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COVERED TASK 8010 PROCEDURE 2012

GILL RANCH STORAGE®

Covered Task 8010 Procedure

2012

CSI

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Task 8010

Maximum Allowable Operating Pressure Determination for Natural Gas Pipelines

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Task Description	This task includes determining the maximum allowable operating pressure (MAOP) that can be used to safely operate the pipeline. This MAOP determination takes into consideration the physical design characteristics of the pipeline and its components, the commodity being transported, the pipeline route, the population densities and pipeline class locations the pipeline will pass through, the test pressure the pipeline is tested to, and other criteria.

Evaluation Criteria – The Qualified Operator must be able to:

1. Determine the Pipe Specifications and Design Factors.
2. Calculate the design pressure P for the pipe.
3. Determine the minimum rating for valves.
4. Determine the minimum rating for flanges.
5. Determine that the standard fittings have adequate ratings for the system.
6. If leak clamps are in use on the line, determine the design pressure ratings.
7. Determine the instrumentation takeoff connection ratings.
8. If an odorant is being injected into the line, determine the design pressure of the injection connections.
9. Determine the allowable pressure by test pressure.
10. Determine the allowable pressure from historic operations.
11. Select the lowest of the allowable operating pressures on the Maximum Allowable Operating Pressure Worksheet as the MAOP.
12. Abnormal Operating Conditions Procedure [Task 9100].

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Gill Ranch Storage's Pipeline Safety Procedures are integrated with corporate Engineering, Construction, Operations and Maintenance, Safety and Health and Environmental practices, policies, and procedures. All Qualified Operators must comply with these corporate programs in the execution of these covered tasks.
The Qualified Operator shall be aware of how these policies and procedures affect the practices of the specific Covered Task that they are performing.

Preceding Tasks / Activities - *A Qualified Operator must assess the work to be performed and determine what preceding tasks must be performed prior to the execution of this task. The preceding tasks and/or activities below as well as any others identified by the qualified individual may be required to be performed prior to the execution of this task.*

- Abnormal Operating Conditions [Task 9100].
- Gather Material Data on pipe, fittings, and pipeline components.
- Perform capacity calculations as required.
- Determine and define pipeline operating parameters.
- Class Population Density Study [Task 9010].
- Continuing Surveillance Task [9020].
- Review pipeline design criteria in 49 CFR 192. Subpart C – – Pipe Design.
- Review pipeline definitions in 49 CFR 192. Subpart A – – General.
- Review pipeline definitions in 49 CFR 192. Subpart B – – Materials.
- Review pipeline definitions in 49 CFR 192. Subpart D – – Design of Pipeline Components.
- Review pipeline testing requirements in 49 CFR 192. Subpart J – – Test Requirements.
- Review pipeline uprating requirements in 49 CFR 192. Subpart K – – Uprating.
- Review pipeline MAOP requirements in sub-parts 192.619 to 192.623 of 49 CFR 192. Subpart L – Operations.
- Determine regulatory permitting requirements.

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Step 1	**Determine the Pipe Specifications and Design Factors.** 1. Determine the following pipe characteristics and enter them on the Determination of Maximum Allowable Operating Pressure MAOP Worksheet Attachment 1: • S = yield strength in pounds per square inch kPa gauge. This is normally the Specified Minimum Yield Strength SMYS to which the pipe was ordered for construction and meets the requirements of one of the specifications listed in Attachment 2, Section I. If steel pipe that has been subjected to cold expansion to meet the SMYS is subsequently heated, other than by welding or stress relieving as a part of welding, the SMYS is limited to 75 percent of its listed SMYS if the temperature of the pipe exceeds 900 °F 482 °C at any time or is held above 600 °F 316 °C for more than 1 hour. If the SMYS is unknown, you must assume that it is 24,000 psi or less. Or you may take random samples from the pipe and do tensile tests. In most cases, you need 1 sample for each 10 joints of pipe. In some cases, you need 1 sample for each 5 joints of pipe. The requirements are shown in Attachment 2, Section II D. S is equal to the lower of 80% of the average of the tensile tests or the minimum value of the tensile tests. If the SMYS is unknown, Attachment 2, Section II D also details requirements for determining inspection parameters and the bending properties and weldability of the pipe. 192.105 Design Formula for Steel Pipe, 192.107 Yield Strengths for steel pipe, and Appendix B to Part 192—Qualification of Pipe • t = Nominal wall thickness of the pipe in inches millimeters. If the nominal wall thickness for steel pipe is not known, it is determined by measuring the thickness of each piece of pipe at quarter points on one end.

