noble MIDSTREAM SERVICES

CRYSTAL GAUGE RECAP LOG DATA SHEET (C-7.b)

Project SGCI AFE/Work Order No. _____

Pipeline Greeley Crescent (Name) DSU 44 (Location)

Testing Contractor Nitrogen Services

Pipe O.D. 6.93 Wall thickness. .665 Grade _____ MFG'R: Flex Steel

Test Fluid water Additive NA

Test Location: Meter Skid Section No. 0+00 - 60+38

Instrumentation: meter skid (Location) (Type)

See Attached (Mfg'r) (S/N) (Date Calibrated)

Time	Pressure PSIG	Ambient Temp.
11:45	1022	65
12:00	1021	67
12:15	1020	69
12:30	1020	69
12:45	1019	70
1:00	1019	71
1:15	1018	72
1:30	1018	72
1:45	1018	72
2:00	1017	73
2:15	1017	73

Time	Pressure PSIG	Ambient Temp.
2:30	1016	73
2:45	1016	74
3:00	1016	75
3:15	1015	75
3:30	1015	75
3:45	1014	70
4:00	1014	68
4:15	1013	65
4:30	1013	64
4:45	1012	63
5:00	1011	61

Time	Pressure PSIG	Ambient Temp.
5:15	1011	58
5:30	1010	56
5:45	1009	54
6:00	1008	52
6:15	1008	51
6:30	1008	49
6:45	1007	48
7:00	1007	47
7:15	1006	46
7:30	1006	45
7:45	1006	44

Test Started 11:45 (Time) (AM)/PM 10-29-17 (Date) Test Ended 7:45 (Time) AM/(PM) 10-29-17 (Date)

Remarks: 8" flexsteel

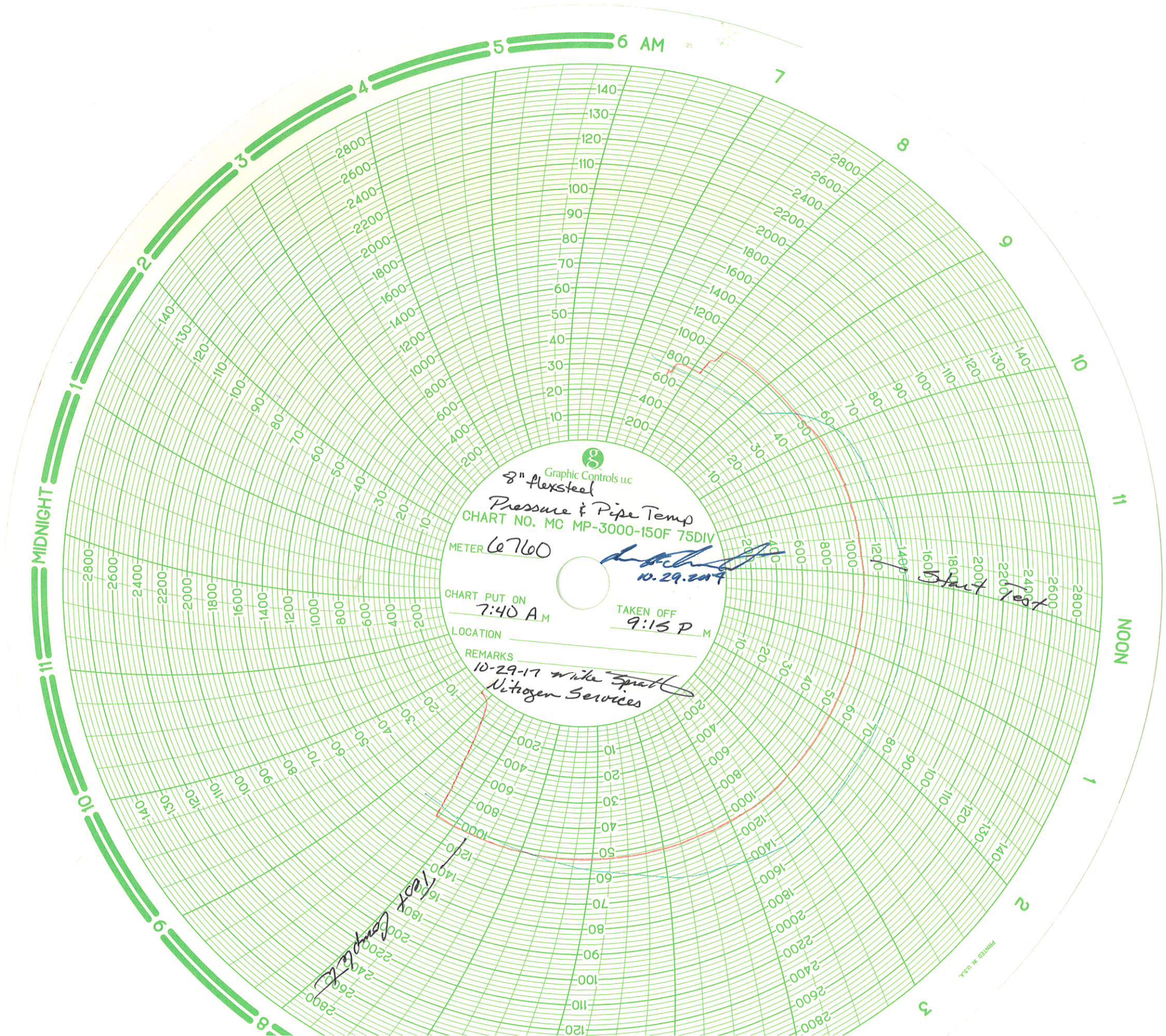
Weather: Partly cloudy, cool, light wind w/ sporatic gusts.

