAL NO. CALIBRATION

**ALL STANDARD DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGIES TEST NO:** (N.I.S.T.) 2.6/172490 & 6.6/139577.

**CALCULATED USING MASS VALUES, AREA, AO, AND STATED GRAVITY.**  
**ROOM TEMPERATURE/HUMIDITY (AT TIME OF TEST):** 66°F / 25%.

CALIBRATED BY: NICK BEDFORD

A handwritten signature in black ink, appearing to read 'NICK BEDFORD', written over a horizontal line.

SIGNATURE

# PSS-COMPANIES



9700 E. 104<sup>TH</sup> AVE, UNIT F- HENDERSON, CO 80640 - Phone (303)857-7986 - Fax (303)389-4945

## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER: CO

Details +/-: 1.0% ACCURACY

DATE CALIBRATED: 01/12/2018  
DUE DATE: 01/12/2019

INDICATED TEMPERATURE RANGE: # 0 – 150°F  
INDICATED PRESSURE RANGE: #0 – 3000 PSI  
SERIAL NO: 265-3801  
MANUFACTURER: BARTON/ 12" RECORDER

TYPE OF INSTRUMENT CALIBRATED: TEMPERATURE / PRESSURE RECORDER

INSTRUMENT FINDINGS/STATUS: UNIT IS IN TOLERANCE/ INSTRUMENT MEETS OR EXCEEDS SPECIFICATIONS.

BASED ON INTERNATIONAL STANDARDS OF GRAVITY: (980.665 cm./sq.)

TYPE OF STANDARD USED TO CALIBRATE: REFINERY DEADWEIGHT TEST UNIT SPT. (35225-3) SERIAL No. 5268; KESSLER TEST THERMOMETERS; SERIAL NO. CALIBRATION DATE: JANUARY 30, 2017

ALL STANDARD DIRECTLY TRACEABLE TO NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGIES TEST NO: (N.I.S.T.) 2.6/172490 & 6.6/139577.

CALCULATED USING MASS VALUES, AREA, AO, AND STATED GRAVITY.  
ROOM TEMPERATURE/HUMIDITY (AT TIME OF TEST): 66°F / 25%.

CALIBRATED BY: NICK BEDFORD

A handwritten signature in black ink, appearing to read 'Nick Bedford', is written over a horizontal line.

Certificate Number: 185517

6/6/2018

Compass Import 10000PSI	As Found - As Left				Pass
Test Description	Nominal	Test Results	Tolerance (+/-)	LIUT Error	Status
0	-0.01 psi	0.0 psi	1.5 psi	0.0 psi	Pass
2000	2000.91 psi	2000.5 psi	1.5 psi	-0.4 psi	Pass
4000	3999.97 psi	3999.8 psi	2.0 psi	-0.2 psi	Pass
6000	5999.86 psi	5999.5 psi	3.0 psi	-0.4 psi	Pass
8000	8000.37 psi	7999.5 psi	4.0 psi	-0.9 psi	Pass
10000	10000.45 psi	9999.6 psi	5.0 psi	-0.9 psi	Pass
8000	7999.28 psi	7998.7 psi	4.0 psi	-0.6 psi	Pass
6000	6001.27 psi	6001.1 psi	3.0 psi	-0.2 psi	Pass
4000	3999.86 psi	4000.0 psi	2.0 psi	0.3 psi	Pass
2000	2000.74 psi	2000.8 psi	1.5 psi	0.1 psi	Pass
0	-0.03 psi	0.0 psi	1.5 psi	0.0 psi	Pass

-- End of measurement results--



# Calibration Certificate

7200 E. Dry Creek Rd, STE C-102, Centennial, CO 80112  
Ph. 303.804-0667 Cal.Lab@Apex-Instruments.com

**Certificate Number: 185546**

**Customer:**  
Cross Country Pipeline Supply  
Aurora, CO

**Manufacturer:** Crystal Engineering  
**Model Number:** nVision RTD100  
**Serial Number:** 788687  
**Description:** Temperature Module (RTD)  
**Procedure:** CRY\_R\_RTD100p  
**Calibrated To:** Manufacturer's Specifications  
**Technician:** Steven Laupan

**Calibration Date:** 6/7/2018  
**Due Date:** 6/7/2019  
**As Found:** Indeterminate  
**As Left:** In Tolerance  
**Temperature:** 73 F  
**Humidity:** 37 %

**Tolerance Specs:**  
Range: 0 to 400 ohms ; -328 to 1562 degF (PT100 0.00385)

Resistance 0 to 100% of FS: +/- (0.015% of R<sub>dg</sub> + 0.02 ohms)  
Class B Probe Temperature Deviation: +/- (0.3 + 0.005°T) degC

**Technician Notes:**

As Found: Indeterminate - Upon receipt, the RTD terminal connector was found to be worn out and provided inconsistent "As Found" data. As a result, no "As Found" data was recorded and the connector was replaced. Adjustments were required to achieve the "As Left" results.

As left userspan: 1.00021  
As left R0: 100.000

Approved Signatory:

Apex Instruments certifies that the instrument listed above meets the specifications of the manufacturer at the completion of its calibration. Standards used are traceable to the National Institute of Standards and Technology (NIST), or have been derived from accepted values, natural physical constants, or through the use of the ratio method of self-calibration techniques.

