

## Chapter PSC 135

## GAS SAFETY

PSC 135.01	Character of construction, maintenance and operation	PSC 135.06	Leak survey reports
PSC 135.02	Facilities, inspection and repairs	PSC 135.07	Over-pressure protection
PSC 135.03	Application of rules	PSC 135.08	Report of proposed construction
PSC 135.04	Protection of utility facilities	PSC 135.09	Adoption of federal minimum safety standards
PSC 135.05	Interference with public service structures		

**History:** Chapter PSC 135 as it was in effect on May 31, 1972 was repealed and a new chapter PSC 135 was created, Register, May, 1972, No. 197, effective 6-1-72.

**PSC 135.01 Character of construction, maintenance, and operation.** All gas transmission, distribution, and utilization equipment and facilities shall be constructed, installed, operated, and maintained in a reasonably adequate and safe manner and as a minimum more specifically provided for herein.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72.

**PSC 135.02 Facilities, inspection and repairs.** All facilities shall be cleaned when necessary and inspected at such intervals as experience has shown to be necessary. Any facilities known to be defective so as to endanger life or property shall be promptly repaired, permanently disconnected, or isolated until repairs can be made. Construction, repairs, additions, and changes to gas transmission and distribution facilities shall be made by qualified persons only.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72.

**PSC 135.03 Application of rules.** Every gas utility that operates gas transmission or distribution facilities in the state shall comply with the rules in this chapter.

(1) **WAIVING RULES.** The rules may be modified or waived by the public service commission. They may be so modified or waived in particular cases wherever shown to be impracticable for special reasons or where the advantage of uniformity with existing construction is greater than the advantage of construction in compliance with the rules providing the existing construction is reasonably safe or if equivalent or safer construction is secured in other ways.

(2) **TEMPORARY INSTALLATIONS.** It will sometimes be necessary to modify or waive certain of the rules in case of temporary installations or installations which are shortly to be dismantled or reconstructed. Such temporary construction may be used for a reasonable length of time provided it is under competent supervision while it or adjoining equipment is under pressure or if it is protected by suitable barriers or warning signs when accessible to any person, without fully complying with this code; but all such construction shall be made reasonably safe.

(3) **EMERGENCY.** In case of emergency or pending decision of the public service commission, the person responsible for the installation may

Register, December, 1982, No. 324

decide as to modification or waiver of any rule or order, subject to review by the public service commission.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72.

**PSC 135.04 Protection of utility facilities.** A public utility upon receiving notice as provided in s. 66.047, Stats., or s. 182.0175 (2) (e), Stats., of work which may affect its facilities used for serving the public shall:

(1) If the notice is of work covered by s. 66.047, Stats., investigate and decide what action, if any, must reasonably be taken to protect or alter utility facilities in order to protect service to the public and to avoid unnecessary damage. The utility shall take such action as is reasonably necessary to protect, remove, alter, or reconstruct its facilities, and shall perform such work with reasonable dispatch taking into account the conditions to be met. Nothing in this rule shall be deemed to affect any right which the utility may have to require advance payment or adequate assurance of payment of the reasonable cost thereof to the utility by the property owner or contractor.

(2) If the notice is of work covered by s. 182.0175 (2) (e), Stats., and is not covered by s. 66.047, Stats., the utility shall respond as required by s. 182.0175 (2) (e).

(3) The utility may, in order to protect its interests, require that the owner or contractor perform certain work upon that part of the service piping or wiring on or being removed from the property upon which the excavating, building, or wrecking operations are being performed.

(4) This rule is not intended to affect the responsibility of the contractor or owner, or the liability or legal rights of any party.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72; r. and recr. Register, May, 1978, No. 269, eff. 6-1-78.

**PSC 135.05 Interference with public service structures.** (1) A utility having any work upon, over, along, or under any public street, highway or private property near existing utility facilities shall give reasonable notice to the other utility and shall exercise care when working in close proximity to such existing facilities. Sections 66.047 and 182.0175, Stats., shall be observed where applicable. In all other cases such notice shall provide the other utility with a reasonable opportunity to protect or alter its facilities and such work shall not proceed without an agreement concerning the location and nature of the proposed work.

(2) Nothing in the above shall prevent a utility from proceeding as quickly as possible with any emergency construction work which might interfere with existing facilities. (Also see s. 182.0175 (2) (d), Stats.)

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72; r. and recr. Register, May, 1978, No. 269, eff. 6-1-78.

**PSC 135.06 Leak survey reports.** The department of transportation in accordance with part 191 of title 49 of the Code of Federal Regulations "Transportation of Natural and Other Gas by Pipeline: Reports of Leaks" requires each operator of a distribution system and/or of a transmission system to submit an annual report for the preceding calendar year not later than February 15. The operators of such systems in Wisconsin shall submit a copy of these reports to this commission on or Register, December, 1982, No. 324

before the filing date as required by the federal regulations. In addition to this annual report and at the same time, the operators shall report the number of leaks which were found in customer owned facilities by either a survey or complaint during the preceding calendar year.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72.

**PSC 135.07 Over-pressure protection.** Over-pressure protection is required by subsection 192.197 of this chapter and shall apply to all installations. All present installations where such protection is not provided shall be changed so that 100% compliance will be attained by the end of the first testing cycle after January 1, 1968 as provided in s. PSC 134.30.

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72.

**PSC 135.09 Adoption of federal minimum safety standards.** (1) The federal department of transportation, office of pipeline safety, pursuant to the Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 1675,— et seq.) has established minimum safety standards for pipeline facilities and the transportation of gas, as set forth in part 192 and part 193 in title 49, Code of Federal Regulations. In accordance with the Natural Gas Pipeline Safety Act of 1968 and requirements of the federal department of transportation, such minimum safety standards are hereby adopted as state safety standards. (The numbering system and sequence used in said minimum safety standards are herein used for convenience and clarity.) Additions have been made to the minimum safety standards of the federal department of transportation as adopted herein and follow the section of the adopted federal standards to which the additions directly relate or if the additions do not directly relate to any particular adopted federal standard the additions are inserted in the numbering sequence within the appropriate subpart. In all cases the additions appear in italics preceded by *PSC 192* plus the appropriate section number. Copies of the publications referred to are available for inspection at the office of the public service commission, the secretary of state and the revisor of statutes or may be procured for personal use from the addresses listed in Appendix A—Incorporated by Reference, I. Lists of organizations and addresses, which follows section *PSC 192.753*.

(2) The inspection and maintenance plans required to be filed by intrastate gas utilities in accordance with s. PSC 135.09—192.17 shall be filed with this commission not later than February 1, 1971. Each change in such plans shall be filed with this commission within 20 days after the change is made.

#### WISCONSIN CODE ADOPTION OF PART 192 IN TITLE 49 CODE OF FEDERAL REGULATIONS WITH ADDITIONS

Sec.		Sec.	
<b>Subpart A—General</b>		192.17	Filing of inspections and maintenance plans.
192.1	Scope of part.		
192.3	Definitions.	<b>Subpart B—Materials</b>	
192.5	Class locations.	192.51	Scope.
192.7	Incorporation by reference.	*192.53	General.
192.9	Gathering lines.	*192.55	Steel pipe.
192.11	Petroleum gas systems.	*192.57	Cast iron or ductile iron pipe.
192.13	General.	*192.59	Plastic pipe.
192.14	Conversion to service subject to this part.	192.61	Copper pipe.
192.15	Rules of regulatory construction.	192.63	Marking of materials.
		192.65	Transportation of pipe.

Register, December, 1982, No. 324

<b>Sec.</b>		<b>Sec.</b>	
<b>Subpart C—Pipe Design</b>		<b>*192.204</b>	<i>Pipelines on private right-of-way of electric transmission lines.</i>
192.101	Scope.		
192.103	General.	<b>Subpart E—Welding of Steel in Pipelines</b>	
192.105	Design formula for steel pipe.	192.221	Scope.
192.107	Yield strength ( <i>S</i> ) for steel pipe.	<b>*192.223</b>	General.
192.109	Nominal wall thickness ( <i>t</i> ) for steel pipe.	192.225	Qualifications of welding procedures.
192.111	Design factor ( <i>F</i> ) for steel pipe.	192.227	Qualification of welders.
192.113	Longitudinal joint factor ( <i>E</i> ) for steel pipe.	192.229	Limitations on welders.
192.115	Temperature derating factor ( <i>T</i> ) for steel pipe.	192.231	Protection from weather.
192.117	Design of cast iron pipe.	192.233	Miter joints.
192.119	Design of ductile iron pipe.	192.235	Preparation for welding.
192.121	Design of plastic pipe.	192.237	Preheating.
192.123	Design limitations for plastic pipe.	192.239	Stress relieving.
<b>*192.125</b>	Design of copper pipe.	192.241	Inspection and test of welds.
<b>Subpart D—Design of Pipeline Components</b>		<b>*192.243</b>	Nondestructive testing.
192.141	Scope.	192.245	Repair or removal of defects.
192.143	General requirements.	<b>*192.246</b>	<i>Precautions to avoid explosions of gas-air mixtures or uncontrolled fires during construction operations.</i>
192.146	Valves.	<b>Subpart F—Joining of Materials Other Than by Welding</b>	
192.147	Flanges and flange accessories.	192.271	Scope.
192.149	Standard fittings.	192.273	General.
192.151	Tapping.	192.275	Cast iron pipe.
192.153	Components fabricated by welding.	192.277	Ductile iron pipe.
192.155	Welded branch connections.	<b>*192.279</b>	Copper pipe.
192.157	Extruded outlets.	<b>*192.281</b>	Plastic pipe.
192.159	Flexibility.	192.283	Plastic pipe; qualifying joining procedures.
192.161	Supports and anchors.	192.285	Plastic pipe; qualifying persons to make joints.
<b>*192.163</b>	Compressor stations: design and construction.	192.287	Plastic pipe; inspection of joints.
192.165	Compressor stations: liquid removal.	<b>Subpart G—General Construction Requirements for Transmission Lines and Mains</b>	
192.167	Compressor stations: emergency shutdown.	192.301	Scope.
192.169	Compressor stations: pressure limiting devices.	192.303	Compliance with specifications or standards.
<b>*192.171</b>	Compressor stations: additional safety equipment.	192.305	Inspection: general.
<b>*192.173</b>	Compressor stations: ventilation.	<b>*192.307</b>	Inspection of materials.
192.175	Pipe-type and bottle-type holders.	<b>*192.309</b>	Repair of steel pipe.
192.177	Additional provisions for bottle-type holders.	192.311	Repair of plastic pipe.
192.179	Transmission line valves.	<b>*192.313</b>	Bends and elbows.
<b>*192.181</b>	Distribution line valves.	192.315	Wrinkle bends in steel pipe.
<b>*192.183</b>	Vaults: structural design requirements.	192.317	Protection from hazards.
192.185	Vaults: accessibility.	<b>*192.319</b>	Installation of pipe in a ditch.
<b>*192.187</b>	Vaults: sealing, venting, and ventilation.	<b>*192.321</b>	Installation of plastic pipe.
<b>*192.189</b>	Vaults: drainage and waterproofing.	<b>*192.323</b>	Casing.
192.191	Design pressure of plastic fittings.	<b>*192.325</b>	Underground clearance.
192.193	Valve installation in plastic pipe.	192.327	Cover.
<b>*192.195</b>	Protection against accidental over-pressuring.	<b>Subpart H—Customer Meters, Service Regulators, and Service Lines</b>	
<b>*192.197</b>	Control of the pressure of gas delivered from high-pressure distribution systems.	192.351	Scope.
<b>*192.199</b>	Requirements for design of pressure relief and limiting devices.	<b>*192.353</b>	Customer meters and regulators: location.
192.201	Required capacity of pressure relieving and limiting stations.	<b>*192.355</b>	Customer meters and regulators: protection from damage.
192.203	Instrument, control, and sampling pipe and components.	192.357	Customer meters and regulators: installation.
		192.359	Customer meter installations: operating pressure.
		192.361	Service lines: installation.

Sec.		Sec.	
192.363	Service lines: valve requirements.		than 30% of SMYS and above 100 p.s.i.g.
*192.365	Service lines: location of valves.	*192.509	Test requirements for pipelines to operate at or below 100 p.s.i.g.
192.367	Service lines: general requirements for connections to main piping.	*192.511	Test requirements for service lines.
192.369	Service lines: connections to cast iron or ductile iron mains.	192.513	Test requirements for plastic pipelines.
*192.371	Service lines: steel.	192.515	Environmental protection and safety requirements.
192.373	Service lines: cast iron and ductile iron.	192.517	Records.
*192.375	Service lines: plastic.		
*192.377	Service lines: copper.	<b>Subpart K—Uprating</b>	
192.379	New service lines not in use.	192.551	Scope.
<b>Subpart I—Requirements for Corrosion Control</b>		192.553	General requirements.
192.451	Scope.	192.555	Uprating to a pressure that will produce a hoop stress of 30% or more of SMYS in steel pipelines.
192.452	Applicability to converted pipelines.	192.557	Uprating: steel pipelines to a pressure that will produce a hoop stress less than 30% of SMYS; plastic, cast iron, and ductile iron pipelines.
192.453	General.		
192.455	External corrosion control: buried or submerged pipelines installed after July 31, 1971.	<b>Subpart L—Operations</b>	
*192.457	External corrosion control: buried or submerged pipelines installed before August 1, 1971.	192.601	Scope.
192.459	External corrosion control: examination of buried pipeline when exposed.	192.603	General provision.
192.461	External corrosion control: protective coating.	192.605	Essentials of operating and maintenance plan.
192.463	External corrosion control: cathodic protection.	192.607	Initial determination of class location and confirmation or establishment of maximum allowable operating pressure.
192.465	External corrosion control: monitoring.	192.609	Change in class location: required study.
192.467	External corrosion control: electrical isolation.	192.611	Change in class location: confirmation or revision of maximum allowable operating pressure.
192.469	External corrosion control: test stations.	*192.613	Continuing surveillance.
192.471	External corrosion control: test leads.	192.615	Emergency plans.
192.473	External corrosion control: interference currents.	192.617	Investigation of failures.
192.475	Internal corrosion control: general.	*192.619	Maximum allowable operating pressure: steel or plastic pipelines.
192.477	Internal corrosion control: monitoring.	*192.621	Maximum allowable operating pressure: high-pressure distribution systems.
192.479	Atmospheric corrosion control: general.	*192.623	Maximum and minimum allowable operating pressure: low-pressure distribution systems.
192.481	Atmospheric corrosion control: monitoring.	192.625	Odorization of gas.
192.483	Remedial measures: general.	192.627	Tapping pipelines under pressure.
192.485	Remedial measures: transmission lines.	*192.629	Purging of pipelines.
192.487	Remedial measures: distribution lines other than cast iron or ductile iron lines.		
192.489	Remedial measures: cast iron and ductile iron pipelines.	<b>Subpart M—Maintenance Procedures</b>	
192.491	Corrosion control records.	192.701	Scope.
<b>Subpart J—Test Requirements</b>		192.703	General.
192.501	Scope.	192.705	Transmission lines: patrolling.
192.503	General requirements.	192.706	Transmission lines, leakage surveys.
*192.505	Strength test requirements for steel pipeline to operate at a hoop stress of 30% or more of SMYS.	*192.707	Transmission lines: markers.
192.507	Test requirements for pipeline to operate at a hoop stress less	192.709	Transmission lines: record-keeping.
		192.711	Transmission lines: general requirements for repair procedures.

Sec.		Sec.	
*192.713	Transmission lines: permanent field repair of imperfections and damage.	192.739	Pressure limiting and regulating stations: inspection and testing.
192.715	Transmission lines: permanent repair of welds.	*192.741	Pressure limiting and regulating stations: telemetering or recording gages.
192.717	Transmission lines: permanent field repair of leaks.	192.743	Pressure limiting and regulating stations: testing of relief devices.
192.719	Transmission lines: testing of repairs.	*192.744	Service regulators and associated safety devices: inspection and testing.
*192.720	<i>Repair of steel pipe operating below 40% of the specified minimum yield strength.</i>	192.745	Valve maintenance: transmission lines.
192.721	Distribution systems: patrolling.	*192.747	Valve maintenance: distribution systems.
*192.722	Distribution mains: markers.	192.749	Vault maintenance.
*192.723	Distribution systems: leakage surveys and procedures.	*192.751	Prevention of accidental ignition.
*192.724	<i>Further leakage survey after repair of leak.</i>	*192.753	Caulked bell and spigot joints.
192.725	Test requirement for reinstating service lines.	192.755	Protecting cast-iron pipelines.
*192.727	Abandonment or inactivation of facilities.	Appendix A	Materials incorporated by reference.
192.729	Compressor stations: procedure for gas compression units.	Appendix B	Qualification of pipe.
192.731	Compressor stations: inspection and testing of relief services.	Appendix C	Qualification of welders for low stress level pipe.
192.733	Compressor stations: isolation of equipment for maintenance or alterations.	Appendix D	Criteria for cathodic protection and determination of measurements.
*192.735	Compressor stations: storage of combustible materials.		
192.737	Pipe-type and bottle-type holders: plan for inspection and testing.		

\*Sections of the Code of Federal Regulations to which additions have been made.

\* (Italics) New sections that have been added.

### Subpart A—General

#### 192.1 Scope of part.

(a) This part prescribes minimum safety requirements for pipeline facilities and the transportation of gas, including pipeline facilities and the transportation of gas within the limits of the outer continental shelf as that term is defined in the Outer Continental Shelf Lands Act (43 U.S.C. 1331).

(b) This part does not apply to:

(1) Offshore gathering of gas upstream from the outlet flange of each facility on the outer continental shelf where hydrocarbons are produced or where produced hydrocarbons are first separated, dehydrated, or otherwise processed, whichever facility is farther downstream; and

(2) Onshore gathering of gas outside of the following areas:

(i) An area within the limits of any incorporated or unincorporated city, town, or village.

(ii) Any designated residential or commercial area such as a subdivision, business or shopping center, or community development.

**192.3 Definitions.**

As used in this part—

“Distribution Line” means a pipeline other than a gathering or transmission line.

“Gas” means natural gas, flammable gas, or gas which is toxic or corrosive.

“Gathering Line” means a pipeline that transports gas from a current production facility to a transmission line or main.

“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.

“Listed specification” means a specification listed in section I of appendix B of this part.

“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.

“Main” means a distribution line that serves as a common source of supply for more than one service line.

“Maximum actual operating pressure” means the maximum pressure that occurs during normal operations over a period of 1 year.

“Maximum allowable operating pressure” means the maximum pressure at which a pipeline or segment of a pipeline may be operated under this part.

“Municipality” means a city, county, or any other political subdivision of a state.

“Offshore” means beyond the line of ordinary low water along that portion of the coast of the United States that is in direct contact with the open seas and beyond the line marking the seaward limit of inland waters.

“Operator” means a person who engages in the transportation of gas.

“Person” means any individual, firm, joint venture, partnership, corporation, association, state, municipality, cooperative association, or joint stock association, and includes any trustee, receiver, assignee, or personal representative thereof.

“Pipe” means any pipe or tubing used in the transportation of gas, including pipe-type holders.

“Pipeline” means all parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

“Pipeline facility” means new and existing pipelines, rights-of-way, and any equipment, facility, or building used in the transportation of gas or in the treatment of gas during the course of transportation.

"Secretary" means the secretary of transportation or any person to whom he has delegated authority in the matter concerned.

"Service line" means a distribution line that transports gas from a common source of supply to (1) a customer meter or the connection to a customer's piping, whichever is farther downstream, or (2) the connection to a customer's piping if there is no customer meter. A customer meter is the meter that measures the transfer of gas from an operator to a consumer.

"SMYS" means specified minimum yield strength is—

(1) For steel pipe manufactured in accordance with a listed specification, the yield strength specified as a minimum in that specification; or

(2) For steel pipe manufactured in accordance with an unknown or unlisted specification, the yield strength determined in accordance with 192.107 (b).

"State" means each of the several states, the District of Columbia, and the Commonwealth of Puerto Rico.

"Transmission line" means a pipeline, other than a gathering line, that—

(1) Transports gas from a gathering line or storage facility to a distribution center or storage facility;

(2) Operates at a hoop stress of 20 percent or more of SMYS; or

(3) Transports gas within a storage field.

"Transportation of gas" means the gathering, transmission, or distribution of gas by pipeline or the storage of gas, in or affecting interstate or foreign commerce.

#### 192.5 Class locations.

(a) Offshore is Class 1 location. The Class location onshore is determined by applying the criteria set forth in this section: The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. Except as provided in paragraphs (d) (2) and (f) of this section, the class location is determined by the buildings in the class location unit. For the purposes of this section, each separate dwelling unit is counted as a separate building intended for human occupancy.

(b) A Class 1 location is any class location unit that has 10 or less buildings intended for human occupancy.

(c) A Class 2 location is any class location unit that has more than 10 but less than 46 buildings intended for human occupancy.

(d) A Class 3 location is—

(1) Any class location unit that has 46 or more buildings intended for human occupancy; or

(2) An area where the pipeline lies within 100 yards of any of the following:



(i) A building that is occupied by 20 or more persons during normal use.

(ii) A small, well-defined outside area that is occupied by 20 or more persons during normal use, such as a playground, recreation area, outdoor theater, or other place of public assembly.

(e) A Class 4 location is any class location unit where buildings with four or more stories above ground are prevalent.

(f) The boundaries of the class locations determined in accordance with paragraphs (a) through (e) of this section may be adjusted as follows:

(1) A Class 4 location ends 220 yards from the nearest building with four or more stories above ground.

(2) When a cluster of buildings intended for human occupancy requires a Class 3 location, the Class 3 location ends 220 yards from the nearest building in the cluster.

(3) When a cluster of buildings intended for human occupancy requires a Class 2 location, the Class 2 location ends 220 yards from the nearest building in the cluster.

#### 192.7 Incorporation by reference.

(a) Any documents or parts thereof incorporated by reference in this part are a part of this regulation as though set out in full.

(b) All incorporated documents are available for inspection in the Office of Pipeline Safety, Room 107, 400 Sixth Street SW., Washington, D.C. In addition, the documents are available at the addresses provided in Appendix A to this part.

(c) The full titles for the publications incorporated by reference in this part are provided in Appendix A to this part.

#### 192.9 Gathering lines.

Each gathering line must comply with the requirements of this part applicable to transmission lines.

#### 192.11 Petroleum gas systems.

(a) No operator may transport petroleum gas in a system that serves 10 or more customers, or in a system, any portion of which is located in a public place (such as a highway), unless that system meets the requirements of this part and of NFPA Standards No. 58 and No. 59. In the event of a conflict, the requirements of this part prevail.

(b) Each petroleum gas system covered by paragraph (a) of this section must comply with the following:

(1) Aboveground structures must have open vents near the floor level.

(2) Belowground structures must have forced ventilation that will prevent any accumulation of gas.

(3) Relief valve discharge vents must be located so as to prevent any accumulation of gas at or below ground level.

(4) Special precautions must be taken to provide adequate ventilation where excavations are made to repair an underground system.

(c) For the purpose of this section, petroleum gas means propane, butane, or mixtures of these gases, other than a gas air mixture that is used to supplement supplies in a natural gas distribution system.

#### 192.13 General

(a) No person may operate a segment of pipeline that is readied for service after March 12, 1971, or in the case of an offshore gathering line, after July 31, 1977, unless:

(1) The pipeline has been designed, installed, constructed, initially inspected, and initially tested in accordance with this part; or

(2) The pipeline qualifies for use under this part in accordance with section 192.14.

(b) No person may operate a segment of pipeline that is replaced, relocated, or otherwise changed after November 12, 1970, or in the case of an offshore gathering line, after July 31, 1977, unless that replacement, relocation, or change has been made in accordance with this part.

(c) Each operator shall maintain, modify as appropriate, and follow the plans, procedures, and programs that it is required to establish under this part.

#### 192.14 Conversion to service subject to this part.

(a) A steel pipeline previously used in service not subject to this part qualifies for use under this part if the operator prepares and follows a written procedure to carry out the following requirements:

(1) The design, construction, operation, and maintenance history of the pipeline must be reviewed and, where sufficient historical records are not available, appropriate tests must be performed to determine if the pipeline is in a satisfactory condition for safe operation.

(2) The pipeline right-of-way, all aboveground segments of the pipeline, and appropriately selected underground segments must be visually inspected for physical defects and operating conditions which reasonably could be expected to impair the strength or tightness of the pipeline.

(3) All known unsafe defects and conditions must be corrected in accordance with this part.

(4) The pipeline must be tested in accordance with Subpart J of this part to substantiate the maximum allowable operating pressure permitted by Subpart L of this part.

(b) Each operator must keep for the life of the pipeline a record of the investigations, tests, repairs, replacements, and alterations made under the requirements of paragraph (a) of this section.

#### 192.15 Rules of regulatory construction.

(a) As used in this part—

“Includes” means including but not limited to.

"May" means "is permitted to" or "is authorized to".

"May not" means "is not permitted to" or "is not authorized to".

"Shall" is used in the mandatory and imperative sense.

(b) In this part—

- (1) Words importing the singular include the plural;
- (2) Words importing the plural include the singular; and
- (3) Words importing the masculine gender include the feminine.

#### 192.17 Filing of inspection and maintenance plans.

(a) Except as provided in paragraph (b) of this section, each operator shall file with the secretary not later than February 1, 1971, a plan for inspection and maintenance of each pipeline facility which he owns or operates. In addition, each change to an inspection and maintenance plan must be filed with the secretary within 20 days after the change is made.

(b) The provisions of paragraph (a) of this section do not apply to pipeline facilities—

- (1) That are subject to the jurisdiction of a state agency that has submitted a certification or agreement with respect to those facilities under section 5 of the Natural Gas Pipeline Safety Act (49 U.S.C. 1675); and
- (2) For which an inspection and maintenance plan is required to be filed with that state agency.

(c) Plans filed with the secretary must be sent to the office of Pipeline Safety, Department of Transportation, Washington, D.C. 20590.

### Subpart B—Materials

#### 192.51 Scope.

This subpart prescribes minimum requirements for the selection and qualification of pipe and components for use in pipelines.

#### 192.53 General.

Materials for pipe and components must be—

(a) Able to maintain the structural integrity of the pipeline under temperature and other environmental conditions that may be anticipated.

*PSC 192.53 (a) Some of the materials conforming to specifications approved for use under this code may not have properties suitable for the lower portion of the temperature band covered by this code. Engineers are cautioned to give attention to the low-temperature properties of the materials used for facilities to be exposed to unusually low ground temperatures or low atmospheric temperatures. Twenty (20) inch steel pipe and larger, with a specified minimum yield strength of 52,000 p.s.i. or higher, shall be tested for fracture toughness in accordance with the applicable section of respective API standard under*

*which it was produced, except for small lot purchases of pipe where testing for fracture toughness is impractical.*

(b) Chemically compatible with any gas that they transport and with any other material in the pipeline with which they are in contact; and

(c) Qualified in accordance with the applicable requirements of this subpart.

*PSC 192.53 (d) When substantial quantities of pipe are acquired certified reports of chemical composition and physical properties shall be obtained; when the quantity of pipe involved is so limited that this requirement would be impractical, a certified statement shall be obtained setting forth the specification under which the pipe was manufactured.*

#### **192.55 Steel pipe.**

(a) New steel pipe is qualified for use under this part if—

(1) It was manufactured in accordance with a listed specification;

(2) It meets the requirements of—

(i) Section II of Appendix B to this part; or

(ii) If it was manufactured before November 12, 1970, either section II or III of Appendix B to this part; or

(3) It is used in accordance with paragraph (c) or (d) of this section.

(b) Used steel pipe is qualified for use under this part if—

(1) It was manufactured in accordance with a listed specification and it meets the requirements of paragraph II-C of Appendix B to this part;

(2) It meets the requirements of—

(i) Section II of Appendix B to this part; or

(ii) If it was manufactured before November 12, 1970, either section II or III of Appendix B to this part;

(3) It has been used in an existing line of the same or higher pressure and meets the requirements of paragraph II-C of Appendix B to this part; or

(4) It is used in accordance with paragraph (c) of this section.

(c) New or used steel pipe may be used at a pressure resulting in a hoop stress of less than 6,000 p.s.i. where no close coiling or close bending is to be done, if visual examination indicates that the pipe is in good condition and that it is free of split seams and other defects that would cause leakage. If it is to be welded, steel pipe that has not been manufactured in a listed specification must also pass the weldability tests prescribed in paragraph II-B of Appendix B to this part.

(d) Steel pipe that has not been previously used may be used as replacement pipe in a segment of pipeline if it has been manufactured prior to November 12, 1970, in accordance with the same specification as the pipe used in constructing that segment of pipeline.

(e) New steel pipe that has been cold expanded must comply with the mandatory provisions of API Standard 5LX.

*PSC 192.55 (f) Pipe manufactured from steel made by the Bessemer process shall not be used.*

#### 192.57 Cast iron or ductile iron pipe.

(a) New cast iron or new ductile iron pipe is qualified for use under this part if it has been manufactured in accordance with a listed specification.

(b) Used cast iron or used ductile iron pipe is qualified for use under this part if inspection shows that the pipe is sound and allows the makeup of tight joints and—

(1) It has been removed from an existing pipeline that operated at the same or higher pressure; or

(2) It was manufactured in accordance with a listed specification.

*PSC 192.57 (c) Cast iron pipe shall not be used as a permanent part of any piping system constructed under this code except where it is used as a temporary installation or replacement of short sections of existing cast iron pipe because of maintenance or relocation. In those cases where cast iron pipe is used it shall be designed, installed, and operated in accordance with the applicable sections of this code.*

#### 192.59 Plastic pipe.

(a) New plastic pipe is qualified for use under this part if—

(1) When the pipe is manufactured, it is manufactured in accordance with the latest listed edition of a listed specification, except that before March 21, 1975, it may be manufactured in accordance with any listed edition of a listed specification; and

(2) It is resistant to chemicals with which contact may be anticipated.

(b) Used plastic pipe is qualified for use under this part if—

(1) When the pipe was manufactured, it was manufactured in accordance with the latest listed edition of a listed specification, except that pipe manufactured before March 21, 1975, need only have met the requirements of any listed edition of a listed specification;

(2) It is resistant to chemicals with which contact may be anticipated;

(3) It has been used only in natural gas service;

(4) Its dimensions are still within the tolerances of the specification to which it was manufactured; and

(5) It is free of visible defects.

(c) For the purpose of paragraphs (a) (1) and (b) (1) of this section, where pipe of a diameter included in a listed specification is impractical to use, pipe of a diameter between the sizes included in a listed specification may be used if it—

(1) Meets the strength and design criteria required of pipe included in that listed specification; and

(2) Is manufactured from plastic compounds which meet the criteria for material required of pipe included in that listed specification.

PSC 192.59 (c) *Plastic pipe and tubing shall be adequately supported during storage. Thermoplastic pipe, tubing and fittings shall be protected from long term exposure to direct sunlight.*

#### 192.61 Copper pipe.

Copper pipe is qualified for use under this part if it has been manufactured in accordance with a listed specification.

#### 192.63 Marking of materials.

(a) Except as provided in paragraph (e) of this section, each valve, fitting, length of pipe, and other component must be marked as prescribed in—

- (1) The specification or standard to which it was manufactured; or
- (2) MSS standard practice, SP-25.

(b) In addition to the requirements in paragraph (a), thermoplastic pipe manufactured in accordance with the 1974a or earlier listed edition of ASTM D2513 must be marked as required by section 9.2 of ASTM D2513 (1975b edition) unless the pipe was manufactured before May 18, 1978, and is installed where operating temperatures are not above 38°C (100°F).

(c) Surfaces of pipe and components that are subject to stress from internal pressure may not be field die stamped.

(d) If any item is marked by die stamping, the die must have blunt or rounded edges that will minimize stress concentrations.

(e) Paragraph (a) of this section does not apply to items manufactured before November 12, 1970, that meet all of the following:

- (1) The item is identifiable as to type, manufacturer, and model.
- (2) Specifications or standards giving pressure, temperature, and other appropriate criteria for the use of items are readily available.

#### 192.65 Transportation of pipe.

In a pipeline to be operated at a hoop stress of 20 percent or more of SMYS, an operator may not use pipe having an outer diameter to wall thickness ratio of 70 to 1, or more, that is transported by railroad unless—

(a) The transportation is performed in accordance with the 1972 edition of API RP5L1, except that before February 25, 1975, the transportation may be performed in accordance with the 1967 edition of API RP5L1.

(b) In the case of pipe transported before November 12, 1970, the pipe is 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.

### Subpart C—Pipe Design

#### 192.101 Scope.

This subpart prescribes the minimum requirements for the design of pipe.

#### 192.103 General.

Pipe must be designed with sufficient wall thickness, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation.