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Step 1 Continued	[t pipe wall thickness continued] If the pipe is of uniform grade, size, and thickness and there are more than 10 lengths, you only need to measure 10 percent of the individual lengths but no fewer than 10 lengths. The nominal wall thickness for the design formula is the next wall thickness found in commercial specifications that is below the average of all the measurements taken. However, the nominal wall thickness used may not be more than: o 1.14 times the smallest measurement taken on pipe less than 20 inches 508 millimeters in outside diameter, nor o 1.11 times the smallest measurement taken on pipe 20 inches 508 millimeters or more in outside diameter. 192.109 Nominal wall thickness t for steel pipe • D = Nominal outside diameter of the pipe in inches millimeters. • F = Design factor or the class factor is determined as follows: 0.72 – Class 1 0.60 – Class 2; Class 1 that crosses the ROW of an unimproved public road w/o a casing, crosses or makes a parallel encroachment on a street, road, or railroad w/o casing; is supported by a bridge; is used in a fabricated assembly 0.50 – Class 3; Class 2 that crosses on a street, road, or railroad w/o casing; Class 1 or 2 in a compressor station, regulator station, or measuring station. 0.40 – Class 4 192.111 Design factor F for steel pipe

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Step 1 Continued	
	▪ E = Longitudinal joint factor is determined by the table shown in Attachment 3. If the longitudinal joint type is unknown, you must assume 0.80 for pipe over 4 inches and 0.60 for pipe for pipe 4 inches or less. 192.113 Longitudinal joint factor E for steel pipe. ▪ T = Temperature derating factor is determined by the table in Attachment 4. 192.115 Temperature derating factor T for steel pipe.

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Step 2	**Calculate the design pressure P for the pipe, in accordance with the following formula and enter it on the Determination of MAOP Worksheet.** 1. $P = 2\ St/D \times F \times E \times T$ *Where:* *P*=Design pressure in pounds per square inch kPa gauge. *S*=Yield strength in pounds per square inch kPa as determined by: *D*=Nominal outside diameter of the pipe in inches millimeters. *t*=Nominal wall thickness of the pipe in inches millimeters. *F*=Design factor. *E*=Longitudinal joint factor. *T*=Temperature derating factor. 192.105 Design formula for steel pipe.

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Step 3	**Determine the minimum rating for valves and enter it on the Determination of MAOP Worksheet.** 1. Determine that the valves meet the minimum requirements of API 6D, or a national or international standard that provides an equivalent performance level. 2. Determine the valves whose shells have been tested to the minimum service rating and enter the minimum service rating on the Determination of MAOP Worksheet. 192.145 Valves.

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Step 4	**Determine the minimum rating for flanges and enter it on the Determination of MAOP Worksheet.** 1. Determine that the flanges meet the minimum requirements of ASME/ANSI B16.5, MSS SP-44, or an equivalent standard. 2. Determine the flanges with the minimum service rating and enter the minimum service rating on the Determination of MAOP Worksheet. 192.147 Flanges and flange accessories.

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Step 5	**Determine that the standard fittings have adequate ratings for the system and enter the minimum rating on the Determination of MAOP Worksheet.** 1. Determine that fittings meet the minimum metal thickness required to withstand the pressures and temperatures specified for the system. 192.149 Standard fittings.

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Step 6	**If leak clamps are in use on the line, determine the design pressure ratings and enter the minimum rating on the Determination of MAOP Worksheet.** 1. Determine if there are leak clamps in use on the line and, if so, the design pressure ratings. 2. Enter the minimum rating on the Determination of MAOP Worksheet.