Methods used are in accordance with the procedure listed above. This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

This certificate does not guarantee the continued performance of the instrument listed above. Any modifications or services performed hereafter may void this certificate.

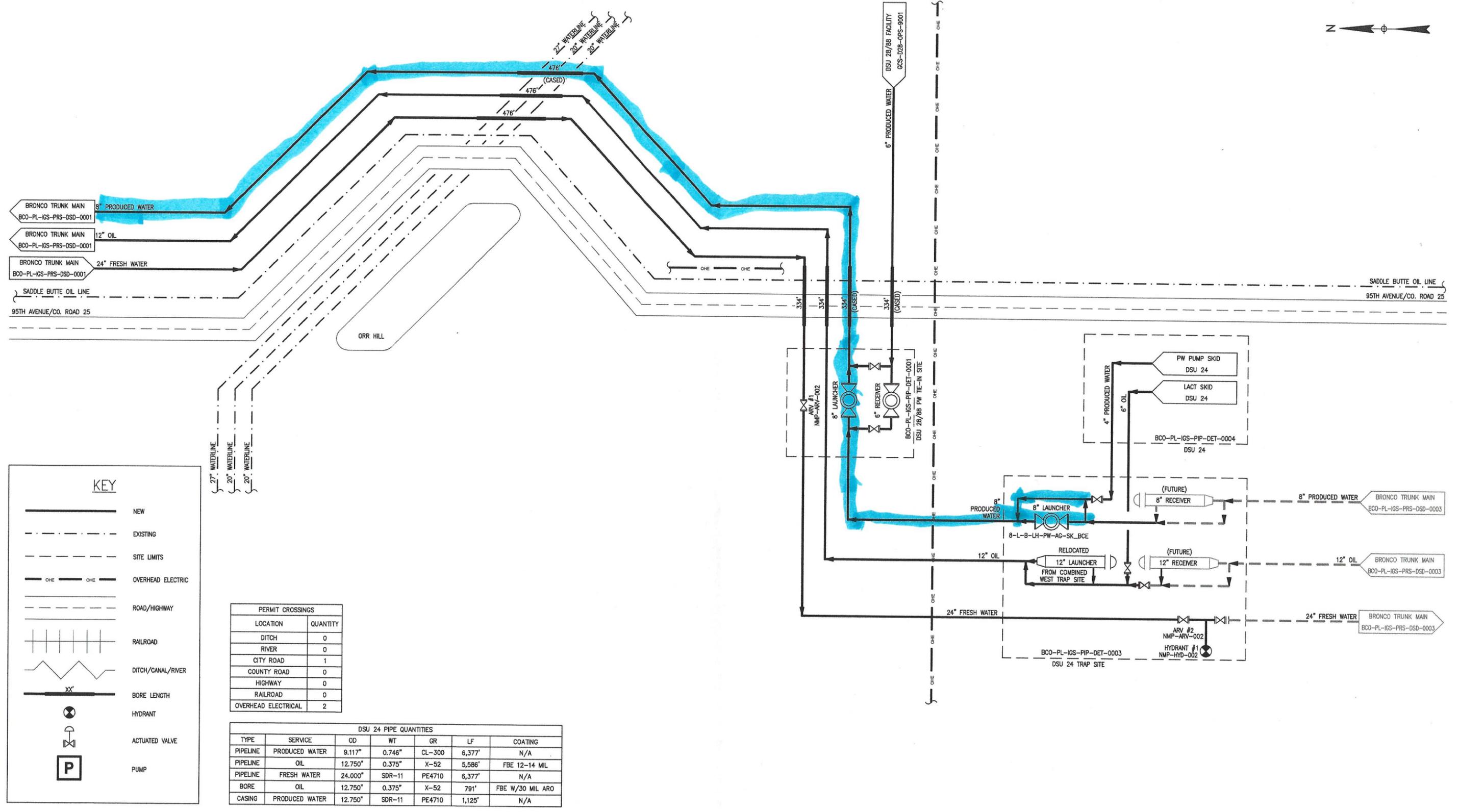
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**Standards Used**

Description	Model Number	Serial Number	Calibration Date	Due Date	ID
Digital Multimeter, 8 1/2 Digit	3458A	2823A11060	1/9/2018	1/9/2019	APX00012
Reference Thermometer Readout / PRT	1502A / 5628-12-D	B64070 / 3528	7/17/2017	7/17/2018	APX00014
Decade Resistor	1433-28	E1-17295164	7/26/2017	7/26/2018	APX02856



FILE PATH: P:\ENGINEERING\PROJECTS\MOBILE\2017 BRONCO SYSTEM\09 PROJECT DRAWINGS\05 PFD-OPS SCV\BCO-PL-IGS-PRS-DSD-0002.DWG BY:MKR/SDS DATE:Jun 04, 2018 4:58pm



**KEY**

- NEW
- EXISTING
- SITE LIMITS
- OVERHEAD ELECTRIC
- ROAD/HIGHWAY
- RAILROAD
- DITCH/CANAL/RIVER
- BORE LENGTH
- RAILROAD
- HYDRANT
- ACTUATED VALVE
- PUMP