#### 192.105 Design formula for steel pipe.

(a) The design pressure for steel pipe is determined in accordance with the following formula:

$$P = \frac{2St}{D} \times F \times E \times T$$

$P$  = Design pressure in pounds per square inch gage.

$S$  = Yield strength in pounds per square inch determined in accordance with 192.107.

$D$  = Nominal outside diameter of the pipe in inches.

$t$  = Nominal wall thickness of the pipe in inches. If this is unknown, it is determined in accordance with 192.109. Additional wall thickness required for concurrent external loads in accordance with 192.103 may not be included in computing design pressure.

$F$  = Design factor determined in accordance with 192.111.

$E$  = Longitudinal joint factor determined in accordance with 192.113.

$T$  = Temperature derating factor determined in accordance with 192.115.

(b) If steel pipe that has been cold worked to meet the SMYS is heated, other than by welding, to 600° F. or more, the design pressure is limited to 75 percent of the pressure determined under paragraph (a) of this section.

#### 192.107 Yield strength ( $S$ ) for steel pipe.

(a) For pipe that is manufactured in accordance with a specification listed in section I of Appendix B of this part, the yield strength to be used in the design formula in 192.105 is the SMYS stated in the listed specification, if that value is known.

(b) For pipe that is manufactured in accordance with a specification not listed in section I of Appendix B to this part or whose specification or tensile properties are unknown, the yield strength to be used in the design formula in 192.105 is one of the following:

(1) If the pipe is tensile tested in accordance with section 11D of Appendix B to this part, the lower of the following:

(i) 80 percent of the average yield strength determined by the tensile tests.

(ii) The lowest yield strength determined by the tensile tests, but not more than 52,000 p.s.i.

(2) If the pipe is not tensile tested as provided in subparagraph (1) of this paragraph 24,000 p.s.i.

**192.109 Nominal wall thickness (*t*) for steel pipe.**

(a) 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.

(b) However, if the pipe is of uniform grade, size, and thickness and there are more than 10 lengths, only 10 percent of the individual lengths, but not less than 10 lengths, need be measured. The thickness of the lengths that are not measured must be verified by applying a gage set to the minimum thickness found by the measurement. The nominal wall thickness to be used in the design formula in 192.105 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 1.14 times the smallest measurement taken on pipe less than 20 inches in outside diameter, nor more than 1.11 times the smallest measurement taken on pipe 20 inches or more in outside diameter.

**192.111 Design factor (*F*) for steel pipe.**

(a) Except as otherwise provided in paragraphs (b), (c), and (d) of this section, the design factor to be used in the design formula in 192.105 is determined in accordance with the following table:

<i>Class location</i>	<i>Design factor (F)</i>
1.....	0.72
2.....	0.60
3.....	0.50
4.....	0.40

(b) A design factor of 0.60 or less must be used in the design formula in 192.105 for steel pipe in Class 1 locations that:

(1) Crosses the right-of-way of an unimproved public road, without a casing;

(2) Crosses without a casing, or makes a parallel encroachment on, the right-of-way of either a hard surfaced road, a highway, a public street, or a railroad;

(3) Is supported by a vehicular, pedestrian, railroad, or pipeline bridge; or

(4) Is used in a fabricated assembly, (including separators, mainline valve assemblies, cross-connections, and river crossing headers) or is used within five pipe diameters in any direction from the last fitting of a fabricated assembly, other than a transition piece or an elbow used in place of a pipe bend which is not associated with a fabricated assembly.



(c) For Class 2 locations, a design factor of 0.50, or less, must be used in the design formula in 192.105 for uncased steel pipe that crosses the right-of-way of a hard surfaced road, a highway, a public street, or a railroad.

(d) For Class 1 and Class 2 locations, a design factor of 0.50, or less, must be used in the design formula in § 192.105 for—

(1) Steel pipe in a compressor station, regulating station, or measuring station; and

(2) Steel pipe, including a pipe riser, on a platform located offshore or in inland navigable waters.

#### 192.113 Longitudinal joint factor (E) for steel pipe.

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	Seamless.....	1.00
	Electric resistance welded.....	1.00
	Furnace butt welded.....	.60
ASTM A 106	Seamless.....	1.00
ASTM A 134	Electric fusion arc welded.....	.80
ASTM A 135	Electric resistance welded.....	1.00
ASTM A 139	Electric fusion welded.....	.80
ASTM A 155	Electric fusion arc welded.....	1.00
ASTM A 211	Spiral welded steel pipe.....	.80
ASTM A 333	Seamless.....	1.00
	Electric resistance welded.....	1.00
ASTM A 381	Double submerged arc 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
API 5 LX	Furnace lap-welded.....	.80
	Seamless.....	1.00
	Electric resistance welded.....	1.00
API 5 LS	Electric flash welded.....	1.00
	Submerged arc welded.....	1.00
	Electric resistance welded.....	1.00
Other	Pipe over 4 inches.....	.80
	Pipe 4 inches 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".

#### 192.115 Temperature derating factor (T) for steel pipe.

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

## PSC 135

Gas temperature in degrees Fahrenheit	Temperature derating factor (F)
250 or less	1.000
300	0.967
350	0.933
400	0.900
450	0.867

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

**192.117 Design of cast iron pipe.**

Cast iron pipe must be designed in accordance with ANSI A 21.1 using the following values for *S* (bursting tensile strength) and *R* (modulus of rupture) in the design equations:

Specification	Type of pipe	S	R
		psi	psi
ANSI A 21.3	Pit cast	11,000	31,000
ANSI A 21.7	Centrifugal (metal mold)	18,000	40,000
ANSI A 21.9	Centrifugal (sand-lined mold)	18,000	40,000

**192.119 Design of ductile iron pipe.**

(a) Ductile iron pipe must be designed in accordance with ANSI A21.50 using the following values in the design equations:

*s* (design hoop stress) = 16,800 p.s.i.

*f* (design bending stress) = 36,000 p.s.i.

(b) Ductile iron pipe must be grade (60-42-10) and must conform to the requirements of ANSI A21.52.

**192.121 Design of plastic pipe.**

The design pressure for plastic pipe is determined in accordance with the following formula, subject to the limitations of s. 192.123:

$$P = 2S \frac{t}{(D-t)} \times 0.32$$

*P* = Design pressure, gage, kPa (psi).

*S* = For thermoplastic pipe the long-term hydrostatic strength determined in accordance with the listed specification at a temperature equal to 23° C (73° F), 38° C (100° F), 49° C (120° F), or 60° C (140° F); for reinforced thermosetting plastic pipe, 75,800 kPa (11,000 psi).

*t* = Specified wall thickness, mm (in.).

*D* = Specified outside diameter, mm (in.).

**192.123 Design limitation for plastic pipe.**

(a) The design pressure may not exceed 689 kPa (100 p.s.i.g.) for plastic pipe used in—

- (1) Distribution systems; or
- (2) Classes 3 and 4 locations.

(b) Plastic pipe may not be used where operating temperatures of the pipe will be—

(1) Below minus 29° C (-20° F); or

(2) In the case of thermoplastic pipe, above the temperature at which the long-term hydrostatic strength used in the design formula under s. 192.121 is determined, except that pipe manufactured before May 18, 1978, may be used at temperatures up to 30° C (100° F); or in the case of reinforced thermosetting plastic pipe, above 66° C (150° F).

(c) The wall thickness for thermoplastic pipe may not be less than 1.57 millimeters (0.062 in.).

(d) The wall thickness for reinforced thermosetting plastic pipe may not be less than that listed in the following table:

<i>Nominal size in inches</i>	<i>Minimum wall thickness in millimeters (inches)</i>
2 -----	1.52 (0.060)
3 -----	1.52 (0.060)
4 -----	1.78 (0.070)
6 -----	2.54 (0.100)

**192.125 Design of copper pipe.**

(a) Copper pipe used in mains must have minimum wall thickness of 0.065 inches and must be hard drawn.

(b) Copper pipe used in service lines must have a minimum wall thickness as specified for type "L" pipe in ASTM B 88.

(c) Copper pipe used in mains and service lines may not be used at pressures in excess of 100 p.s.i.g.

(d) Copper pipe that does not have an internal corrosion resistant lining may not be used to carry gas that has an average hydrogen sulfide content of more than 0.3 grains per 100 standard cubic feet of gas.

PSC 192.125 (e) Fittings in copper piping. It is recommended that fittings in copper piping and exposed to the soil, such as service tees, pressure control fittings, etc., be made of bronze, copper or brass.

**Subpart D—Design of Pipeline Components**

**192.141 Scope .**

This subpart prescribes minimum requirements for the design and installation of pipeline components and facilities. In addition, it prescribes requirements relating to protection against accidental overpressuring.

**192.143 General Requirements.**

Each component of a pipeline must be able to withstand operating pressures and other anticipated loadings with unit stresses equivalent to

those allowed for comparable material in pipe in the same location and kind of service.

#### 192.145 Valves.

(a) Each valve must meet the minimum requirements, or the equivalent, of API 6A, API 6D, MSS SP-70, MSS SP-71, or MSS SP-78, except that a valve designed before July 1, 1976, may meet the minimum requirements of MSS SP-52. A valve may not be used under operating conditions that exceed the applicable pressure-temperature ratings contained in those standards.

(b) Each valve must be able to meet the anticipated operating conditions.

(c) No valve having shell components made of ductile iron may be used at pressures exceeding 80% of the pressure ratings for comparable steel valves at their listed temperature. However, a valve having shell components made of ductile iron may be used at pressures up to 80% of the pressure ratings for comparable steel valves at their listed temperature, if—

(1) The temperature-adjusted service pressure does not exceed 1,000 p.s.i.g.; and

(2) Welding is not used on any ductile iron component in the fabrication of the valve shells or their assembly.

(d) No valve having pressure containing parts made of ductile iron may be used in the gas pipe components of compressor stations.

#### 192.147 Flanges and flange accessories.

(a) *General requirements.* Each flange or flange accessory must meet the minimum requirements of ANSI B16.5, MSS SP-44, or ANSI B16.24, or the equivalent.

(b) Each flange assembly must be able to withstand the maximum pressure at which the pipeline is to be operated and to maintain its physical and chemical properties at any temperature to which it is anticipated that it might be subjected in service.

#### 192.149 Standard fittings.

(a) The minimum metal thickness of threaded fittings may not be less than specified for the pressures and temperatures in the applicable standards referenced in this part, or their equivalent.

(b) Each steel butt-welding fitting must have pressure and temperature ratings based on stresses for pipe of the same or equivalent material. The actual bursting strength of the fitting must at least equal the computed bursting strength of pipe of the designated material and wall thickness, as determined by a prototype that was tested to at least the pressure required for the pipeline to which it is being added.

#### 192.151 Tapping.

(a) Each mechanical fitting used to make a hot tap must be designed for at least the operating pressure of the pipeline.

(b) Where a ductile iron pipe is tapped, the extent of full-thread engagement and the need for the use of outside-sealing service connections, tapping saddles, or other fixtures must be determined by service conditions.

(c) Where a threaded tap is made in cast iron or ductile iron pipe, the diameter of the tapped hole may not be more than 25% of the nominal diameter of the pipe unless the pipe is reinforced, except that

(1) Existing taps may be used for replacement service, if they are free of cracks and have good threads; and

(2) A 1¼-inch tap may be made in a 4-inch cast iron or ductile iron pipe, without reinforcement.

However, in areas where climate, soil and service conditions may create unusual external stresses on cast iron pipe, unreinforced taps may be used only on 6-inch or larger pipe.

#### 192.153 Components fabricated by welding.

(a) Except for branch connections and assemblies of standard pipe and fittings joined by circumferential welds, the design pressure of each component fabricated by welding, whose strength cannot be determined, must be established in accordance with paragraph UG-101 of section VIII of the ASME Boiler and Pressure Vessel Code.

(b) Each prefabricated unit that uses plate and longitudinal seams must be designed, constructed, and tested in accordance with the ASME Boiler and Pressure Vessel Code, except for the following:

(1) Regularly manufactured butt-welding fittings.

(2) Pipe that has been produced and tested under a specification listed in Appendix B to this part.

(3) Partial assemblies such as split rings or collars.

(4) Prefabricated units that the manufacturer certifies have been tested to at least twice the maximum pressure to which they will be subjected under the anticipated operating conditions.

(c) Orange-peel bull plugs and orange-peel swages may not be used on pipelines that are to operate at a hoop stress of 20% or more of the SMYS of the pipe.

(d) Except for flat closures designed in accordance with section VIII of the ASME Boiler and Pressure Code, flat closures and fish tails may not be used on pipe that either operates at 100 p.s.i.g., or more, or is more than 3 inches nominal diameter.

#### 192.155 Welded branch connections.

Each welded branch connection made to pipe in the form of a single connection, or in a header or manifold as a series of connections, must be designed to ensure that the strength of the pipeline system is not reduced, taking into account the stresses in the remaining pipe wall due to the opening in the pipe or header, the shear stresses produced by the pressure acting on the area of the branch opening, and any external loadings due to thermal movement, weight, and vibration.

**192.157 Extruded outlets.**

Each extruded outlet must be suitable for anticipated service conditions and must be at least equal to the design strength of the pipe and other fittings in the pipeline to which it is attached.

**192.159 Flexibility.**

Each pipeline must be designed with enough flexibility to prevent thermal expansion or contraction from causing excessive stresses in the pipe or components, excessive bending or unusual loads at joints, or undesirable forces or moments at points of connection to equipment, or at anchorage or guide points.

**192.161 Supports and anchors.**

(a) Each pipeline and its associated equipment must have enough anchors or supports to—

- (1) Prevent undue strain on connected equipment;
- (2) Resist longitudinal forces caused by a bend or offset in the pipe; and
- (3) Prevent or damp out excessive vibration.

(b) Each exposed pipeline must have enough supports or anchors to protect the exposed pipe joints from the maximum end force caused by internal pressure and any additional forces caused by temperature expansion or contraction or by the weight of the pipe and its contents.

(c) Each support or anchor on an exposed pipeline must be made of durable, noncombustible material and must be designed and installed as follows:

(1) Free expansion and contraction of the pipeline between supports or anchors may not be restricted.

(2) Provision must be made for the service conditions involved.

(3) Movement of the pipeline may not cause disengagement of the support equipment.

(d) Each support on an exposed pipeline operated at a stress level of 50% or more of SMYS must comply with the following:

- (1) A structural support may not be welded directly to the pipe.
- (2) The support must be provided by a member that completely encircles the pipe.
- (3) If an encircling member is welded to a pipe, the weld must be continuous and cover the entire circumference.

(e) Each underground pipeline that is connected to a relatively unyielding line or other fixed object must have enough flexibility to provide for possible movement, or it must have an anchor that will limit the movement of the pipeline.

(f) Except for offshore pipelines, each underground pipeline that is being connected to new branches must have a firm foundation for both the header and the branch to prevent lateral and vertical movement.

**192.163 Compressor stations: design and construction.**

(a) *Location of compressor building.* Except for a compressor building on a platform located offshore or in inland navigable waters, each main compressor building of a compressor station must be located on property under the control of the operator. It must be far enough away from adjacent property, not under control of the operator, to minimize the possibility of fire being communicated to the compressor building from structures on adjacent property. There must be enough open space around the main compressor building to allow the free movement of fire-fighting equipment.

(b) *Building construction.* Each building on a compressor station site must be made of noncombustible materials if it contains either—

(1) Pipe more than 2 inches in diameter that is carrying gas under pressure; or

(2) Gas handling equipment other than gas utilization equipment used for domestic purposes.

**PSC 192.163 (b)** *All compressor station buildings shall be constructed of non-combustible materials as defined by the Wisconsin state building code administered by the department of industry, labor and human relations.*

(c) *Exits.* Each operating floor of a main compressor building must have at least two separated and unobstructed exits located so as to provide a convenient possibility of escape and an unobstructed passage to a place of safety. Each door latch on an exit must be of a type which can be readily opened from the inside without a key. Each swinging door located in an exterior wall must be mounted to swing outward.

**PSC 192.163 (c)** *Exits shall be provided in compliance with the requirements of the Wisconsin state building code administered by the department of industry, labor and human relations. Ladders shall not be used for exits.*

(d) *Fenced areas.* Each fence around a compressor station must have at least 2 gates located so as to provide a convenient opportunity for escape to a place of safety, or have other facilities affording a similarly convenient exit from the area. Each gate located within 200 feet of any compressor plant building must open outward and, when occupied, must be openable from the inside without a key.

(e) *Electrical facilities.* Electrical equipment and wiring installed in compressor stations must conform to the National Electrical Code, ANSI Standard C1, so far as that code is applicable.

**PSC 192.163 (e)** *All electrical equipment and wiring installed in gas transmission and distribution compressor stations shall conform to the requirements of the Wisconsin state electrical code.*

**192.165 Compressor stations: liquid removal.**

(a) Where entrained vapors in gas may liquefy under the anticipated pressure and temperature conditions, the compressor must be protected against the introduction of those liquids in quantities that could cause damage.

(b) Each liquid separator used to remove entrained liquids at a compressor station must—

- (1) Have a manually operable means of removing these liquids.
- (2) Where slugs of liquid could be carried into the compressors, have either automatic liquid removal facilities, an automatic compressor shutdown device, or a high liquid level alarm; and
- (3) Be manufactured in accordance with section VIII of the ASME Boiler and Pressure Vessel Code, except that liquid separators constructed of pipe and fittings without internal welding must be fabricated with a design factor of 0.4, or less.

**192.167 Compressor stations: emergency shutdown.**

(a) Except for unattended field compressor stations of 1,000 horsepower or less, each compressor station must have an emergency shutdown system that meets the following:

- (1) It must be able to block gas out of the station and blow down the station piping.
- (2) It must discharge gas from the blowdown piping at a location where the gas will not create a hazard.
- (3) It must provide means for the shutdown of gas compressing equipment, gas fires, and electrical facilities in the vicinity of gas headers and in the compressor building, except, that—

(i) Electrical circuits that supply emergency lighting required to assist station personnel in evacuating the compressor building and the area in the vicinity of the gas headers must remain energized; and

(ii) Electrical circuits needed to protect equipment from damage may remain energized.

(4) It must be operable from at least 2 locations, each of which is—

- (i) Outside the gas area of the station;
- (ii) Near the exit gates, if the station is fenced, or near emergency exits, if not fenced; and
- (iii) Not more than 500 feet from the limits of the station.

(b) If a compressor station supplies gas directly to a distribution system with no other adequate source of gas available, the emergency shutdown system must be designed so that it will not function at the wrong time and cause an unintended outage on the distribution system.

(c) On a platform located offshore or in inland navigable waters, the emergency shutdown system must be designed and installed to actuate automatically by each of the following events:

(1) In the case of an unattended compressor station—

(i) When the gas pressure equals the maximum allowable operating pressure plus 15 percent; or

(ii) When an uncontrolled fire occurs on the platform; and



(2) In the case of compressor station in a building—

(i) When an uncontrolled fire occurs in the building; or

(ii) When the concentration of gas in air reaches 50 percent or more of the lower explosive limit in a building which has a source of ignition.

For the purpose of paragraph (c) (2) (ii) of this section an electrical facility which conforms to Class 1, Group D of the National Electrical Code is not a source of ignition.

**192.169 Compressor stations: pressure limiting devices.**

(a) Each compressor station must have pressure relief or other suitable protective devices of sufficient capacity and sensitivity to ensure that the maximum allowable operating pressure of the station piping and equipment is not exceeded by more than 10%.

(b) Each vent line that exhausts gas from the pressure relief valves of a compressor station must extend to a location where the gas may be discharged without hazard.

**192.171 Compressor stations: additional safety equipment.**

(a) Each compressor station must have adequate fire protection facilities. If fire pumps are a part of these facilities, their operation may not be affected by the emergency shutdown system.

**PSC 192.171 (a) Fire protection.** *Fire-protection facilities shall be provided as specifically directed by the department of industry, labor and human relations and the local fire department. The operation of fire-protection facilities, such as pumps, shall not be affected by an emergency shutdown.*

(b) Each compressor station prime mover, other than an electrical induction or synchronous motor, must have an automatic device to shut down the unit before the speed of either the prime mover or the driven unit exceeds a maximum safe speed.

(c) Each compressor unit in a compressor station must have a shutdown or alarm device that operates in the event of inadequate cooling or lubrication of the unit.

(d) Each compressor station gas engine that operates with pressure gas injection must be equipped so that stoppage of the engine automatically shuts off the fuel and vents the engine distribution manifold.

(e) Each muffler for a gas engine in a compressor station must have vent slots or holes in the baffles of each compartment to prevent gas from being trapped in the muffler.

**192.173 Compressor stations: ventilation.**

Each compressor station building must be ventilated to ensure that employees are not endangered by the accumulation of gas in rooms, sumps, attics, pits, or other enclosed places.

**PSC 192.173** *There shall be compliance with the department of industry, labor and human relations' heating, ventilation, and air conditioning code.*

**192.175 Pipe-type and bottle-type holders.**

(a) Each pipe-type and bottle-type holder must be designed so as to prevent the accumulation of liquids in the holder, in connecting pipe, or in auxiliary equipment, that might cause corrosion or interfere with the safe operation of the holder.

(b) Each pipe-type or bottle-type holder must have minimum clearance from other holders in accordance with the following formula:

$$C = \frac{3D \times P \times F}{1,000}$$

in which:

C=Minimum clearance between pipe containers or bottles in inches.

D=Outside diameter of pipe containers or bottles in inches.

P=Maximum allowable operating pressure, p.s.i.g.

F=Design factor as set forth in 192.111 of this part.

#### 192.177 Additional provisions for bottle-type holders.

(a) Each bottle-type holder must be—

(1) Located on a storage site entirely surrounded by fencing that prevents access by unauthorized persons and with minimum clearance from the fence as follows:

<i>Maximum allowable operating pressure</i>	<i>Minimum clearance (feet)</i>
Less than 1,000 p.s.i.g. -----	25
1,000 p.s.i.g. or more -----	100

(2) Designed using the design factors set forth in 192.111; and

(3) Buried with a minimum cover in accordance with 192.327.

(b) Each bottle-type holder manufactured from steel that is not weldable under field conditions must comply with the following:

(1) A bottle-type holder made from alloy steel must meet the chemical and tensile requirements for the various grades of steel in either API Standard 5A or ASTM A 372.

(2) The actual yield-tensile ratio of the steel may not exceed 0.85.

(3) Welding may not be performed on the holder after it has been heat treated or stress relieved, except that copper wires may be attached to the small diameter portion of the bottle end closure for cathodic protection if a localized thermit welding process is used.

(4) The holder must be given a mill hydrostatic test at a pressure that produces a hoop stress at least equal to 85% of the SMYS.

(5) The holder, connection pipe, and components must be leak tested after installation as required by Subpart J of this part.

#### 192.179 Transmission line valves.

(a) Each transmission line, other than offshore segments, must have sectionalizing block valves spaced as follows:

Register, December, 1982, No. 324

- (1) Each point on the pipeline in a Class 4 location must be within 2½ miles of a valve.
- (2) Each point on the pipeline in a Class 3 location must be within 4 miles of a valve.
- (3) Each point on the pipeline in a Class 2 location must be within 7½ miles of a valve.
- (4) Each point on the pipeline in a Class 1 location must be within 10 miles of a valve.

(b) Each sectionalizing block valve on a transmission line, other than offshore segments, must comply with the following:

- (1) The valve and the operating device to open or close the valve must be readily accessible and protected from tampering and damage.
- (2) The valve must be supported to prevent settling of the valve or movement of the pipe to which it is attached.

(c) Each section of a transmission line, other than offshore segments, between main line valves must have a blowdown valve with enough capacity to allow the transmission line to be blown down as rapidly as practicable. Each blowdown discharge must be located so the gas can be blown to the atmosphere without hazard and, if the transmission line is adjacent to an overhead electric line, so that the gas is directed away from the electrical conductors.

(d) Offshore segments of transmission lines must be equipped with valves or other components to shut off the flow of gas to an offshore platform in an emergency.

#### 192.181 Distribution line valves.

(a) Each high-pressure distribution system must have valves spaced so as to reduce the time to shut down a section of main in an emergency. The valve spacing is determined by the operating pressure, the size of the mains, and the local physical conditions.

(b) Each regulator station controlling the flow or pressure of gas in a distribution system must have a valve installed on the inlet piping at a distance from the regulator station sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

*PSC 192.181 (b) It is intended that the distance between the valve and the regulator or regulators shall be sufficient to permit the operation of the valve during an emergency such as a large gas leak or a fire in the station. These valves shall be in accessible locations not closer than 25 feet and preferably not more than 1,500 feet distant from each regulator station.*

(c) Each valve on a main installed for operating or emergency purposes must comply with the following:

- (1) The valve must be placed in a readily accessible location so as to facilitate its operation in an emergency.
- (2) The operating stem or mechanism must be readily accessible.

(3) If the valve is installed in a buried box or enclosure, the box or enclosure must be installed so as to avoid transmitting external loads to the main.

**192.183 Vaults: structural design requirements.**

(a) Each underground vault or pit for valves, pressure relieving, pressure limiting, or pressure regulating stations, must be able to meet the loads which may be imposed upon it, and to protect installed equipment.

(b) There must be enough working space so that all of the equipment required in the vault or pit can be properly installed, operated, and maintained.

(c) Each pipe entering, or within, a regulator vault or pit must be steel for sizes 10 inches, and less, except that control and gage piping may be copper. Where pipe extends through the vault or pit structure, provision must be made to prevent the passage of gases or liquids through the opening and to avert strains in the pipe.

**PSC 192.183** (d) *In the design of vaults and pits for pressure limiting, pressure relieving and pressure regulating equipment, consideration shall be given to the protection of the installed equipment from damage, such as that resulting from an explosion within the vault or pit, which may cause portions of the roof or cover to fall into the vault.*

**PSC 192.183** (e) *Vault or pit openings shall be located so as to minimize the hazards of tools or other objects falling upon the regulator, piping, or other equipment. The control piping and the operating parts of the equipment installed shall not be located under a vault or pit opening where workmen can step on them when entering or leaving the vault or pit, unless such parts are suitably protected. Whenever a vault or pit opening is to be located above equipment which could be damaged by a falling cover, a circular cover should be installed or other suitable precautions taken.*

**192.185 Vaults: accessibility.** Each vault must be located in an accessible location and, so far as practical, away from—

- (a) Street intersections or points where traffic is heavy or dense;
- (b) Points of minimum elevation, catch basins, or places where the access cover will be in the course of surface waters; and
- (c) Water, electric, steam, or other facilities.

**192.187 Vaults: sealing, venting, and ventilation.** Each underground vault or closed top pit containing either a pressure regulating or reducing station, or a pressure limiting or relieving station, must be sealed, vented or ventilated, as follows:

- (a) When the internal volume exceeds 200 cubic feet—
  - (1) The vault or pit must be ventilated with 2 ducts, each having at least the ventilating effect of a pipe 4 inches in diameter;
  - (2) The ventilation must be enough to minimize the formation of combustible atmosphere in the vault or pit; and

(3) The ducts must be high enough above grade to disperse any gas-air mixtures that might be discharged.

*PSC 192.187 (a) (3) The outside end of the ducts shall be equipped with a suitable weatherproof fitting or vent-head designed to prevent foreign matter from entering or obstructing the duct. The effective area of the openings in such fittings or vent-heads shall be at least equal to the cross-sectional area of a 4-inch duct. The horizontal section of the ducts shall be as short as practical and shall be pitched to prevent the accumulation of liquids in the line. The number of bends and offsets shall be reduced to a minimum and provisions shall be incorporated to facilitate the periodic cleaning of the ducts.*

(b) When the internal volume is more than 75 cubic feet but less than 200 cubic feet—

(1) If the vault or pit is sealed, each opening must have a tight fitting cover without open holes through which an explosive mixture might be ignited, and there must be a means for testing the internal atmosphere before removing the cover;

(2) If the vault or pit is vented, there must be a means of preventing external sources of ignition from reaching the vault atmosphere; or

(3) If the vault or pit is ventilated, paragraph (a) or (c) of this section applies.

(c) If a vault or pit is covered by paragraph (b) of this section is ventilated by openings in the covers or gratings and the ratio of the internal volume, in the cubic feet, to the effective ventilating area of the cover or grating, in square feet, is less than 20 to 1, no additional ventilation is required.

**192.189 Vaults: drainage and waterproofing.** (a) Each vault must be designed so as to minimize the entrance of water.

*PSC 192.189 (a) Nevertheless, vault equipment shall always be designed to operate safely, if submerged.*

(b) A vault containing gas piping may not be connected by means of a drain connection to any other underground structure.

(c) All electrical equipment in vaults must conform to the applicable requirements of Class 1, Group D, of the National Electrical Code, ANSI Standard C1.

*PSC 192.189 (c) Electrical equipment in vaults shall conform to the applicable requirements of the Wisconsin state electrical code.*

**192.191 Design pressure of plastic fittings.** (a) Thermosetting fittings for plastic pipe must conform to ASTM D 2517.

(b) The design pressure of Acrylonitrile-butadiene—styrene (ABS) and polyvinyl chloride (PVC) Schedule 40 and 80 thermoplastic fittings must be obtained from the following table:

**DESIGN PRESSURE OF THERMOPLASTIC FITTINGS P.S.I.G. OF VARIOUS  
STRENGTHS, MATERIALS AND CLASS LOCATIONS**

Size inches	Schedule	ABS Type I and PVC Type II class location			PVC Type I class location		
		1	2 and 3	4	1	2 and 3	4
½	40	100	100	100	100	100	100
	80	100	100	100	100	100	100
¾	40	100	100	96	100	100	100
	80	100	100	100	100	100	100
1	40	100	100	90	100	100	100
	80	100	100	100	100	100	100
1¼	40	100	92	74	100	100	100
	80	100	100	100	100	100	100
1½	40	100	83	66	100	100	100
	80	100	100	94	100	100	100
2	40	89	69	55	100	100	100
	80	100	100	81	100	100	100
2½	40	99	76	61	100	100	100
	80	100	100	85	100	100	100
3	40	84	66	53	100	100	100
	80	100	94	75	100	100	100
3½	40	77	60	48	100	100	96
	80	100	86	69	100	100	100
4	40	71	56	44	100	100	89
	80	100	81	65	100	100	100
5	40	62	49	39	100	97	78
	80	93	72	58	100	100	100
6	40	56	44	35	100	88	71
	80	89	70	56	100	100	100

Note: These pressure ratings are the same value as the design pressure of the corresponding pipe size and schedule in the same class location, as determined by the formula given in 192.121 and the limitations in 192.123 of this part.

**192.193 Valve installation in plastic pipe.** Each valve installed in plastic pipe must be designed so as to protect the plastic material against excessive torsional or shearing loads when the valve or shutoff is operated, and from any other secondary stresses that might be exerted through the valve or its enclosure.

**192.195 Protection against accidental overpressuring.** (a) *General requirements.* Except as provided in 192.197, each pipeline that is connected to a gas source so that the maximum allowable operating pressure could be exceeded as the result of pressure control failure or of some other type of failure, must have pressure relieving or pressure limiting devices that meet the requirements of 192.199 and 192.201.

(b) *Additional requirements for distribution systems.* Each distribution system that is supplied from a source of gas that is at a higher pressure than the maximum allowable operating pressure for the system must—

(1) Have pressure regulation devices capable of meeting the pressure, load, and other service conditions that will be experienced in normal operation of the system, and that could be activated in the event of failure of some portion of the system; and

(2) Be designed so as to prevent accidental overpressuring.

**PSC 192.195 (3) Suitable types of protective devices to prevent overpressuring of high-pressure distribution systems include:**

Register, December, 1982, No. 324

(i) *Spring-loaded relief valves of types meeting the provisions of the ASME Unfired Pressure Vessel Code.*

(ii) *Pilot-loaded back-pressure regulators used as relief valves, so designed that failure of the pilot system or control lines will cause the regulator to open.*

(iii) *Weight-loaded relief valves.*

(iv) *A monitoring regulator installed in series with the primary pressure regulator.*

(v) *A series regulator installed upstream from the primary regulator, and set to continuously limit the pressure on the inlet of the primary regulator in accordance with the provisions of section 192.201.*

(vi) *An automatic shut-off device installed in series with the primary pressure regulator, and set to shut off in accordance with the provisions of 192.201. This device must remain closed until manually reset. It should not be used where it might cause an interruption in service to a large number of customers.*

(vii) *Spring-loaded diaphragm-type relief valves.*

**PSC 192.195 (4)** *Suitable types of protective devices to prevent over-pressuring of low-pressure distribution systems include:*

(i) *A liquid seal relief device that can be set to open accurately and consistently at the desired pressure.*

(ii) *Weight loaded relief valves.*

(iii) *An automatic shut-off device as described in PSC 192.195 (3) (vi).*

(iv) *A pilot loaded back-pressure regulator as described in PSC 192.195 (3) (ii).*

(v) *A monitoring regulator as described in PSC 192.195 (3) (iv).*

(vi) *A series regulator as described in PSC 192.195 (3) (v).*

**PSC 192.195 (c)** *Suitable types of protective devices to prevent over-pressuring of gas pressure holders, pipelines and other facilities that might at times be bottle tight include:*

(1) *Spring-loaded relief valves of types meeting the provisions of the ASME Unfired Pressure Vessel Code.*

(2) *Pilot-loaded back-pressure regulators used as relief valves, so designed that failure of the pilot system or control lines will cause the regulator to open.*

**192.197 Control of the pressure of gas delivered from high-pressure distribution systems.**

(a) *If the maximum actual operating pressure of the distribution system is under 60 p.s.i.g. and a service regulator having the following characteristics is used, no other pressure limiting device is required:*

(1) *A regulator capable of reducing distribution line pressure to pressures recommended for household appliances.*

(2) A single port valve with proper orifice for the maximum gas pressure at the regulator inlet.