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Step 7	**Determine the instrumentation takeoff connection ratings and enter the minimum rating on the Determination of MAOP Worksheet.** 1. Determine that each takeoff connection and attaching boss, fitting, or adapter is made material that can withstand the maximum service pressure and temperature of the pipe or equipment to which it is attached, and is designed to satisfactorily withstand all stresses without failure by fatigue 2. Determine the instrumentation takeoff connection ratings and enter the minimum rating on the Determination of MAOP Worksheet. 192.203 Instrument, control, and sampling pipe and components.

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Step 8	**If an odorant is being injected into the line, determine the design pressure of the injection connections and enter it on the Determination of MAOP Worksheet.** 1. If an odorant is being injected into the line, determine the design pressure of the injection connections and enter it on the Determination of MAOP Worksheet.

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Step 9	**Determine the allowable pressure by test pressure and enter that pressure on the Determination of MAOP Worksheet.** 1. Determine the most recent test pressure. 2. Divide that pressure by the Class Location factor [design factor F] in 49 CFR 192.619(a)(2)(ii). 3. Enter the result on the Determination of MAOP Worksheet. 192 Subpart J – Test Requirements

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Step 10	**Determine the allowable pressure from historic operations and enter that pressure on the Determination of MAOP Worksheet.** 1. Determine if the line meets the grandfather requirements of 192.619 c or if the timing of testing or if uprating as discussed in 192.619 a3 needs to be considered in determining the MAOP. 2. Enter the lower of the resulting allowable pressures on the Determination of MAOP Worksheet. 192.619 Maximum allowable operating pressure: steel or plastic pipelines.

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Step 11	**Select the lowest of the allowable operating pressures on the Maximum Allowable Operating Pressure Worksheet as the MAOP.** 1. Select the lowest of the allowable operating pressures on the Maximum Allowable Operating Pressure Worksheet as the MAOP.

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Step 12	Abnormal Operating Conditions Procedure [Task 9100] 1. Complete documentation as required.

Abnormal Operating Condition(s) - *In the performance of this task, it is reasonably anticipated to have or encounter:*

1. Review Procedure and assure that all AOC conditions have been included in the MAOP determination / review.
2. Loss of Communications

Response to AOC *(steps the Qualified Individual is authorized to conduct or supervise the execution of):*

1. Notify Plan Administrator and suspend operations until given approval to proceed.

2. If communications are lost, the operator will go to a non-explosive area and establish communications with the control room; the operator will provide the control room with the current conditions and any required information. The operator will then execute the actions based on directives from the supervisor/control room.

   [Note: If communications cannot be re-established, the operator must evaluate the current operating conditions and determine if it is necessary to suspend and/or terminate the operation.]

Post Tasks – Complete the following inspection / testing / field activities. Complete records identified below and transmit them to the appropriate personnel after the completion of the task.

Gill Ranch Storage	▪ Abnormal Operating Conditions [Task 9100].
Gill Ranch Storage	▪ File applications for regulatory permits/amend existing permits.
Gill Ranch Storage	▪ Gathering of MAOP calculations and back up data used in the calculations.
Gill Ranch Storage	▪ Pipeline System Uprating/Derating [Task 8030].
Gill Ranch Storage	▪ Incorporate changes in MAOP into the appropriate programs.
Gill Ranch Storage	▪ Review Pipeline Integrity Management requirements.

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DETERMINATION OF
MAXIMUM ALLOWABLE OPERATING PRESSURE
WORKSHEET

Identity of Pipeline System **ATTACHMENT 1**

[Pipeline Description] _____

_____

_____

Pipe specifications and design factors

Yield Strength in lbs/in^2 SMYS	S = _____
Nominal wall thickness in inches	t = _____
Nominal outside diameter in inches	D = _____
Design or Class Location factor	F = _____
Longitudinal joint factor	E = _____
Temperature derating factor	T = _____