PERMIT CROSSINGS	
LOCATION	QUANTITY
DITCH	0
RIVER	0
CITY ROAD	1
COUNTY ROAD	0
HIGHWAY	0
RAILROAD	0
OVERHEAD ELECTRICAL	2

DSU 24 PIPE QUANTITIES						
TYPE	SERVICE	OD	WT	GR	LF	COATING
PIPELINE	PRODUCED WATER	9.117"	0.746"	CL-300	6,377'	N/A
PIPELINE	OIL	12.750"	0.375"	X-52	5,586'	FBE 12-14 MIL
PIPELINE	FRESH WATER	24.000"	SDR-11	PE4710	6,377'	N/A
BORE	OIL	12.750"	0.375"	X-52	791'	FBE W/30 MIL ARO
CASING	PRODUCED WATER	12.750"	SDR-11	PE4710	1,125'	N/A

NOTES:

REFERENCE DRAWINGS		REVISIONS				APPROVALS	
BCO-PL-IGS-PIP-DET-0001	DSU 28/88 PW TIE-IN SITE					SIGNATURE	DATE
GCS-D28-OPS-9001	OPERATIONAL SCHEMATIC						
DWG NO.	TITLE	REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE
		0	ISSUED FOR CONSTRUCTION	MAK	30-MAY-2018	DAN	30-MAY-2018

