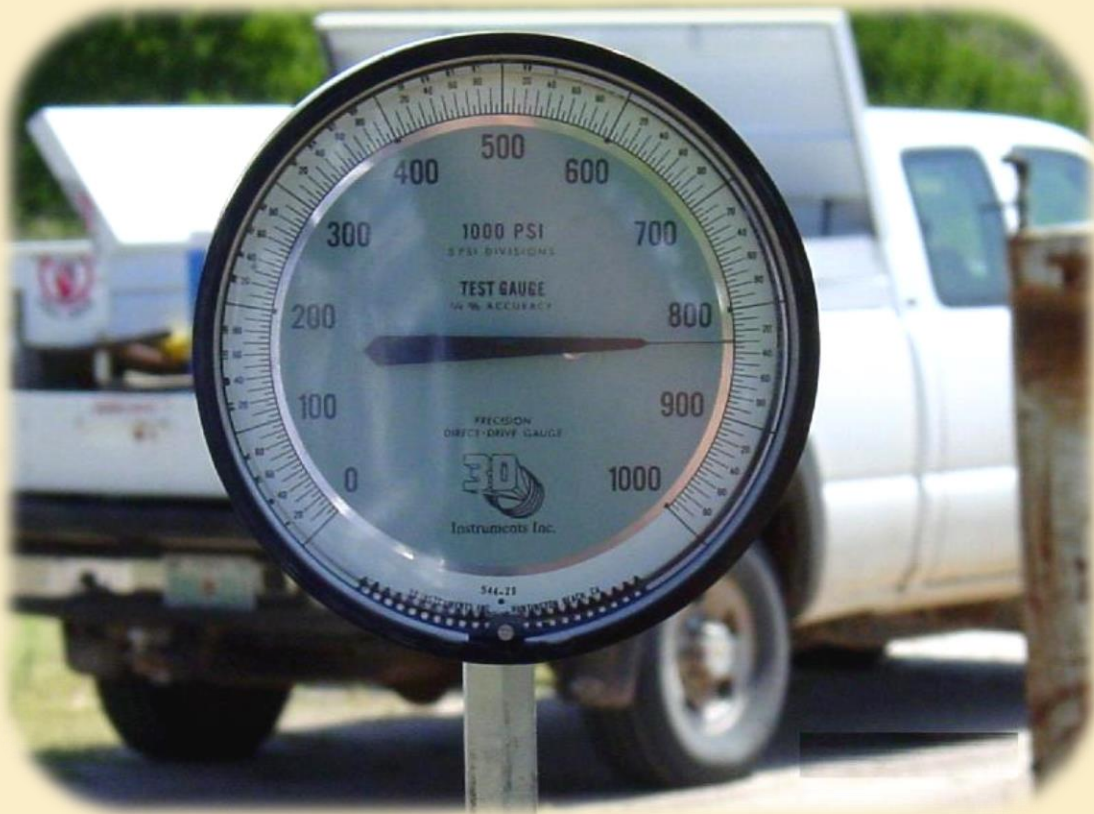




Maximum Allowable Operating Pressure for Natural Gas Pipelines

MAOP Found In Sub Parts



✓ 192.619

✓ 192.621

✓ 192.623

Pressures

MAOP

MOP

OP

MAOP

"Maximum Allowable Operating Pressure" means the maximum pressure at which a pipeline or segment of a pipeline may be operated under this part.

§192.3

MOP

"Maximum Actual Operating Pressure"
means the maximum pressure that occurs during normal operations over a period of one year.

§192.3

OP

"Operating Pressure" means the pressure on the pipeline at any given time.

Usually the set pressure of the Regulator

Class Location Definition

§192.5

The *class location unit* is an onshore area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline.

The class location is determined by the buildings in the *class location unit*. For the purposes of this section, each separate dwelling unit in a multiple dwelling building is counted as a separate building intended for human occupancy.

Class Location Unit

- A *Class 1* = 10 or less buildings intended for human occupancy or an offshore area.
- A *Class 2* = Greater than 10 but less than 46 buildings intended for human occupancy.
- A *Class 3* = 46 or more buildings intended for human occupancy; or

Class Location Unit

Class 3 - where the pipeline lies within 100 yards of either a building or a small,

- Well-defined Outside Area
 - Playground
 - Recreation Area
 - Outdoor Theater
- Occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period



Class Location Unit

Class 4 - where buildings with four or more stories aboveground are prevalent.