(3) A valve seat made of resilient material designed to withstand abrasion of the gas, impurities in gas, cutting by the valve, and to resist permanent deformation when it is pressed against the valve port.

(4) Pipe connections to the regulator not exceeding 2 inches in diameter.

(5) A regulator that, under normal operating conditions, is able to regulate the downstream pressure within the necessary limits of accuracy and to limit the build-up of pressure under no-flow conditions to prevent a pressure that would cause the unsafe operation of any connected and properly adjusted gas utilization equipment.

(6) A self-contained service regulator with no external static or control lines.

(b) If the maximum actual operating pressure of the distribution system is 60 p.s.i.g., or less, and a service regulator that does not have all of the characteristics listed in paragraph (a) of this section is used, or if the gas contains materials that seriously interfere with the operation of service regulators, there must be suitable protective devices to prevent unsafe overpressuring of the customer's appliances if the service regulator fails.

(c) If the maximum actual operating pressure of the distribution systems exceeds 60 p.s.i.g. one of the following methods must be used to regulate and limit, to the maximum safe value, the pressure or gas delivered to the customer:

(1) A service regulator having the characteristics listed in paragraph (a) of this section, and another regulator located upstream from the service regulator. The upstream regulator may not be set to maintain a pressure higher than 60 p.s.i.g. A device must be installed between the upstream regulator and the service regulator to limit the pressure on the inlet of the service regulator to 60 p.s.i.g. or less in case the upstream regulator fails to function properly. This device may be either a relief valve or an automatic shutoff that shuts, if the pressure on the inlet of the service regulator exceeds the set pressure (60 p.s.i.g. or less), and remains closed until manually reset.

(2) A service regulator and a monitoring regulator set to limit, to a maximum safe value, the pressure of the gas delivered to the customer.

(3) A service regulator with a relief valve vented to the outside atmosphere, with the relief valve set to open so that the pressure of gas going to the customer does not exceed a maximum safe value. The relief valve may either be built into the service regulator or it may be a separate unit installed downstream from the service regulator. This combination may be used alone only in those cases where the inlet pressure on the service regulator does not exceed the manufacturer's safe working pressure rating of the service regulator, and may not be used where the inlet pressure on the service regulator exceeds 125 p.s.i.g. For higher inlet pressures, the methods in subparagraph (1) or (2) of this paragraph must be used.



(4) A service regulator and an automatic shutoff device that closes upon a rise in pressure downstream from the regulator and remains closed until manually reset.

*PSC 192.197 (d) The service regulator must be of a type that is capable under normal operating conditions of regulating the downstream pressure within the limits of section PSC 134.23 and of limiting the build-up of pressure under no-flow conditions of 50% or less of the discharge pressure maintained under flow conditions.*

*PSC 192.197 (e) In addition to the provisions of 192.197 (a) and (b) if the maximum actual operating pressure of the distribution system is greater than low pressure and is equal to or less than 60 p.s.i.g., a suitable protective device shall be installed to prevent unsafe overpressuring of the customer's appliances should the service regulator fail. Some of the suitable types of protective devices to prevent overpressuring of customers' appliances are:*

(a) A monitoring regulator

(b) A relief valve

(c) An automatic shut-off device

*These devices may be installed as an integral part of the service regulator or as a separate unit.*

*PSC 192.197 (f) Breather vents shall be provided on all service regulators.*

#### **192.199 Requirements for design of pressure relief and limiting devices.**

Except for rupture discs each pressure relief or pressure limiting device must—

(a) Be constructed of materials such that the operation of the device will not be impaired by corrosion;

(b) Have valves and valve seats that are designed not to stick in a position that will make the device inoperative;

(c) Be designed and installed so that it can be readily operated to determine if the valve is free, can be tested to determine the pressure at which it will operate, and can be tested for leakage when in the closed position;

(d) Have support made of noncombustible material;

(e) Have discharge stacks, vents, or outlet ports designed to prevent accumulation of water, ice, or snow, located where gas can be discharged into the atmosphere without undue hazard;

*PSC 192.199 (e) In addition the outlet ports must be insect-proof and consideration should be given to all exposures in the immediate vicinity including windows or locations where gas can enter confined areas.*

(f) Be designed and installed so that the size of the openings, pipes, and fittings located between the system to be protected and the pressure

relieving device, and the size of the vent line, are adequate to prevent hammering of the valve and to prevent impairment of relief capacity;

(g) Where installed at a district regulator station to protect a pipeline system from overpressuring, be designed and installed to prevent any single incident such as an explosion in a vault or damage by a vehicle from affecting the operation of both the overpressure protective device and the district regulator; and

(h) Except for a valve that will isolate the system under protection from its source of pressure, be designed to prevent unauthorized operation of any stop valve that will make the pressure relief valve or pressure limiting device inoperative.

*PSC 192.199 (h) Acceptable methods for complying with 192.199 (h) are:*

(i) *Lock the stop valve in the open position. Instruct authorized personnel of the importance of not inadvertently leaving the stop valve closed and of being present during the entire period that the stop valve is closed so that they can lock it in the open position before they leave the location.*

(ii) *Install duplicate relief valves, each having adequate capacity by itself to protect the system and arrange the isolating valves or 3-way valve so that mechanically it is possible to render only one safety device inoperative at a time.*

*PSC 192.199 (i) Precautions shall be taken to prevent unauthorized operation of any valve which will make pressure limiting devices inoperative. This provision applies to isolating valves, by-pass valves, and valves on control or float lines which are located between the pressure limiting device and the system which the device protects. A method similar to PSC 192.199 (h) shall be considered acceptable in complying with this provision.*

**192.201 Required capacity of pressure relieving and limiting stations.**

(a) Each pressure relief station or pressure limiting station or group of those stations installed to protect a pipeline must have enough capacity, and must be set to operate, to insure the following:

(1) In a low pressure distribution system, the pressure may not cause the unsafe operation of any connected and properly adjusted gas utilization equipment.

(2) In pipelines other than a low pressure distribution system—

(i) If the maximum allowable operating pressure is 60 p.s.i.g. or more, the pressure may not exceed the maximum allowable operating pressure plus 10 percent, or the pressure that produces a hoop stress of 75 percent of SMYS, whichever is lower;

(ii) If the maximum allowable operating pressure is 12 p.s.i.g. or more, but less than 60 p.s.i.g. the pressure may not exceed the maximum allowable operating pressure plus 6 p.s.i.g.; or

(iii) If the maximum allowable operating pressure is less than 12 p.s.i.g., the pressure may not exceed the maximum allowable operating pressure plus 50 percent.

(b) When more than one pressure regulating or compressor station feeds into a pipeline, relief valves or other protective devices must be installed at each station to ensure that the complete failure of the largest capacity regulator or compressor, or any single run of lesser capacity regulators or compressors in that station, will not impose pressures on any part of the pipeline or distribution system in excess of those for which it was designed, or against which it was protected, whichever is lower.

(c) Relief valves or other pressure limiting devices must be installed at or near each regulator station in a low-pressure distribution system, with a capacity to limit the maximum pressure in the main to a pressure that will not exceed the safe operating pressure for any connected and properly adjusted gas utilization equipment.

#### 192.203 Instrument, control, and sampling pipe and components.

(a) *Applicability.* This section applies to the design of instrument, control, and sampling pipe and components. It does not apply to permanently closed systems, such as fluid-filled temperature-responsive devices.

(b) *Materials and design.* All materials employed for pipe and components must be designed to meet the particular conditions of service and the following:

(1) Each takeoff connection and attaching boss, fitting, or adapter must be made of suitable material, be able to withstand the maximum service pressure and temperature of the pipe or equipment to which it is attached, and be designed to satisfactorily withstand all stresses without failure by fatigue.

(2) A shutoff valve must be installed in each takeoff line as near as practicable to the point of takeoff. Blowdown valves must be installed where necessary.

(3) Brass or copper material may not be used for metal temperatures greater than 400° F.

(4) Pipe or components that may contain liquids must be protected by heating or other means from damage due to freezing.

(5) Pipe or components in which liquids may accumulate must have drains or drips.

(6) Pipe or components subject to clogging from solids or deposits must have suitable connections for cleaning.

(7) The arrangement of pipe, components, and supports must provide safety under anticipated operating stresses.

(8) Each joint between sections of pipe, and between pipe and valves or fittings, must be made in a manner suitable for the anticipated pressure and temperature condition. Slip type expansion joints may not be used. Expansion must be allowed for by providing flexibility within the system itself.

(9) Each control line must be protected from anticipated causes of damage and must be designed and installed to prevent damage to any one control line from making both the regulator and the overpressure protective device inoperative.

**PSC 192.204 Pipelines on private right-of-way of electric transmission lines.**

*Where gas pipelines parallel overhead electric transmission lines on the same right-of-way, the company operating the pipelines shall take the following precautions:*

(a) *Employ blow-down connections that will direct the gas away from the electric conductors.*

(b) *Install a bonding conductor across points where the main is to be separated and maintain this connection while the pipeline is separated. The current carrying capacity of the bonding conductor should be at least one-half of the capacity of the overhead line conductors.*

(c) *Make a study in collaboration with the electric company on the common problems of corrosion and electrolysis, taking the following factors into consideration:*

(1) *The possibility of the pipeline carrying either unbalanced line currents or fault currents.*

(2) *The possibility of lightning or fault currents inducing voltages sufficient to puncture pipe coatings or pipe.*

(3) *Cathodic protection of the pipeline, including location of ground beds, especially if the electric line is carried on steel towers.*

(4) *Bonding connections between the pipeline and either the steel tower footings or the buried ground facilities or the ground-wire of the overhead electric system.*

(d) *Investigate the necessity of protecting insulating joints in the pipeline against induced voltages or currents resulting from lightning strokes. Such protection can be obtained by connecting buried sacrificial anodes to the pipe near the insulating joints or by bridging the pipeline insulator with a spark-gap or by other effective means.*

**Subpart E—Welding of Steel in Pipelines**

**192.221 Scope.**

(a) This subpart prescribes minimum requirements for welding steel materials in pipelines.

(b) This subpart does not apply to welding that occurs during the manufacture of steel pipe or steel pipeline components.

**192.223 General.**

(a) Welding must be performed in accordance with established written welding procedures that have been qualified under 192.225 to produce sound, ductile welds.

(b) Welding must be performed by welders who are qualified under 192.227 and 192.229 for the welding procedures to be used.

**PSC 192.223** (c) *Prior to welding in or around a structure or area containing gas facilities, a thorough check shall be made to determine the possible presence of a combustible gas mixture. Welding shall begin only when safe conditions are indicated.*

**192.225 Qualifications of welding procedures.**

(a) Each welding procedure must be qualified under section IX of the 1974 edition of the ASME Boiler and Pressure Vessel Code or section 2 of the 1973 edition of API Standard 1104, whichever is appropriate to the function of the weld, except that a welding procedure qualified under section IX of the 1963 edition of the ASME Boiler and Pressure Vessel Code before July 1, 1976, or section 2 of the 1968 edition of API Standard 1104 before March 20, 1975, may continue to be used but may not be requalified under that edition.

(b) When a welding procedure is being qualified under section IX of the ASME Boiler and Pressure Vessel Code, the following steels are considered to fall within the P-Number 1 grouping for the purpose of the essential variable and do not require separate qualification of welding procedures:

(1) Carbon steels that have a carbon content of 0.32 (ladle analysis) or less.

(2) Carbon steels that have a carbon equivalent ( $C + \frac{1}{4} Mn$ ) of 0.65 percent (ladle analysis) or less.

(3) Alloy steels with weldability characteristics that have been shown to be similar to the carbon steels listed in subparagraphs (1) and (2) of this paragraph.

Alloy steels and carbon steels that are not covered by subparagraph (1), (2), or (3) of this paragraph require separate qualification of procedures for each individual pipe specification in accordance with sections VIII and IX of the ASME Boiler and Pressure Vessel Code.

(c) Each welding procedure must be recorded in detail during the qualifying tests. This record must be retained and followed whenever the procedure is used.

**192.227 Qualification of welders.**

(a) Except as provided in paragraph (c) of this section, each welder must be qualified in accordance with one of the following:

(1) Section IX of the 1974 edition of the ASME Boiler and Pressure Vessel Code or, if qualified before July 1, 1976, the 1968 edition, except that a welder may not requalify under the 1968 edition.

(2) The following editions of Section 3 of API Standard 1104:

(i) The 1973 edition, except, that a welder may be qualified by radiography under subsection 3.51 without regard for the standards in subsection 6.9 for depth of undercutting adjacent to the root bead unless that depth is visually determined by use of a depth measuring device on all undercutting along the entire circumference of the weld, or

(ii) If a welder is qualified before March 20, 1975, the 1968 edition, except that a welder may not requalify under the 1968 edition.

(b) When a welder is being qualified under section IX of the ASME Boiler and Pressure Vessel Code, the following steels are considered to fall within the P-Number 1 grouping for the purpose of the essential variables and do not require separate qualification:

(1) Carbon steels that have a carbon content of 0.32 percent (ladle analysis) or less.

(2) Carbon steels that have a carbon equivalent (C+¼ Mn) of 0.65 percent (ladle analysis) or less.

(3) Alloy steels with weldability characteristics that have been shown to be similar to the carbon steels listed in subparagraphs (1) and (2) of this paragraph.

Alloy steels and carbon steels that are not covered by subparagraph (1), (2), or (3) of this paragraph require separate qualification of welders for each individual pipe specification in accordance with sections VIII and IX of the ASME Boiler and Pressure Vessel Code.

(c) A welder may qualify to perform welding on pipe to be operated at a pressure that produces a hoop stress of less than 20% of SMYS by performing an acceptable test weld, for the process to be used, under the test set forth in section I of Appendix C to this part. A welder who makes welded service line connections to mains must also perform an acceptable test weld under section II of Appendix C to this part as a part of his qualifying test. After initial qualification, a welder may not perform welding unless—

(1) Within the preceding 12 calendar months, he has requalified; or

(2) Within the preceding 6 calendar months he has had—

(i) A production weld cut out, tested and found acceptable in accordance with the qualifying test; or

(ii) For welders who work only on service lines 2 inches or smaller in diameter, two sample welds tested and found acceptable in accordance with the test in section III of Appendix C to this part.

#### 192.229 Limitations on welders.

(a) No welder whose qualification is based on nondestructive testing may weld compressor station pipe and components.

(b) No welder may weld with a particular welding process unless, within the preceding 6 calendar months, he has engaged in welding with that process.

(c) A welder qualified under section 192.227 (a) may not weld unless within the preceding 6 calendar months the welder has had one weld tested and found acceptable under—

(1) Section 3 or 6 of the 1973 edition of API Standard 1104, except for the standards in subsection 6.9 for depth of undercutting adjacent to the root bead unless that depth is visually determined by use of a depth measuring device on all undercutting along the entire circumference of the weld; or

(2) In the case of tests conducted before March 20, 1975, section 3 or 6 of the 1968 edition of API Standard 1104.

#### 192.231 Protection from weather.

The welding operation must be protected from weather conditions that would impair the quality of the completed weld.

#### 192.233 Miter joints.

(a) A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of 30% or more of SMYS may not deflect the pipe more than 3°.

(b) A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of less than 30%, but more than 10%, of SMYS may not deflect the pipe more than 12½° and must be a distance equal to one pipe diameter or more away from any other miter joint, as measured from the crotch of each joint.

(c) A miter joint on steel pipe to be operated at a pressure that produces a hoop stress of 10% or less of SMYS may not deflect the pipe more than 90°.

#### 192.235 Preparation for welding.

Before beginning any welding, the welding surfaces must be clean and free of any material that may be detrimental to the weld, and the pipe or component must be aligned to provide the most favorable condition for depositing the root bead. This alignment must be preserved while the root bead is being deposited.

#### 192.237 Preheating.

(a) Carbon steel that has a carbon content in excess of 0.32 percent (ladle analysis) or a carbon equivalent (C+¼ Mn) in excess of 0.65 percent (ladle analysis) must be preheated for welding.

(b) Carbon steel that has a lower carbon content or carbon equivalent than the steels covered by paragraph (a) of this section must be preheated for welding when reheating will alleviate existing conditions that would limit the welding technique or tend to adversely affect the quality of the weld.

(c) When steel materials with different preheat temperatures are being preheated for welding, the higher temperature must be used.

(d) Preheat temperature must be monitored to ensure that the required preheat temperature is reached before, and maintained during, the welding operation.

#### 192.239 Stress relieving.

(a) Except as provided in paragraph (f) of this section, each weld on carbon steel that has a carbon content in excess of 0.32 percent (ladle analysis) or a carbon equivalent (C+¼ Mn) in excess of 0.65 percent (ladle analysis) must be stress relieved as prescribed in section VIII of the ASME Boiler and Pressure Vessel Code.

(b) Except as provided in paragraph (f) of this section, each weld on carbon steel that has a carbon content of less than 0.32 percent (ladle

analysis) or a carbon equivalent ( $C + \frac{1}{4} Mn$ ) of less than 0.65 percent (ladle analysis) must be thermally stress relieved when conditions exist which cool the weld at a rate detrimental to the quality of the weld.

(c) Except as provided in paragraph (f) of this section, each weld on carbon steel pipe with a wall thickness of more than  $1\frac{1}{4}$  inches must be stress relieved.

(d) When a weld connects pipe or components that are of different thickness, the wall thickness to be used in determining whether stress relieving is required under this section is—

(1) In the case of pipe connections, the thicker of the two pipes joined; or

(2) In the case of branch connections, slip-on flanges, or socket weld fittings, the thickness of the pipe run or header.

(e) Each weld of different materials must be stress relieved, if either material requires stress relieving under this section.

(f) Notwithstanding paragraphs (a), (b), and (c) of this section, stress relieving is not required for the following:

(1) A fillet or groove weld one-half inch, or less, in size (leg) that attaches a connection 2 inches, or less, in diameter; or

(2) A fillet or groove weld three-eighths inch, or less, in groove size that attaches a supporting member or other nonpressure attachment.

(g) Stress relieving required by this section must be performed at a temperature of at least  $1,100^{\circ} F$ . for carbon steels and at least  $1,200^{\circ} F$ . for ferritic alloy steels. When stress relieving a weld between steel materials with the different stress relieving temperatures, the higher temperature must be used.

(h) When stress relieving, the temperature must be monitored to ensure that a uniform temperature is maintained and that the proper stress relieving cycle is accomplished.

#### 192.241 Inspection and test of welds.

(a) Visual inspection of welding must be conducted to insure that—

(1) The welding is performed in accordance with the welding procedure; and

(2) The weld is acceptable under paragraph (c) of this section.

(b) The welds on a pipeline to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS must be nondestructively tested in accordance with 192.243, except that welds that are visually inspected and approved by a qualified welding inspector need not be nondestructively tested if—

(1) The pipe has a nominal diameter of less than 6 inches; or

(2) The pipeline is to be operated at a pressure that produces a hoop stress of less than 40% of SMYS and the welds are so limited in number that nondestructive testing is impractical.



(c) The acceptability of a weld that is nondestructively tested or visually inspected is determined according to the standards in Section 6 of the 1973 edition of API Standard 1104. However, the standards in subsection 6.9 for depth of undercutting adjacent to the root bead apply only if—

(1) That depth is visually determined by use of a depth measuring device on all undercutting along the entire circumference of the weld; and

(2) Visual determination of internal undercutting is made in all pipe of the same diameter in a pipeline, except where impractical at tie-in welds.

#### 192.243 Nondestructive testing.

(a) Nondestructive testing of welds must be performed by any process, other than trepanning, that will clearly indicate defects that may affect the integrity of the weld.

(b) Nondestructive testing of welds must be performed—

(1) In accordance with written procedures; and

(2) By persons who have been trained and qualified in the established procedures and with the equipment employed in testing.

(c) Procedures must be established for the proper interpretation of each nondestructive test of a weld to ensure the acceptability of the weld under 192.241 (c).

(d) When nondestructive testing is required under 192.241 (b), the following percentages of each day's field butt welds, selected at random by the operator, must be nondestructively tested over their entire circumference:

(1) In Class 1 locations, except offshore, at least 10%.

(2) In Class 2 locations, at least 15%.

(3) In Class 3 and Class 4 locations, at crossings of major or navigable rivers, and offshore, 100% if practicable, but not less than 90%.

(4) Within railroad or public highway rights-of-way, including tunnels, bridges and overhead road crossings, and at pipeline tie-ins, 100%.

*PSC 192.243 (d) (5) In addition, all welds within 500 feet of buildings intended for human occupancy shall be tested.*

*PSC 192.243 (d) (6) If one weld in any random sample is found to be unacceptable then the minimum percentage of welds selected for examination will be that of the next higher class location. If a second weld is found to be unacceptable or if 2 or more welds are found to be unacceptable in the original random sample, then 100% of the welds shall be inspected if practicable, but in no case less than 90% of the welds in that day's construction.*

(e) Except for a welder whose work is isolated from the principal welding activity, a sample of each welder's work for each day must be nondestructively tested, when nondestructive testing is required under 192.241 (b).

(f) When nondestructive testing is required under 192.241 (b), each operator must retain, for the life of the pipeline, a record showing by milepost, engineering station, or by geographic feature, the number of girth welds made, the number of nondestructively tested, the number of rejected, and the disposition of the rejects.

#### **192.245 Repair or removal of defects.**

(a) Each weld that is unacceptable under 192.241 (c) must be removed or repaired. Except for welds on an offshore pipeline being installed from a pipelay vessel, a weld must be removed if it has a crack that is more than 2 inches long or that penetrates either the root or second bead.

(b) Each weld that is repaired must have the defect removed down to clean metal and the segment to be repaired must be preheated. After repair, the segment of the weld that was repaired must be inspected to insure its acceptability. If the repair is not acceptable, the weld must be removed, except that additional repairs made in accordance with written welding procedures qualified under 192.225 are permitted for welds on an offshore pipeline being installed from a pipelay vessel.

#### **PSC 192.246 Precautions to avoid explosions of gas-air mixtures or uncontrolled fires during construction operations.**

(a) *Operations such as gas or electric welding and cutting with cutting torches can be safely performed on pipelines and mains and auxiliary equipment, provided that they are completely full of gas, or air that is free from combustible material. Steps shall be taken to prevent a mixture of gas and air at all points where such operations are to be performed.*

(b) *When a pipeline or main can be kept full of gas during a welding or cutting operation, the following procedures are recommended:*

(1) *Keep a slight flow of gas moving toward the point where cutting or welding is being done.*

(2) *The gas pressure at the site of the work shall be controlled by suitable means.*

(3) *Close all slots or open ends immediately after they are cut with tape, and/or tightly fitting canvas or other suitable material.*

(4) *Do not permit two openings to remain uncovered at the same time. This is doubly important if the two openings are at different elevations.*

(c) *No welding or acetylene cutting shall be done on a pipeline, main, or auxiliary apparatus that contains air if it is connected to a source of gas, unless a suitable means has been provided to prevent the leakage of gas into the pipeline or mains.*

(d) *In situations where welding or cutting must be done on facilities which are filled with air and connected to a source of gas and the precautions recommended above cannot be taken, one or more of the following precautions, depending upon the circumstances at the job are required:*

(1) *Purging of the pipe or equipment upon which welding or cutting is to be done, with combustible gas or inert gas.*

(2) *Testing of the atmosphere in the vicinity of the zone to be heated before the work is started and at intervals as the work progresses, with a combustible gas indicator or by other suitable means.*

(3) *Careful verification before the work starts that the valves that isolate the work from a source of gas do not leak.*

### **Subpart F—Joining of Materials Other Than by Welding**

#### **192.271 Scope.**

(a) This subpart prescribes minimum requirements for joining materials in pipelines, other than by welding.

(b) This subpart does not apply to joining during the manufacture of pipe or pipeline components.

#### **192.273 General.**

(a) The pipeline must be designed and installed so that each joint will sustain the longitudinal pullout or thrust forces caused by contraction or expansion of the piping or by anticipated external or internal loading.

(b) Each joint must be made in accordance with written procedures that have been proven by test or experience to produce strong gastight joints.

(c) Each joint must be inspected to insure compliance with this subpart.

#### **192.275 Cast iron pipe.**

(a) Each caulked bell and spigot joint in cast iron pipe must be sealed with mechanical leak clamps.

(b) Each mechanical joint in cast iron pipe must have a gasket made of a resilient material as the sealing medium. Each gasket must be suitably confined and retained under compression by a separate gland or follower ring.

(c) Cast iron pipe may not be joined by threaded joints.

(d) Cast iron pipe may not be joined by brazing.

(e) Each flange on a flanged joint in cast iron pipe must conform in dimensions and drilling to ANSI Standard B16.1 and be cast integrally with the pipe, valve, or fitting.

#### **192.277 Ductile iron pipe.**

(a) Each mechanical joint in ductile iron pipe must conform to ANSI Standard A21.52 and ANSI Standard A21.11.

(b) Ductile iron pipe may not be joined by threaded joints.

(c) Ductile iron pipe may not be joined by brazing.

**192.279 Copper pipe.**

Copper pipe may not be threaded, except that copper pipe used for joining screw fittings or valves may be threaded if the wall thickness is equivalent to the comparable size of standard wall pipe, as defined in ANSI Standard B36.10.

**PSC 192.279**

*Copper pipe shall be joined by using either a compression type coupling or a brazed or soldered lap joint. The filler material used for brazing shall be a copper-phosphorous alloy or silver base alloy. Butt welds are not permissible for joining copper pipe or tubing.*

**192.281 Plastic pipe.**

(a) *General.* A plastic pipe joint that is joined by solvent cement, adhesive, or heat fusion may not be disturbed until it has properly set. Plastic pipe may not be joined by a threaded joint or miter joint.

(b) *Solvent cement joints.* Each solvent cement joint on plastic pipe must comply with the following:

(1) The mating surfaces of the joint must be clean, dry, and free of material which might be detrimental to the joint.

(2) The solvent cement must conform to ASTM Specification D 2513.

(3) The safety requirements of Appendix A of ASTM Specification D 2513 must be met.

(4) The joint may not be heated to accelerate the setting of the cement.

*PSC 192.281 (b) (5) Proper fit between the pipe or tubing and mating socket or sleeve is essential to a good joint. Sound joints cannot normally be made between loose fitting parts.*

*PSC 192.281 (b) (6) A uniform coating of the solvent cement is required on both mating surfaces. After the joint is made, excess cement shall be removed from the outside of the joint. The joint shall not be disturbed until it has properly set.*

*PSC 192.281 (b) (7) This type joint shall not be made between different kinds of plastics.*

(c) *Heat-fusion joints.* Each heat-fusion joint on plastic pipe must comply with the following:

(1) A butt heat-fusion joint must be joined by a device that holds the heater element square to the ends of the piping, compresses the heated ends together, and holds the pipe in proper alignment while the plastic hardens.

(2) A socket heat-fusion joint must be joined by a device that heats the mating surfaces of the joint uniformly and simultaneously to essentially the same temperature.

(3) Heat may not be applied with a torch or other open flame.

PSC 192.281 (c) (4) *Care must be used in the heating operation to prevent damage to the plastic material from overheating or having the material not sufficiently heated to assure a sound joint.*

PSC 192.281 (c) (5) *This type joint shall not be made between different kinds of plastics.*

(d) *Adhesive joints.* Each adhesive joint on plastic pipe must comply with the following:

(1) The adhesive must conform to ASTM Specification D 2517.

(2) The materials and adhesive must be compatible with each other.

PSC 192.281 (d) (3) *An adhesive bonded joint may be heated in accordance with the pipe manufacturer's recommendation in order to accelerate cure.*

PSC 192.281 (d) (4) *Provision shall be made to clamp or otherwise prevent the joined materials from moving until the adhesive is properly set.*

(e) *Mechanical joints.* Each compression type mechanical joint on plastic pipe must comply with the following:

(1) The gasket material in the coupling must be compatible with the plastic.

(2) A rigid internal tubular stiffener, other than a split tubular stiffener, must be used in conjunction with the coupling.

PSC 192.281 (e) (2) *The tubular stiffener should be flush with end of pipe or tubing and project at least 1/2 in. beyond the outside end of the compression fitting when installed. The stiffener shall be free of rough or sharp edges and shall not be a force fit in the plastic.*

**192.283 Plastic pipe; qualifying joining procedures.** (a) *Heat Fusion, Solvent Cement and Adhesive Joints.* Before any written procedure established under ss. 192.273 (b) is used for making plastic pipe joints by a heat fusion, solvent cement or adhesive method, the procedure must be qualified by subjecting specimen joints made according to the procedure to the following tests:

(a) The burst test requirements of —

(i) In the case of thermoplastic pipe, paragraph 8.6 (Sustained Pressure Test) or paragraph 8.7 (Minimum Hydrostatic Burst Pressure) of ASTM D2513; or

(ii) In the case of thermosetting plastic pipe, paragraph 8.5 (Minimum Hydrostatic Burst Pressure) or paragraph 8.9 (Sustained Pressure Test) of ASTM D2517.

(2) For procedures intended for lateral pipe connections, subject a specimen joint made from pipe sections joined at right angles according to the procedure to a force on the lateral pipe until failure occurs in the specimen. If failure initiates outside the joint area, the procedure qualifies for use; and

(3) For procedures intended for nonlateral pipe connections, follow the tensile test requirements of ASTM D638, except that the test may be

conducted at ambient temperature and humidity. If the specimen elongates no less than 25 percent or failure initiates outside the joint area, the procedure qualifies for use.

(b) *Mechanical Joints.* Before any written procedure established under ss. 192.273 (b) is used for making mechanical plastic pipe joints that are designed to withstand tensile forces, the procedure must be qualified by subjecting 5 specimen joints made according to the procedure to the following tensile test:

(1) Use an apparatus for the test as specified in ASTM D638-77a (except for conditioning).

(2) The specimen must be of such length that the distance between the grips of the apparatus and the end of the stiffener does not affect the joint strength.

(3) The speed of testing is 5.0 mm (0.20 in.) per minute, plus or minus 2.5 percent.

(4) Pipe specimens less than 102 mm (4 in.) in diameter are qualified if the pipe yields to an elongation of no less than 25 percent or failure initiates outside the joint area.

(5) Pipe specimens 102 mm (4 in.) and larger in diameter shall be pulled until the pipe is subjected to a tensile stress equal to or greater than the maximum thermal stress that would be produced by a temperature change of 55.6° C. (100° F.) or until the pipe is pulled from the fitting. If the pipe pulls from the fitting, the lowest value of the five test results, or the manufacturer's rating, whichever is lower, must be used in the design calculations for stress.

(6) Each specimen that fails at the grips must be retested using new pipe.

(7) Results obtained pertain only to the specific outside diameter, and material of the pipe tested, except that testing of a heavier wall pipe may be used to qualify pipe of the same material but with a lesser wall thickness.

(c) A copy of each written procedure being used for joining plastic pipe must be available to the persons making and inspecting joints.

(d) Pipe or fittings manufactured before July 1, 1980 may be used in accordance with procedures that the manufacturer certifies will produce a joint as strong as the pipe.

**192.285 Plastic pipe; qualifying persons to make joints.** (b) The specimen joint must be —

(1) Visually examined during and after assembly or joining and found to have the same appearance as a joint or photographs of a joint that is acceptable under the procedure; and

(2) In the case of a heat fusion, solvent cement, or adhesive joint:

(i) Tested under any one of the test methods listed under ss. 192.283 (a) applicable to the type of joint and material being tested;

(ii) Examined by ultrasonic inspection and found not to contain flaws that would cause failure; or

(iii) Cut into at least 3 longitudinal straps, each of which is —

(A) Visually examined and found not to contain voids or discontinuities on the cut surfaces of the joint areas; and

(B) Deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area.

(c) A person must be requalified under an applicable procedure, if during any 12-month period that person—

(1) Does not make any joints under that procedure; or

(2) Has 3 joints or 3 percent of the joints made, whichever is greater, under that procedure that are found unacceptable by testing under ss. 192.513.