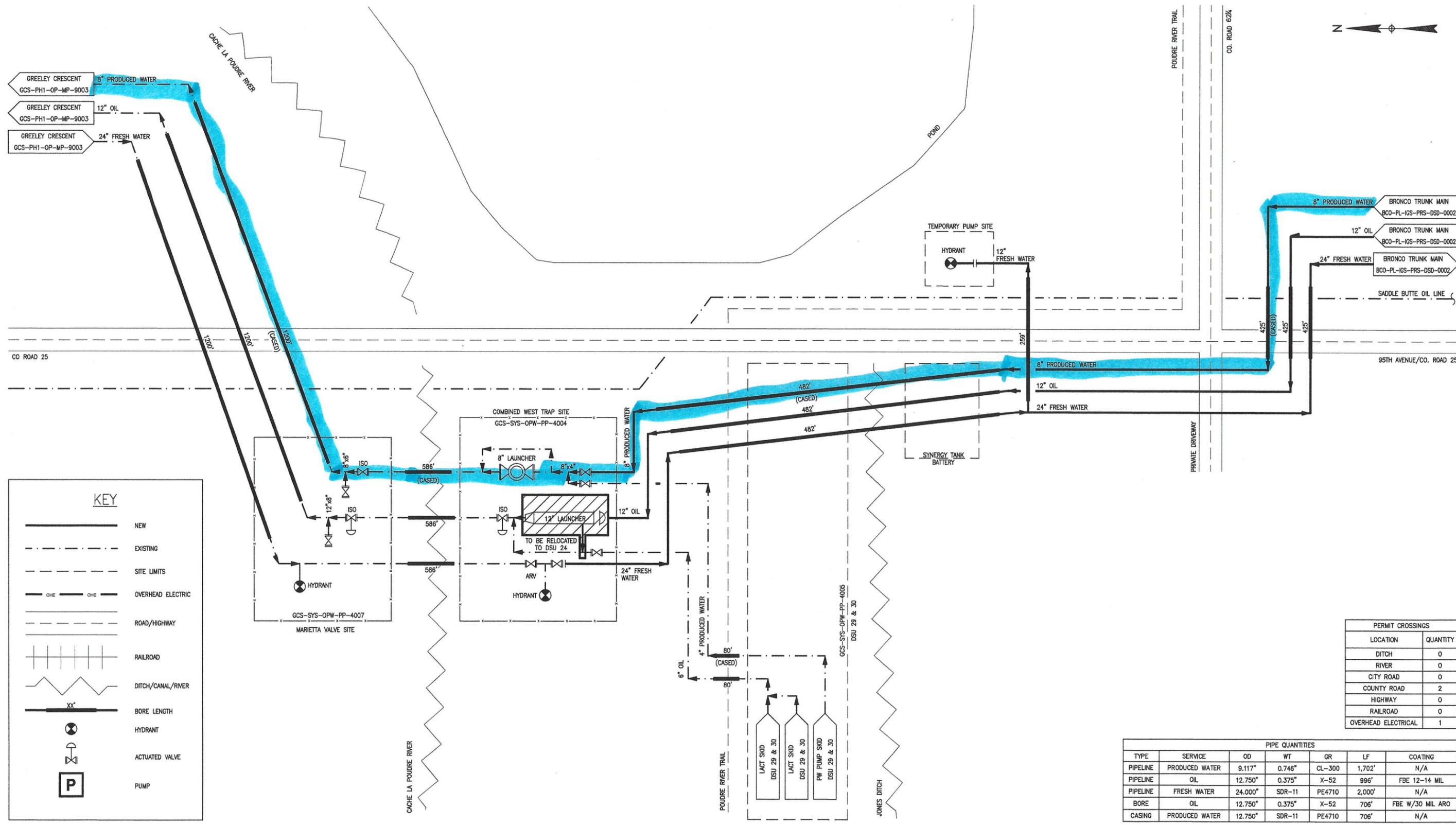
**PSI**

**Noble MIDSTREAM**

GREELEY CRESCENT SYSTEM  
BRONCO TRUNK MAIN  
OPERATIONAL SCHEMATIC  
DSU 24

SCALE: NTS  
DRAWING NO. BCO-PL-IGS-PRS-DSD-0002  
REV. 0

FILE PATH: P:\ENGINEERING\PROJECTS\NOBLE\2017 BRONCO SYSTEM\09 PROJECT DRAWINGS\05 PFD-OPS SCA\BCO-PL-IGS-PRS-DSD-000.DWG BY:MMUNUSEN DATE:Jun 29, 2018 11:49am



**KEY**

- NEW
- EXISTING
- SITE LIMITS
- OVERHEAD ELECTRIC
- ROAD/HIGHWAY
- RAILROAD
- DITCH/CANAL/RIVER
- BORE LENGTH
- HYDRANT
- ACTUATED VALVE
- P PUMP

PERMIT CROSSINGS	
LOCATION	QUANTITY
DITCH	0
RIVER	0
CITY ROAD	0
COUNTY ROAD	2
HIGHWAY	0
RAILROAD	0
OVERHEAD ELECTRICAL	1

PIPE QUANTITIES						
TYPE	SERVICE	OD	WT	GR	LF	COATING
PIPELINE	PRODUCED WATER	9.117"	0.748"	CL-300	1,702'	N/A
PIPELINE	OIL	12.750"	0.375"	X-52	996'	FBE 12-14 MIL
PIPELINE	FRESH WATER	24.000"	SDR-11	PE4710	2,000'	N/A
BORE	OIL	12.750"	0.375"	X-52	706'	FBE W/30 MIL ARO
CASING	PRODUCED WATER	12.750"	SDR-11	PE4710	706'	N/A

NOTES:

REF	TITLE

REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
1	ISSUED FOR CONSTRUCTION - REMOVAL OF ARV	MAK	29-JUN-2018	DAN	29-JUN-2018	-	-
0	ISSUED FOR CONSTRUCTION	MAK	05-JUN-2018	DAN	05-JUN-2018	-	-

APPROVALS		
SIGNATURE	DATE	

**Noble MIDSTREAM**

**GREELEY CRESCENT SYSTEM  
BRONCO TRUNK MAIN  
OPERATIONAL SCHEMATIC  
DSU 24**

SCALE: NTS      DRAWING NO. BCO-PL-IGS-PRS-DSD-0001      REV. 1





Hydrostatic Pressure Test Procedure  
DSU 24/27 – 8” PW Pipeline

DJBU

NMP Doc.  
No.:

N/A

Rev.:

0



**Greeley Crescent II-Gathering System**

**DSU 24/27 – 8” Flexsteel Produced Water Pipeline (CL 300)  
Hydrostatic Pressure Test Procedure**



0	6/4/2018	JL	Issued for Implementation		
REV	DATE	BY	DESCRIPTION	CHKD	APPVD
			Noble Midstream Partners, LLC		
			Hydrostatic Pressure Test Procedure		
			Doc. No. N/A		

	Hydrostatic Pressure Test Procedure DSU 24/27 – 8” PW Pipeline			DJBU
	NMP Doc. No.:	N/A	Rev.: 0	

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	Hydrostatic Pressure Test Procedure DSU 24/27 – 8” PW Pipeline			DJBU
	NMP Doc. No.:	N/A	Rev.: 0	

## 1 EXECUTIVE SUMMARY

This procedure and the accompanying site-specific Hydrostatic Test Plan define the minimum requirements for the hydrostatic pressure testing of the **DSU 24/27 – 8” Flexsteel Produced Water Pipeline**. The piping and components to be tested using this procedure meet or exceed the pressure requirements of the ASME Class 300 flange rating for Type 2.2 materials between - 20 °F and 100 °F.

The hydrostatic pressure test has been analyzed for acceptable practices per applicable codes.

## 2 PRE-TEST CONSIDERATIONS

The pressure test shall comply with American Petroleum Institute’s “Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide.” (*API RP 1110*) Chapter 6 of API’s handbook provides general guidelines for pressure test implementation of steel pipe. In addition, testing will be in accordance with *ASME B31.4*, *ASME B16.5*, *49 CFR Part 195*, and the *FlexSteel Technical Manual*.

### 2.1 TEST PRESSURE

The **DSU 24/27 – 8” Flexsteel Produced Water Pipeline** shall be tested at a minimum test pressure of **940 PSIG** (125% the internal pressure rating) and a maximum test pressure of **1,100 PSIG** (150% the internal design pressure rounded to the next highest 25 psig increment). The upper and lower bounds of the test pressures are derived from *ASME B16.5* and *ASME B31.4 / 49 CFR Part 195* respectively.

The **DSU 24/27 – 8” Flexsteel Produced Water Pipeline** internal design pressure is **720 PSIG**, limited by the stainless steel flange rating.