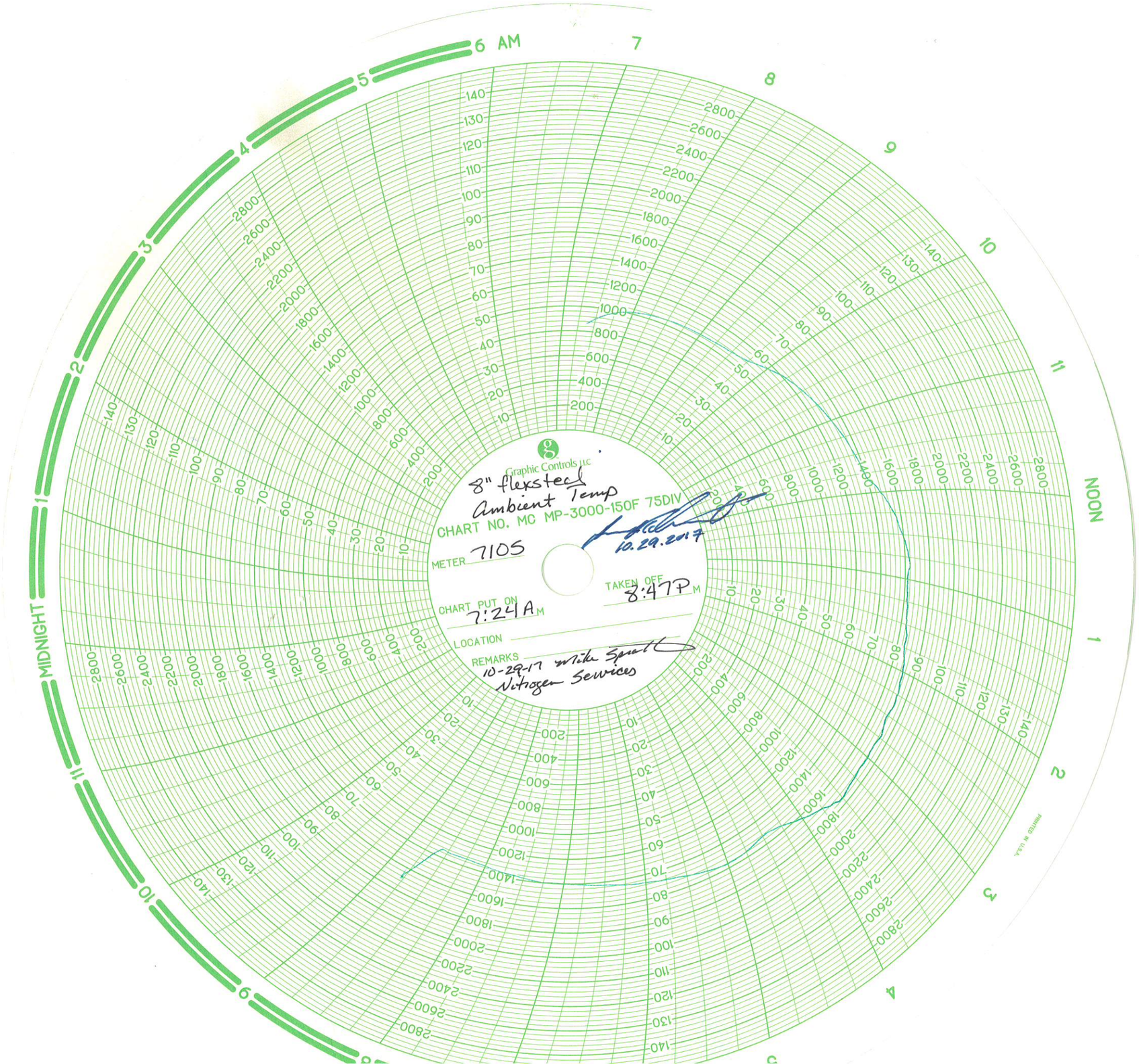
Testing Contractor's Representative Mike Spratlen (Name) Supervisor (Title) Mike Spratlen (Signature) 10-29-17 (Date)