“Prevalent” means
“widely existing”



§192.619 - All Pipelines

Lowest of the following:

(a)(1) Design

(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

§192.619 - All Pipelines

Lowest of the following:

(a)(1) *Design*



(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

Design of Pipe and Components



Pipe

- For Steel - §192.105
- For Plastic - §192.121



Components

- Manufacturers Rating

§192.105 - Design of Steel Pipe

$$P = (2St/D)(F)(E)(T)$$

P = Design Pressure

S = Yield Strength

D = Outside Diameter

t = Wall Thickness

F = Design factor - §192.111

E = Longitudinal joint factor - §192.113

T = Temperature de-rating factor - §192.115

Converted or Uprated Lines

- If any variable necessary to determine the design pressure under the design formula is unknown, one of the following is used;
- Eighty percent of the first test pressure that produces yield under N5.0 of ASME B31.8; or
- If the pipe is 12.750 or less and is not tested to yield, 200 psig.

§192.619(a)(1)

Pipe Specifications

API 5L
Grade B
8"
.322" wt.



Design Pressure Calculation

$$P = 2St / D$$

$$P = (2)(35,000)(.322) / 8.625$$

$$P = 2613\#$$



**Equivalent Pressure
at 100% SMYS**

§192.111 - Design Factor (F) for Steel Pipe

$$P = \frac{2St}{D} (F)$$

Class location	Design factor (F)
1	.72
2	.60
3	.50
4	.40

§192.111 - Design Factor (F) for Steel Pipe In Class 3

$$P = \frac{(2)(35,000)(.322)(0.50)}{8.625}$$

$$P = 1307\#$$

E = Longitudinal Joint Factor - §192.113

T = Temperature De-rating Factor - §192.115

**Usually Not a Factor
Be Sure to Check!!**

(250°F or less)



Components



- **1000# WOG Valve**
- **ANSI Class 300# Flange**
- **ANSI Class 600# Valve**

(WOG = Water, Oil, Gas)

Components Pressure Ratings

- 1000# WOG Valve - 1000#
- ANSI Class 300# Flange - 720#
- ANSI Class 600# Valve - 1440#



Manufacturer's Rating

Design Pressure of the Weakest Link

Components = 720#

Pipe = 1307#

§192.619 - All Pipelines

Lowest of the following:

(a)(1) *Design = 720#*

(a)(2) *Test Pressure*



(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 (a)(2)(ii)

Test Pressure / Factor

**Testing Steel
≥ 100# PSIG**

Class location	Installed before (Nov. 12, 1970)	Installed after (Nov. 11, 1970)	Covered under §192.14
1	1.1	1.1	1.25
2	1.25	1.25	1.25
3	1.4	1.5	1.5
4	1.4	1.5	1.5

Test Pressure / Factor

Test Pressure - 1964 = 1500#

For Class 3 - 1500/1.4 = 1071#



§192.619 - All Pipelines

Lowest of the following:

(a)(1) Design = 720#

(a)(2) Test Pressure = 1071#

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3) ←

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

MOP – Transmission and Distribution Lines

- 5 years preceding the applicable date in §192.619 (a)(3)

Unless:

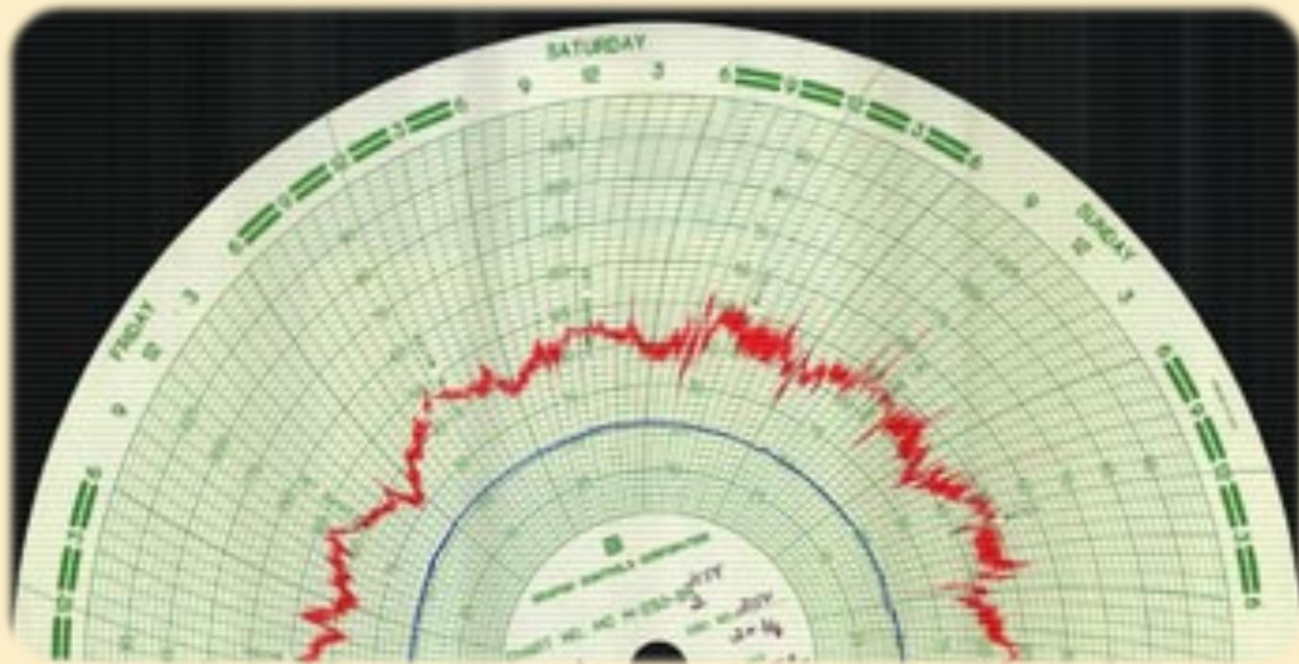
- Tested in accordance §192.619(a)(2) after July 1, 1965
- Uprated in accordance with Subpart K of this part.

192.619 (a)(3)

Pipeline segment	Pressure date	Test date
<p>—Onshore gathering line that first became subject to this part (other than §192.612) after April 13, 2006.</p> <p>—Onshore transmission line that was a gathering line not subject to this part before March 15, 2006.</p>	March 15, 2006, or date line becomes subject to this part, whichever is later.	5 years preceding applicable date in second column.
Offshore gathering lines.	July 1, 1976.	July 1, 1971.
All other pipelines.	July 1, 1970.	July 1, 1965.

MOP

Operating Charts for 1968 - 850#



§192.619 - All Pipelines

Lowest of the following:

(a)(1) Design = 720#

(a)(2) Test Pressure = 1071#

(a)(3) MOP = 850#

(a)(4) Maximum Safe Pressure determined by the
Operator (For de-rating only) ←

Maximum Safe Pressure

Considering:



- **History**
- **Corrosion**
- **Actual Operating Pressure**

(For de-rating only)

§192.619(b) Maximum Safe Pressure

If used:

Must provide Overpressure Protection as required by
§192.195



§192.619(c) *Grandfather Clause*

The requirements on pressure restrictions in this section **do not apply** in the following instance.

An operator may operate a segment of pipeline found to be in satisfactory condition, considering its operating and maintenance history, at the **highest actual operating pressure** to which the segment was subjected **during the 5 years preceding the applicable date** in the second column of the table in paragraph (a)(3) of this section.

§192.619(c)

Design = 720#

Test Pressure = 1500#

MOP = 850#

§192.619 - All Pipelines

Plastic Pipeline

Lowest of the following:

- (a)(1) Design
- (a)(2) Test Pressure
- (a)(3) MOP during the 5 years preceding the applicable date
- (a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 - All Pipelines

Plastic Pipeline

Lowest of the following:

(a)(1) Design



(a)(2) Test Pressure

(a)(3) MOP during the 5 years preceding the applicable date in (a)(3)