The **DSU 24/27 – 8” Flexsteel Produced Water Pipeline** final hydrostatic test pressure shall be either **987 PSIG** or **1,050 PSIG**, at the point of filling, depending on where the operator chooses to fill the pipeline. See the table in **Section 3.4** for the two possible locations.

**Table 1: Upper and Lower Bound Test Pressures**

ASME Flange Class	Pipeline Wall Thickness (in)	Design Pressure – DP (psig)	Pipe Pressure Rating – PR (psig)	Minimum Test Pressure 125% PR (psig)	Maximum Test Pressure 150% DP (psig)
300	0.746	720	750	940	1,100

	Hydrostatic Pressure Test Procedure DSU 24/27 – 8” PW Pipeline			DJBU
	NMP Doc. No.:	N/A	Rev.: 0	

## 2.2 TEST DURATION

The hydrostatic test pressure shall be maintained for **8 hours** after final test pressure has stabilized, and the pipe has been conditioned properly in the field. With pipe conditioning, accounted for, the test commonly takes **16 – 20 hours**. This is dependent, however on how well the pipe responds to the conditioning procedure (**times up to 24 hours may be required**).

The test pressure shall be considered stabilized after **5 minutes** without fluctuation.

## 2.3 SAFETY PRECAUTIONS

This safety information is in addition to the safety information in other sections of this document.

Always take precautions to eliminate hazards to persons near lines being tested. For the entire duration of the procedure, including filling, initial pressurization, time at test pressure, and depressurization, only persons conducting the test or inspecting the system should be allowed near the section under test. These persons should be fully informed of the hazards of field pressure testing. All other persons should be kept a safe distance away. The test section must be supervised at all times. Failure may result in sudden, violent, uncontrolled, and dangerous movement of system piping, or components, or parts of components.

## 2.4 TEST EQUIPMENT AND MATERIALS

Pressure test equipment shall be selected to meet the hydrostatic test conditions and shall be in working order. The measurement equipment shall be designed for the pressures expected during the pressure test.

### 2.4.1 FILL PUMP

The pump used to fill the line shall be a high-volume pump which provides adequate pressure to overcome static head and maintains sufficient velocity to move pigs, spheres, and any debris in the pipeline.

The fill pump or associated discharge piping shall be equipped with a flow measurement device capable of maintaining a specified fill rate.

### 2.4.2 SUPPLY WATER FILTER

The pump discharge piping shall be equipped with an in-line filter capable of capturing debris greater than **1 mm**.

### 2.4.3 PRESSURIZATION PUMP

The pressurization pump shall be a variable speed, positive displacement pump that pressurizes the line to the specified test pressure. The pump shall have a known volume per stroke and shall be equipped with a stroke counter.

A constant-speed pump with a variable flowrate control may be used in lieu of the above pump if the liquid test medium injected into the pipeline is measured during pressurization.

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#### 2.4.4 CALIBRATION DEVICES

##### 2.4.4.1 Pressure Calibration Device

A deadweight tester or an equivalent pressure sensing device that is capable of measuring in increments of less than or equal to one (1) psig shall be used. The device shall have a certificate of calibration that is not more than one year old at the start of testing.

##### 2.4.4.2 Temperature Calibration Device

A certified thermometer shall be provided. The device shall have a certificate of calibration that is not more than one year old at the start of testing.

#### 2.4.5 RECORDING DEVICES

##### 2.4.5.1 Pressure Recording

This procedure refers to the recording device used during the test duration as a chart recorder. A digital recorder may be used in lieu of the more traditional chart recorder.

Pressure recording equipment shall be provided and qualified as follows:

- A continuous-recording pressure measurement device that provides a permanent record of pressure versus time. This device should be calibrated immediately before each use with the deadweight tester.
- Electronic pressure/temperature monitoring and recording systems that assist in the analysis of test data. Such systems can be used in lieu of the components listed above provided that the individual pressure sensors included in the systems have a level of sensitivity and can be field calibrated in a manner similar to those instruments listed above.

##### 2.4.5.2 Temperature Recording

Temperature recording equipment shall be provided and qualified as follows:

- A test medium temperature sensing and display instrument that is properly calibrated to a range suitable for anticipated test temperatures. Temperature instrument accuracy should be within 1 °F of actual temperature. Temperature instrument sensitivity should be within 0.1 °F.
- A continuous-recording temperature measurement device that provides a permanent record of test medium temperature versus time. This device should be calibrated immediately before each use with a certified thermometer.
- An ambient temperature sensing and display instrument that is properly calibrated to a range suitable for anticipated ambient temperatures. Temperature instrument accuracy should be within 1 °F of actual temperature. Temperature instrument sensitivity should be within 0.1 °F.
- A continuous-recording temperature measurement device that provides a permanent record of ambient temperature versus time. This device should be calibrated immediately before each use with a certified thermometer.

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#### 2.4.6 SAFETY RELIEF VALVE

The hydrostatic test fill pump and pressurization pump or associated discharge piping shall be equipped with a pressure relief valve. The pressure relief valve shall be set to relieve at **1,100 PSIG**, maximum test pressure.

#### 2.5 QUALIFICATION OF CONTRACTOR AND OPERATOR PERSONNEL

Qualifications of contractor and operator personnel for conducting pressure tests will be based on certification requirements by *49 CFR Part 195*, Code, or Noble standards and procedures.