Pipe design pressure including service lines P = _____

Valves _____
Flanges _____
Fittings _____

Mechanical Couplings	N/A
Leak Clamps	_____
Instruments	_____
Odorizers	_____

Pressure Test
Steel Pipe operated at or over 100 psi:
Test Pressure divided by Class Location Factor F _____

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DETERMINATION OF
MAXIMUM ALLOWABLE OPERATING PRESSURE
WORKSHEET

ATTACHMENT 1

Historic Operations

Highest operating pressure between 7/1/65 and 7/1/70 unless the pressure test was after 7/1/65 or an uprating in accordance with Subpart K has been conducted. _____

Part 192.619c: Alternate consideration for transmission lines. Unknown

Determination of MAOP.

The lowest pressure on any of the above lines is the MAOP.

MAOP _____

By _____

Date _____

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ATTACHMENT 2

Appendix B to Part 192—Qualification of Pipe

AS COPIED FROM ECFR ON 03/16/09

I. Listed Pipe Specifications

API 5L—Steel pipe, "API Specification for Line Pipe" ibr, *see* §192.7

ASTM A 53/A53M–99b—Steel pipe, "Standard Specification for Pipe, Steel Black and Hot-Dipped, Zinc-Coated, Welded and Seamless" ibr, *see* §192.7.

ASTM A 106—Steel pipe, "Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service" ibr, *see* §192.7.

ASTM A 333/A 333M—Steel pipe, "Standard Specification for Seamless and Welded Steel Pipe for Low Temperature Service" ibr, *see* §192.7.

ASTM A 381—Steel pipe, "Standard Specification for Metal-Arc-Welded Steel Pipe for Use with High-Pressure Transmission Systems" ibr, *see* §192.7.

ASTM A 671—Steel pipe, "Standard Specification for Electric-Fusion-Welded Pipe for Atmospheric and Lower Temperatures" ibr, *see* §192.7.

ASTM A 672—Steel pipe, "Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures" ibr, *see* §192.7.

ASTM A 691—Steel pipe, "Standard Specification for Carbon and Alloy Steel Pipe, Electric-Fusion-Welded for High Pressure Service at High Temperatures" ibr, *see* §192.7.

ASTM D 2513—Thermoplastic pipe and tubing, "Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings" ibr, *see* §192.7.

ASTM D 2517—Thermosetting plastic pipe and tubing, "Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings" ibr, *see* §192.7.

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ATTACHMENT 2

II. *Steel pipe of unknown or unlisted specification.*

A. *Bending Properties.* For pipe 2 inches 51 millimeters or less in diameter, a length of pipe must be cold bent through at least 90 degrees around a cylindrical mandrel that has a diameter 12 times the diameter of the pipe, without developing cracks at any portion and without opening the longitudinal weld.

For pipe more than 2 inches 51 millimeters in diameter, the pipe must meet the requirements of the flattening tests set forth in ASTM A53 ibr, *see* §192.7, except that the number of tests must be at least equal to the minimum required in paragraph II-D of this appendix to determine yield strength.

B. *Weldability.* A girth weld must be made in the pipe by a welder who is qualified under subpart E of this part. The weld must be made under the most severe conditions under which welding will be allowed in the field and by means of the same procedure that will be used in the field. On pipe more than 4 inches 102 millimeters in diameter, at least one test weld must be made for each 100 lengths of pipe. On pipe 4 inches 102 millimeters or less in diameter, at least one test weld must be made for each 400 lengths of pipe. The weld must be tested in accordance with API Standard 1104 ibr, *see* §192.7. If the requirements of API Standard 1104 cannot be met, weldability may be established by making chemical tests for carbon and manganese, and proceeding in accordance with section IX of the ASME Boiler and Pressure Vessel Code ibr, *see* 192.7. The same number of chemical tests must be made as are required for testing a girth weld.

C. *Inspection.* The pipe must be clean enough to permit adequate inspection. It must be visually inspected to ensure that it is reasonably round and straight and there are no defects which might impair the strength or tightness of the pipe.