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

Design of Pipe and Components

Pipe

- For Steel - §192.105
- For Plastic - §192.121

Components

- Manufacturers Rating



§192.121 - Design of Plastic Pipe

$$P = \frac{2S \times 0.32}{(SDR - 1)}$$

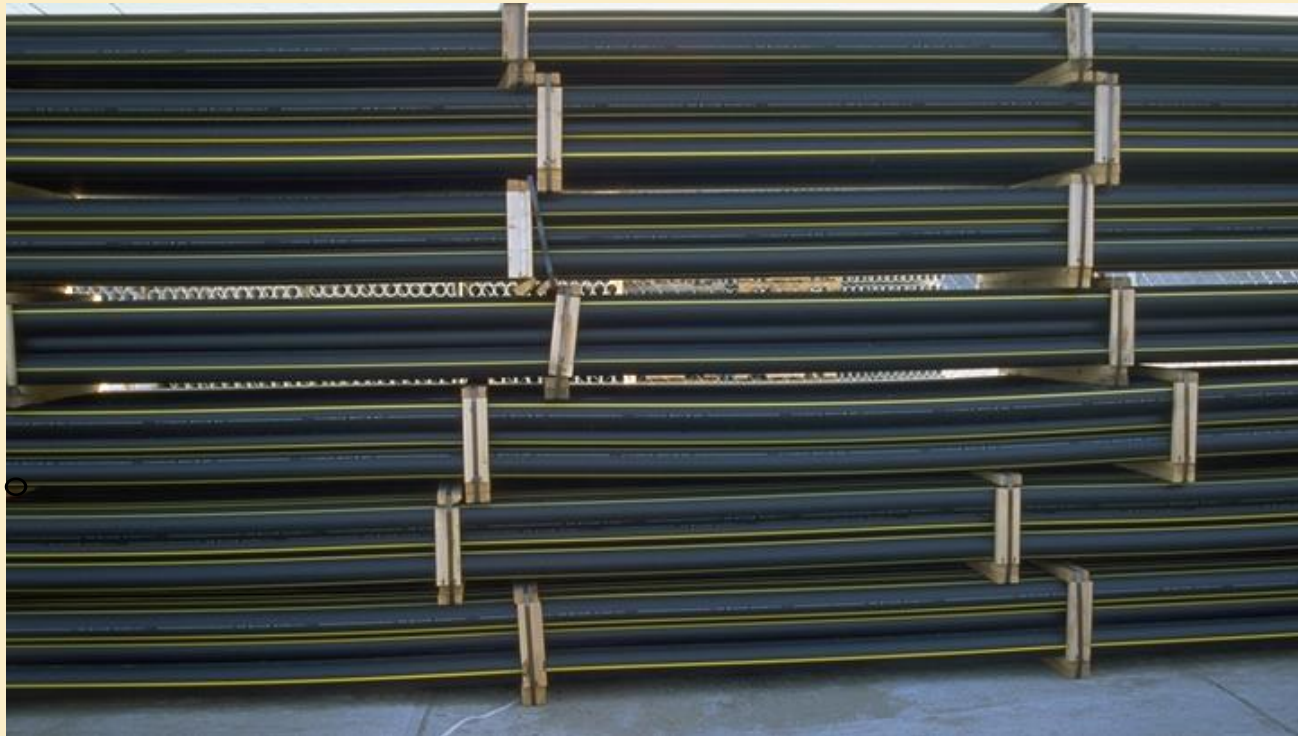
- P = Design Pressure
- S = Long Term Hydrostatic Strength - estimated tensile hoop stress that when applied continuously failure of the pipe at 100,000 hours (11.43 years) - *(HDB - Hydrostatic Design Base)*
- SDR = Standard Dimension Ratio = outside diameter / wall thickness

Hydrostatic Design Base

Thermoplastic Pipe

Piping Material	73° F	100° F	120° F	140° F
2606/2780	1250	1250	1000	800
3608/3710 4608/4710	1600	1250	1000	800

Pipe Specifications



PE 4710
ASTM - D2513
4" Diameter,
SDR = 11
Ambient Temp. 84° F

§192.121 - Design Pressure

$$P = 2S / (SDR - 1) \times 0.32$$

$$P = \frac{(2)(1250)}{(11 - 1)} \times 0.32 = 80\#$$



$$P = 2S / (SDR - 1) \times 0.32$$

73 °F

$$P = (2)(1600) / (11-1) \times 0.32 = 102\#$$

100 °F

$$P = (2)(1250) / (11-1) \times 0.32 = 80\#$$

120 °F

$$P = (2)(1000) / (11-1) \times 0.32 = 64\#$$

140 °F

$$P = (2)(800) / (11-1) \times 0.32 = 51\#$$



Design Pressure

Plastic Pipe

Piping Material	73 °F	100 °F	120 °F	140 °F
2606/2780	80	80	64	51
3608/4710	102	80	64	51

SDR = 11

§192.619 - All Pipelines

Plastic Pipeline

Lowest of the following:

(a)(1) Design = 80#

(a)(2) Test Pressure



(a)(3) MOP during the 5 years preceding the applicable date

(a)(4) Maximum Safe Pressure determined by the Operator (For de-rating only)

§192.619 - All Pipelines
Plastic Pipeline

For Plastic - Test Pressure / 1.5

Test Pressure - 1964 = 95#

$$95 / 1.5 = 63\#$$



§192.619 - All Pipelines

Plastic Pipeline

Lowest of the following:

(a)(1) Design = 80#

(a)(2) Test Pressure = 63#

(a)(3) MOP during the 5 years preceding the applicable date ←

(a)(4) Maximum Safe Pressure determined by the Operator
(For de-rating only)

MOP

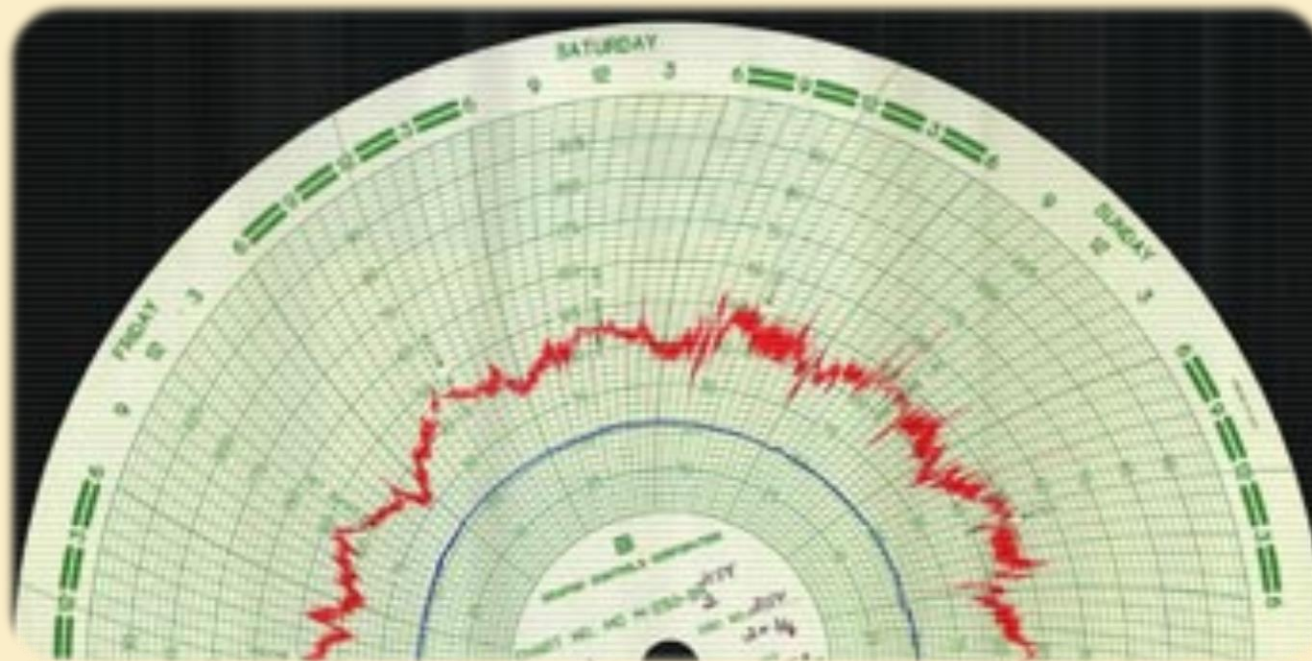
- Highest actual operating history for the 5 years preceding the applicable date in §192.619 (a)(3)

Unless:

- Tested in accordance §192.619(a)(2) after July 1, 1965
- Updated in accordance with Subpart K of this part.

MOP

Operating Charts for 1968 - 45#



§192.619 - All Pipelines

Plastic Pipeline

Lowest of the following:

(a)(1) Design = 80#

(a)(2) Test Pressure = 63#

(a)(3) MOP = 45#

(a)(4) Maximum Safe Pressure determined by the
Operator (For de-rating only)



Maximum Safe Pressure

Considering:



- **History**
- **Corrosion**
- **Actual Operating Pressure**

(For de-rating only)

For Distribution

From §192.619 carry over determined MAOP

Does §192.619(c) apply?

- **High Pressure Distribution - §192.621**
- **Low Pressure Distribution - §192.623**

High Pressure Distribution System



Means a distribution system in which the gas pressure in the main is higher than the pressure provided to the customer.

(Service Regulators)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest of the following:

(a)(1) Design

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest of the following:

(a)(1) *Design* ←

(a)(2) **60#** - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.621 MAOP: High-Pressure Distribution Systems.

Lowest of the following:

(a)(1) Design = 80#

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c) ←



§192.621 MAOP: High-Pressure Distribution Systems.