Noble personnel and contractors involved with designing, planning, conducting, or approval of a pressure test should be qualified by both training and experience. Noble is responsible for establishing these qualifications. The following factors to determine qualifications are recommended per *API RP 1110*:

- Performance of applicable calculations and interpretation of test data and results.
- Knowledge of code requirements and regulations.
- Qualification requirements of governing authority to conduct or witness testing.
- Governmental or operator requirements to certify test results.
- Familiarity with equipment and pressure test set-up.
- Familiarity with test procedures.

#### 2.6 PERMIT TO WORK

Prior to commencing work, work permits shall be obtained. At a minimum, the below documents shall be submitted:

- Operator Qualification records for each person performing tasks.
- Test equipment certifications.
- Water source.
- Biocide injection plan. (If Applicable)
- Biocide Safety Data Sheets (SDS). (If Applicable)
- Leak monitoring plan.
- Depressurization plan.
- Water disposal plan.
- Drying plan (If Applicable).

### 3 TEST PROCEDURE

As part of the work permit, a hydrostatic test plan for each section of pipe shall be developed and submitted to the appointed Noble representative prior to commencing work. The test plan shall, at a minimum, address the requirements specified in this procedure.

#### 3.1 SOURCE WATER

The quality and source of the test water shall be determined prior to the permitting process.

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Non-potable water shall be treated with biocide prior to entering the pipeline. The SDS sheets and injection rate for the Biocide shall be submitted and approved by a Noble representative prior to work permit issuance. **Note: Biocide treatment may not always be required.**

Water shall be filtered prior to entering the pipeline. The maximum allowable particle size is **1 mm.**

**3.2 EQUIPMENT INSTALLATION**

If possible, excavated segments shall be backfilled prior to the initial pressurization.

Temporary piping shall be properly anchored and adequately secured from movement. Pipe couplings shall have safety devices or restraints to limit movement due to unexpected piping separation.

A flow meter shall be placed in the line to monitor and maintain the planned design rate of fill.

The sensor on each temperature recording device shall be installed so that it is in contact with the pipeline at a point where it has normal cover. Additionally, it shall be at a distance far enough from the injection point so that the effects of the exposed piping and make-up injection(s) on temperature is minimized. The backfill around the temperature recording device sensor shall be tamped.

Insulation, if appropriate, shall be used on the capillary lines to the temperature recorder and the temperature recorder should be installed in an insulated box. Large centrifugal pumps and storage tanks will affect the temperature of the test medium.

NOTE: According to the *FlexSteel Commissioning Field Notes*, FlexSteel recommends that the vent valves on all end fittings be removed during the hydrostatic test and replaced thereafter.

**3.3 LINE FILL**

Calculated line fill water volume: **474 US Oil Barrels**

All temporary piping and test heads shall be adequately secured before the line fill process is started.

If pigs or spheres are used in the filling process, they shall be equipped with trackers for monitoring location and speed during the line fill process.

NOTE: Only polyurethane pigs are allowed to be used with FlexSteel. (*FlexSteel Commissioning Field Notes*)

The fill pump shall be sized for the pigs to travel at a speed that will maintain a seal with the pipeline. This will reduce the risk of introducing air behind the pigs. A travel speed of 2 – 3 mph shall be maintained. The line fill flow rate for the **DSU 24/27 – 8” Flexsteel Produced Water Pipeline** must be **450 – 680 GPM (11 – 16 BPM)** in order to maintain the pig velocity in the 2 – 3 mph range.

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High velocities may cause excessive wearing of the pigs and may cause the displaced air to mix with the test medium. As pigs travel down the line and down a slope, unless backpressure is applied during the line fill, the weight of the column of fluid could cause the pig to travel faster than the specified speed and introduce air behind the pig.

Air shall be bled during the filling process to minimize the time for line pressure stabilization. The total amount of residual air shall be less than 0.2% of the volume of the test section.

If it is determined that air is trapped in the pipeline, vents or traps at high elevation points may be installed in order to bleed the air from the pipeline. Any equipment added to the pipeline shall be removed after the pipeline has been dewatered.

The temperature, pressure, and flow rate of the test medium during line fill shall be recorded. All applicable conditions shall be monitored to prevent over-pressurization during line fill.

### 3.4 INITIAL PRESSURIZATION

A pipe maintained at high pressure is potentially dangerous. Established safety guidelines in accordance with the work permit shall be followed at all times.

The amount of water required to increase the pressure from the initial fill to the final test pressure shall be calculated prior to the pressure test and made available to test personnel.

The initial pressurization of the segment of pipe to be tested begins once the segment is full of fluid and the appropriate measures have been taken to bleed all air.

Personnel conducting the test shall maintain continuous surveillance over the operation to ensure that it is carefully controlled. Test personnel should be located at a safe distance from the test section.

Pipe connections shall be periodically checked for leaks during the pressurization process.

The flowrate shall be monitored and logged for the preparation of a pressure-volume plot.

A pressure-volume plot shall be initiated at the start of the pressurization process and continue until the test pressure is reached. The lower end of the pressure-volume plot can be used to determine the total amount of residual air in the test section. The upper end of the pressure-volume plot can be used to determine if any pipe in the test segment may have reached its elastic limit.