(d) Each operator shall establish a method to determine that each person making joints in plastic pipelines in his system is qualified in accordance with this section.

**192.287 Plastic pipe; inspection of joints.** No person may carry out the inspection of joints in plastic pipes required by ss. 192.273 (c) and 192.185 (b) unless that person has been qualified by appropriate training or experience in evaluating the acceptability of plastic pipe joints made under the applicable joining procedure.

### **Subpart G—General Construction Requirements for Transmission Lines and Mains**

#### **192.301 Scope.**

This subpart prescribes minimum requirements for constructing transmission lines and mains.

**192.303 Compliance with specifications or standards.** Each transmission line or main must be constructed in accordance with comprehensive written specifications or standards that are consistent with this part.

**192.305 Inspection; general.** Each transmission line or main must be inspected to ensure that it is constructed in accordance with this part.

#### **192.307 Inspection of materials.**

Each length of pipe and each other component must be visually inspected at the site of installation to ensure that it has not sustained any visually determinable damage that could impair its serviceability.

**PSC 192.307 Detection of gouges and grooves.** *The field inspection provided on each job shall be suitable to reduce to an acceptable minimum the chances that gouged or grooved pipe will get into the finished transmission line or main. Inspection for this purpose just ahead of the coating operation and during the lowering in and backfill operation is required.*

**192.309 Repair of steel pipe.** (a) Each imperfection or damage that impairs the serviceability of a length of steel pipe must be repaired or removed. If a repair is made by grinding, the remaining wall thickness must at least be equal to either:

(1) The minimum thickness required by the tolerances in the specification to which the pipe was manufactured; or

(2) The nominal wall thickness required for the design pressures of the pipeline.

(b) Each of the following dents must be removed from steel pipe to be operated at a pressure that produces a hoop stress of 20%, or more, of SMYS:

(1) A dent that contains a stress concentrator such as a scratch, gouge, groove, or arc burn.

(2) A dent that affects the longitudinal weld or a circumferential weld.

(3) In pipe to be operated at a pressure that produces a hoop stress of 40% or more of SMYS, a dent that has a depth of—

(i) More than one-quarter inch in pipe 12 ¼ inches or less in outer diameter; or

(ii) More than 2% of the nominal pipe diameter in pipe over 12 ¼ inches in outer diameter.

For the purpose of this section a "dent" is a depression that produces a gross disturbance in the curvature of the pipe wall without reducing the pipe-wall thickness. The depth of a dent is measured as the gap between the lowest point of the dent and a prolongation of the original contour of the pipe.

(c) Each arc burn on steel pipe to be operated at a pressure that produces a hoop stress of 40%, or more, of SMYS must be repaired or removed. If a repair is made by grinding, the arc burn must be completely removed and the remaining wall thickness must be at least equal to either:

(1) The minimum wall thickness required by the tolerances in the specification to which the pipe was manufactured; or

(2) The nominal wall thickness required for the design pressure of the pipeline.

(d) A gouge, groove, arc burn, or dent may not be repaired by insert patching or by pounding out.

(e) Each gouge, groove, arc burn, or dent that is removed from a length of pipe must be removed by cutting out the damaged portion as a cylinder.

**PSC 192.309 (f)** *Due primarily to climate conditions, gouges, grooves, notches, and dents have been found to be an important cause of steel pipe failures and an attempt shall be made to prevent or eliminate harmful defects of this nature. Subsection 192.309 (b) pertains to transmission lines and mains intended to operate at hoop stresses of 20% or 40% or more of the specified minimum yield strength. However, applicable portions of these paragraphs should also be applied to facilities intended to operate below this hoop stress level.*



**192.311 Repair of plastic pipe.** Each imperfection or damage that would impair the serviceability of plastic pipe must be repaired by a patching saddle or removed.

**192.313 Bends and elbows.** (a) Each field bend in steel pipe, other than a wrinkle bend made in accordance with 192.315, must comply with the following:

(1) A bend must not impair the serviceability of the pipe.

(2) For pipe more than 4 inches in nominal diameter, the difference between the maximum and minimum diameter at a bend must not be more than 2½ percent of the nominal diameter.

(3) Each bend must have a smooth contour and be free from buckling, cracks, or any other mechanical damage.

(4) On pipe containing a longitudinal weld, the longitudinal weld must be as near as practicable to the neutral axis of the bend unless:

(A) The bend is made with an internal bending mandrel; or

(B) The pipe is 12 inches or less in outside diameter or has a diameter to wall thickness ratio less than 70.

(b) Each circumferential weld of steel pipe which is located where the stress during bending causes a permanent deformation in the pipe must be non-destructively tested either before or after the bending process.

(c) Wrought-steel welding elbows and transverse segments of these elbows may not be used for changes in direction on steel pipe that is 2 inches or more in diameter unless the arc length, as measured along the crotch, is at least 1 inch.

(Sec. 3, Pub. L. 90-481, 82 Stat. 721, 49 USC 1672; 40 FR 43901, 49 CFR 1.53).

**PSC 192.313 (a) (5) Smooth bends on pipe 4 inches in size and smaller shall have a difference between the maximum and minimum diameter of not more than 12.5 percent of the nominal diameter.**

(b) Each circumferential weld of steel pipe that is subjected to stress during bending must be nondestructively tested.

(c) Wrought-steel welding elbows and transverse segments of these elbows may not be used for changes in direction on steel pipe that is 2 inches or more in diameter unless the arc length, as measured along the crotch, is at least 1 inch.

(d) Each bend, other than a wrinkle bend made in accordance with 192.315, must have a smooth contour and be free of mechanical damage.

**192.315 Wrinkle bends in steel pipe.**

(a) A wrinkle bend may not be made on steel pipe to be operated at a pressure that produces a hoop stress of 30%, or more, of SMYS.

(b) Each wrinkle bend on steel pipe must comply with the following:

(1) The bend must not have any sharp kinks.

(2) When measured along the crotch of the bend, the wrinkles must be a distance of at least one pipe diameter.

(3) On pipe 16 inches or larger in diameter, the bend may not have a deflection of more than  $1\frac{1}{2}^\circ$  for each wrinkle.

(4) On pipe containing a longitudinal weld the longitudinal seam must be as near as practicable to the neutral axis of the bend.

#### 192.317 Protection from hazards.

(a) Each transmission line or main must be protected from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads. In addition, offshore pipelines must be protected from damage by mud slides, water currents, hurricanes, ship anchors, and fishing operations.

(b) Each aboveground transmission line or main, not located offshore or in inland navigable water areas, must be protected from accidental damage by vehicular traffic or other similar causes, either by being placed at a safe distance from the traffic or by installing barricades.

(c) Pipelines, including pipe risers, on each platform located offshore or in inland navigable waters must be protected from accidental damage by vessels.

#### 192.319 Installation of pipe in a ditch.

(a) When installed in a ditch, each transmission line that is to be operated at a pressure producing a hoop stress of 20% or more of SMYS must be installed so that the pipe fits the ditch so as to minimize stresses and protect the pipe coating from damage.

*PSC 192.319 (a) This includes grading the ditch so that the pipe has a firm, substantially continuous bearing on the bottom of the ditch. When long sections of pipe that have been welded alongside the ditch are lowered in, care shall be exercised so as not to jerk the pipe or impose any strains that may kink or put a permanent bend in the pipe.*

(b) When a ditch for a transmission line or main is backfilled, it must be backfilled in a manner that—

(1) Provides firm support under the pipe; and

(2) Prevents damage to the pipe and pipe coating from equipment or from the backfill material.

(c) All offshore pipe in water at least 12 feet deep but not more than 200 feet deep, as measured from the mean low tide must be installed so that the top of the pipe is below the natural bottom unless the pipe is supported by stanchions, held in place by anchors or heavy concrete coating, or protected by an equivalent means.

*PSC 192.319 (b) (3) If there are large rocks in the material to be used for backfill, care should be used to prevent damage to the coating or pipe by such means as the use of rock shield material, or by making the initial fill with rock free material to a sufficient depth over the pipe to prevent rock damage.*

*PSC 192.319 (b) (4) Where flooding of the trench is done to consolidate the backfill, care shall be exercised to see that the pipe is not floated from its firm bearing on the trench bottom.*

**PSC 192.319** (c) *The provisions of 192.319 (a) shall also apply to mains operating at less than 20% of the SMYS.*

**192.321 Installation of plastic pipe.**

(a) Plastic pipe must be installed below ground level.

(b) Plastic pipe that is installed in a vault or any other below grade enclosure must be completely encased in gas-tight metal pipe and fittings that are adequately protected from corrosion.

(c) Plastic pipe must be installed so as to minimize shear or tensile stresses.

(d) Thermoplastic pipe that is not encased must have a minimum wall thickness of 0.090 inches, except that pipe with an outside diameter of 0.875 inches or less may have a minimum wall thickness of 0.062 inches.

(e) Plastic pipe that is not encased must have an electrically conductive wire or other means of locating the pipe while it is underground.

(f) Plastic pipe that is being encased must be inserted into the casing pipe in a manner that will protect the plastic. The leading end of the plastic must be closed before insertion.

**PSC 192.321** (f) *The casing pipe shall be reamed and cleaned to the extent necessary to remove any sharp edges, projections, or abrasive material which could damage the plastic during and after insertion. That portion of the plastic piping which spans disturbed earth shall be adequately protected by a bridging piece or other means from crushing or shearing from external loading or settling of backfill. Care shall be taken to prevent the plastic piping from bearing on the end of the casing.*

**PSC 192.321** (g) *Care shall be exercised to avoid rough handling of plastic pipe and tubing. It shall not be pushed or pulled over sharp projections, dropped or have other objects dropped upon it. Caution shall be taken to prevent kinking or buckling, and any kinks or buckles which occur shall be removed by cutting out as a cylinder.*

**PSC 192.321** (h) *Changes in direction of plastic piping may be made with bends, tees or elbows under the following limitations:*

(1) *Plastic pipe and tubing may be deflected to a radius not less than the minimum recommended by the manufacturer for the kind, type, grade, wall thickness and diameter of the particular plastic used.*

(2) *The bends shall be free of buckles, cracks, or other evidence of damage.*

(3) *Changes in direction that cannot be made in accordance with PSC 192.321 (h) (1) above shall be made with elbow-type fittings.*

(4) *Miter bends are not permitted.*

(5) *Branch connections shall be made only with socket-type tees or other suitable fittings specifically designed for the purpose.*

**PSC 192.321** (i) *Plastic piping shall be laid on undisturbed or well compacted soil. If plastic piping is to be laid in soils which may damage*

*it, the piping shall be protected by suitable rock free materials before back-filling is completed. Plastic piping shall not be supported by blocking. Well tampered earth or other continuous support shall be used.*

**192.323 Casing.**

Each casing used on a transmission line or main under a railroad or highway must comply with the following:

- (a) The casing must be designed to withstand the superimposed loads.
- (b) If there is a possibility of water entering the casing, the ends must be sealed.
- (c) If the ends of an unvented casing are sealed and the sealing is strong enough to retain the maximum allowable operating pressure of the pipe, the casing must be designed to hold this pressure at a stress level of not more than 72% of SMYS.
- (d) If vents are installed on a casing, the vents must be protected from the weather to prevent water from entering the casing.

*PSC 192.323 (e) Casing requirements of highway authorities shall be followed; however, construction type shall not be any less than provided by this code.*

**192.325 Underground clearance.**

(a) Each transmission line must be installed with at least 12 inches of clearance from any other underground structure not associated with the transmission line. If this clearance cannot be attained, the transmission line must be protected from damage that might result from the proximity of the other structure.

(b) Each main must be installed with enough clearance from any other underground structure to allow proper maintenance and to protect against damage that might result from proximity to other structures.

*PSC 192.325 (b) If the structure is a public building where people assemble or in areas such as playground, assembly ground, or park, wherever possible the clearance shall be at least 100 feet if the main is operated at more than 100 p.s.i. but less than 500 p.s.i. and shall be at least 150 feet if operated at 500 p.s.i. or more. If these clearances cannot be maintained, then the next higher type of construction shall be used except such construction may be pressure-tested the same as the remainder of the line. No distribution main or transmission line shall be installed under buildings.*

(c) In addition to meeting the requirements of paragraph (a) or (b) of this section, each plastic transmission line or main must be installed with sufficient clearance, or must be insulated, from any source of heat so as to prevent the heat from impairing the serviceability of the pipe.

(d) Each pipe-type or bottle-type holder must be installed with a minimum clearance from any other holder as prescribed in 192.175 (b).

**192.327 Cover.**

(a) Except as provided in paragraphs (c) and (e) of this section, each buried transmission line must be installed with a minimum cover as follows:

Location	Normal Soil	Consolidated rock
	Inches	Inches
Class 1 location .....	30	18
Class 2, 3, and 4 locations .....	36	24
Drainage ditches of public roads and railroad crossings .....	36	24

(b) Except as provided in paragraphs (c) and (d) of this section, each buried main must be installed with at least 24 inches of cover.

(c) Where an underground structure prevents the installation of a transmission line or main with the minimum cover, the transmission line or main may be installed with less cover if it is provided with additional protection to withstand anticipated external loads.

(d) A main may be installed with less than 24 inches of cover if the law of the State or municipality—

- (1) Establishes a minimum cover of less than 24 inches;
- (2) Requires that mains be installed in a common trench with other utility lines; and
- (3) Provides adequately for prevention of damage to the pipe by external forces.

(e) All pipe which is installed in a navigable river, stream, or harbor must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock, and all pipe installed in any offshore location under water less than 12 feet deep, as measured from mean low tide, must have a minimum cover of 36 inches in soil or 18 inches in consolidated rock, between the top of the pipe and the natural bottom. However, less than the minimum cover is permitted in accordance with paragraph (c) of this section.

**Subpart H—Customer Meters, Service Regulators, and Service Lines**

**192.351 Scope.**

This subpart prescribes minimum requirements for installing customer meters, service regulators, service lines, service line valves, and service line connections to mains.

**192.353 Customer meters and regulators: location.**

(a) Each meter and service regulator, whether inside or outside of a building, must be installed in a readily accessible location and be protected from corrosion and other damage. However, the upstream regulator in a series may be buried.

## PSC 135

(b) Each service regulator installed within a building must be located as near as practical to the point of service line entrance.

*PSC 192.353 (b) Whenever practical, the meters shall be installed at the same location.*

(c) Each meter installed within a building must be located in a ventilated place and not less than 3 feet from any source of ignition or any source of heat which might damage the meter.

*PSC 192.353 (c) Meters shall not be installed in bedrooms, closets, bathrooms, under combustible stairways or in unventilated or inaccessible places, nor closer than three feet to sources of ignition, including furnaces and water heaters.*

(d) Where feasible, the upstream regulator in a series must be located outside the building, unless it is located in a separate metering or regulated building.

### 192.355 Customer meters and regulators: protection from damage.

(a) *Protection from vacuum or back pressure.* If the customer's equipment might create either a vacuum or a back pressure, a device must be installed to protect the system.

*PSC 192.355 (a) (1) Install a check valve or equivalent if:*

(i) *The utilization equipment might induce a back-pressure.*

(ii) *The gas utilization equipment is connected to a source of oxygen or compressed air.*

(iii) *Liquefied petroleum gas or other supplementary gas is used as standby and might flow back into the meter. A three-way valve installed to admit the standby supply and at the same time shut off the regular supply, can be substituted for a check valve if desired.*

(b) *Service regulator vents and relief vents.* The outside terminal of each service regulator vent and relief vent must—

(1) Be rain and insect resistant;

(2) Be located at a place where gas from the vent can escape freely into the atmosphere and away from any opening into the building; and

(3) Be protected from damage caused by submergence in areas where flooding may occur.

*PSC 192.355 (b) (3) At locations where service regulators might be submerged during floods, either a special anti-flood type breather vent fitting shall be installed, or the vent line shall be extended above the height of the expected flood waters.*

(c) *Pits and vaults.* Each pit or vault that houses a customer meter or regulator at a place where vehicular traffic is anticipated, must be able to support that traffic.

### 192.357 Customer meters and regulators: installation.

(a) Each meter and each regulator must be installed so as to minimize anticipated stresses upon the connecting piping and the meter.

(b) When close all-thread nipples are used, the wall thickness remaining after the threads are cut must meet the minimum wall thickness requirements of this part.

(c) Connections made of lead or other easily damaged material may not be used in the installation of meters or regulators.

(d) Each regulator that might release gas in its operation must be vented to the outside atmosphere.

**192.359 Customer meter installations: operating pressure.**

(a) A meter may not be used at a pressure that is more than 67% of the manufacturer's shell test pressure.

(b) Each newly installed meter manufactured after November 12, 1970 must have been tested to a minimum of 10 p.s.i.g.

(c) A rebuilt or repaired tinned steel case meter may not be used at a pressure that is more than 50% of the pressure used to test the meter after rebuilding or repairing.

**192.361 Service lines: installation.**

(a) *Depth.* Each buried service line must be installed with at least 12 inches of cover in private property and at least 18 inches of cover in streets and roads. However, where an underground structure prevents installation at those depths, the service line must be able to withstand any anticipated external load.

(b) *Support and backfill.* Each service line must be properly supported on undisturbed or well-compacted soil, and material used for backfill must be free of materials that could damage the pipe or its coating.

(c) *Grading for drainage.* Where condensate in the gas might cause interruption in the gas supply to the customer, the service line must be graded so as to drain into the main or into drips at the low points in the service line.

(d) *Protection against piping strain and external loading.* Each service line must be installed so as to minimize anticipated piping strain and external loading.

(e) *Installation of service lines into buildings.* Each underground service line installed below grade through the outer foundation wall of a building must—

(1) In the case of a metal service line, be protected against corrosion;

(2) In the case of a plastic service line, be protected from shearing action and backfill settlement; and

(3) Be sealed at the foundation wall to prevent leakage into the building.

(f) *Installation of service lines under buildings.* Where an underground service line is installed under a building—

(1) It must be encased in a gas-tight conduit;

(2) The conduit and the service line must, if the service line supplies the building it underlies, extend into a normally usable and accessible part of the building; and

(3) The space between the conduit and the service line must be sealed to prevent gas leakage into the building and, if the conduit is sealed at both ends, a vent line from the annular space must extend to a point where gas would not be a hazard, and extend above grade, terminating in a rain and insect resistant fitting.

*PSC 192.361 (g) It is recommended that service to one customer and/or one building be supplied through one service and one shut-off valve.*

**192.363 Service lines: valve requirements.**

(a) Each service line must have a service-line valve that meets the applicable requirements of subparts B and D of this part. A valve incorporated in a meter bar, that allows the meter to be bypassed, may not be used as a service-line valve.

(b) A soft seat service line valve may not be used if its ability to control the flow of gas could be adversely affected by exposure to anticipated heat.

(c) Each service-line valve on a high-pressure service line, installed above ground or in an area where the blowing of gas would be hazardous, must be designed and constructed to minimize the possibility of the removal of the core of the valve with other than specialized tools.

**192.365 Service lines: location of valves.**

(a) *Relation to regulator or meter.* Each service-line valve must be installed upstream of the regulator or, if there is no regulator, upstream of the meter.

(b) *Outside valves.* Each service line must have a shut-off valve in a readily accessible location that, if feasible, is outside of the building.

*PSC 192.365 (b) Whenever gas is supplied to a theatre, church, school, factory or other building where large numbers of persons assemble, an outside valve in such case will be required.*

(c) *Underground valves.* Each underground service-line valve must be located in a covered durable curb box or standpipe that allows ready operation of the valve and is supported independently of the service lines.

**192.367 Service lines: general requirements for connections to main piping.**

(a) *Location.* Each service-line connection to a main must be located at the top of the main or, if that is not practical, at the side of the main, unless a suitable protective device is installed to minimize the possibility of dust and moisture being carried from the main into the service line.

(b) *Compression-type connection to main.* Each compression-type service line to main connection must—



(1) Be designed and installed to effectively sustain the longitudinal pull-out or thrust forces caused by contraction or expansion of the piping, or by anticipated external or internal loading; and

(2) If gaskets are used in connecting the service line to the main connection fitting, have gaskets that are compatible with the kind of gas in the system.

**192.369 Service lines: connections to cast iron or ductile iron mains.**

(a) Each service line connected to a cast iron or ductile iron main must be connected by a mechanical clamp, by drilling and tapping the main, or by another method meeting the requirements of 192.273.

(b) If a threaded tap is being inserted, the requirements of 192.151 (b) and (c) must also be met.

**192.371 Service lines: steel.**

Each steel service line to be operated at less than 100 p.s.i.g. must be constructed of pipe designed for a minimum of 100 p.s.i.g.

**PSC 192.371**

*(a) When coated steel pipe is to be installed as a service line in a bore, care should be exercised to prevent damage to the coating during installation. For all installations to be made by boring, driving or similar methods or in a rocky type soil, the following practices or their equivalents are recommended:*

*(1) When a service line is to be installed by boring or driving and a coated steel pipe is to be used for the service line, the coated pipe should not be used as the bore pipe or drive pipe and left in the ground as part of the service line. It is preferable to make such installations by first making an oversize bore, removing the pipe used for boring and then inserting the coated pipe.*

*(2) Coated steel pipe preferably should not be inserted through a bore in exceptionally rocky soil where there is a likelihood of damage to the coating resulting from the insertion.*

**192.373 Service lines: cast iron and ductile iron.**

(a) Cast iron or ductile iron pipe less than 6 inches in diameter may not be installed for service lines.

(b) If cast iron pipe or ductile iron pipe is installed for use as a service line, the part of the service line which extends through the building wall must be of steel pipe.

(c) A cast iron or ductile iron service line may not be installed in unstable soil or under a building.

**192.375 Service lines: plastic.**

(a) Each plastic service line outside a building must be installed below ground level, except that it may terminate above ground and outside the building, if—

## PSC 135

(1) The above ground part of the plastic service line is protected against deterioration and external damage; and

(2) The plastic service line is not used to support external loads.

*PSC 192.375 (a) (3) The above ground portion of the plastic service line is completely enclosed in a rigid metal tube or metal pipe. The metal tube or pipe shall have a minimum wall thickness of 0.035 in., adequate protection against corrosion, and shall extend a minimum of 6 inches below grade.*

(b) Each plastic service line inside a building must be protected against external damage.

**192.377 Service lines: copper.**

Each copper service line installed within a building must be protected against external damage.

**PSC 192.377**

*Copper service lines installed within a building may not be concealed.*

*PSC 192.377 (a) Ferrous valves and fittings installed on underground copper service lines shall be protected from contact with the soil or insulated from the copper pipe.*

**192.379 New Service lines not in use.**

Each service line that is not placed in service upon completion of installation must comply with one of the following until the customer is supplied with gas:

(a) The valve that is closed to prevent the flow of gas to the customer must be provided with a locking device or other means designed to prevent the opening of the valve by persons other than those authorized by the operator.

(b) A mechanical device or fitting that will prevent the flow of gas must be installed in the service line or in the meter assembly.

(c) The customer's piping must be physically disconnected from the gas supply and the open pipe ends sealed.

**Subpart I—Requirements for Corrosion Control****192.451 Scope.**

(a) This subpart prescribes minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion.

**192.452 Applicability to converted pipelines.**

Notwithstanding the date the pipeline was installed or any earlier deadlines for compliance, each pipeline which qualifies for use under this part in accordance with 192.14 must meet the requirements of this subpart specifically applicable to pipelines installed before August 1, 1971, and all other applicable requirements within 1 year after the pipeline is readied for service. However, the requirements of this subpart Register, December, 1982, No. 324

specifically applicable to pipelines installed after July 31, 1971, apply if the pipeline substantially meets those requirements before it is readied for service or it is a segment which is replaced, relocated, or substantially altered.

**192.453 General.**

Each operator shall establish procedures to implement the requirements of this subpart. These procedures, including those for the design, installation, operation and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in pipeline corrosion control methods.

**192.455 External corrosion control: buried or submerged pipelines installed after July 31, 1971.**

(a) Except as provided in paragraphs (b), (c), and (f) of this section, each buried or submerged pipeline installed after July 31, 1971, must be protected against external corrosion, including the following:

(1) It must have an external protective coating meeting the requirements of 192.46.

(2) It must have a cathodic protection system designed to protect the pipeline in its entirety in accordance with this subpart, installed and placed in operation within one year after completion of construction.

(b) An operator need not comply with paragraph (a) of this section, if the operator can demonstrate by tests, investigation, or experience in the area of application, including, as a minimum, soil resistivity measurements and tests for corrosion, accelerating bacteria, that a corrosive environment does not exist. However, within 6 months after an installation made pursuant to the preceding sentence, the operator shall conduct tests, including pipe-to-soil potential measurements with respect to either a continuous reference electrode, or an electrode using close spacing, not to exceed 20 feet, and soil resistivity measurements at potential profile peak locations, to adequately evaluate the potential profile along the entire pipeline. If the tests made indicate that a corrosive condition exists, the pipeline must be cathodically protected in accordance with paragraph (a) (2) of this section.

(c) An operator need not comply with paragraph (a) of this section, if the operator can demonstrate by tests, investigation, or experience that—

(1) For a copper pipeline, a corrosive environment does not exist; or

(2) For a temporary pipeline with an operating period of service not to exceed 5 years beyond installation, corrosion during the 5-year period of service of the pipeline will not be detrimental to public safety.

(d) Notwithstanding the provisions of paragraph (b) or (c) of this section, if a pipeline is externally coated, it must be cathodically protected in accordance with paragraph (a) (2) of this section.

(e) Aluminum may not be installed in a buried or submerged pipeline if that aluminum is exposed to an environment with a natural pH in excess of 8, unless tests or experience indicate its suitability in the particular environment involved.

(f) This section does not apply to electrically isolated, metal alloy fittings in plastic pipelines if —

(1) For the size fitting to be used, an operator can show by tests, investigation, or experience in the area of application that adequate corrosion control is provided by alloyage;

(2) The fitting is designed to prevent leakage caused by localized corrosion pitting; and

(3) A means is provided for identifying the location of the fitting.

**192.457 External corrosion control: buried or submerged pipelines installed before August 1, 1971.**

(a) Except for buried piping at compressor, regulator, and measuring stations, each buried or submerged transmission line installed before August 1, 1971, that has an effective external coating must be cathodically protected along the entire area that is effectively coated, in accordance with this subpart. For the purposes of this subpart, a pipeline does not have an effective external coating if its cathodic protection current requirements are substantially the same as if it were bare. The operator shall make tests to determine the cathodic protection current requirements.

(b) Except for cast iron or ductile iron, each of the following buried or submerged pipelines installed before August 1, 1971, must be cathodically protected in accordance with this subpart in areas in which active corrosion is found:

(1) Bare or ineffectively coated transmission lines.

(2) Bare or coated pipes at compressor, regulator, and measuring stations.

(3) Bare or coated distribution lines. The operator shall determine the areas of active corrosion by electrical survey, or where electrical survey is impractical, by the study of corrosion and leak history records, by leak detection survey, or by other means.

(c) For the purpose of this subpart, active corrosion means continuing corrosion which, unless controlled, could result in a condition that is detrimental to public safety.

*PSC 192.457 (d) Notwithstanding the provisions of 192.457 (b) (regarding active corrosion), effectively coated steel distribution pipelines, except for those portions including services and short sections that because of their nature and installation make cathodic protection impractical and uneconomical, must, not later than August 1, 1975, be cathodically protected along the entire area that is effectively coated in accordance with this subpart.*

**192.459 External corrosion control: examination of buried pipeline when exposed.**

Whenever an operator has knowledge that any portion of a buried pipeline is exposed, the exposed portion must be examined for evidence of external corrosion if the pipe is bare, or if the coating is deteriorated. If external corrosion is found, remedial action must be taken to the extent necessary to protect the pipeline. Register, December, 1982, No. 324

tent required by 192.483 and the applicable paragraphs of 192.485, 192.487, or 192.489.

**192.461 External corrosion control: protective coating.**

(a) Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must—

- (1) Be applied on a properly prepared surface;
- (2) Have sufficient adhesion to the metal surface to effectively resist underfilm migration of moisture;
- (3) Be sufficiently ductile to resist cracking;
- (4) Have sufficient strength to resist damage due to handling and soil stress; and
- (5) Have properties compatible with any supplemental cathodic protection.

(b) Each external protective coating which is an electrically insulating type must also have low moisture absorption and high electrical resistance.

(c) Each external protective coating must be inspected just prior to lowering the pipe into the ditch and backfilling, and any damage detrimental to effective corrosion control must be repaired.

(d) Each external protective coating must be protected from damage resulting from adverse ditch conditions or damage from supporting blocks.

(e) If coated pipe is installed by boring, driving, or other similar method, precautions must be taken to minimize damage to the coating during installation.

**192.463 External corrosion control: cathodic protection.**

(a) Each cathodic protection system required by this subpart must provide a level of cathodic protection that complies with one or more of the applicable criteria contained in Appendix D of this subpart. If none of these criteria is applicable, the cathodic protection system must provide a level of cathodic protection at least equal to that provided by compliance with one or more of these criteria.

(b) If amphoteric metals are included in a buried or submerged pipeline containing a metal of different anodic potential—

- (1) The amphoteric metals must be electrically isolated from the remainder of the pipeline and cathodically protected; or
- (2) The entire buried or submerged pipeline must be cathodically protected at a cathodic potential that meets the requirements of Appendix D of this part for amphoteric metals.

(c) The amount of cathodic protection must be controlled so as not to damage the protective coating or the pipe.

**192.465 External corrosion control: monitoring.**

(a) Each pipeline that is under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of § 192.463. However, if tests at those intervals are impractical for separately protected or short sections of protected mains or transmission lines, not in excess of 100 feet, these pipelines may be surveyed on a sampling basis. At least 10 percent of these protected structures, distributed over the entire system, must be surveyed each calendar year, with a different 10 percent checked each subsequent year, so that the entire system is tested in each 10-year period.

(b) Each cathodic protection rectifier or other impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2½ months, to insure that it is operating.

(c) Each reverse current switch, each diode, and each interference bond whose failure would jeopardize structure protection must be electrically checked for proper performance six times each calendar year, but with intervals not exceeding 2½ months. Each other interference bond must be checked at least once each calendar year, but with intervals not exceeding 15 months.

(d) Each operator shall take prompt remedial action to correct any deficiencies indicated by the monitoring.

(e) After the initial evaluation required by paragraphs (b) and (c) of 192.455 and paragraph (b) of 192.457, each operator shall, at intervals not exceeding 3 years, reevaluate its unprotected pipelines and cathodically protect them in accordance with this subpart in areas in which active corrosion is found. The operator shall determine the areas of active corrosion by electrical survey, or where electrical survey is impractical, by the study of corrosion and leak history records, by leak detection survey, or by other means.

**192.467 External corrosion control: electrical isolation.**

(a) Each buried or submerged pipeline must be electrically isolated from other underground metallic structures, unless the pipeline and the other structures are electrically interconnected and cathodically protected as a single unit.

(b) One or more insulating devices must be installed where electrical isolation of a portion of a pipeline is necessary to facilitate the application of corrosion control.

(c) Except for unprotected copper inserted in ferrous pipe, each pipeline must be electrically isolated from metallic casings that are a part of the underground system. However, if isolation is not achieved because it is impractical, other measures must be taken to minimize corrosion of the pipeline inside the casing.

(d) Inspection and electrical tests must be made to assure that electrical isolation is adequate.

(e) An insulating device may not be installed in an area where a combustible atmosphere is anticipated unless precautions are taken to prevent arcing.

(f) Where a pipeline is located in close proximity to electrical transmission tower footings, ground cables or counterpoise, or in other areas where fault currents or unusual risk of lightning may be anticipated, it must be provided with protection against damage due to fault currents or lightning, and protective measures must also be taken at insulating devices.

**192.469 External corrosion control: test stations.**

Each pipeline under cathodic protection required by this subpart must have sufficient test stations or other contact points for electrical measurements to determine the adequacy of cathodic protection.

**192.471 External corrosion control: test leads.**

(a) Each test lead wire must be connected to the pipeline so as to remain mechanically secure and electrically conductive.

(b) Each test lead wire must be attached to the pipeline so as to minimize stress concentration on the pipe.

(c) Each bared test lead wire and bared metallic area at point of connection to the pipeline must be coated with an electrical insulating material compatible with the pipe coating and the insulation on the wire.

**192.473 External corrosion control: interference currents.**

(a) Each operator whose pipeline system is subjected to stray currents shall have in effect a continuing program to minimize the detrimental effects of such currents.

(b) Each impressed current type cathodic protection system or galvanic anode system must be designed and installed so as to minimize any adverse effects on existing adjacent underground metallic structures.