D. *Tensile Properties.* If the tensile properties of the pipe are not known, the minimum yield strength may be taken as 24,000 p.s.i. 165 MPa or less, or the tensile properties may be established by performing tensile tests as set forth in API Specification 5L ibr, *see* §192.7. All test specimens shall be selected at random and the following number of tests must be performed:

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ATTACHMENT 2

Number of Tensile Tests - All Sizes

10 lengths or less.....	1 set of tests for each length.
11 to 100 lengths.....	1 set of tests for each 5 lengths, but not less than 10 tests.
Over 100 lengths.....	1 set of tests for each 10 lengths, but not less than 20 tests.

If the yield-tensile ratio, based on the properties determined by those tests, exceeds 0.85, the pipe may be used only as provided in §192.55c.

III. *Steel pipe manufactured before November 12, 1970, to earlier editions of listed specifications*.

Steel pipe manufactured before November 12, 1970, in accordance with a specification of which a later edition is listed in section I of this appendix, is qualified for use under this part if the following requirements are met:

A. *Inspection.* The pipe must be clean enough to permit adequate inspection. It must be visually inspected to ensure that it is reasonably round and straight and that there are no defects which might impair the strength or tightness of the pipe.

B. *Similarity of specification requirements.* The edition of the listed specification under which the pipe was manufactured must have substantially the same requirements with respect to the following properties as a later edition of that specification listed in section I of this appendix:

1 Physical mechanical properties of pipe, including yield and tensile strength, elongation, and yield to tensile ratio, and testing requirements to verify those properties.

2 Chemical properties of pipe and testing requirements to verify those properties.

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ATTACHMENT 2

C. *Inspection or test of welded pipe.* On pipe with welded seams, one of the following requirements must be met:

1 The edition of the listed specification to which the pipe was manufactured must have substantially the same requirements with respect to nondestructive inspection of welded seams and the standards for acceptance or rejection and repair as a later edition of the specification listed in section I of this appendix.

2 The pipe must be tested in accordance with subpart J of this part to at least 1.25 times the maximum allowable operating pressure if it is to be installed in a class 1 location and to at least 1.5 times the maximum allowable operating pressure if it is to be installed in a class 2, 3, or 4 location. Notwithstanding any shorter time period permitted under subpart J of this part, the test pressure must be maintained for at least 8 hours.

[35 FR 13257, Aug. 19, 1970]

Editorial Note: For Federal Register citations affecting appendix B of part 192, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

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ATTACHMENT 3

§ 192.113 Longitudinal joint factor E for steel pipe.

AS COPIED FROM ECFR ON 03/16/09

The longitudinal joint factor to be used in the design formula in §192.105 is determined in accordance with the following table:

Specification	Pipe class	Longitudinal joint factor (E)
ASTM A 53/A53M	Seamless	1.00
	Electric resistance welded	1.00
	Furnace butt welded	.60
ASTM A 106	Seamless	1.00
ASTM A 333/A 333M	Seamless	1.00
	Electric resistance welded	1.00
ASTM A 381	Double submerged arc welded	1.00
ASTM A 671	Electric-fusion-welded	1.00
ASTM A 672	Electric-fusion-welded	1.00
ASTM A 691	Electric-fusion-welded	1.00
API 5 L	Seamless	1.00
	Electric resistance welded	1.00
	Electric flash welded	1.00
	Submerged arc welded	1.00
	Furnace butt welded	.60
Other	Pipe over 4 inches (102 millimeters)	.80
Other	Pipe 4 inches (102 millimeters) or less	.60

If the type of longitudinal joint cannot be determined, the joint factor to be used must not exceed that designated for "Other."

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ATTACHMENT 4

§ 192.115 Temperature derating factor T for steel pipe.

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The temperature derating factor to be used in the design formula in §192.105 is determined as follows:

Gas temperature in degrees Fahrenheit (Celsius)	Temperature derating factor (T)
250°F (121°C) or less	1.000
300°F (149°C)	0.967
350°F (177°C)	0.933
400°F (204°C)	0.900
450°F (232°C)	0.867

For intermediate gas temperatures, the derating factor is determined by interpolation.

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