The **DSU 24/27 – 8” Flexsteel Produced Water Pipeline** is **8,381 feet** of **9.117” OD 0.746” w.t.** FlexSteel pipe. It will be pressurized to either of the following hydrostatic test pressures at the corresponding location:

<b>Combined West Tie-In (0+00.00)</b>	<b>1050 psig</b>
<b>DSU 28/88 Tie-In Site (63+14.18)</b>	<b>998 psig</b>
<b>DSU 24 PW Pump Skid (83+80.64)</b>	<b>987 psig</b>

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Pressurization up to 25% of the final test pressure shall occur at a rate of **10 PSIG/MIN**.

Once 25% of the final test pressure is reached, the pressure must be allowed to stabilize for a minimum of **15 minutes**. The pressure shall be considered stabilized after **5 minutes** without fluctuation.

This process should be repeated for pressurizing the pipe to 50% of the final test pressure. Once the pressure has stabilized for **15 minutes**, the pipe should be pressurized to 75% of the final test pressure at a rate of **10 PSIG/MIN**. Now, the pressure should be allowed to stabilize for 1 hour.

After the pressure has stabilized to 75% of the final test pressure, pressurization at a rate of **5 PSIG/MIN** shall be used to complete the pressurization process up to the final test pressure. The final test pressure shall be considered stabilized after **5 minutes** without fluctuation.

When the final test pressure is reached and has stabilized, pressurization shall cease, the pipe blocked in, and all valves and connections to the line shall be inspected for leakage.

### 3.5 PIPE CONDITIONING

FlexSteel must be conditioned prior to commencing a “hold” or test period. This is for the purpose of allowing the polymer liner in the FlexSteel to creep to bed into the tensile elements in the FlexSteel. (*FlexSteel Technical Manual*)

After the test pressure has stabilized in the Initial Pressurization phase, the pipe should be blocked in. Then, the pressure drop in the pipe should be monitored and recorded continuously, or at least every fifteen (15) minutes for 1 hour. After that, the pipe should be re-pressurized to the test pressure, blocked in, and have its pressure monitored and recorded continuously, or at least every fifteen (15) minutes for 1 hour. (*FlexSteel Technical Manual*)

The two recorded pressure drops should be compared. If the rate of pressure drop is smaller for the second run, the pipe is conditioning and not leaking. (*FlexSteel Technical Manual*)

However, if the pressure drop rate does not decrease, there is a possibility that leak exists in the pressure boundary system. These leaks are usually in the test equipment or flanges rather than the pipe. If this occurs, testing should continue for two (2) additional cycles to verify that the pressure drop rate is still not changing. If the pressure drop rate remains constant, or increases, the test fittings and flange connections should be checked for leakage. Following this, if there is still no decline in the rate of pressure drop, the pipe is leaking. A leak in the pipe is rare, and if it occurs, it could result from a faulty end fitting or end fitting installation. Thus, the end fittings should be carefully inspected and/or replaced to determine if the leak occurred at an end fitting. (*FlexSteel Technical Manual*)

If the rate of pressure drop did decrease without any issues, the cycle of pressurizing to the test pressure, blocking the pipe in, and monitoring and recording the test pressure for an hour should continue a few more times to get more data and demonstrate that the rate of pressure drop is decreasing with each cycle. If an issue arises, then the steps mentioned above to determine if a leak is present should be followed.

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Otherwise, the anticipated 24-hour test pressure drop shall be calculated. That is, in a hypothetical 24-hour test, the anticipated pressure drop shall be calculated assuming the most recent pressure drop rate is maintained. If the predicted pressure is less than the Lower-Bound Test pressure (see the Site-Specific Hydrostatic Test Plan), then more conditioning cycles are needed. After each cycle, the predicted pressure drop shall be calculated for a 24-hour test to see if the pressure will always stay above the Lower-Bound Test Pressure. Once this has been confirmed, the pipe has been properly conditioned. The pipe should be re-pressurized to the test pressure, blocked in, and The Test Period shall start. (*FlexSteel Technical Manual*)

NOTE: The conditioning process can take several hours (8 – 12). It may be the case that the pipe needs to be pressurized up to the final test pressure a few times to finalize the conditioning before being blocked in and starting the test period. Also, it is recommended that all personnel be at least 50 feet away from the pipe during the pressure test. (*FlexSteel Commissioning Field Notes*)

Conditioning may occur during the evening and/or in cold weather situations and precautions must be taken to eliminate the possibility of freezing in the appurtenances, such precautions may include the use of thermal blankets and heaters.

3.6 THE TEST PERIOD

The Test Period shall begin after the temperature of the test medium, pipe temperature, and ground temperature have stabilized. When this stabilization process is complete, the pressurization pump should be isolated from the test section.

After inspecting for leakage, test personnel shall verify that the specified test pressure is being maintained.

Pressure and temperature shall be continuously monitored during the test. Data shall be recorded every half hour throughout the duration of the test.