Constr. Contractor's Representative Justin C Peeler (Name) Foreman (Title) Justin C Peeler (Signature) (Date)

Company Representative GEORGE TRUMANTIES (Name) PIC (Title) (Signature) 10.29.2017 (Date)

Construction Superintendent _____ (Name) (Title) (Signature) (Date)


Graphic Controls LLC
8" Flexsteel
Pressure & Pipe Temp
CHART NO. MC MP-3000-150F 75DIV
METER 67760
10.29.2014
CHART PUT ON 7:40 AM
TAKEN OFF 9:15 PM
LOCATION
REMARKS
10-29-17 w/ Mike Spratt
Nitrogen Services
Start Test
Start Temp
MIDNIGHT
NOON
6 AM
PRINTED IN U.S.A.


Graphic Controls LLC
8" flexstem
Ambient Temp
CHART NO. MC MP-3000-150F 75DIV
METER 7105
10.29.2017
TAKEN OFF 8:47PM
CHART PUT ON 7:24AM
LOCATION
REMARKS
10-29-17 mike Spratt
Nitrogen Services
6 AM
7
8
9
10
11
NOON
1
2
3
4
5
MIDNIGHT

CHARTS ltd.

GAS MEASUREMENT

CALIBRATION CERTIFICATE

Date:	4/21/2017
DueDate:	4/21/2018

Customer:	NITROGEN SERVICES LLC
Model:	DEADWEIGHT
SERIAL:	5366

This is to cerify that this instrument has been inspected and t against Additel Digital Guage ADT GP30K, Serial#218141D00 Calibrated (11-12-16). Reference Standard Serial#11-218 Ce with Dead Weight Model#KY250 Traceability#1500132804 Traceable to NIST. Calibrated in accordance with ISO9000 Quality Standards

This instrument is cerified to be accurate within +/- 1% of nominal value

Input Type/ Range: 3000# **Color:** N/A
Pen Number: N/A

Ascending Applied:	Reading	Descending Applied:	Reading:
0	0	2995	3000
499	500	2495	2400
1498	1500	1498	1500
2495	2400	499	500
2995	3000	0	0

Input Type/ Range: **Color:**
Pen Number:

Ascending Applied:	Reading:	Descending Applied:	Reading;

Input Type/Range: **Color:**
Pen Number:

Ascending Appiled:	Reading:	Descending Applied:	Reading:

P.O. BOX 2983 2031 TRADE DR.
MIDLAND, TX 79706
(432) 697-7801 (432) 520-3564Fax

Technician: Blake Estep

CHARTS ltd.

GAS MEASUREMENT

CALIBRATION CERTIFICATE

Date:	4/21/2017
DueDate:	4/21/2018

Customer:	NITROGEN SERVICES LLC
Model:	CLP 12"
SERIAL:	7105

This is to cerify that this instrument has been inspected and t against Additel Digital Guage ADT GP30K, Serial#218141D00 Calibrated (11-12-16). Reference Standard Serial#11-218 Ce with Dead Weight Model#KY250 Traceability#1500132804 Traceable to NIST. Calibrated in accordance with ISO9000 Quality Standards

This instrument is cerified to be accurate within +/- 1% of nominal value

Input Type/ Range: 3000# **Color:** RED
Pen Number: 1

Ascending Applied:	Reading	Descending Applied:	Reading:
0	0	2990	3000
900	900	2399	2400
1500	1500	1500	1500
2398	2400	900	900
2990	3000	0	0

Input Type/ Range: 0-150F **Color:** GREEN
Pen Number: 2

Ascending Applied:	Reading:	Descending Applied:	Reading;
0	0	150	150
32	32	32	32
150	150	0	0

Input Type/Range: **Color:**
Pen Number:

Ascending Appiled:	Reading:	Descending Applied:	Reading:

P.O. BOX 2983 2031 TRADE DR.
MIDLAND, TX 79706
(432) 697-7801 (432) 520-3564Fax

Technician: Susanna Lopez

CHARTS ltd.