**192.475 Internal corrosion control: general.**

(a) Corrosive gas may not be transported by pipeline, unless the corrosive effect of the gas on the pipeline has been investigated and steps have been taken to minimize internal corrosion.

(b) Whenever any pipe is removed from a pipeline for any reason, the internal surface must be inspected for evidence of corrosion. If internal corrosion is found—

(1) The adjacent pipe must be investigated to determine the extent of internal corrosion;

(2) Replacement must be made to the extent required by the applicable paragraphs of 192.485, 192.487 or 192.489; and

(3) Steps must be taken to minimize the internal corrosion.

(c) Gas containing more than 0.1 grain of hydrogen sulfide per 100 standard cubic feet may not be stored in pipe-type or bottle-type holders.

**192.477 Internal corrosion control: monitoring.**

If corrosive gas is being transported, coupons or other suitable means must be used to determine the effectiveness of the steps taken to minimize internal corrosion. Each coupon or other means of monitoring in-

ternal corrosion must be checked two times each calendar year, at intervals but with intervals not exceeding 7½ months:

**192.479 Atmospheric corrosion control: general.**

(a) *Pipelines installed after July 31, 1971.* Each aboveground pipeline or portion of a pipeline installed after July 31, 1971 that is exposed to the atmosphere must be cleaned and either coated or jacketed with a material suitable for the prevention of atmospheric corrosion. An operator need not comply with this paragraph, if the operator can demonstrate by test, investigation, or experience in the area of application, that a corrosive atmosphere does not exist.

(b) *Pipelines installed before August 1, 1971.* Each operator having an aboveground pipeline or portion of a pipeline installed before August 1, 1971 that is exposed to the atmosphere, shall—

(1) Determine the areas of atmospheric corrosion on the pipeline;

(2) If atmospheric corrosion is found, take remedial measures to the extent required by the applicable paragraphs of 192.485, 192.487, or 192.489; and

(3) Clean and either coat or jacket the areas of atmospheric corrosion on the pipeline with a material suitable for the prevention of atmospheric corrosion.

**§ 192.481 Atmospheric corrosion control: monitoring.**

After meeting the requirements of s. 192.479 (a) and (b), each operator shall, at intervals not exceeding 3 years for onshore pipelines and at least once each calendar year, but with intervals not exceeding 15 months, for offshore pipelines, reevaluate each pipeline that is exposed to the atmosphere and take remedial action whenever necessary to maintain protection against atmospheric corrosion.

**192.483 Remedial measures: general.**

(a) Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must have a properly prepared surface and must be provided with an external protective coating that meets the requirements of 192.461.

(b) Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must be cathodically protected in accordance with this subpart.

(c) Except for cast iron or ductile iron pipe, each segment of buried or submerged pipe that is required to be repaired because of external corrosion must be cathodically protected in accordance with this subpart.

**192.485 Remedial measures: transmission lines.**

(a) *General corrosion.* Each segment of transmission line with general corrosion and with a remaining wall thickness less than that required for the maximum allowable operating pressure of the pipeline must be replaced or the operating pressure reduced commensurate with the strength of the pipe based on the actual remaining wall thickness. However, if the area of general corrosion is small, the corroded pipe may be repaired. Corrosion pitting so closely grouped as to affect the overall Register, December, 1982, No. 324



strength of the pipe is considered general corrosion for the purpose of this paragraph.

(b) *Localized corrosion pitting.* Each segment of transmission line pipe with localized corrosion pitting to a degree where leakage might result must be replaced or repaired, or the operating pressure must be reduced commensurate with the strength of the pipe, based on the actual remaining wall thickness in the pits.

**192.487 Remedial measures: distribution lines other than cast iron or ductile iron lines.**

(a) *General corrosion.* Except for cast iron or ductile iron pipe, each segment of generally corroded distribution line pipe with a remaining wall thickness less than that required for the maximum allowable operating pressure of the pipeline, or a remaining wall thickness less than 30 percent of the nominal wall thickness, must be replaced. However, if the area of general corrosion is small, the corroded pipe may be repaired. Corrosion pitting so closely grouped as to affect the overall strength of the pipe is considered general corrosion for the purpose of the paragraph.

(b) *Localized corrosion pitting.* Except for cast iron or ductile iron pipe, each segment of distribution line pipe with localized corrosion pitting to a degree where leakage might result must be replaced or repaired.

**192.489 Remedial measures: cast iron and ductile iron pipelines.**

(a) *General graphitization.* Each segment of cast iron or ductile iron pipe on which general graphitization is found to a degree where a fracture or any leakage might result, must be replaced.

(b) *Localized graphitization.* Each segment of cast iron or ductile iron pipe on which localized graphitization is found to a degree where any leakage might result, must be replaced or repaired, or sealed by internal sealing methods adequate to prevent or arrest any leakage.

**192.491 Corrosion control records.**

(a) Each operator shall maintain records or maps to show the location of cathodically protected piping, cathodic protection facilities, other than unrecorded galvanic anodes installed before August 1, 1971, and neighboring structures bonded to the cathodic protection system.

(b) Each of the following records must be retained for as long as the pipeline remains in service:

(1) Each record or map required by paragraph (a) of this section.

(2) Records of each test, survey, or inspection required by this subpart, in sufficient detail to demonstrate the adequacy of corrosion control measures or that a corrosive condition does not exist.

## **Subpart J—Test Requirements**

### **192.501 Scope.**

This subpart prescribes minimum leak-test and strength-test requirements for pipelines.

**192.503 General requirements.**

(a) No person may operate a new segment of pipeline, or return to service a segment of pipeline that has been relocated or replaced, until—

(1) It has been tested in accordance with this subpart to substantiate the proposed maximum allowable operating pressure; and

(2) Each potentially hazardous leak has been located and eliminated.

(b) The test medium must be liquid, air, natural gas, or inert gas that is—

(1) Compatible with the material of which the pipeline is constructed;

(2) Relatively free of sedimentary materials; and

(3) Except for natural gas, nonflammable.

(c) Except as provided in 192.505 (a), if air, natural gas, or inert gas is used as the test medium, the following maximum hoop stress limitations apply:

Class location	Maximum hoop stress allowed as percentage of SMYS	
	Natural gas	Air or inert gas
1.....	80	80
2.....	30	75
3.....	30	50
4.....	30	40

(d) Each weld used to tie-in a test segment of pipeline is excepted from the test requirements of this subpart.

**192.505 Strength test requirements for steel pipeline to operate at a hoop stress of 30 percent or more of SMYS.**

(a) Except for service lines, each segment of a steel pipeline that is to operate at a hoop stress of 30% or more of SMYS must be strength tested in accordance with this section to substantiate the proposed maximum allowable operating pressure. In addition, in a Class 1 or Class 2 location, if there is a building intended for human occupancy within 300 feet of a pipeline, a hydrostatic test must be conducted to a test pressure of at least 125% of maximum operating pressure on that segment of the pipeline within 300 feet of such a building, but in no event may the test section be less than 600 feet unless the length of the newly installed or relocated pipe is less than 600 feet. However, if the buildings are evacuated while the hoop stress exceeds 50% of SMYS, air or inert gas may be used as the test medium.

(b) In a Class 1 or Class 2 location, each compressor station, regulator station, and measuring station, must be tested to at least Class 3 location test requirements.

(c) Except as provided in paragraph (e) of this section, the strength test must be conducted by maintaining the pressure at or above the test pressure for at least 8 hours.

(d) If a component other than pipe is the only item being replaced or added to a pipeline, a strength test after installation is not required, if the manufacturer of the component certifies that—

(1) The component was tested to at least the pressure required for the pipeline to which it is being added; or

(2) The component was manufactured under a quality control system that ensures that each item manufactured is at least equal in strength to a prototype and that the prototype was tested to at least the pressure required for the pipeline to which it is being added.

(e) For fabricated units and short sections of pipe, for which a post installation test is impractical, a preinstallation strength test must be conducted by maintaining the pressure at or above the test pressure for at least 4 hours.

*PSC 192.505 (f) Except in freezing weather or when water is not available, pipelines or mains larger than 6 inches in diameter, installed in class locations 1, 2, or 3, shall be hydrostatically tested in place to at least 90% of the specified minimum yield strength.*

**192.507 Test requirements for pipelines to operate at a hoop stress less than 30% of SMYS and above 100 p.s.i.g.**

Except for service lines and plastic pipelines, each segment of a pipeline that is to be operated at a hoop stress less than 30% of SMYS and above 100 p.s.i.g. must be tested in accordance with the following:

(a) The pipeline operator must use a test procedure that will ensure discovery of all potentially hazardous leaks in the segments being tested.

(b) If, during the test, the segment is to be stressed to 20% or more of SMYS and natural gas, inert gas, or air is the test medium—

(1) A leak test must be made at a pressure between 100 p.s.i.g. and the pressure required to produce a hoop stress of 20% of SMYS; or

(2) The line must be walked to check for leaks while the hoop stress is held at approximately 20% of SMYS.

(c) The pressure must be maintained at or above the test pressure for at least 1 hour.

**192.509 Test requirements for pipelines to operate at or below 100 p.s.i.g.** Except for service lines and plastic pipelines, each segment of a pipeline that is to be operated at or below 100 p.s.i.g. must be leak tested in accordance with the following:

(a) The test procedure used must ensure discovery of all potentially hazardous leaks in the segment being tested.

(b) Each main that is to be operated at less than 1 p.s.i.g. must be tested to at least 10 p.s.i.g. and each main to be operated at or above 1 p.s.i.g. must be tested to at least 90 p.s.i.g.

*PSC 192.509 (c) If substantial protective coatings are used that would seal a split seam, the leak test pressure shall be 100 p.s.i.g.*

**192.511 Test requirements for service lines.** (a) Each segment of a service line (other than plastic) must be leak tested in accordance with

this section before being placed in service. If feasible, the service-line connection to the main must be included in the test; if not feasible, it must be given a leakage test at the operating pressure when placed in service.

(b) Each segment of a service line (other than plastic) intended to be operated at a pressure of at least 1 p.s.i.g. but not more than 40 p.s.i.g. must be given a leak test at a pressure of not less than 50 p.s.i.g.

(c) Each segment of a service line (other than plastic) intended to be operated at pressures of more than 40 p.s.i.g. must be tested to at least 90 p.s.i.g., except that each segment of a steel service line stressed to 20% or more of SMYS must be tested in accordance with 192.507 of this subpart.

*PSC 192.511 (d) Each segment of a service line (other than plastic) intended to be operated at a pressure between 0 and 1 p.s.i.g. must be given a leak test at a pressure of not less than 50 p.s.i.g.*

**192.513 Test requirements for plastic pipelines.** (a) Each segment of a plastic pipeline must be tested in accordance with this section.

(b) The test procedure must insure discovery of all potentially hazardous leaks in the segment being tested.

(c) The test pressure must be at least 150% of the maximum operating pressure or 50 p.s.i.g., whichever is greater. However, the maximum test pressure may not be more than 3 times the design pressure of the pipe.

(d) The temperature of thermoplastic material must not be more than 100° F. during the test.

**192.515 Environmental protection and safety requirements.** (a) In conducting tests under this subpart, each operator shall insure that every reasonable precaution is taken to protect its employees and the general public during the testing. Whenever the hoop stress of the segment of the pipeline being tested will exceed 50% of SMYS, the operator shall take all practicable steps to keep persons not working on the testing operation outside of the testing area until the pressure is reduced to or below the proposed maximum allowable operating pressure.

(b) The operator shall insure that the test medium is disposed of in a manner that will minimize damage to the environment.

**192.517 Records.** Each operator shall make, and retain for the useful life of the pipeline, a record of each test performed under 192.505 and 192.507. The record must contain at least the following information:

(a) The operator's name, the name of the operator's employee responsible for making the test, and the name of any test company used.

(b) Test medium used.

(c) Test pressure.

(d) Test duration.

(e) Pressure recording charts, or other record of pressure readings.

(f) Elevation variations, whenever significant for the particular test.

- (g) Leaks and failures noted and their disposition.

### Subpart K—Uprating

**192.551 Scope.** This subpart prescribes minimum requirements for increasing maximum allowable operating pressures (uprating) for pipelines.

**192.553 General requirements.** (a) *Pressure increases.* Whenever the requirements of this subpart require that an increase in operating pressure be made in increments, the pressure must be increased gradually, at a rate that can be controlled, and in accordance with the following:

(1) At the end of each incremental increase, the pressure must be held constant while the entire segment of pipeline that is affected is checked for leaks.

(2) Each leak detected must be repaired before a further pressure increase is made, except that a leak determined not to be potentially hazardous need not be repaired, if it is monitored during the pressure increase and it does not become potentially hazardous.

(b) *Records.* Each operator who uprates a segment of pipeline shall retain for the life of the segment a record of each investigation required by this subpart, of all work performed, and of each pressure test conducted, in connection with the uprating.

(c) *Written plan.* Each operator who uprates a segment of pipeline shall establish a written procedure that will ensure that each applicable requirement of this subpart is complied with.

(d) *Limitation on increase in maximum allowable operating pressure.* Except as provided in 192.555 (c), a new maximum allowable operating pressure established under this subpart may not exceed the maximum that would be allowed under this part for a new segment of pipeline constructed of the same materials in the same location.

**192.555 Uprating to a pressure that will produce a hoop stress of 30% or more of SMYS in steel pipelines.** (a) Unless the requirements of this section have been met, no person may subject any segment of a steel pipeline to an operating pressure that will produce a hoop stress of 30% or more of SMYS and that is above the established maximum allowable operating pressure.

(b) Before increasing operating pressure above the previously established maximum allowable operating pressure the operator shall—

(1) Review the design, operating, and maintenance history and previous testing of the segment of pipeline and determine whether the proposed increase is safe and consistent with the requirements of this part; and

(2) Make any repairs, replacements, or alterations in the segment of pipeline that are necessary for safe operation at the increased pressure.

(c) After complying with paragraph (b) of this section, an operator may increase the maximum allowable operating pressure of a segment of pipeline constructed before September 12, 1970, to the highest pressure

that is permitted under 192.619, using as test pressure the highest pressure to which the segment of pipeline was previously subjected (either in a strength test or in actual operation).

(d) After complying with paragraph (b) of this section, an operator that does not qualify under paragraph (c) of this section may increase the previously established maximum allowable operating pressure if at least one of the following requirements is met:

(1) The segment of pipeline is successfully tested in accordance with the requirements of this part for a new line of the same material in the same location.

(2) An increased maximum allowable operating pressure may be established for a segment of pipeline in a Class 1 location if the line has not previously been tested, and if—

(i) It is impractical to test it in accordance with the requirements of this part;

(ii) The new maximum operating pressure does not exceed 80% of that allowed for a new line of the same design in the same location; and

(iii) The operator determines that the new maximum allowable operating pressure is consistent with the condition of the segment of pipeline and the design requirements of this part.

(e) Where a segment of pipeline is uprated in accordance with paragraph (c) or (d) (2) of this section, the increase in pressure must be made in increments that are equal to—

(1) 10% of the pressure before the uprating; or

(2) 25% of the total pressure increase, whichever produces the fewer number of increments.

**192.557 Uprating: steel pipelines to a pressure that will produce a hoop stress less than 30% of SMYS; plastic, cast iron, and ductile iron pipelines.** (a) Unless the requirements of this section have been met, no person may subject—

(1) A segment of steel pipeline to an operating pressure that will produce a hoop stress less than 30% of SMYS and that is above the previously established maximum allowable operating pressure; or

(2) A plastic, cast iron, or ductile iron pipeline segment to an operating pressure that is above the previously established maximum allowable operating pressure.

(b) Before increasing operating pressure above the previously established maximum allowable operating pressure, the operator shall—

(1) Review the design, operating, and maintenance history of the segment of pipeline;

(2) Make a leakage survey (if it has been more than 1 year since the last survey) and repair any leaks that are found, except that a leak determined not to be potentially hazardous need not be repaired, if it is monitored during the pressure increase and it does not become potentially hazardous;

(3) Make any repairs, replacements, or alterations in the segment of pipeline that are necessary for safe operation at the increased pressure;

(4) Reinforce or anchor offsets, bends and dead ends in pipe joined by compression couplings or bell and spigot joints to prevent failure of the pipe joint, if the offset, bend, or dead end is exposed in an excavation;

(5) Isolate the segment of pipeline in which the pressure is to be increased from any adjacent segment that will continue to be operated at a lower pressure; and

(6) If the pressure in mains or service lines, or both, is to be higher than the pressure delivered to the customer, install a service regulator on each service line and test each regulator to determine that it is functioning. Pressure may be increased as necessary to test each regulator, after a regulator has been installed on each pipeline subject to the increased pressure.

(c) After complying with paragraph (b) of this section, the increase in maximum allowable operating pressure must be made in increments that are equal to 10 p.s.i.g. or 25% of the total pressure increase, whichever produces the fewer number of increments. Whenever the requirements of paragraph (b) (6) of this section apply, there must be at least 2 approximately equal incremental increases.

(d) If records for cast iron or ductile iron pipeline facilities are not complete enough to ascertain compliance with 192.117 or 192.119, as applicable, the following procedures must be followed:

(1) If the original laying conditions cannot be ascertained, the operator shall assume, when applying the design formulas of ANSI A21.1, that cast iron pipe was supported on blocks with tamped backfill and, when applying the design formulas of ANSI A21.50, that ductile iron pipe was laid without blocks with tamped backfill.

(2) Unless the actual maximum cover depth is known, the operator shall measure the actual cover in at least three places where the cover is most likely to be greatest and shall use the greatest cover measured.

(3) Unless the actual nominal wall thickness is known, the operator shall determine the wall thickness by cutting and measuring coupons from at least three separate pipe lengths. The coupons must be cut from pipe lengths in areas where the cover depth is most likely to be the greatest. The average of all measurements taken must be increased by the allowance indicated in the following table:

Pipe size (inches)	Allowance (inches)		
	Cast iron pipe		
	Pit cast pipe	Centrifugally cast pipe	Ductile iron pipe
3-8	0.075	0.065	0.065
10-12	0.08	0.07	0.07
14-24	0.08	0.08	0.075
30-42	0.09	0.09	0.075
48	0.09	0.09	0.08
54-60	0.09	—	—

Note—The nominal wall thickness of the cast iron is the standard thickness listed in table 10 or table 11, as applicable, of ANSI A21.1 nearest the value obtained under this subparagraph. The nominal wall thickness of ductile iron pipe is the standard thickness listed in table 6 of ANSI A21.50 nearest the value obtained under this subparagraph.

(4) For cast iron pipe, unless the pipe manufacturing process is known, the operator shall assume that the pipe is pit case pipe with a bursting tensile strength of 11,000 p.s.i. and a modulus of rupture of 31,000 p.s.i.

### Subpart L—Operations

**192.601 Scope.** This subpart prescribes minimum requirements for the operation of pipeline facilities.

**192.603 General provisions.** (a) No person may operate a segment of pipeline unless it is operated in accordance with this subpart.

(b) Each operator shall establish a written operating and maintenance plan meeting the requirements of this part and keep records necessary to administer the plan.

**192.605 Essentials of operating and maintenance plan:** Each operator shall include the following in its operating and maintenance plan:

(a) Instructions for employees covering operating and maintenance procedures during normal operations and repairs.

(b) Items required to be included by the provisions of Subpart M of this part.

(c) Specific programs relating to facilities presenting the greatest hazard to public safety either in an emergency or because of extraordinary construction or maintenance requirements.

(d) A program for conversion procedures, if conversion of a low-pressure distribution system to a higher pressure is contemplated.

(e) Provision for periodic inspections to ensure that operating pressures are appropriate for the class location.

**192.607 Initial determination of class location and confirmation or establishment of maximum allowable operating pressure.** (a) Before April 15, 1971, each operator shall complete a study to determine for each segment of pipeline with a maximum allowable operating pressure that will produce a hoop stress that is more than 40% of SMYS—

(1) The present class location of all such pipeline in its system; and



(2) Whether the hoop stress corresponding to the maximum allowable operating pressure for each segment of pipeline is commensurate with the present class location.

(b) Each segment of pipeline that has been determined under paragraph (a) of this section to have an established maximum allowable operating pressure producing a hoop stress that is not commensurate with the class location of the segment of pipeline and that is found to be in satisfactory condition, must have the maximum allowable operating pressure confirmed or revised in accordance with 192.611. The confirmation or revision must be completed not later than December 31, 1974.

(c) Each operator required to confirm or revise an established maximum allowable operating pressure under paragraph (b) of this section shall, not later than December 31, 1971, prepare a comprehensive plan, including a schedule, for carrying out the confirmations or revisions. The comprehensive plan must also provide for confirmations or revisions determined to be necessary under 192.609 to the extent that they are caused by changes in class locations taking place before July 1, 1973.

**192.609 Change in class location: required study.** Whenever an increase in population density indicates a change in class location for a segment of an existing steel pipeline operating at hoop stress that is more than 40% of SMYS, or indicates that the hoop stress corresponding to the established maximum allowable operating pressure for a segment of existing pipeline is not commensurate with the present class location, the operator shall immediately make a study to determine—

- (a) The present class location for the segment involved.
- (b) The design, construction, and testing procedures followed in the original construction, and a comparison of these procedures with those required for the present class location by the applicable provisions of this part.
- (c) The physical condition of the segment to the extent it can be ascertained from available records;
- (d) The operating and maintenance history of the segment;
- (e) The maximum actual operating pressure and the corresponding operating hoop stress, taking pressure gradient into account, for the segment of pipeline involved; and
- (f) The actual area affected by the population density increase, and physical barriers or other factors which may limit further expansion of the more densely populated area.

**192.611 Change in class location: confirmation or revision of maximum allowable operating pressure.** If the hoop stress corresponding to the established maximum allowable operating pressure of a segment of pipeline is not commensurate with the present class location, and the segment is in satisfactory physical condition, the maximum allowable operating pressure of that segment of pipeline must be confirmed or revised as follows:

- (a) If the segment involved has been previously tested in place to at least 90% of its SMYS for a period of not less than 8 hours, the maximum allowable operating pressure must be confirmed or reduced so that the corresponding hoop stress will not exceed 72% of SMYS of the pipe

in Class 2 locations, 60% of SMYS in Class 3 locations, or 50% of SMYS in Class 4 locations.

(b) If the segment involved has not been previously tested in place as described in paragraph (a) of this section, the maximum allowable operating pressure must be reduced so that the corresponding hoop stress is not more than that allowed by this part for new segments of pipelines in the existing class location.

(c) If the segment of pipeline involved has not been qualified for operation under paragraph (a) or (b) of this section, it must be tested in accordance with the applicable requirements of Subpart J of this part, and its maximum allowable operating pressure must then be established so as to be equal to or less than the following:

(1) The maximum allowable operating pressure after the requalification test is 0.8 times the test pressure for Class 2 locations, 0.667 times the test pressure for Class 3 locations, and 0.555 times the test pressure for Class 4 locations.

(2) The maximum allowable operating pressure confirmed or revised in accordance with this section, may not exceed the maximum allowable operating pressure established before the confirmation or revision.

(3) The corresponding hoop stress may not exceed 72% of the SMYS of the pipe in Class 2 locations, 60% of SMYS in Class 3 locations, or 50% of the SMYS in Class 4 locations.

(d) Confirmation or revision of the maximum allowable operating pressure of a segment of pipeline in accordance with this section does not preclude the application of 192.553 and 192.555.

(e) Confirmation or revision of the maximum allowable operating pressure that is required as a result of a study under 192.609 must be completed as follows:

(1) Confirmation or revision due to changes in class location that occur before July 1, 1973, must be completed not later than December 31, 1974.

(2) Confirmation or revision due to changes in class location that occur on or after July 1, 1973, must be completed within 18 months of the change in class location.

**192.613 Continuing surveillance.** (a) Each operator shall have a procedure for continuing surveillance of its facilities to determine and take appropriate action concerning changes in class location, failures, leakage history, corrosion, substantial changes in cathodic protection requirements, and other unusual operating and maintenance conditions.

(b) If a segment of pipeline is determined to be in unsatisfactory condition but no immediate hazard exists, the operator shall initiate a program to recondition or phase out the segment involved, or, if the segment cannot be reconditioned or phased out, reduce the maximum allowable operating pressure in accordance with 192.619 (a) and (b).

**PSC 192.613 (c)** *When street is paved or repaved. Whenever a road or street is paved or repaved with permanent pavement, the operator shall:*

(1) Check for leaks along all mains and services in the streets and abutting property. The check shall be conducted by testing with a combustible gas indicator air samples taken from holes placed near the pipes. The utility may substitute for bar hole tests a ground surface survey with a continuous-sampling instrument capable of detecting combustible gas in air concentrations of 100 parts per million.

(2) Determine condition of pipe and joints by sample visual examination.

(3) Place clamps on, reconstruct, or repair joints if they are likely to dry out or are leaking.

(4) Replace pipe if existing pipe is corroded to such an extent that it is likely to require replacement before the street is again resurfaced.

PSC 192.613 (d) *Underground pipes.* Whenever underground pipes are exposed in order to repair leaks, the utility shall record on the repair order the nature of the leak and possible cause from observation.

PSC 192.615 *Emergency plans.* (a) Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedures must provide for the following:

(1) Receiving, identifying, and classifying notices of events which require immediate response by the operator.

(2) Establishing and maintaining adequate means of communication with appropriate fire, police, and other public officials.

(3) Prompt and effective response to a notice of each type of emergency, including the following:

(i) Gas detected inside or near a building.

(ii) Fire located near or directly involving a pipeline facility.

(iii) Explosion occurring near or directly involving a pipeline facility.

(iv) Natural disaster.

(4) The availability of personnel, equipment, tools, and materials, as needed at the scene of an emergency.

(5) Actions directed toward protecting people first and then property.

(6) Emergency shutdown and pressure reduction in any section of the operator's pipeline system necessary to minimize hazards to life or property.

(7) Making safe any actual or potential hazard to life or property.

(8) Notifying appropriate fire, police, and other public officials of gas pipeline emergencies and coordinating with them both planned responses and actual responses during an emergency.

(9) Safely restoring any service outage.

(10) Beginning action under 192.617, if applicable, as soon after the end of the emergency as possible.

(b) Each operator shall—

(1) Furnish its supervisors who are responsible for emergency action a copy of that portion of the latest edition of the emergency procedures established under paragraph (a) of this section as necessary for compliance with those procedures.

(2) Train the appropriate operating personnel to assure that they are knowledgeable of the emergency procedures and verify that the training is effective.

(3) Review employee activities to determine whether the procedures were effectively followed in each emergency.

(c) Each operator shall establish and maintain liaison with appropriate fire, police, and other public officials to—

(1) Learn the responsibility and resources of each government organization that may respond to a gas pipeline emergency;

(2) Acquaint the officials with the operator's ability in responding to a gas pipeline emergency;

(3) Identify the types of gas pipeline emergencies of which the operator notifies the officials; and

(4) Plan how the operator and officials can engage in mutual assistance to minimize hazards to life or property.

(d) Each operator shall establish a continuing educational program to enable customers, the public, appropriate government organizations, and persons engaged in excavation related activities to recognize a gas pipeline emergency for the purpose of reporting it to the operator or the appropriate public officials. The program and the media used must be as comprehensive as necessary to reach all areas in which the operator transports gas. The program must be conducted in English and in other languages commonly understood by a significant number and concentration of the non-English speaking population in the operator's area.

**192.617 Investigation of failures.** Each operator shall establish procedures for analyzing accidents and failures, including the selection of samples of the failed facility or equipment for laboratory examination, where appropriate, for the purpose of determining the causes of the failure and minimizing the possibility of a recurrence.

**192.619 Maximum allowable operating pressure: steel or plastic pipelines.** (a) Except as provided in paragraph (c) of this section, no person may operate a segment of steel or plastic pipeline at a pressure that exceeds the lowest of the following:

(1) The design pressure of the weakest element in the segment, determined in accordance with Subparts C and D of this part.

(2) The pressure obtained by dividing the pressure to which the segment was tested after construction as follows:

(i) For plastic pipe in all locations, the test pressure is divided by a factor of 1.5.

**PSC 192.619 (a) (2) (i)** For plastic pipe used as a gas service, the maximum allowable operating pressure in any class location shall not exceed 60 p.s.i.g.

(ii) For steel pipe, operated at 100 p.s.i.g. or more, the test pressure is divided by a factor determined in accordance with the following table:

Class location	Factors*		
	Segment installed before (Nov. 12, 1970)	Segment installed after (Nov. 11, 1970)	Segment converted 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

\* For offshore segments installed, uprated, or converted after July 31, 1977, that are not located on an offshore platform, the factor is 1.25. For segments installed, uprated, or converted after July 31, 1977, that are located on an offshore platform or on a platform in inland navigable waters (including a pipe riser), the factor is 1.5.

(3) The highest actual operating pressure to which the segment was subjected during the 5 years preceding July 1, 1970, (or in the case of offshore gathering lines, July 1, 1971) unless the segment was tested in accordance with paragraph (a) (2) of this section after July 1, 1965, (or in the case of offshore gathering lines, July 1, 1971) or the segment was uprated in accordance with Subpart K of this part.

(4) For furnace butt welded steel pipe, a pressure equal to 60% of the mill test pressure to which the pipe was subjected.

(5) For steel pipe other than furnace butt welded pipe, a pressure equal to 85% of the highest test pressure to which the pipe has been subjected, whether by mill test or by the post installation test.

(6) The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressure.

(b) No person may operate a segment to which paragraph (a) (6) of this section is applicable, unless over-pressure protective devices are installed on the segment in a manner that will prevent the maximum allowable operating pressure from being exceeded, in accordance with 192.195.

(c) Notwithstanding the other requirements of this section, 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 July 1, 1970, or in the case of offshore gathering lines, July 1, 1976, subject to the requirements of 192.611.

**192.621 Maximum allowable operating pressure: high-pressure distribution systems.** (a) No person may operate a segment of a high pressure distribution system at a pressure that exceeds the lowest of the following pressures, as applicable:

(1) The design pressure of the weakest element in the segment, determined in accordance with Subparts C and D of this part.

(2) Sixty p.s.i.g., for a segment of a distribution system otherwise designed to operate at over 60 p.s.i.g., unless the service lines in the segment are equipped with service regulators or other pressure limiting devices in series that meet the requirements of 192.197 (c).

(3) Twenty-five p.s.i.g. in segments of cast iron pipe in which there are unreinforced bell and spigot joints.

**PSC 192.621 (a) (3)** *No person may operate a segment of a cast iron pipe in which there are unreinforced bell and spigot joints at a pressure higher than low pressure unless it can be proven to the commission that they can be operated at a higher pressure. However, the maximum allowable operating pressure under any circumstances shall not exceed 15 p.s.i.g.*

(4) The pressure limits to which a joint could be subjected without the possibility of its parting.

(5) The pressure determined by the operator to be the maximum safe pressure after considering the history of the segment, particularly known corrosion and the actual operating pressures.

(b) No person may operate a segment of pipeline to which paragraph (a) (5) of this section applies, unless overpressure protective devices are installed on the segment in a manner that will prevent the maximum allowable operating pressure from being exceeded, in accordance with 192.195.

**PSC 192.621 (c)** *Sixty p.s.i.g. in individual distribution systems or portions thereof. The intercity or supply mains for these distribution systems may be operated at higher pressures provided by this code if the number of services supplied from these mains are limited and these mains are not an integral part of the distribution system. The pressure and the services supplied from these higher pressure intercity and supply mains shall be limited to 60 p.s.i.g. unless the service lines are equipped with series regulators or other pressure limiting devices as prescribed in 192.197 (c)*

**192.623 Maximum and minimum allowable operating pressure: low-pressure distribution systems.** (a) No person may operate a low-pressure distribution system at a pressure high enough to make unsafe the operation of any connected and properly adjusted low-pressure gas burning equipment.

(b) No person may operate a low pressure distribution system at a pressure lower than the minimum pressure at which the safe and continuing operation of any connected and properly adjusted low-pressure gas burning equipment can be assured.

**PSC 192.623 (c)** *No person may operate a low pressure distribution system at a pressure in excess of that provided by section PSC 134.23 (1).*

**192.625 Odorization of gas.** (a) A combustible gas in a distribution line must contain a natural odorant or be odorized so that at a concentration in air of one-fifth of the lower explosive limit, the gas is readily detectable by a person with a normal sense of smell.

(b) After December 31, 1976, a combustible gas in a transmission line in a Class 3 or Class 4 location must comply with the requirements of paragraph (a) of this section unless—

(1) At least 50 percent of the length of the line downstream from that location is in a Class 1 or Class 2 location;

(2) The line transports gas to any of the following facilities which received gas without an odorant from that line before May 5, 1975;

(i) An underground storage field;

(ii) A gas processing plant;

(iii) A gas dehydration plant; or

(iv) An industrial plant using gas in a process where the presence of an odorant—

(A) Makes the end product unfit for the purpose of which it is intended;

(B) Reduces the activity of a catalyst; or

(C) Reduces the percentage completion of a chemical reaction; or

(3) In the case of a lateral line which transports gas to a distribution center, at least 50 percent of the length of that line is in a Class 1 or Class 2 location.