The maximum allowable range of pressure fluctuation during the pressure test is defined by the “**Upper Bound Test Pressure**” and “**Lower Bound Test Pressure**” as shown in the **site-specific Hydrostatic Test Plan**, which is supplemental to this Hydrostatic Test Procedure. Any pressure excursions outside of these limits shall be reported to the Noble representative for further analysis.

Weather changes, such as the development of rain or clouds, which could affect the pressure and temperature of the pipe and test medium shall be documented on the test log.

The volume of any added or subtracted test medium shall be documented on the test log as well as its temperature and pressure at that time and be accounted for in the assessment of the results of the pressure test. For any pressure test of piping that cannot be 100% visually checked for leaks, it is mandatory that the volume of any test medium added or removed be accounted for to determine if the pressure test has been completed without evidence of leakage.

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### 3.7 SEARCHING FOR LEAKS

Prior to commencing work, the method(s) for locating leaks or failures shall be approved by the Noble representative. The operator may choose to fly, drive and/or walk the pipeline right-of-way to visually check for evidence of leaks during the pressure test. The operator should develop contingency plans for locating large and small leaks in areas of difficult terrain or in the event of inclement weather.

Acceptable methods for finding leaks during a pressure test are listed as follows:

- Sectioning or segmenting the pipeline and monitoring the pressure of each section. Closing mainline block valves will isolate the pipeline into smaller segments. Freeze plugs may also be used to isolate sections of the pipeline for evaluation.
- Acoustical monitoring equipment may be employed to narrow the search area.
- Odorants or tracers introduced into the test medium during the filling process will allow the operator to detect leaks with sensing equipment.

### 3.8 PRESSURE TEST FAILURES

All leaks and test failures shall be reported to the Noble representative immediately.

Any pipeline leaks or failures shall be documented in the test report.

If a rupture or a substantial leak occurs, the test shall be stopped and the pipeline depressurized. The cause of failure shall be understood, test procedures shall be reevaluated, and approval from the Noble representative shall be obtained before proceeding with repairs and starting a new hydrostatic test.

Pipe, valves, fittings, and test components that fail during a pressure test shall be investigated to determine the cause of failure and to minimize the possibility of a recurrence.

Pipe or other failed components shall be preserved for further examination and failure analysis.

If a small leak occurs, the pressure should be reduced to 80% of the final test pressure while locating the leak. After repairs are completed and authorization from the Noble representative has been obtained, the test can be restarted per the initial pressurization steps above.

Pressure excursions outside of the **Maximum and Minimum Test Pressures** as defined in **Section 2.1** of this procedure are considered test failures.

### 3.9 DEPRESSURIZATION, DISPLACEMENT, AND DISPOSAL OF TEST WATER

Prior to commencing work, a depressurization, displacement, and disposal plan shall be submitted to and approved by the Noble representative.

Depressurization activities shall not commence without authorization from the Noble representative. Once authorization is received, depressurization should commence at a rate of **10 PSIG/MIN** in increments of 25% of the final test pressure. The pressure should be allowed to stabilize for **15 minutes** between increments.

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Displacement and disposal activities shall not commence prior to Noble engineering acceptance of the hydrostatic test results.

A disposal plan for the test medium must be developed and the Noble representative shall review and approve the disposal plan.

Pigs or spheres used in the dewatering process shall be equipped with trackers for monitoring location and speed during the dewatering process.

The travel speed for the dewatering pigs shall be maintained at **2 – 3 MPH**.

### 3.10 DRYING OPERATIONS

If the pipeline will not be placed into service within seven (7) days of dewatering, drying operations are required.

Prior to commencing work, a drying plan shall be submitted to and approved by the Noble representative.

Upon completion of drying, a **5 PSIG** nitrogen blanket shall be maintained on the pipeline until commissioning.

## 4 RECORDS

After the hydrostatic test has been completed, the following records shall be submitted as part of the Final Test Report, **which must be reviewed and accepted by an authorized Noble representative**. These records must be retained as long as the pipeline is in use.

- Pressure / Volume Plot
- Pressure Recording Chart / Plot
- Calibration Records
  - Deadweight Tester
  - Chart Recorder
  - Temperature Recorders
  - Certified Thermometer
- 49 CFR Part 195 Operator Qualifications
  - Operator
  - Person responsible for making the test
  - Test company used, if any
- Hydrostatic Test Log, including:
  - Date and time of the test
  - Minimum test pressure
  - Test medium
  - Description of the pipeline tested and the test apparatus
- Leak Reports
- Failure Reports
- Site-specific hydrostatic test plan including:
  - Elevation profile of the pipeline
  - Locations of test sites over the entire length of the pipeline
- Temperature Chart / Plot

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**5 REFERENCES**

- 1) API RP1110 “Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide”
- 2) ASME B31.4 “Pipeline Transportation Systems for Liquids and Slurries”
- 3) ASME B16.5 “Pipe Flanges and Flanged Fittings”
- 4) 49 CFR Part 195 “Transportation of Hazardous Liquids by Pipeline”
- 5) “FlexSteel Technical Manual”
- 6) “FlexSteel Commissioning Field Notes”
- 7) Site Specific Hydrostatic Test Plan

# DSU 24/27 - 8" Flexsteel Produced Water Pipeline Hydrostatic Pressure Test Plan