Lowest of the following:

(a)(1) Design = 80#

(a)(2) 60# - unless service lines equipped with pressure limiting devices meeting §192.197(c)

§192.619(a)(3) 45# ←

((a)(3) MOP during the 5 years preceding the applicable date)

§192.621 MAOP: High-Pressure Distribution Systems

Additional Limitations

- (a)(3) Cast Iron Pipe 25# if there are Unreinforced Bell and Spigot Joints**
- (a)(4) The Pressure Limits of Joints**
- (a)(5) Maximum Safe Pressure determined by the Operator (Must provide Overpressure Protection per §192.195) (For de-rating only)**

Low Pressure Distribution System

Means a distribution system in which the gas pressure in the main is substantially the same as the pressure provided to the customer.

(No Service Regulators)



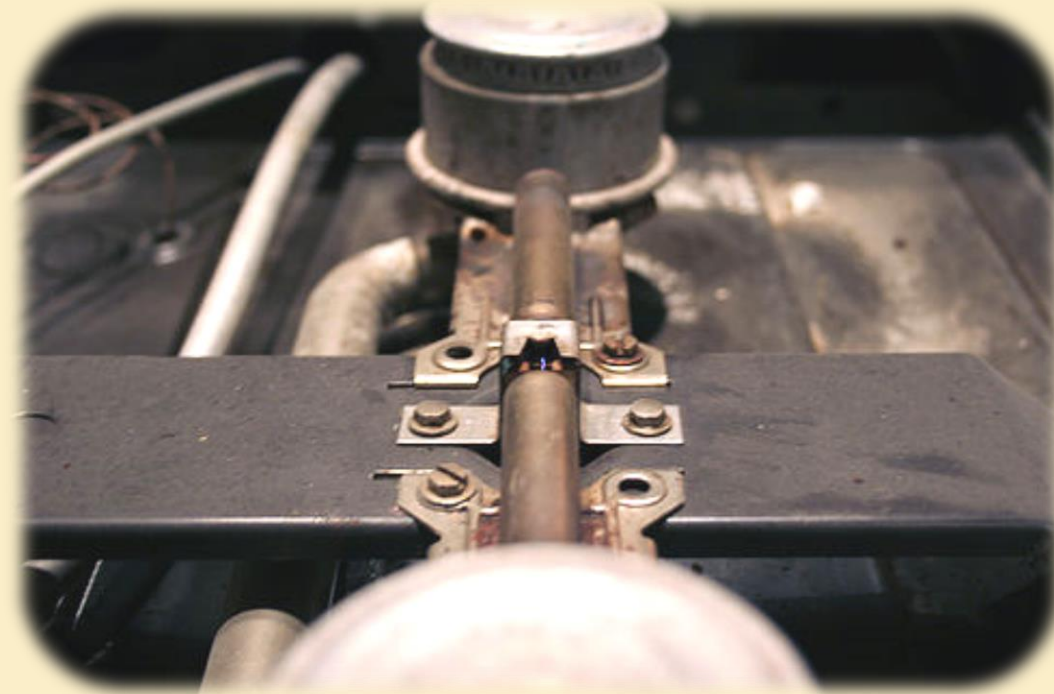
§192.623 Low-Pressure Distribution Systems: *Maximum* and Minimum Allowable Operating Pressure



Pressure high enough to make unsafe the operation of properly adjusted low-pressure gas burning equipment.

§192.623 Low-Pressure Distribution Systems: Maximum and *Minimum* Allowable Operating Pressure

Pressure lower than the minimum pressure at which the safe and continuing operation of any properly adjusted low-pressure gas burning equipment can be assured.



Advisory Bulletin ADB-2012-6

- On January 10, 2011, PHMSA issued Advisory Bulletin 11-01. This Advisory Bulletin reminded operators that if they are relying on the review of design, construction, inspection, testing and other related data to establish MAOP and MOP, they must ensure that the records used are reliable, traceable, verifiable, and complete. If such a document and records search, review, and verification cannot be satisfactorily completed, the operator cannot rely on this method for calculating MAOP or MOP and must instead rely on another method as allowed in 49 CFR 192.619 or 49 CFR 195.406.

Websites

ACC Pipeline Safety

<http://www.azcc.gov/divisions/safety/pipeline.asp>

PHMSA Pipeline Safety Regulations

<https://www.phmsa.dot.gov/standards-rulemaking/pipeline/standards-and-rulemaking-overview>