(c) In the concentrations in which it is used, the odorant in combustible gases must comply with the following:

(1) The odorant may not be deleterious to persons, materials, or pipe.

(2) The products of combustion from the odorant may not be toxic when breathed nor may they be corrosive or harmful to those materials to which the products of combustion will be exposed.

(d) The odorant may not be soluble in water to an extent greater than 2.5 parts to 100 parts by weight.

(e) Equipment for odorization must introduce the odorant without wide variations in the level of odorant.

(f) Each operator shall conduct periodic sampling of combustible gases to assure the proper concentration of odorant in accordance with this section.

(g) The odorization requirements of Part 190 of this chapter, as in effect on August 12, 1970, must be complied with, in each State in which odorization of gas in transmission lines is required by that part, until the earlier of the following dates:

(1) January 1, 1977; or

(2) The date upon which the distribution companies in that State are odorizing gas in accordance with paragraphs (a) through (f) of this section.

**192.627 Tapping pipelines under pressure.** Each tap made on a pipeline under pressure must be performed by a crew qualified to make hot taps.

**192.629 Purging of pipelines.** (a) When a pipeline is being purged of air by use of gas, the gas must be released into one end of the line in a moderately rapid and continuous flow. If gas cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the gas.

(b) When a pipeline is being purged of gas by use of air, the air must be released into one end of the line in a moderately rapid and continuous flow. If air cannot be supplied in sufficient quantity to prevent the formation of a hazardous mixture of gas and air, a slug of inert gas must be released into the line before the air.

*PSC 192.629 (c) No pipeline, main, or service shall be purged into any building or confined space.*

### Subpart M—Maintenance

#### 192.701 Scope.

This subpart prescribes minimum requirements for maintenance of pipeline facilities.

**192.703 General.** (a) No person may operate a segment of pipeline, unless it is maintained in accordance with this subpart.

(b) Each segment of pipeline that becomes unsafe must be replaced, repaired, or removed from service.

(c) Hazardous leaks must be repaired promptly.

**192.705 Transmission lines; patrolling.** (a) Each operator shall have a patrol program to observe surface conditions on and adjacent to the transmission line right-of-way for indications of leaks, construction activity, and other factors affecting safety and operation.

(b) The frequency of patrols is determined by the size of the line, the operating pressures, the class location, terrain, weather, and other relevant factors, but intervals between patrols may not be longer than prescribed in the following table:

Class location of line	Maximum intervals between patrols	
	At highway and rail-road crossings	At all other places
1, 2.....	6 months	1 year
3.....	3 months	6 months
4.....	do	3 months

**192.706 Transmission lines; leakage surveys.** (a) Each operator of a transmission line shall provide for periodic leakage surveys of the line in its operating and maintenance plan.

(b) Leakage surveys of a transmission line must be conducted at intervals not exceeding 1 year. However, in the case of a transmission line which transports gas in conformity with section 192.625 without an odor or odorant, leakage surveys using leak detector equipment must be conducted—

(1) In Class 3 locations, at intervals not exceeding 6 months; and



- (2) In Class 4 locations, at intervals not exceeding 3 months.

**192.707 Line markers for mains and transmission lines.** (a) *Buried pipelines.* Except as provided in paragraph (b) of this section, a line marker must be placed and maintained as close as practical over each buried main and transmission line—

(1) At each crossing of a public road, railroad, and navigable waterway; and

(2) Wherever necessary to identify the location of the transmission line or main to reduce the possibility of damage or interference.

However, until January 1, 1978, paragraphs (a) (1) and (a) (2) of this section do not apply to mains installed before April 21, 1975, and until January 1, 1978, paragraph (a) (1) of this section does not apply to transmission lines installed before April 21, 1975.

(b) *Exceptions for buried pipelines.* Line markers are not required for buried mains and transmission lines—

(1) Located offshore or under inland navigable waters;

(2) In Class 3 or Class 4 locations—

(i) Where placement of a marker is impractical; or

(ii) Where a program for preventing interference with underground pipelines is established by law; or

(3) In the case of navigable waterway crossings, within 100 feet of a line marker placed and maintained at that waterway in accordance with this section.

(c) *Pipelines aboveground.* Line markers must be placed and maintained along each section of a main and transmission line that is located aboveground in an area accessible to the public.

(d) *Markers other than at navigable waterways.* The following must be written legibly on a background of sharply contrasting color on each line marker not placed at a navigable waterway.

(1) The word "Warning," "Caution," or "Danger" followed by the words "Gas (or name of gas transported) Pipeline" all of which, except for markers in heavily developed urban areas, must be in letters at least one inch high with one-quarter inch stroke.

(2) The name of the operator and the telephone number (including area code) where the operator can be reached at all times.

(e) *Markers at navigable waterways.* Each line marker at a navigable waterway must have the following characteristics:

(1) A sign, rectangular in shape, with a narrow strip along each edge colored international orange and the area between lettering on the sign and boundary strips colored white.

(2) Written on the sign in block style, black letters—

(i) The word "Warning," "Caution," or "Danger" followed by the words "Do Not Anchor or Dredge" and the words "Gas (or name of gas transported) Pipeline Crossing"; and

## PSC 135

(ii) The name of the operator and the telephone number (including area code) where the operator can be reached at all times.

(3) In overcast daylight, the sign is visible and the writing required by paragraph (e) (2) (i) of this section is legible, from approaching or passing vessels that may damage or interfere with the pipeline.

(f) *Existing markers.* Line markers installed before April 21, 1975, which do not comply with paragraph (d) or (e) of this section may be used until January 1, 1980.

## PSC 192.707

*When transmission lines are located outside urban areas, their location shall be marked (recognizable to the public) at each fence line, road crossing, railroad crossing, river, lake, stream, or drainage ditch crossing and wherever it is considered necessary to identify the location of a pipeline to reduce the possibility of damage or interference.*

**192.709 Transmission lines: record-keeping.** Each operator shall keep records covering each leak discovered, repair made, transmission line break, leakage survey, line patrol, and inspection, for as long as the segment of transmission line involved remains in service.

**192.711 Transmission lines: general requirements for repair procedures.** (a) Each operator shall take immediate temporary measures to protect the public whenever—

(1) A leak, imperfection, or damage that impairs its serviceability is found in a segment of steel transmission line operating at or above 40% of the SMYS; and

(2) It is not feasible to make a permanent repair at the time of discovery. As soon as feasible, the operator shall make permanent repairs.

(b) Except as provided in 192.717 (a) (3), no operator may use a welded patch as a means of repair.

**192.713 Transmission lines: permanent field repair of imperfections and damages.** (a) Except as provided in paragraph (b) of this section each imperfection or damage that impairs the serviceability of a segment of steel transmission line operating at or above 40% of SMYS must be repaired as follows:

(1) If it is feasible, to take the segment out of service, the imperfection or damage must be removed by cutting out a cylindrical piece of pipe and replacing it with pipe of similar or greater design strength.

(2) If it is not feasible to take the segment out of service, a full encirclement welded split sleeve of appropriate design must be applied over the imperfection or damage.

(3) If the segment is not taken out of service, the operating pressure must be reduced to a safe level during the repair operations.

*PSC 192.713(a) (4) Gouges and grooves of lesser depth than 10% of the nominal wall thickness of the pipe may be removed by grinding out to a smooth contour provided the grinding does not reduce the remaining wall thickness to less than the minimum prescribed by this code for the conditions of use.*

(b) *Submerged offshore pipelines and submerged pipelines in inland navigable waters may be repaired by mechanically applying a full encirclement split sleeve of appropriate design over the imperfection or damage.*

**192.715 Transmission lines: permanent field repair of welds.** Each weld that is unacceptable under 192.241 (c) must be repaired as follows:

(a) If it is feasible to take the segment of transmission line out of service, the weld must be repaired in accordance with the applicable requirements of 192.245.

(b) A weld may be repaired in accordance with 192.245 while the segment of transmission line is in service if—

- (1) The weld is not leaking;
- (2) The pressure in the segment is reduced so that it does not produce a stress that is more than 20% of the SMYS of the pipe; and
- (3) Grinding of the defective area can be limited so that at least 1/8-inch thickness in the pipe weld remains.

(c) A defective weld which cannot be repaired in accordance with paragraph (a) or (b) of this section must be repaired by installing a full encirclement welded split sleeve of appropriate design.

**192.717 Transmission lines: permanent field repair of leaks.** (a) Except as provided in paragraph (b) of this section, each permanent field repair of a leak on a transmission line must be made as follows:

(1) If feasible, the segment of transmission line must be taken out of service and repaired by cutting out a cylindrical piece of pipe and replacing it with pipe of similar or greater design strength.

(2) If it is not feasible to take the segment of transmission line out of service, repairs must be made by installing a full encirclement welded split sleeve of appropriate design, unless the transmission line—

(i) Is joined by mechanical couplings; and

(ii) Operates at less than 40 percent of SMYS.

(3) If the leak is due to a corrosion pit, the repair may be made by installing a properly designed bolt-on-leak clamp; or, if the leak is due to a corrosion pit and on pipe of not more than 40,000 psi SMYS, the repair may be made by fillet welding over the pitted area a steel plate patch with rounded corners, of the same or greater thickness than the pipe, and not more than one-half of the diameter of the pipe in size.

(b) Submerged offshore pipelines and submerged pipelines in inland navigable waters may be repaired by mechanically applying a full encirclement split sleeve of appropriate design over the leak.

**192.719 Transmission lines: testing of repairs.** (a) *Testing of replacement pipe.* (1) If a segment of transmission line is repaired by cutting out the damaged portion of the pipe as a cylinder, the replacement pipe must be tested to the pressure required for a new line installed in the same location.

(2) The test required by subparagraph (1) of this paragraph may be made on the pipe before it is installed, but all field girth bolt welds that are not strength tested must be tested after installation by nondestructive tests meeting the requirements of 192.243.

(b) *Testing of repairs made by welding.* Each repair made by welding in accordance with 192.713, 192.715, and 192.717 must be examined in accordance with 192.241.

**PSC 192.720** *Repair of steel pipe operating below 40% of the specified minimum yield strength.*

*If inspections at any time reveal an injurious defect, gouge, groove, dent, or leak, immediate temporary measures shall be employed to protect the property and public if it is not feasible to make permanent repair at time of discovery. As soon as feasible, permanent repairs shall be made using recognized methods of repair.*

**192.721 Distribution systems: patrolling.** (a) The frequency of patrolling mains must be determined by the severity of the conditions which could cause failure or leakage, and the consequent hazards to public safety.

(b) Mains in places or on structures where anticipated physical movement or external loading could cause failure or leakage must be patrolled at intervals not exceeding 3 months.

**PSC 192.722 Distribution mains: markers.** *When distribution mains are located outside urban areas, their location shall be marked (recognizable to the public) at each fence line, road crossing, railroad crossing, river, lake, stream, or drainage ditch crossing and wherever it is considered necessary to identify the location of a pipeline to reduce the possibility of damage or interference.*

**192.723 Distribution systems: leakage surveys and procedures.** (a) Each operator of a distribution system shall provide for periodic leakage surveys in its operating and maintenance plan.

(b) The type and scope of the leakage control program must be determined by the nature of the operations and the local conditions, but it must meet the following minimum requirements:

(1) A gas detector survey must be conducted in business districts, including tests of the atmosphere in gas, electric, telephone, sewer and water system manholes, at cracks in pavement and sidewalks, and at other locations providing an opportunity for finding gas leaks, at intervals not exceeding 1 year.

(2) Leakage surveys of the distribution system outside of the principal business areas must be made as frequently as necessary, but at intervals not exceeding 5 years.

**PSC 192.723** *Every operator shall maintain a gas leak-detection program and shall maintain records of operation under the program. The program shall consist of not less than the following:*

(a) *In principal business districts (as shown by maps filed with the public service commission by each utility) a reasonable street-opening survey shall be conducted twice annually by making tests with combustible gas indicators in street openings such as telephone and electric*

vaults and manholes, catch basins and sewer system manholes, and gas system openings.

(b) In each principal business district a building survey shall be conducted once a year. The piping from the service entrance to the meter outlet and metering and regulating equipment shall be tested for gas leakage in those buildings that have gas service.

(c) A survey of all buildings used for public gatherings such as schools, churches, hospitals, and theaters shall be conducted once each year. The piping from the service entrance to the meter outlet and metering and regulating equipment shall be tested for gas leakage.

(d) In residential areas, in addition to a survey of public buildings the vegetation shall be checked. At least 3 barhole tests shall be made in each block; at least one street opening shall be checked if one exists in each block or at each intersection; and on streets where system is operating at a pressure of more than 10 p.s.i.g., all street openings shall be checked. (See 192.723 (b) (1) above for types of street openings.) The utility may substitute for the barhole tests a ground surface survey with a hand-operated, continuous-sampling instrument capable of detecting combustible gas in air concentrations of 100 parts per million. The utility may substitute for all the tests required by this section (PSC 192.723 (d)) a survey by mobile flame ionization or infrared gas detection units, provided that a method be included to check individual services. The tests required by this section (PSC 192.723 (d)) shall be made each year.

(e) Along lines in rural areas, the vegetation shall be checked annually.

(f) When a leak complaint is received and the odor of gas indicates that there is a leak in or near the premises, a search shall be carried to conclusion until such leak is found.

**PSC 192.724 Further leakage survey after repair of leak.** When a leak is found and repaired, a further check shall be made in the vicinity of the repaired leak to determine if there is any other source of migrant gas in the neighborhood.

**192.725 Test requirements for reinstating service lines.** (a) Except as provided in paragraph (b) of this section, each disconnected service line must be tested in the same manner as a new service line, before being reinstated.

(b) Each service line temporarily disconnected from the main must be tested from the point of disconnection to the service line valve in the same manner as a new service line, before reconnecting. However, if provisions are made to maintain continuous service, such as by installation of a bypass, any part of the original service line used to maintain continuous service need not be tested.

**192.727 Abandonment or inactivation of facilities.** (a) Each operator shall provide in its operating and maintenance plan for abandonment or deactivation of pipelines, including provisions for meeting each of the requirements of this section.

(b) Each pipeline abandoned in place must be disconnected from all sources and supplies of gas; purged of gas; in the case of offshore pipe-

lines, filled with water or inert materials; and sealed at the ends. However, the pipeline need not be purged when the volume of gas is so small that there is no potential hazard.

(c) Except for service lines, each inactive pipeline that is not being maintained under this part must be disconnected from all sources and supplies of gas; purged of gas; in the case of off-shore pipelines, filled with water or inert materials; and sealed at the ends. However, the pipeline need not be purged when the volume of gas is so small that there is no potential hazard.

(d) Whenever service to a customer is discontinued, one of the following must be complied with:

(1) The valve that is closed to prevent the flow of gas to the customer must be provided with a locking device or other means designed to prevent the opening of the valve by persons other than those authorized by the operator.

(2) A mechanical device or fitting that will prevent the flow of gas must be installed in the service line or in the meter assembly.

(3) The customer's piping must be physically disconnected from the gas supply and the open pipe ends sealed.

(e) If air is used for purging, the operator shall insure that a combustible mixture is not present after purging.

(f) Each abandoned vault must be filled with a suitable compacted material.

**PSC 192.727 (g)** *Special efforts shall be made to include services which have not been used for two years in a way that will remove gas from the customers' premises. The plan shall include the following provisions:*

(1) *If the facilities are abandoned in place, they shall be physically disconnected from the piping system. The open ends of all abandoned facilities shall be capped, plugged, or otherwise effectively sealed.*

(2) *In cases where a main is abandoned, together with the service lines connected to it, insofar as service lines are concerned, only the customers' end of such service lines need be sealed as stipulated above.*

**192.729 Compressor stations: procedures for gas compressor units.** Each operator shall establish starting, operating, and shutdown procedures for gas compressor units.

**192.731 Compressor stations: inspection and testing of relief devices.** (a) Except for rupture discs, each pressure relieving device in a compressor station must be inspected and tested in accordance with 192.739 and 192.743, and must be operated periodically to determine that it opens at the correct set pressure.

(b) Any defective or inadequate equipment found must be promptly repaired or replaced.

(c) Each remote control shutdown device must be inspected and tested, at intervals not to exceed 1 year, to determine that it functions properly.

**192.733 Compressor stations: isolation of equipment for maintenance or alterations.** Each operator shall establish procedures for maintaining compressor stations, including provisions for isolating units or sections of pipe for purging before returning to service.

**192.735 Compressor stations: storage of combustible materials.**  
(a) Flammable or combustible materials in quantities beyond those required for everyday use, or other than those normally used in compressor buildings, must be stored a safe distance from the compressor building.

(b) Aboveground oil or gasoline storage tanks must be protected in accordance with National Fire Protection Association Standard No. 30.

**PSC 192.735 (c)** *All aboveground oil or gasoline storage tanks shall be constructed and protected in accordance with the applicable codes of the department of industry, labor and human relations.*

**192.737 Pipe-type and bottle-type holders: plan for inspection and testing.** Each operator having a pipe-type or bottle-type holder shall establish a plan for the systematic, routine inspection and testing of these facilities, including the following:

(a) Provision must be made for detecting external corrosion before the strength of the container has been impaired.

(b) Periodic sampling and testing of gas in storage must be made to determine the dew point of vapors contained in the stored gas, that if condensed, might cause internal corrosion or interfere with the safe operation of the storage plant.

(c) The pressure control and pressure limiting equipment must be inspected and tested periodically to determine that it is in a safe operating condition and has adequate capacity.

**192.739 Pressure limiting and regulating stations: inspection and testing.**

Each pressure limiting station, relief device (except rupture discs), and pressure regulating station and its equipment must be subjected, at intervals not exceeding 1 year, to inspections and tests to determine that it is—

- (a) In good mechanical condition;
- (b) Adequate from the standpoint of capacity and reliability of operation for the service in which it is employed;
- (c) Set to function at the correct pressure; and
- (d) Properly installed and protected from dirt, liquids, or other conditions that might prevent proper operation.

**192.741 Pressure limiting and regulating stations: telemetering or recording gages.**

(a) Each distribution system supplied by more than one district pressure regulating station must be equipped with telemetering or recording pressure gages to indicate the gas pressure in the district.

## PSC 135

(b) On distribution systems supplied by a single district pressure regulating station, the operator shall determine the necessity of installing telemetering or recording gages in the district, taking into consideration the number of customers supplied, the operating pressures, the capacity of the installation, and other operating conditions.

(c) If there are indications of abnormally high- or low-pressure, the regulator and the auxiliary equipment must be inspected and the necessary measures employed to correct any unsatisfactory operating conditions.

**PSC 192.741** (d) *Each low pressure distribution system must be equipped with telemetering or recording pressure gage or gages as may be required to properly indicate the gas pressure in the system at all times. At least once each year the pressure variation shall be determined throughout each system.*

**192.743 Pressure limiting and regulating stations: testing of relief devices.** (a) If feasible, pressure relief devices (except rupture discs) must be tested in place, at intervals not exceeding 1 year, to determine that they have enough capacity to limit the pressure on the facilities to which they are connected to the desired maximum pressure.

(b) If a test is not feasible, review and calculation of the required capacity of the relieving device at each station must be made, at intervals not exceeding one year, and these required capacities compared with the rated or experimentally determined relieving capacity of the device for the operating conditions under which it works.

(c) If the relieving device is of insufficient capacity, a new or additional device must be installed to provide the additional capacity required.

**PSC 192.744 Service regulators and associated safety devices: inspection and testing.** *Company service regulators and associated safety devices on customers' premises shall be inspected and tested periodically to determine whether they are in proper operating condition. The above shall include testing of the set pressure of the regulator at a specific flow rate, determination of the lock-up pressure, and determine as to whether there are any leaks, internal or external, associated with the regulator. The test interval shall be the same as the interval between meter changes in the meter rotation program. (See section PSC 134.30.)*

**192.745 Valve maintenance: transmission lines.** Each transmission line valve that might be required during any emergency must be inspected and partially operated, at intervals not exceeding 1 year.

**192.747 Valve maintenance: distribution systems.** Each valve, the use of which may be necessary for the safe operation of a distribution system, must be checked and serviced, at intervals not exceeding 1 year.

**PSC 192.747** (a) *Inspection shall include checking of alignment to permit use of a key or wrench and clearing from the valve box or vault any debris which would interfere or delay the operation of the valve. Records shall be maintained to show specific valve location and such records shall be made continuously accessible to authorized personnel for use under emergency conditions.*



(b) Existing connections in the form of inline valves between low pressure gas distribution systems and high pressure gas distribution systems shall be physically severed by January 1, 1974.

(c) The by-pass valves in district regulator stations supplying gas to a low pressure distribution system shall be sealed, locked or otherwise be rendered incapable of operation, except by authorized personnel by January 1, 1974.

**192.749 Vault maintenance.** (a) Each vault housing pressure regulating and pressure limiting equipment, and having a volumetric internal content of 200 cubic feet or more, must be inspected, at intervals not exceeding 1 year, to determine that it is in good physical condition and adequately ventilated.

(b) If gas is found in the vault, the equipment in the vault must be inspected for leaks, and any leaks found must be repaired.

(c) The ventilating equipment must also be inspected to determine that it is functioning properly.

(d) Each vault cover must be inspected to assure that it does not present a hazard to public safety.

**192.751 Prevention of accidental ignition.** Each operator shall take steps to minimize the danger of accidental ignition of gas in any structure or area where the presence of gas constitutes a hazard of fire or explosion, including the following:

(a) When a hazardous amount of gas is being vented into open air, each potential source of ignition must be removed from the area and a fire extinguisher must be provided.

(b) Gas or electric welding or cutting may not be performed on pipe or on pipe components that contain a combustible mixture of gas and air in the area of work.

(c) Post warning signs, where appropriate.

**PSC 192.751 (d)** Whenever the accidental ignition in the open air of gas-air mixture might be likely to cause personal injury or property damage, precautions shall be taken as, for example:

(1) Prohibit smoking and open flames in the area, and

(2) Install a metallic bond around the location of cuts in gas pipes to be made by other means than cutting torches, and

(3) Take precautions to prevent static electricity sparks, and

(4) Provide fire extinguishers of appropriate size and type in accordance with the department of industry, labor and human relations' requirements.

**192.753 Caulked bell and spigot joints.** (a) Each cast-iron caulked bell and spigot joint that is subject to pressures of 25 p.s.i.g. or more must be sealed with:

(1) A mechanical leak clamp; or

(2) A material or device which—

## PSC 135

- (i) Does not reduce the flexibility of the joint;
  - (ii) Permanently bonds, either chemically or mechanically, or both, with the bell and spigot metal surfaces or adjacent pipe metal surfaces; and
  - (iii) Seals and bonds in a manner that meets the strength, environmental, and chemical compatibility requirements of 192.53 (a) and (b) and 192.143.
- (b) Each cast iron caulked bell and spigot joint that is subject to pressures of less than 25 p.s.i.g. and is exposed for any reason, must be sealed by a means other than caulking.

*PSC 192.753 Existing unreinforced bell and spigot jointed cast iron pipe shall be operated at low pressure unless it can be proved to the commission that they can be satisfactorily operated at a higher pressure. However, the operating pressure under any circumstances shall not exceed 15 p.s.i.g.*

**192.755 Protecting cast-iron pipelines.** When an operator has knowledge that the support for a segment of a buried cast-iron pipeline is disturbed:

- (a) That segment of the pipeline must be protected, as necessary, against damage during the disturbance by:
  - (1) Vibrations from heavy construction equipment, trains, trucks, buses, or blasting;
  - (2) Impact forces by vehicles;
  - (3) Earth-movement;
  - (4) Apparent future excavations near the pipeline; or
  - (5) Other foreseeable outside forces which may subject that segment of the pipeline to bending stress.
- (b) As soon as feasible, appropriate steps must be taken to provide permanent protection for the disturbed segment from damage that might result from external loads, including compliance with applicable requirements of 192.317 (a), 192.319, and 192.361 (b) - (d).

## APPENDIX A—INCORPORATED BY REFERENCE

### I. List of organizations and addresses.

A. American National Standards Institute (ANSI), 1430 Broadway, New York, N. Y. 10018 (formerly the United States of American Standards Institute (USASI)). All current standards issued by USASI and ASA have been redesignated as American National Standards and continued in effect.

B. American Petroleum Institute (API), 1801 K Street NW, Washington, D.C. 20006, or 300 Corrigan Tower Building, Dallas, Texas, 75201.

C. The American Society of Mechanical Engineers (ASME) United Engineering Center, 345 East 47th Street, New York, N. Y. 10017.

D. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pa. 19103.

E. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS), 1815 North Fort Myer Drive, Room 913, Arlington, Va. 22209.

F. National Fire Protection Association (NFPA), 470 Atlantic Avenue, Boston, Mass. 02110.

II. Documents incorporated by reference. Numbers in parentheses indicate applicable editions. Only the latest listed edition applies, except that an earlier listed edition may be followed with respect to pipe or components which were manufactured, designed, or installed before the latest edition is adopted, unless otherwise provided in this part.

A. American Petroleum Institute:

(1) API Standard 5A "API Specifications for Casing, Tubing, and Drill Pipe" (1968, 1971, 1973 plus Supp. 1).

(2) API Standard 6A "API Specification for Wellhead Equipment" (1968, 1974).

(3) API Standard 6D "API Specification for Pipeline Valves" (1968, 1974).

(4) API Standard 5L "API Specification for Line Pipe" (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975).

(5) API Standard 5LS "API Specification for Spiral-Weld Line Pipe" (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975 plus Supp. 1, and 1977).

(6) API Standard 5LX "API Specification for High-Test Line Pipe" (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975 plus Supp. 1, and 1977).

(7) API Recommended Practice 5LI "API Recommended Practice for Railroad Transportation of Line Pipe" (1967, 1972).

(8) API Standard 1104 "Standard for Welding Pipe Lines and Related Facilities" (1968, 1973).

B. The American Society for Testing and Materials:

(1) ASTM Specification A53 "Standard Specification for Welded and Seamless Steel Pipe" (A53-65, A53-68, A53-73).

(2) ASTM Specification A72 "Standard Specification for Welded Wrought-Iron Pipe" (A72-64T, A72-68).

(3) ASTM Specification A106 "Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service" (A106-66, A106-68, A106-72a).

(4) ASTM Specification A134 "Standard Specification for Electric-Fusion (Arc)-Welded Steel Plate Pipe, Sizes 16 in. and over" (A134-64, A134-68, A134-73).

(5) ASTM Specification A135 "Standard Specification for Electric-Resistance-Welded Steel Pipe" (A135-63T, A135-68, A135-73a).

- (6) ASTM Specification A139 "Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (Sizes 4 in. and over)" (A139-64, A139-68, A139-73).
- (7) ASTM Specification A155 "Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service" (A155-65, A155-68, A155-72a).
- (8) ASTM Specification A211 "Standard Specification for Spiral-Welded Steel or Iron Pipe" (A211-63, A211-68, A211-73).
- (9) ASTM Specification A333 "Standard Specification for Seamless and Welded Steel Pipe for Low Temperature Service" (A333-64, A333-67, A333-73).
- (10) ASTM Specification A372 "Standard Specification for Carbon and Alloy Steel Forgings for Thin-Walled Pressure Vessel" (A372-67, A372-71).
- (11) ASTM Specification A377 "Standard Specifications for Cast Iron and Ductile Iron Pressure Pipe" (A377-66, A377-73).
- (12) ASTM Specification A381 "Standard Specification for Metal-Arc-Welded Steel Pipe for High-Pressure Transmission Systems" (A381-66, A381-68, A381-73).
- (13) ASTM Specification A539 "Standard Specification for Electric Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines" (A539-65, A539-73).
- (14) ASTM Specification B42 "Standard Specification for Seamless Copper Pipe, Standard Sizes" (B42-62, B42-66, B42-72).
- (15) ASTM Specification B68 "Standard Specification for Seamless Copper Tube, Bright Annealed" (B68-65, B68-68, B68-74).
- (16) ASTM Specification B75 "Standard Specification for Seamless Copper Tube" (B75-65, B75-68, B75-74).
- (17) ASTM Specification B88 "Standard Specification for Seamless Copper Water Tube" (B88-66, B88-72).
- (18) ASTM Specification B251 "Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube" (B251-66, B251-68, B251-72).
- (19) ASTM Specification D638 "Standard Test Method of Tensile Properties of Plastic" (D638-77a).
- (20) ASTM Specification D2513 "Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings" (D2513-66T, D2513-68, D2513-70, D2513-71, D2513-73, D2513-74a).
- (21) ASTM Specification D2517 "Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings" (D2517-66T, D2517-67, D2517-73).

C. The American National Standards Institute, Inc.:

- (1) ANSI A21.1 "Thickness Design of Cast-Iron Pipe" (A21.1-1967, A21.1-1972).

- (2) ANSI A21.3 "Specifications for Cast Iron Pit Cast Pipe for Gas" (A21.3-1953).
- (3) ANSI A21.7 "Cast-Iron Pipe Centrifugally Cast in Metal Molds for Gas" (A21.7-1962).
- (4) ANSI A21.9 "Cast-Iron Pipe Centrifugally Cast in Sand-Lined Molds for Gas" (A21.9-1962).
- (5) ANSI A21.11 "Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings" (A21.11-1964, A21.11-1972).
- (6) ANSI A21.50 "Thickness Design of Ductile-Iron Pipe" (A21.50-1965, A21.50-1971).
- (7) ANSI A21.52 "Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Gas" (A21.52-1965, A21.52-1971).
- (8) ANSI B16.1 "Cast Iron Pipe Flanges and Flanged Fittings" (B16.1-1967).
- (9) ANSI B16.5 "Steel Pipe Flanges, Flanged Valves and Fittings" (B16.5-1968, B16.5-1973).
- (10) ANSI B16.24 "Bronze Flanges and Flanged Fittings" (B16.24-1962, B16.10-1971).
- (11) ANSI B36.10 "Wrought Steel and Wrought Iron Pipe" (B36.10-1959, B36.10-1970).
- (12) ANSI C1 "National Electrical Code" (C1-1968, C1-1975).

D. The American Society of Mechanical Engineers:

- (1) ASME Boiler and Pressure Vessel Code Section VIII "Pressure Vessels, Division 1" (1968, 1974).
- (2) ASME Boiler and Pressure Vessel Code, Section IX "Welding Qualifications" (1968, 1974).

E. Manufacturer's Standardization Society of the Valve and Fittings Industry:

- (1) MSP-25 "Standard Marking System for Valves, Fittings, Flanges, and Union" (1964).
- (2) MSS SP-44 "Steel Pipe Line Flanges" (1955, 1972, 1975).
- (3) MSS SP-52 "Cast Iron Pipe Line Valves" (1957).
- (4) MSS SP-70 "Cast Iron Gate Valves, Flanged and Threaded Ends" (1970).
- (5) MSS Sp-71 "Cast Iron Swing Check Valves, Flanged and Threaded Ends" (1970).
- (6) MSS Sp-78 "Cast Iron Plug Valves" (1972).

F. National Fire Protection Association:

- (1) NFPA Standard 30 "Flammable and Combustible Liquids Code" (1969, 1973).

(2) NFPA Standard 58 "Standard for the Storage and Handling of Liquefied Petroleum Gases" (1969, 1972).

(3) NFPA Standard 59 "Standard for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants" (1968).

(4) NFPA Standard 59A "Storage and Handling Liquefied Natural Gas" (1971, 1972).

### APPENDIX B—QUALIFICATION OF PIPE

I. Listed Pipe Specifications. Numbers in parentheses indicate applicable editions. Only the latest listed edition applies, except that an earlier listed edition may be followed with respect to pipe or components which were manufactured, designed, or installed before the latest edition is adopted unless otherwise provided in this part.

API 5L—Steel and iron pipe (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975).

API 5LS—Steel pipe (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975 plus Supp. 1 and 1977).

API 5LX—Steel pipe (1967, 1970, 1971 plus Supp. 1, 1973 plus Supp. 1, 1975 plus Supp. 1 and 1977).

ASTM A53—Steel pipe (1965, 1968, 1973).

ASTM A72—Wrought Iron Pipe (1964T, 1968).

ASTM A106—Steel pipe (1966, 1968, 1972a).

ASTM A134—Steel pipe (1964, 1968, 1973).

ASTM A135—Steel pipe (1963T, 1968, 1973a).

ASTM A139—Steel pipe (1964, 1968, 1973).

ASTM A155—Steel pipe (1965, 1968, 1972a).

ASTM A211—Steel and iron pipe (1963, 1968, 1973).

ASTM A333—Steel pipe (1964, 1967, 1973).

ASTM A377—Cast iron pipe (1966, 1973).