GAS MEASUREMENT

CALIBRATION CERTIFICATE

Cert Date:	4/21/2017
Due Date:	4/21/2018

Customer:	NITROGEN SERVICES, LLC
Model:	BULLFROG 12"
Serial#	6760

This is to certify that this instrument has been inspected and tested against ADDITEL Digital Gauge ADT680-GP3K, S#218140F0012 Calibrated (11-2-16). Reference Standard#1244 Certified-- with Piston Gauge PG7202 Traceability#1500155509 to NIST. Calibrated in accordance with ISO Quality Standards

This instrument is cerified to be accurate within +/- 1% of nominal value

Input Type/ Range: 3000# **Color:RED**
Pen Number: 1

Ascending		Descending	
Applied	Reading:	Applied:	Reading :
0	0	2998	3000
600	600	2398	2400
1500	1500	1500	1500
2398	2400	600	600
2998	3000	0	0

Input Type/Range: 0-150F **Color:GREEN**
Pen Number: 2

Ascending		Descending	
Applied:	Reading:	Appiled:	Reading;
0	0	150	150
32	32	32	32
150	150	0	0

Input Type/ Range: **Color:**
Pen Number:

Ascending		Descending	
Appiled;	Reading:	Applied:	Reading:

P.O. BOX 2983 2031 TRADE DR.
MIDLAND, TX 79706
(432) 697-7801 (432) 520-3564

Technician: Lusanna, Lopez LP

Greeley Crescent Gathering Project

DSU 44 Lateral – 6” PW Pipeline (CL 300)

Hydrostatic Pressure Test Procedure

1	7/17/2017	LZT	Issued for Review	DAN	
REV	DATE	BY	DESCRIPTION	CHKD	APPVD

	Noble Midstream Partners, LLC
	Hydrostatic Pressure Test Procedure
	Doc. No. N/A

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

This procedure and the accompanying site-specific Hydrostatic Test Plan define the minimum requirements for the hydrostatic pressure testing of the **6" Greeley Crescent DSU 44 Lateral PW** 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 **6" Greeley Crescent DSU 44 Lateral** pipeline shall be tested at a minimum test pressure of 125% the internal pressure rating and a maximum test pressure of 150% the internal design pressure rounded to the next higher 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 **Greeley Crescent DSU 44 Lateral** internal design pressure is **720 PSIG**, limited by the flange rating.

The **Greeley Crescent DSU 44 Lateral** final hydrostatic test pressure shall be **1,000 PSIG** or **1,008 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.

The minimum pipeline test pressure shall be **940 PSIG** and the maximum test pressure shall be **1,100 PSIG**.

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	0.665	720	750	940	1,100

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 **100 µm**.

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.

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.

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**.

2.5 QUALIFICATION OF CONTRACTOR AND OPERATOR PRESONNEL

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.

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 **100 µm**.

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: **184 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 **6" Greeley Crescent DSU 44 Lateral** pipeline must be **260 – 390 GPM (6 – 9 BPM)** in order to maintain the pig velocity in the 2 – 3 mph range.

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 **Greeley Crescent DSU 44 Lateral PW** pipeline is **6,039 feet** of **6.93" OD 0.665" w.t.** FlexSteel pipe. It will be pressurized to either of the following hydrostatic test pressures at the corresponding location:

DSU 44 Tie-In Site	**1,000 psig**
DSU 44 Pump Skid Area	**1,008 psig**

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.

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)*

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.

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.

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.

Drying shall be accomplished by sweeping the pipeline with nitrogen.

Upon completion of the nitrogen sweep, 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 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

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

Greeley Crescent DSU 44 Lateral - 6 in PW Pipeline Hydrostatic Pressure Test Plan

Start Test Location Target Parameters
- **Target Pressure:** 1,000 psig
- **Upper Bound Pressure:** 1,025 psig
- **Lower Bound Pressure:** 975 psig

End Test Location Target Parameters
- **Target Pressure:** 1,008 psig
- **Upper Bound Pressure:** 1,033 psig
- **Lower Bound Pressure:** 983 psig

Design Note:
The test conditions detailed in this exhibit shall be performed and verified in order for the system to be rated for the internal design pressure of 750 psig.
This test is designed to comply with hydrostatic testing standards outlined in API RP 1110, ASME B31.4, ASME B16.5, and 49 CFR Part 195.

Pipe Spec: 6.93 in OD, 0.665 in w.t., FlexSteel
Minimum Flange or Valve ANSI Rating: CL300 (720 psig)
Approximate Line Length: 6,039 feet
Water Volume: 184 US Oil Barrels