ASTM A381—Steel pipe (1966, 1968, 1973).

ASTM A539—Steel tubing (1965, 1973).

ASTM B42—Copper pipe (1962, 1966, 1972).

ASTM B68—Copper tubing (1965, 1968, 1974).

ASTM B75—Copper tubing (1965, 1968, 1974).

ASTM B88—Copper tubing (1966, 1972).

ASTM B251—Copper pipe and tubing (1966, 1968, 1972).

ASTM D2513—Thermoplastic pipe and tubing (1966T, 1968, 1970, 1971, 1973, 1974a).

ASTM D2517—Thermosetting plastic pipe and tubing (1966T, 1967, 1973).

ANSI A21.3—Cast iron pipe (1953).

ANSI A21.7—Cast iron pipe (1962).

ANSI A21.9—Cast iron pipe (1962).

ANSI A21.52—Ductile iron pipe (1965, 1971).

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

A. *Bending Properties.* For pipe 2 inches 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 in diameter, the pipe must meet the requirements of the flattening test set forth in ASTM A53, 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 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 in diameter, at least one test weld must be made for each 100 lengths of pipe. On pipe 4 inches 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. 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. 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.g. or less, or the tensile properties may be established by performing tensile tests as set forth in API Standard 5LX. All test specimens shall be selected at random and the following number of tests must be performed:

### 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 192.55 (c).

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.

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.

### APPENDIX C—QUALIFICATION FOR WELDERS OF LOW STRESS LEVEL PIPE

I. *Basic test.* The test is made on pipe 12 inches or less in diameter. The test weld must be made with the pipe in a horizontal fixed position so that the test weld includes at least one section of overhead position welding. The beveling, root opening, and other details must conform to the specifications of the procedure under which the welder is being qualified. Upon completion, the test weld is cut into four coupons and subjected to a root bend test. If, as a result of this test, two or more of the four coupons develop a crack in the weld material, or between the weld material and base metal, that is more than 1/8-inch long in any direction, the weld is unacceptable. Cracks that occur on the corner of the specimen during testing are not considered.



II. *Additional tests for welders of service line connections to mains.* A service line connection fitting is welded to a pipe section with the same diameter as a typical main. The weld is made in the same position as it is made in the field. The weld is unacceptable if it shows a serious undercutting or if it has rolled edges. The weld is tested by attempting to break the fitting off the run pipe. The weld is unacceptable if it breaks and shows incomplete fusion, overlap, or poor penetration at the junction of the fittings and run pipe.

III. *Periodic tests for welders of small service lines.* Two samples of the welder's work each about 8 inches long with the weld located approximately in the center, are cut from steel service line and tested as follows:

(1) One sample is centered in a guided bend testing machine and bent to the contour of the die for a distance of 2 inches on each side of the weld. If the sample shows any breaks or cracks after removal from the bending machine, it is unacceptable.

(2) The ends of the second sample are flattened and the entire joint subjected to a tensile strength test. If failure occurs adjacent to or in the weld metal, the weld is unacceptable. If a tensile strength testing machine is not available, this sample must also pass the bending test prescribed in subparagraph (1) of this paragraph.

#### APPENDIX D—CRITERIA FOR CATHODIC PROTECTION AND DETERMINATION OF MEASUREMENTS

I. *Criteria for cathodic protection—A. Steel, cast iron, and ductile iron structures.*

(1) A negative (cathodic) voltage of at least 0.85 volt, with reference to a saturated copper-copper sulfate half cell. Determination of this voltage must be made with the protective current applied, and in accordance with sections II and IV of this appendix.

(2) A negative (cathodic) voltage shift of at least 300 millivolts. Determination of this voltage shift must be made with the protective current applied, and in accordance with sections II and IV of this appendix. This criterion of voltage shift applies to structures not in contact with metals of different anodic potentials.

(3) A minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with sections III and IV of this appendix.

(4) A voltage at least as negative (cathodic) as that originally established at the beginning of the Tafel segment of the E-log-I curve. This voltage must be measured in accordance with section IV of this appendix.

(5) A net protective current from the electrolyte into the structure surface as measured by an earth current technique applied at predetermined current discharge (anodic) points of the structure.

B. *Aluminum structures.* (1) Except as provided in subparagraph (3) and (4) of this paragraph, a minimum negative (cathodic) voltage shift of 150 millivolts, produced by the application of protective current. The

voltage shift must be determined in accordance with sections II and IV of this appendix:

(2) Except as provided in subparagraphs (3) and (4) of this paragraph, a minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with sections III and IV of this appendix.

(3) Notwithstanding the alternative minimum criteria in subparagraphs (1) and (2) of this paragraph, aluminum, if cathodically protected at voltages in excess of 1.20 volts as measured with reference to a copper-copper sulfate half cell, in accordance with section IV of this appendix, and compensated for the voltage (IR) drops other than those across the structure-electrolyte boundary, may suffer corrosion resulting from the buildup of alkali on the metal surface. A voltage in excess of 1.20 volts may not be used unless previous test results indicate no appreciable corrosion will occur in the particular environment.

(4) Since aluminum may suffer from corrosion under high pH conditions, and since application of the cathodic protection tends to increase the pH at the metal surface, careful investigation or testing must be made before applying cathodic protection to stop pitting attack on aluminum structures in environments with a natural pH in excess of 8.

*C. Copper structures.* A minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with sections III and IV of this appendix.

*D. Metals of different anodic potentials.* A negative (cathodic) voltage, measured in accordance with section IV of this appendix, equal to that required for the most anodic metal in the system must be maintained. If amphoteric structures are involved that could be damaged by high alkalinity covered by subparagraphs (3) and (4) of paragraph B of this section, they must be electrically isolated with insulating flanges, or the equivalent.

*II. Interpretation of voltage measurement.* Voltage (IR) drops other than those across the structure-electrolyte boundary must be considered for valid interpretation of the voltage measurement in paragraph A (1) and (2) and paragraph B (1) of section I of this appendix.

*III. Determination of polarization voltage shift.* The polarization voltage shift must be determined by interrupting the protective current and measuring the polarization decay. When the current is initially interrupted, an immediate voltage shift occurs. The voltage reading after the immediate shift must be used as the base reading from which to measure polarization decay in paragraphs A (3), B (2), and C of section I of this appendix.

*IV. Reference half cells.* A. Except as provided in paragraphs B and C of this section, negative (cathodic) voltage must be measured between the structure surface and a saturated copper-copper sulfate half cell contacting the electrolyte.

B. Other standard reference half cells may be substituted for the saturated copper-copper sulfate half cell. Two commonly used reference half cells are listed below along with their voltage equivalent to -0.85 volt as referred to a saturated copper-copper sulfate half cell:

- (1) Saturated KCl calomel half cell: —0.78 volt.  
 (2) Silver-silver chloride half cell used in sea water: —0.80 volt.

C. In addition to the standard reference half cells, an alternate metallic material or structure may be used in place of the saturated copper-copper sulfate half cell if its potential stability is assured and if its voltage equivalent referred to a saturated copper-copper sulfate half cell is established.

## WISCONSIN CODE ADOPTION OF PART 193 IN TITLE 49 CODE OF FEDERAL REGULATIONS

### PART 193—LIQUEFIED NATURAL GAS FACILITIES: FEDERAL SAFETY STANDARDS

Subpart	A—General	Design of Components and Buildings
<b>Sec.</b>		193.2121 General.
193.2001	Scope of part.	193.2123 Valves.
193.2003	Semishod facilities.	193.2125 Automatic shutoff valves.
193.2005	Applicability.	193.2127 Piping.
193.2007	Definitions.	193.2129 Piping attachments and supports.
193.2009	Rules of regulatory construction.	193.2131 Building design.
193.2011	Reporting.	193.2133 Buildings; ventilation.
193.2013	Incorporation by reference.	193.2136 Expansion or contraction.
193.2015	Petition for finding or approval.	193.2137 Frost heave.
193.2017	Plans and Procedures.	193.2139 Ice and snow.
		193.2141 Electrical systems.
		193.2143 Lightning.
<b>Subpart</b>	<b>B—Siting Requirements</b>	193.2145 Boilers and pressure vessels.
		193.2147 Combustion engines and turbines.
193.2051	Scope.	
193.2055	General.	
193.2057	Thermal radiation protection.	<b>Impoundment Design and Capacity</b>
193.2059	Flammable vapor-gas dispersion protection.	193.2149 Impoundment required.
193.2061	Seismic investigation and design forces.	193.2151 General design characteristics.
193.2063	Flooding.	193.2153 Classes of impounding systems.
193.2065	Soil characteristics.	193.2155 Structural requirements.
193.2067	Wind forces.	193.2157 Coatings and coverings.
193.2069	Other severe weather and natural conditions.	193.2159 Floors.
193.2071	Adjacent activities.	193.2161 Dikes, general.
193.2073	Separation of facilities.	193.2163 Vapor barriers.
		193.2165 Dike dimensions.
<b>Subpart</b>	<b>C—Design</b>	193.2167 Covered systems.
		193.2169 Gas leak detection.
<b>Sec.</b>		193.2171 Sump basins.
193.2101	Scope.	193.2173 Water removal.
		193.2175 Shared impoundment.
<b>Materials</b>		193.2179 Impoundment capacity, general.
193.2103	General.	193.2181 Impoundment capacity, LNG storage tanks.
193.2105	Extreme temperatures: normal operations.	193.2183 Impoundment capacity, equipment and transfer facilities.
193.2107	Extreme temperatures: emergency conditions.	193.2185 Impoundment capacity, parking areas, portable vessels.
193.2109	Insulation.	
193.2111	Cold boxes.	
193.2113	Piping.	
193.2115	Concrete subject to cryogenic temperatures.	<b>LNG Storage Tanks</b>
193.2117	Combustible materials.	<b>Sec.</b>
193.2119	Records.	193.2187 General.
		193.2189 Loading forces.

## PSC 135

193.2191	Stratification.	193.2431	Vents.
193.2193	Movement and stress.	193.2433	Sensing devices.
193.2195	Penetrations.	193.2435	Warning devices.
193.2197	Internal design pressure.	193.2437	Pump and compressor control
193.2199	External design pressure.	193.2439	Emergency shutdown control systems.
193.2201	Internal temperature.	193.2441	Control center.
193.2203	Foundation.	193.2443	Failsafe control.
193.2205	Frost heave.	193.2445	Sources of power.
193.2207	Insulation.		
193.2209	Instrumentation for LNG storage tanks.	<b>Subpart</b>	<b>F—Operations</b>
193.2211	Metal storage tanks.	193.2501	Scope.
193.2213	Concrete storage tanks.	193.2503	Operating procedures.
193.2215	Thermal barriers.	193.2505	Cooldown.
193.2217	Support system.	193.2507	Monitoring operations.
193.2219	Internal piping.	193.2509	Emergency procedures.
193.2221	Marking.	193.2511	Personnel safety.
		193.2513	Transfer procedures.
<b>Design of Transfer Systems</b>		193.2515	Investigations of failures.
193.2223	General.	193.2517	Purging.
193.2227	Backflow.	193.2519	Communication systems.
193.2229	Cargo transfer systems.	193.2521	Operating records.
193.2231	Cargo transfer area.		
193.2233	Shutoff valves.	<b>Subpart</b>	<b>G—Maintenance</b>
		193.2601	Scope.
<b>Subpart</b>	<b>D—Construction</b>	193.2603	General.
193.2301	Scope.	193.2605	Maintenance procedures.
193.2303	Construction acceptance.	193.2607	Foreign material.
193.2304	Corrosion control overview.	193.2609	Support systems.
193.2305	Procedures.	193.2611	Fire protection.
193.2307	Inspection.	193.2613	Auxiliary power sources.
193.2309	Inspection and testing methods.	193.2615	Isolating and purging.
193.2311	Cleanup.	193.2617	Repairs.
		193.2619	Control systems.
<b>Sec.</b>		193.2621	Testing transfer hoses.
193.2313	Pipe welding.	193.2623	Inspecting LNG storage tanks.
193.2315	Piping connections.	193.2625	Corrosion protection.
193.2317	Retesting.	193.2627	Atmospheric corrosion control.
193.2319	Strength tests.	193.2629	External corrosion control; buried or submerged components.
193.2321	Nondestructive tests.	193.2631	Internal corrosion control.
193.2323	Leak tests.	193.2633	Interference currents.
193.2325	Testing control systems.	193.2635	Monitoring corrosion control.
193.2327	Storage tank tests.	193.2637	Remedial measures.
193.2329	Construction records.	193.2639	Maintenance records.
		<b>Subpart</b>	<b>H— Personnel Qualifications and Training</b>
<b>Subpart</b>	<b>E—Equipment</b>	193.2701	Scope.
193.2401	Scope.	193.2703	Design and fabrication.
<b>Vaporization Equipment</b>		193.2705	Construction, installation, inspection and testing.
193.2403	General.	193.2707	Operations and maintenance.
193.2405	Vaporizer design.	193.2709	Security.
193.2407	Operational control.	193.2711	Personnel health.
193.2409	Shutoff valves.	193.2713	Training operations and maintenance.
193.2411	Relief devices.	193.2715	Training security.
193.2413	Combustion air intakes.	193.2717	Training; fire protection.
		193.2719	Training; records.
<b>Liquefaction Equipment</b>		<b>Subpart</b>	<b>I—Fire Protection</b>
193.2415	General.	193.2801	Scope.
193.2417	Control of incoming gas.	193.2803	General.
193.2419	Backflow.	193.2805	Fire prevention plan.
193.2421	Cold boxes.		
193.2423	Air in gas.		
193.2425	Equipment supports.		
<b>Control Systems</b>			
193.2427	General.		
193.2429	Relief devices.		

193.2807	Smoking.	193.2903	Security procedures.
193.2809	Open fires.	193.2905	Protective enclosures.
193.2811	Hotwork.	193.2907	Protective enclosure construction.
193.2813	Storage of flammable fluids.	193.2909	Security communications.
193.2815	Motorized equipment.	193.2911	Security lighting.
193.2817	Fire control equipment.	193.2913	Security monitoring.
193.2819	Gas detection.	193.2915	Alternative power sources.
193.2821	Fire detection.	193.2917	Warning signs.
<b>Subpart</b>	<b>J—Security</b>		
193.2901	Scope.		

## Appendix A to Part 193—Incorporation by Reference

### I. List of organizations and addresses

### II. Documents Incorporated by Reference

Authority: 49 U.S.C. 1671 et seq.; 49 CFR 153, Appendix A of Part 1, and Appendix A of Part 106.

### Subpart A—General

§ 193.2001 **Scope of part.** (a) This part prescribes safety standards for LNG facilities used in the transportation of gas by pipeline that is subject to the Natural Gas Pipeline Safety Act of 1968 and Part 192 of this chapter.

(b) This part does not apply to—

- (1) LNG facilities used by ultimate consumers of LNG or natural gas.
- (2) LNG facilities used in the course of natural gas treatment or hydrocarbon extraction which do not store LNG.
- (3) In the case of a marine cargo transfer system and associated facilities, any matter other than siting pertaining to the system or facilities between the marine vessel and the last manifold (or in the absence of a manifold, the last valve) located immediately before a storage tank.
- (4) Any LNG facility located in navigable waters (as defined in Section 3 (8) of the Federal Power Act (16 U.S.C. 796 (8))).

§ 193.2003 **Semisolid facilities.** An LNG facility used in the transportation or storage of LNG in a semisolid state need not comply with any requirement of this part which the Director finds impractical or unnecessary because of the semisolid state of LNG. In making such a finding, the Director may impose appropriate alternative safety conditions.

§ 193.2005 **Applicability.** (a) New or amended standards in this part governing the siting, design, installation, or construction of an LNG facility and related personnel qualifications and training do not apply to—

- (1) LNG facilities under construction before the date such standards are published; or
- (2) LNG facilities for which an application for approval of the siting, construction, or operation was filed before March 1, 1978, with the Department of Energy (or any predecessor organization of that Department) or the appropriate State or local agency in the case of any facility not subject to the jurisdiction of the Department of Energy under the

Natural Gas Act (not including any facility the construction of which began after November 29, 1979, not pursuant to such an approval).

(b) If an LNG facility listed in paragraph (a) of this section is replaced, relocated, or significantly altered after February 11, 1980, the replacement, relocated facility, or significantly altered facility must comply with the applicable requirements of this part governing siting, design, installation, and construction, except that—

(1) The siting requirements apply only to LNG storage tanks that are significantly altered by increasing the original storage capacity or relocated, not pursuant to an application for approval filed as provided by paragraph (a) (2) of this section before March 1, 1978; and

(2) To the extent compliance with the design, installation, and construction requirements would make the replaced, relocated, or altered facility incompatible with other facilities or would otherwise be impracticable, the replaced, relocated, or significantly altered facility may be designed, installed, or constructed in accordance with the original specifications for the facility, or in a manner that the Director finds acceptable.

(c) The siting, design, installation, and construction of an LNG facility under construction before February 11, 1980, or that is listed in paragraph (a) (2) of this section (except a facility under construction before July 1, 1976) must meet the applicable requirements of NFPA 59A (1972 edition) and Part 192 of this chapter or the applicable requirements of this part, except that no Part 192 standard issued after March 1, 1978, applies to an LNG facility listed in paragraph (a) (2) of this section.

§ 193.2007 Definitions. As used in this part—

“Ambient vaporizer” means a vaporizer which derives heat from naturally occurring heat sources, such as the atmosphere, sea water, surface waters, or geothermal waters.

“Cargo transfer system” means a component, or system of components functioning as a unit, used exclusively for transferring hazardous fluids in bulk between a tank car, tank truck, or marine vessel and a storage tank.

“Component” means any part, or system of parts functioning as a unit, including, but not limited to, piping, processing equipment, containers, control devices, impounding systems, lighting, security devices, fire control equipment, and communication equipment, and whose integrity or reliability is necessary to maintain safety in controlling, processing, or containing a hazardous fluid.

“Container” means a component other than piping that contains a hazardous fluid.

“Control system” means a component, or system of components functioning as a unit, including control valves and sensing, warning, relief, shutdown, and other control devices, which is activated either manually or automatically to establish or maintain the performance of another component.

"Controllable emergency" means an emergency where reasonable and prudent action can prevent harm to people or property.

"Design pressure" means the pressure used in the design of components for the purpose of determining the minimum permissible thickness or physical characteristics of its various parts. When applicable, static head shall be included in the design pressure to determine the thickness of any specific part.

"Determine" means make an appropriate investigation using scientific methods, reach a decision based on sound engineering judgment, and be able to demonstrate the basis of the decision.

"Dike" means the perimeter of an impounding space forming a barrier to prevent liquid from flowing in an unintended direction.

"Director" means Director of the Materials Transportation Bureau or any person to whom authority in the matter concerned has been delegated.

"Emergency" means a deviation from normal operation, a structural failure, or severe environmental conditions that probably would cause harm to people or property.

"Exclusion zone" means an area surrounding an LNG facility in which an operator or government agency legally controls all activities in accordance with § 193.2057 and § 193.2059 for as long as the facility is in operation.

"Fail-safe" means a design feature which will maintain or result in a safe condition in the event of malfunction or failure of a power supply, component, or control device.

"g" means the standard acceleration of gravity of 9.806 metre per second<sup>2</sup> (32.17 feet per second<sup>2</sup>).

"Gas," except when designated as inert, means natural gas, other flammable gas, or gas which is toxic or corrosive.

"Hazardous fluid" means gas or hazardous liquid.

"Hazardous liquid" means LNG or a liquid that is flammable or toxic.

"Heated vaporizer" means a vaporizer which derives heat from other than naturally occurring heat sources.

"Impounding space" means a volume of space formed by dikes and floors which is designed to confine a spill of hazardous liquid.

"Impounding system" includes an impounding space, including dikes and floors for conducting the flow of spilled hazardous liquids to an impounding space.

"Liquefied natural gas" or "LNG" means natural gas or synthetic gas having methand (CH<sub>4</sub>) as its major constituent which has been changed to a liquid or semisolid.

"LNG facility" means a pipeline facility that is used for liquefying or solidifying natural gas or synthetic gas or transferring, storing, or vaporizing liquefied natural gas.

"LNG plant" means an LNG facility or system of LNG facilities functioning as a unit.

"m<sup>3</sup>" means a volumetric unit which is one cubic metre, 6.2898 barrels, 35.3147 ft.<sup>3</sup>, or 264.1720 U.S. gallons, each volume being considered as equal to the other.

"Maximum allowable working pressure" means the maximum gage pressure permissible at the top of the equipment, containers or pressure vessels while operating at design temperature.

"Normal operation" means functioning within ranges of pressure, temperature, flow, or other operating criteria required by this part.

"Operator" means a person who owns or operates an LNG facility.

"Person" means any individual, firm, joint venture, partnership, corporation, association, state, municipality, cooperative association, or joint stock association and includes any trustee, receiver, assignee, or personal representative thereof.

"Pipeline facility" means new and existing piping, rights-of-way, and any equipment, facility, or building used in the transportation of gas or in the treatment of gas during the course of transportation.

"Piping" means pipe, tubing, hoses, fittings, valves, pumps, connections, safety devices or related components for containing the flow of hazardous fluids.

"Storage tank" means a container for storage a hazardous fluid, including an underground cavern.

"Transfer piping" means a system of permanent and temporary piping used for transferring hazardous fluids between any of the following: liquefaction process facilities, storage tanks, vaporizers, compressors, cargo transfer systems, and facilities other than pipeline facilities.

"Transfer system" includes transfer piping and cargo transfer system.

"Waterfront LNG plant" means an LNG plant with docks, wharves, piers, or other structures in, on, or immediately adjacent to the navigable waters of the United States or Puerto Rico and any shore area immediately adjacent to those waters to which vessels may be secured and at which LNG cargo operations may be conducted.

"Vaporization" means an addition of thermal energy changing a liquid or semisolid to a vapor or gaseous state.

"Vaporizer" means a heat transfer facility designed to introduce thermal energy in a controlled manner for changing a liquid or semisolid to a vapor or gaseous state.

§ 193.209 Rules of regulatory construction. (a) As used in this part—

- (1) "Includes" means including but not limited to;
- (2) "May" means is permitted to or is authorized to;
- (3) "May not" means if not permitted to or is not authorized to; and
- (4) "Shall" or "must" is used in the mandatory and imperative sense.



(b) In this part—

- (1) Words importing the singular include the plural; and
- (2) Words importing the plural include the singular.

§ 193.2011 **Reporting.** Leaks and spills of LNG must be reported in accordance with the requirements of Part 191 of this chapter.

§ 193.2013 **Incorporation by reference.** (a) There are incorporated by reference in this Part all materials referred to in this Part that are not set forth in full. The incorporated materials are deemed published under 5 U.S.C. 552 (a) and 1 CFR Part 51 and are part of this regulation as though set forth in full. All incorporated materials are listed in Appendix A to this Part 193 with the applicable editions in parentheses following the title of the referenced material. Only the latest listed edition applies, except that an earlier listed edition may be followed with respect to components which are designed, manufactured, or installed in accordance with the earlier edition before the latest edition is adopted, unless otherwise provided in this part. The incorporated materials are subject to change, but any change will be announced by publication in the Federal Register before it becomes effective.

(b) All incorporated materials are available for inspection in the Materials Transportation Bureau, U.S. Department of Transportation, 400 Seventh Street, SW., Washington, D.C. 20590, and at the Office of the Federal Register Library, 1100 L Street, NW., Washington, D.C. In addition, copies of the incorporated materials are available from the respective organizations listed in Appendix A to this Part 193.

(c) Incorporated by reference provisions approved by the Director of the Federal Register.

(49 U.S.C. 1671 (a); 49 CFR 1.53 and Appendix A to Part 1)

§ 193.2015 **Petitions for finding or approval.** Where a rule in this part authorizes the Director to make a finding or approval, any operator may petition the Director to make such finding or approval. Petitions must be sent to the Director, Materials Transportation Bureau, 400 7th Street, SW., Washington, D.C. 20590, and be received at least 90 days before the operator requests that the finding or approval be made. Each petition must refer to the rule authorizing the action sought and contain information or arguments that justify the action. Unless otherwise specified, no public proceeding is held on a petition before it is granted or denied. Within 9 days after a petition is received, the Director notifies the petitioner of the disposition of the petition or, if the request requires more extensive consideration or additional information or comments are requested and delay is expected, of the date by which action will be taken.

### **Subpart B—Siting Requirements**

§ 193.2051 **Scope.** This subpart prescribes siting requirements for the following LNG facilities: Containers and their impounding systems, transfer systems and their impounding systems, emergency shutdown control systems, fire control systems, and associated foundations, support systems, and normal or auxiliary power facilities necessary to maintain safety.

§ 193.2017 **Plans and procedures.** (a) Each operator shall maintain at each LNG plant the plans and procedures required for that plant by this part. The plans and procedures must be available upon request for review and inspection by the Director or any State Agency that has submitted a current certification or agreement with respect to the plant under section 5 of the Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 1674). In addition, each change to the plans or procedures must be available at the LNG plant for review and inspection within 20 days after the change is made.

(b) The Director or the State Agency, after notice and opportunity for hearing, may require the operator to amend its plans and procedures as necessary to provide a reasonable level of safety.

§ 193.2055 **General.** An LNG facility must be located at a site of suitable size, topography, and configuration so that the facility can be designed to minimize the hazards to persons and offsite property resulting from leaks and spills of LNG and other hazardous fluids at the site. In selecting a site, each operator shall determine all site-related characteristics which could jeopardize the integrity and security of the facility. A site must provide ease of access so that personnel, equipment, and materials from offsite locations can reach the site for fire fighting or controlling spill associated hazards or for evacuation of personnel.

§ 193.2057 **Thermal radiation protection.** (a) *Thermal exclusion zone.* Each LNG container and LNG transfer system must have a thermal exclusion zone in accordance with the following:

(1) Within the thermal exclusion zone, the impounding system may not be located closer in targets listed in paragraph (d) of this section than the exclusion distance "d" determined according to this section, unless the target is a pipeline facility of the operator.

(2) If grading and drainage are used under § 193.2149 (b), operators must comply with the requirements of this section by assuming the space needed for drainage and collection of spilled liquid is an impounding system.

(b) *Measurement.* The exclusion distance "d" is measured along the line (PT), as shown in the following impoundment diagram, where the following apply:

(1) T is a point on the target that is closest to (P).

(2) D is a point closest to (T) on the top inside edge of the innermost dike.

(3)  $\Theta$  is one of the following angles with the vertical, to account for flame tilt and potential preignition vapor formation:

(i) An assumed angle of  $(\Theta)=45^\circ$ ; or

(ii) An angle determined in accordance with a mathematical model that meets the criteria of paragraph (c) (2) of this section, using the maximum wind speed that is exceeded less than 5 percent of the time based on recorded data for the area.

(4) L is one of the following lengths to account for flame height:

(i) An assumed length of  $(L) = 6(A/\pi)^{0.5}$ , where (A) is the horizontal area across the impounding space measured at the lowest point along the top inside edge of the dike; or

(ii) A length determined in accordance with a mathematical model that meets the criteria of paragraph (c) (2) of this section, using appropriate parameters consistent with the time period that a target could be subjected to exposure before harm would result.

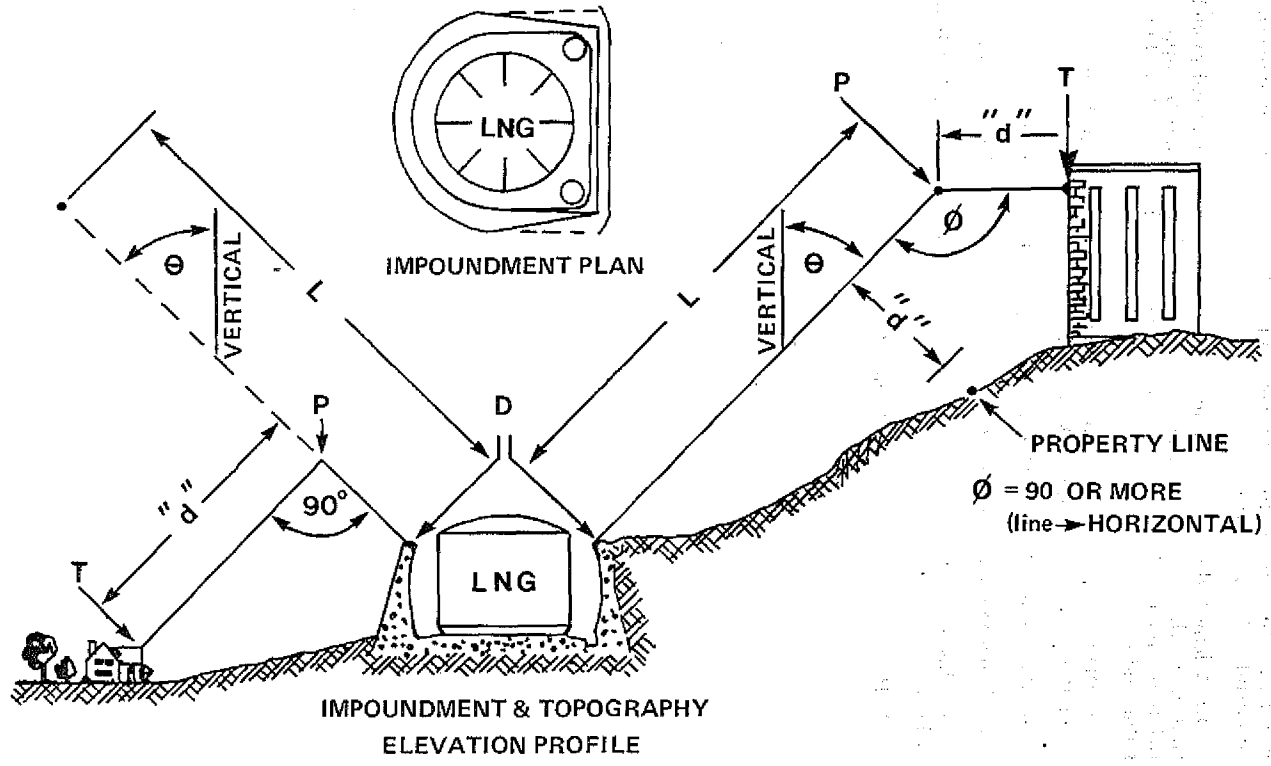
(5) PD is a line of length (L) or less, lying at angle  $O$  in the vertical plane that intersects points (D) and (T).

(6) PT is a line lying in the vertical plane of line (PD), that:

(i) Is perpendicular to line (PD) when (PD) is less than (L); or

(ii) Has an angular elevation not above the horizontal at (P) when (PD) equals (L);

(7) P is the point where (PT) and (PD) intersect.



Register, December, 1982, No. 324

(c) *Exclusion distance length.* The length of an exclusion distance for each impounding space may not be less than the distance "d" determined in accordance with one of the following:

(1)  $d = (f) (A)^{0.5}$ , where

A = the largest horizontal area across the impounding space measured at the lowest point along the top inside edge of the dike.

f = values for targets prescribed in paragraph (d) of this section.

(2) Determine "d" from a mathematical model for thermal radiation and other appropriate fire characteristics which assures that the incident thermal flux levels in paragraph (d) of this section are not exceeded. The model must:

(i) Use atmospheric conditions which, if applicable, result in longer exclusion distances than other atmospheric conditions occurring at least 95 percent of the time based on recorded data for the site area;

(ii) Have been evaluated and verified by testing at a scale, considering scaling effects, appropriate for the range of application;

(iii) Have been submitted to the Director for approval, with supportive data as necessary to demonstrate validity; and

(iv) Have received approval by the Director.

(d) *Limiting values for incident radiant flux on offsite targets.* The maximum incident radiant flux at an offsite target from burning of a total spill in an impounding space must be limited to the distances in paragraph (c) of this section using the following values of "(f)" or "Incident Flux":

Offsite target	(f)	Incident flux Btu/ft.² hour
(1) Outdoor areas occupied by 20 or more persons during normal use, such as beaches, playgrounds, outdoor theaters, other recreation areas or other places of public assembly .....	(3)	1,600
(2) Buildings that are used for residences, or occupied by 20 or more persons during normal use .....	(1.6)	4,000
(3) Buildings made of cellulosic materials or are not fire resistant or do not provide durable shielding from thermal radiation that: (i) Have exceptional value, or contain objects of exceptional value based on historic uniqueness described in Federal, State, or local registers: (ii) Contain explosive, flammable, or toxic materials in hazardous quantities; or (iii) Could result in additional hazard if exposed to high levels of thermal radiation .....	(1.6)	4,000
(4) Structures that are fire resistant and provide durable shielding from thermal radiation that have the characteristics described in subdivisions (3) (i) through (3) (iii) above .....	(1.1)	6,700
(5) Public streets, highways, and mainlines of railroads .....	(1.1)	6,700
(6) Other structures, or if closer to (P), the right-of-way of the property .....	(0.8)	10,000

§ 193.2059 *Flammable vapor-gas dispersion protection.* (a) *Dispersion exclusion zone.* Except as provided by paragraph (e) of this section, each LNG container and LNG transfer system must have a dispersion exclusion zone with a boundary described by the minimum dispersion distance computed in accordance with this section. The following are prohibited in a dispersion exclusion zone unless it is an LNG facility of the operator:

(1) Outdoor areas occupied by 20 or more persons during normal use, such as beaches, playgrounds, outdoor theaters, other recreation areas, or other places of public assembly.

(2) Buildings that are:

(i) Used for residences;

(ii) Occupied by 20 or more persons during normal use;

(iii) Contain explosive, flammable, or toxic materials in hazardous quantities;

(iv) Have exceptional value or contain objects of exceptional value based on historic uniqueness described in Federal, State, or local registers; or

(v) Could result in additional hazard if exposed to a vapor-gas cloud.

(b) *Measuring dispersion distance.* The dispersion distance is measured radially from the inside edge of an impounding system along the ground contour to the exclusion zone boundary.

(c) *Computing dispersion distance.* A minimum dispersion distance must be computed for the impounding system. If grading and drainage are used under § 193.2149 (b), operators must comply with the requirements of this section by assuming the space needed for drainage and collection of spilled liquid is an impounding system. Dispersion distance must be determined in accordance with the following dispersion parameters, using applicable parts of the mathematical model in Appendix B of the report, "Evaluation of LNG Vapor Control Methods," 1974, or a model for vapor dispersion which meets the requirements of subdivisions (ii) through (iv) in § 193.2057 (c) (2):

(1) Average gas concentration in air = 2.5 percent.

(2) Dispersion conditions are a combination of those which result in longer predicted downwind dispersion distances than other weather conditions at the site at least 90 percent of the time, based on U.S. Government weather data, or as an alternative where the model used gives longer distances at lower wind speeds. Category F atmosphere, wind speed = 4.5 miles per hour, relative humidity equals 50.0 percent, and atmospheric temperatures = 0.0 C.

(3) Dispersion coordinates y, z, and H, where applicable, = 0.

(d) *Vaporization design rate.* In computing dispersion distance under paragraph (c) of this section, the following applies:

(1) Vaporization results from the spill caused by an assumed rupture of a single transfer pipe (or multiple pipes that lack provisions to prevent parallel flow) which has the greatest overall flow capacity, discharging at maximum potential capacity, in accordance with the following conditions:

(i) The rate of vaporization is not less than the sum of flash vaporization and vaporization from boiling by heat transfer from contact surfaces during the time necessary for spill detection, instrument response, and automatic shutdown by the emergency shutdown system but, not less than 10 minutes, plus, in the case of impounding systems for LNG

storage tanks with side or bottom penetrations, the time necessary for the liquid level in the tank to reach the level of the penetrations or equilibrate with the liquid impounded assuming failures of the internal shut-off valve.

(ii) In determining variations in vaporization rate due to surface contact, the time necessary to wet 100 percent of the impounding floor area shall be determined by equation C-9 in the report "Evaluation of LNG Vapor Control Methods," 1974, or an alternate model which meets the requirements of subdivisions (ii) through (iv) in § 193.2057 (c) (2).

(iii) After spill flow is terminated, the rate of vaporization is vaporization of the remaining spillage, if any, from boiling by heat transfer from contact surfaces that are reducing in area and temperature as a function of time.

(iv) Vapor detention space is all space provided for liquid impoundment and vapor detention outside the component served, less the volume occupied by the spilled liquid at the time the vapor escapes the vapor detention space.

(2) The boiling rate of LNG on which dispersion distance is based is determined using the weighted average value of the thermal properties of the contact surfaces in the impounding space determined from eight representative experimental tests on the materials involved. If surfaces are insulated, the insulation must be designed, installed, and maintained so that it will retain its performance characteristics under spill conditions.

(e) *Planned vapor control.* An LNG facility need not have a dispersion exclusion zone if the Director finds that compliance with paragraph (a) of this section would be impractical and the operator prepares and follows a plan for controlling LNG vapor that is found acceptable by the Director. The plan must include circumstances under which LNG vapor is controlled to preclude the dispersion of a flammable mixture from the LNG facility under all predictable environmental conditions that could adversely affect control. The reliability of the method of control must be demonstrated by testing or experience with LNG spills.

§ 193.2061 **Seismic investigation and design forces.** (a) Except for shop fabricated storage tanks of 70,000 gallons or less capacity mounted within 2 feet of the ground, if an LNG facility is located at a site in Zone O or I of the "Seismic Risk Map of the United States," UBC, each operator shall determine, based on a study of faults, hydrologic regime, and soil conditions, whether a potential exists at the site for surface faulting or soil liquefaction.

(b) Subject to paragraph (f) of this section LNG facilities must be designed and built to withstand, without loss of structural or functional integrity, the following seismic design forces, as applicable:

(1) For LNG facilities (other than shop fabricated storage tanks of 70,000 gallons or less capacity mounted within 2 feet of the ground) located at a site in Puerto Rico in Zone 2, 3, or 4 of the "Seismic Risk Map of the United States," or at a site determined under paragraph (a) of this section to have a potential for surface faulting or soil liquefaction, the forces that could reasonably be expected to occur at the foundation of the facility due to the most critical ground motion, motion amplification, permanent differential ground displacement, soil liquefaction, and

symmetric and asymmetric reaction forces resulting from hydrodynamic pressure and motion of contained liquid in interaction with the facility structure.

(2) For all other LNG facilities, the total lateral force set forth in UBC, Volume 1, corresponding to the zone of the "Seismic Risk Map of the United States" in which the facility is located, and a vertical force equal to the total lateral force.

(c) Each operator of an LNG facility to which paragraph (b) (1) of this section applies shall determine the seismic design forces on the basis of a detailed geotechnical investigation and in accordance with paragraphs (d) and (e) of this section. The investigation must include each of the following items that could reasonably be expected to affect the site and be sufficient in scope to identify all hazards that could reasonably be expected to affect the facility design:

(1) Identification and evaluation of faults. Quaternary activity of those faults, tectonic structures, static and dynamic properties of materials underlying the site, and, as applicable, tectonic provinces within 100 miles of the site:

(2) Identification and evaluation of all historically reported earthquakes which could affect the determination under this section of the most critical ground motion or differential displacement at the site when correlated with particular faults, tectonic structures, and tectonic provinces, as applicable; and

(3) Identification and evaluation of the hydrologic regime and the potential of liquefaction-induced soil failures.

(d) The most critical ground motion must be determined in accordance with paragraph (e) of this section either:

(1) Probabilistically, when the available earthquake data are sufficient to show that the yearly probability of exceedance of most critical ground motion is  $10^{-4}$  or less; or

(2) Deterministically, when the available earthquake data are insufficient to provide probabilistic estimates, with the objective of determining a most critical ground motion with a yearly probability of exceedance of  $10^{-4}$  or less.

(e) The determination of most critical ground motion, considering local and regional seismological conditions, must be made by using the following:

(1) A regionally appropriate attenuation relationship, assuming that earthquakes occur at a location on a fault, tectonic structure, or tectonic province, as applicable, which would cause the most critical seismic movement at the site, except that where epicenters of historically reported earthquakes cannot be reasonably related to known faults or tectonic structures, but are recognized as being within a specific tectonic province which is within 100 miles of the site, assume that those earthquakes occur within their respective provinces at a source closest to the site.

(2) A horizontal design response spectrum determined from the mean plus one standard deviation of a freefield horizontal elastic response Register, December, 1982, No. 324



spectra whose spectral amplitudes are consistent with values expected for the most critical ground motion.

(3) A vertical design response spectrum that is either two-thirds of the amplitude of the horizontal design response spectrum at all frequencies or equal to the horizontal design response spectrum where the site is located within 10 miles of the earthquake source.

(f) An LNG storage tank or its impounding system may not be located at a site where an investigation under paragraph (c) of this section shows that any of the following conditions exists unless the Director grants an approval for the site:

(1) The estimated design horizontal acceleration exceeds  $0.4g$  at the tank or dike foundation.

(2) The specific local geologic and seismic data base is sufficient to predict future differential surface displacement beneath the tank and dike area, but displacement not exceed  $30$  inches cannot be assured with a high level of confidence.

(3) The specific local geologic and seismic data base is not sufficient to predict future differential surface displacement beneath the tank and dike area, and the estimated cumulative displacement of a Quaternary fault within one mile of the tank foundation exceeds  $60$  inches.

(4) The potential for soil liquefaction cannot be accommodated by design and construction in accordance with paragraph (b) (1) of this section.

(g) An application for approval of a site under paragraph (f) of this section must provide at least the following:

(1) A detailed analysis and evaluation of the geologic and seismic characteristics of the site based on the geotechnical investigation performed under paragraph (c) of this section, with emphasis on prediction of near field seismic response.

(2) The design plans and structural analysis for the tank, its impounding system, and related foundations, with a report demonstrating that the design requirements of this section are satisfied, including any test results or other documentation as appropriate.

(3) A description of safety-related features of the site or designs, in addition to those required by this part, if applicable, that would mitigate the potential effects of a catastrophic spill (e.g., remoteness or topographic features of the site, additional exclusion distances, or multiple barriers for containing or impounding LNG).

(b) Each container which does not have a structurally liquid-tight cover must have sufficient freeboard with an appropriate configuration to prevent the escape of liquid due to sloshing, wave action, and vertical liquid displacement caused by seismic action.

§ 193.2063 **Flooding.** (a) Each operator shall determine the effects of flooding on an LNG facility site based on the worst occurrence in a 100-year period. The determination must take into account:

- (1) Volume and velocity of the floodwater;
- (2) Tsunamis (local, regional, and distant);

- (3) Potential failure of dams;
- (4) Predictable land developments which would affect runoff accumulation of water, and
- (5) Tidal action.

(b) The effect of flooding determined under paragraph (a) of this section must be accommodated by location or design and construction, as applicable, to reasonably assure:

- (1) The structural or functional integrity of LNG facilities; and
- (2) Access from outside the LNG facility and movement of personnel and equipment about the LNG facility site for the control of fire and other emergencies.

§ 193.2065 **Soil characteristics.** (a) Soil investigations including borings and other appropriate tests must be made at the site of each LNG facility to determine bearing capacity, settlement characteristics, potential for erosion, and other soil characteristics applicable to the integrity of the facility.

(b) The naturally occurring or designed soil characteristics at each LNG facility site must provide load bearing capacities, using appropriate safety factors, which can support the following loads without excessive lateral or vertical movement that causes a loss of the functional or structural integrity of the facility involved:

- (1) Static loading caused by the facility and its contents and any hydrostatic testing of the facility; and
- (2) Dynamic loading caused by movement of contents of the facility during normal operation, including flow, sloshing, and rollover.

§ 193.2057 **Wind forces.** (a) LNG facilities must be designed to withstand without loss of structural or functional integrity:

- (1) The direct effect of wind forces;
- (2) The pressure differential between the interior and exterior of a confining, or partially confining, structure; and
- (3) In the case of impounding systems for LNG storage tanks, impact forces and potential penetrations by wind borne missiles.

(b) The wind forces at the location of the specific facility must be based on one of the following:

(1) For shop fabricated containers of LNG or other hazardous fluids with a capacity of not more than 70,000 gallons, applicable wind load data in ANSIA 58.1, 1972 edition.

(2) For all other LNG facilities—

(i) An assumed sustained wind velocity of not less than 200 miles per hour, unless the Director finds a lower velocity is justified by adequate supportive data; or

(ii) The most critical combination of wind velocity and duration, with respect to the effect on the structure, having a probability of exceedance

in a 50-year period of 0.5 percent or less, if adequate wind data are available and the probabilistic methodology is reliable.

§ 193.2069 **Other severe weather and natural conditions.** (a) In addition to the requirements of §§ 193.2061, 193.2063, 193.2065, and 193.2067, each operator shall determine from historical records and engineering studies the worst effect of other weather and natural conditions which may predictably occur at an LNG facility site.

(b) The facility must be located and designed so that such severe conditions cannot reasonably be expected to result in an emergency involving the factors listed in § 193.2063 (b).

§ 193.2071 **Adjacent activities.** (a) Each operator shall determine that present and reasonably foreseeable activities adjacent to an LNG facility site that could adversely affect the operation of the LNG facility or the safety of persons or offsite property, if damage to the facility occurs.

(b) An LNG facility must not be located where present or projected offsite activities would be reasonably expected to—

- (1) Adversely affect the operation of any of its safety control systems;
- (2) Cause failure of the facility; or
- (3) Cause the facility not to meet the requirements of this part.

§ 193.2073 **Separation of facilities.** Each LNG facility site must be large enough to provide for minimum separations between facilities and between facilities and the site boundary to—

(a) Permit movement of personnel, maintenance equipment, and emergency equipment around the facility; and

(b) Comply with distances specified in Sections 2-2.4 through 2-2.7 of NEDA 59A.

### **Subpart C—Design**

§ 193.2101 **Scope.** This subpart prescribes requirements for the selection and qualification of materials for components, and for the design and installation or construction of components and buildings, including separate requirements for impounding systems, LNG storage tanks, and transfer systems.

### **Materials**

§ 193.2103 **General.** Materials for all components must be—

(a) Able to maintain their structural integrity under all design loadings, including applicable environmental design forces under Subpart B of this part:

(b) Physically, chemically, and thermally compatible within design limits with any fluid or other materials with which they are in contact; and

(c) Qualified in accordance with the applicable requirements of this subpart.

§ 193.2105 **Extreme temperatures; normal operations.** Each operator shall—

(a) Determine the range of temperatures to which components will be subjected during normal operations, including required testing, initial startup, cooldown operations, and shutdown conditions; and

(b) Use component materials that meet the design standards of this part for strength, ductility, and other properties throughout the entire range of temperatures to which the component will be subjected in normal operations.

§ 193.2107 **Extreme temperatures, emergency conditions.** (a) Each operator shall determine the effects on components not normally exposed to extreme cold (including a component's foundation or support system) of contact by LNG or cold refrigerant that could result from error, a spill, or other emergency determined as required by this part.

(b) Each operator shall determine the effects on components (including their foundations or support systems) of the extreme heat which could result from an LNG or other hazardous fluid fire.

(c) Where the exposure determined under paragraph (a) or (b) of this section could result in a failure that would worsen the emergency, the component or its foundation or support system, as appropriate, must be:

(1) Made of material or constructed to be suitable for the extreme temperature to which it could be subjected; or

(2) Protected by insulation or other means that will delay failure due to extreme temperature in order to allow adequate time to take emergency responses.

(d) If a material that has low resistance to flame temperatures is used in any component containing a hazardous fluid, the material must be protected so that any heat resulting from a controllable emergency does not cause the release of fluid that would result in an uncontrollable emergency.

§ 193.2109 **Insulation.** During normal operations, insulation materials must—

(a) Maintain insulating values;

(b) Withstand thermal and mechanical design loads; and

(c) Be covered with a material that is noncombustible in the installed state, is not subject to detrimental ultraviolet decay, and that can withstand the forces of wind according to ANSI A58.1 and anticipated loading which could occur in a controllable emergency.

§ 193.2111 **Cold boxes.** All cold boxes must be made of noncombustible material and the insulation must be made of materials which are noncombustible in the installed condition.

§ 193.2113 **Piping.** (a) Piping made of cast iron, malleable iron, or ductile iron may not be used to carry any cryogenic or hazardous fluids.

(b) Piping materials intended for normal use at temperatures below  $-28.9^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ) or for use under § 193.2107 (c) (1) must be qualified by testing in accordance with ANSI B 31.3 to comply with § 193.2103 (b).

§ 193.2115 **Concrete subject to cryogenic temperatures.** Concrete intended for normal use at cryogenic temperatures or for use under § 193.2107 (c) (1) may not be used unless—

(a) Materials, measurements, mixing, placing, prestressing, and post-stressing of concrete meets generally accepted engineering practices;

(b) Metallic reinforcing, prestressing wire, structural and nonstructural members used in concrete are acceptable in the installed condition for the temperature and stress levels encountered at design loading conditions; and

(c) Tests for the compressive strength, the coefficient of contraction, an acceptable thermal gradient, and, if applicable, acceptable surface loading to prevent detrimental spalling are performed on the concrete at the lowest temperature for which the concrete is designed or similar test data on these properties are available.

§ 193.2117 **Combustible materials.** Combustible materials are not permitted for the construction of buildings, plant equipment, and the foundations and supports of buildings and plant equipment in areas where ignition of the material would worsen an emergency. However, limited combustible materials may be used when the use of noncombustible materials is impractical.

§ 193.2119 **Records** Each operator shall keep a record of all materials for components, buildings, foundations, and support systems, as necessary to verify that material properties meet the requirements of this part. These records must be maintained for the life of the item concerned.

### **Design of Components and Buildings**

§ 193.2121 **General.** Components, including their foundations and support systems, must be designed, fabricated, and installed to withstand, without loss of functional or structural integrity, predictable loadings not including environmental design forces under Subpart B of this part unless applicable under that subpart.

§ 193.2123 **Valves.** (a) Each valve, including control valves and relief valves, must be designed, manufactured, and tested to comply with ANSI B31.3 or ANSI B31.5 or ANSI B 31.8 or API Standard 6D, if design conditions fall within their scope.

(b) Extended bonnet valves must be used for service temperatures below  $-45.6^{\circ}\text{C}$  ( $-50^{\circ}\text{F}$ ).

(c) Valves used for cryogenic liquid service must be designed to operate in the position in which they are installed.

(d) Powered local and remote operation must be provided for valves intended for use during a controllable emergency that would be difficult or excessively time consuming to operate manually during such an emergency.

(e) Valves must be designed and installed so that an excessive load on the piping system does not render the valve inoperable.

§ 193.2125 **Automatic shutoff valves.** Each automatic shutoff valve or combination of valves must—

(a) Have a fail-safe design;

(b) Operate to stop fluid flow which would endanger the operational integrity of plant equipment; and

(c) Close at a rate to avoid fluid hammer which would endanger the operating integrity of a component.

§ 193.2127 **Piping.** (a) Piping must be designed, manufactured, and tested to comply with ANSI B 31.3.

(b) All cryogenic and hazardous fluid piping must have connections to facilitate shutdown and purge as required by this part.

(c) Each cryogenic or hazardous fluid piping system that is above-ground must be identified by color coding, painting, or labeling.

(d) Seamless pipe or pipe with a longitudinal joint efficiently of 1.0 determined in accordance with ANSI B31.3 or pipe with a design pressure less than two-thirds of the mill-proof test pressure or subsequent shop or field hydrostatic test pressure must be used for process and transfer piping handling cryogenic or other hazardous fluids with a service temperature below  $-22^{\circ}\text{F}$  ( $-30^{\circ}\text{C}$ ).

(e) For longitudinal or spiral weld piping handling LNG or cryogenic fluids, the heat affected zone must comply with § 323.2.2 of ANSI B31.3.

(f) Threaded piping used in hazardous fluid service must be at least Schedule 80.

§ 193.2129 **Piping attachments and supports.** Piping attachments and supports for LNG or refrigerant piping must be designed to prevent excessive heat transfer which can result in either unintentional restraint of piping caused by ice formations or the embrittlement of supporting steel.

§ 193.2131 **Building design.** (a) Each building or structural enclosure in which potentially hazardous quantities of flammable materials are handled must be designed and constructed to minimize fire hazards.

(b) Buildings or structural enclosures in which hazardous or cryogenic fluids are handled shall be of light-weight, noncombustible construction with nonload-bearing walls.

(c) If rooms containing such fluids are located within or attached to buildings in which such fluids are not handled, i.e., control rooms, shops, etc., the common walls shall be limited to not more than two in number, shall be designed to withstand a static pressure of at least 4800 Pa (100 psf), have no doors or other communicating openings, and shall have a fire resistance rating of at least 1 hour.

§ 193.2133 **Buildings; ventilation.** (a) Each building in which potentially hazardous quantities of flammable fluids are handled must be ventilated to minimize the possibility, during normal operation, of hazardous accumulation of a flammable gas and air mixture, hazardous Register, December, 1982, No. 324

products of combustion, and other hazardous vapors in enclosed process areas by one of the following means:

- (1) A continuously operating mechanical ventilation system;
- (2) A combination gravity ventilation system and normally off mechanical ventilation system which is activated by suitable flammable gas detectors at a concentration not exceeding 25 percent of the lower flammable limit of the gas;
- (3) A dual rate mechanical ventilation system with the high rate activated by suitable flammable gas detectors at a concentration not exceeding 25 percent of the lower flammable limit of the gas; or
- (4) A gravity ventilation system composed of a combination of wall openings, roof ventilators, and, if there are basements or depressed floor levels, a supplemental mechanical ventilation system.

(b) The ventilation rate must be at least 1 cubic foot per minute of air per square foot of floor area. If vapors heavier than air can be present, the ventilation must be proportioned, according to the area of each level.

§ 193.2135 Expansion or contraction. Each operator shall consider the amount of contraction and expansion of each component during operating and environmental thermal cycling and shall—

- (a) Provide components that operate without detrimental stress or restriction of movement, within each component and between components, caused by contraction and expansion; and
- (b) Prevent ice buildup from detrimentally restricting the movement of components caused by contraction and expansion.

§ 193.2137 Frost heave. (a) Each operator shall—

- (1) Determine which components and their foundations could be endangered by frost heave from ambient temperatures or operating temperatures of the component; and
  - (2) Provide protection against frost heave which might impair their structural integrity.
- (b) For each component and foundation determined under paragraph (a) of this section, instrumentation must be installed to warn of potential structural impairment due to frost heave, unless the operator includes in the maintenance procedures required by this part, a method and schedule of inspection that will detect changes in the elevation.

§ 193.2139 Ice and snow. (a) Components must be designed to support the weight of ice and snow which could normally collect or form on them.

- (b) Each operator shall provide protection for components from falling ice or snow which may accumulate on structures.
- (c) Valves and moving components must not become inoperative due to ice formation on the component.

§ 193.2141 Electrical systems. (a) Each operator shall select and install electrical equipment and wiring for components in accordance with NFPA-70 and, where applicable Section 7-62 of NFPA-59A.

(b) Electrical grounding and bonding must be in accordance with Section 7-7.1.1 of NFPA-59A.

(c) Protective measures for stray or impressed currents must be provided in accordance with Section 7-7.3 of NFPA-59A.

§ 193.2143 **Lightning.** Each operator shall install proper grounds as necessary to minimize the hazard to plant personnel and components, including all electrical circuits, as a result of lightning.

§ 193.2145 **Boilers and pressure vessels.** Boilers must be designed and fabricated in accordance with Section I or Section IV of the ASME Boiler and Pressure Vessel Code. Other pressure vessels subject to that Code must be designed and fabricated in accordance with Division 1 or Division 2 of Section VIII.

§ 193.2147 **Combustion engines and turbines.** Combustion engines and gas turbines must be installed in accordance with NFPA-37.

### **Impoundment Design and Capacity**

§ 193.2149 **Impoundment required.** (a) An impounding system must be provided for storage tanks to contain a potential spill of LNG or other hazardous liquid.

(b) Grading or drainage or an impounding system must be provided to ensure that accidental spills or leaks from the following components and areas do not endanger components or adjoining property or enter navigable waterways:

- (1) Liquefaction and other process equipment;
- (2) Vaporizers;
- (3) Transfer systems;
- (4) Parking areas for tank cars or tank trucks; and
- (5) Areas for loading, unloading, or storing portable containers and dewar vessels.

(c) Impounding systems for LNG must be designed and constructed in accordance with this subpart. Impounding systems intended for containment of hazardous liquids other than LNG must meet the requirements of NFPA-30.

§ 193.2151 **General design characteristics.** (a) An impounding system must have a configuration or design which, to the maximum extent possible, will prevent liquid from escaping impoundment by leakage, splash from collapse of a structure or part thereof, momentum and low surface friction, foaming, failure of pressurized piping, and accidental pumping.

(b) The basic form of an impounding system may be excavation, a natural geological formation, manufactured diking, such as berms or walls, or any combination thereof.

§ 193.2153 **Classes of impounding systems.** (a) for the purpose of this part, impounding systems are classified as follows:

Register, December, 1982, No. 324



*Class 1.* A system which surrounds the component served with the inner surface of the dike constructed against or within 24 inches of the component served.

*Class 2.* A system which surrounds the component or area served with the dike located a distance away from the component or at the periphery of the area.

*Class 3.* A system which conducts a spill by dikes and floors to a remote impounding space which does not surround the component or area served.

(b) In the case of an impounding system consisting of a combination of classes, requirements of this part regarding a single class apply according to the percentage of impoundment provided by each class.

§ 193.2155 **Structural requirements.** (a) Subject to paragraph (b) of this section, the structural parts of an impounding system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of the following:

(1) The imposed loading from—

(i) Full hydrostatic head of impounded LNG;

(ii) Hydrodynamic action, including the effect of any material injected into the system for spill control;

(iii) The impingement of the trajectory of an LNG jet discharged at any predictable angle; and

(iv) Anticipated hydraulic forces from a credible opening in the component or item served, assuming that the discharge pressure equals design pressure.

(2) The erosive action from a spill, including jetting of spilling LNG, and any other anticipated erosive action including surface water runoff, ice formation, dislodgement of ice formation, and snow removal.

(3) The effect of the temperature, any thermal gradient, and any other anticipated degradation resulting from sudden or localized contact with LNG.

(4) Exposure to fire from impounded LNG or from sources other than impounded LNG.

(5) If applicable, the potential impact and loading on the dike due to—

(i) Collapse of the component or item served or adjacent components; and

(ii) If the LNG facility adjoins the right-of-way of any highway or railroad, collision by or explosion of a train, tank car, or tank truck that could reasonably be expected to cause the most severe loading.

(b) For spills from LNG storage tanks with Class 2 or 3 impounding systems, imposed loading and surging flow characteristics must be based on a credible release of the tank contents.

(c) If an LNG storage tank is located within a horizontal distance of 6,100 m. (20,000 ft.) from the nearest point of the nearest runway serv-

ing large aircraft as defined in 14 CFR Part 1.1 a Class 1 impounding system must be used which is designed to withstand collision by, or explosion of, the heaviest aircraft which can take off or land at the airport.

§ 193.2157 **Coatings and coverings.** Insulation, sealants, or other coatings and coverings which are part of an impounding system—

(a) Must be noncombustible in an installed condition when exposed to an LNG fire resulting from a spill that covers the floor of the impounding space;

(b) Must withstand exposure to fire from sources determined as required by this part, other than impounded LNG, for a period of time until fire protective or fire extinguishing action is taken; and

(c) When used for the purpose of maintaining the functional integrity of an impounding system, must be capable of withstanding sudden exposure to LNG without loss of such integrity.

§ 193.2159 **Floors.** Floors of Class 2 and Class 3 impounding systems must, to the extent feasible—

(a) Slope away from the component or item impounded and to a sump basin installed under § 193.2171;

(b) Slope away from the nearest adjacent component;

(c) Drain surface waters from the floor at rates based on a storm of 10-year frequency and 1-hour duration and other natural water sources; and

(d) Be designed to minimize the wetted floor area.

§ 193.2161 **Dikes, general.** (a) Penetrations in dikes to accommodate piping or any other purpose are prohibited.

(b) An outer wall of a component served by an impounding system may not be used as a dike except for a concrete wall designed to comply with the requirements of § 193.2155 (c) or equivalent design impact loading.

§ 193.2163 **Vapor barriers.** If vapor barriers are installed in meeting the requirements of § 193.2059, they must be designed and constructed to detain LNG vapor.

§ 193.2165 **Dike dimensions.** In addition to dike dimensions needed to comply with other requirements of this subpart, to minimize the possibility that a trajectory of accidentally discharged liquid would pass over the top of a dike, the horizontal distance from the inner wall of the component or vessel served to the closest inside edge of the top of the dike must at least equal the vertical distance from the maximum liquid level in the component or vessel to the inside edge of the top of the dike.

§ 193.2167 **Covered systems.** (a) A covered impounding system is prohibited unless it is—

(1) Sealed from the atmosphere and filled with an inert gas; or

(2) Permanently interconnected with the vapor space of the component served.

(b) Flammable nonmetallic membranous covering is prohibited in a covered system.

(c) For systems to which paragraph (a) (1) of this section applies, instrumentation and controls must be provided to—

- (1) Maintain pressures at a safe level; and
- (2) Monitor gas concentrations in accordance with § 193.2169.

(d) Dikes must have adequate structural strength to assure that they can withstand impact from a collapsed cover and all anticipated conditions which could cause a failure of the impounding space cover.

§ 193.2169 **Gas leak detection.** Appropriate areas within an impounding system where collection or passage of LNG or LNG vapor could be expected must be equipped with sensing and warning devices to monitor continuously for the presence of LNG or LNG vapor and to warn before LNG gas concentration levels exceed 25 percent of the lower flammable limit.

§ 193.2171 **Sump basins.** Except for Class 1 impounding systems, a sump basin must be located in each impounding system for collection of water.

§ 193.2173 **Water removal.** (a) Except for Class 1 systems, impounding systems must have sump pumps and piping running over the dike to remove water collecting in the sump basin.

(b) The water removal system must have adequate capacity to remove water at rates which equal the maximum predictable collection rate from a storm of 10-year frequency and 1-hour duration, and other natural causes.

(c) Sump pumps for water removal must—

(1) Be operated as necessary to keep the impounding space as dry as practical; and

(2) If sump pumps are designed for automatic operation, have redundant automatic shutdown controls to prevent operation when LNG is present.

§ 193.2176 **Shared impoundment.** When an impounding system serves more than one LNG storage tank, a means must be provided to prevent low temperature or fire resulting from leakage from any one of the storage tanks served causing any other storage tank to leak. The means must not result in a vapor dispersion distance which exceeds the exclusion zone required by § 193.2059.

§ 193.2179 **Impoundment capacity; general.** In addition to capacities otherwise required by this subpart, an impounding system must have sufficient volumetric capacity to provide for—

(a) Displacement by the component, tank car, tank truck, container, or dewar vessel served; and

(b) Where applicable, displacement which could occur when a higher density substance than the liquid to be impounded enters the system, considering all relevant means of assuring capacity.

§ 193.2181 **Impoundment capacity, LNG storage tanks.** (a) Except as provided in paragraph (b) of this section, each impounding system serving an LNG storage tank must have a minimum volumetric liquid impoundment capacity as follows:

Number of tanks in system	Class or type of system	System capacity in percent of LNG tank's maximum liquid capacity
1	Class 1 .....	110 percent.
	Classes 2 and 3	150 percent.
More than 1	Classes 2 and 3	100 percent of all tanks or 150 percent of largest tank, whichever is greater.

(b) For purposes of this section, a covered impounding system serving a single LNG storage tank may have a capacity of 110 percent of the LNG tank's maximum liquid capacity if it is covered by a roof that is separate and independent from the LNG storage tank.

§ 193.2183 **Impoundment capacity; equipment and transfer systems.** If an impounding system serves a component under § 193.2149 (b) (1) - (3), it must have a minimum volumetric liquid impoundment capacity equal to the sum of—

(a) One-hundred percent of the volume of liquid that could be contained in the component and, where applicable, tank car or tank truck served; and

(b) The maximum volume of liquid which could discharge into the impounding space from any single failure of equipment or piping during the time period necessary for spill detection, instrument response, and sequenced shutdown by the automatic shutdown system under § 193.2439.

§ 193.2185 **Impoundment capacity; parking areas, portable containers.** Each impounding system serving an area listed under § 193.2149 (b) (4) or (5) must have a minimum volumetric liquid impoundment capacity which complies with the requirements of § 193.2181, assuming each tank car, tank truck, portable container, or dewar vessel to be a storage tank.

### LNG Storage Tanks

§ 193.2187 **General.** (a) LNG storage tanks must comply with the requirements of this subpart and the other applicable requirements of this part.

(b) A flammable nonmetallic membrane liner may not be used as an inner container in a storage tank.

§ 193.2189 **Loading forces.** Each part of an LNG storage tank must be designed to withstand without loss of functional or structural integrity any predictable combination of forces which would result in the highest stress to the part, including the following:

(a) Internal design pressure determined under § 193.2197.

- (b) External design pressure determined under § 193.2199.
- (c) Weight of the structure.
- (d) Weight of liquid to be stored, except that in no case will the density assumed be less than 29.3 pounds per cubic foot (470 kilograms per cubic meter).
- (e) Loads due to testing required by § 193.2327.
- (f) Nonuniform reaction forces on the foundation due to predictable settling and other movement.
- (g) Superimposed forces from piping, stairways, and other connected appurtenances.
- (h) Predictable snow and ice loads.
- (i) The loading of internal insulation on the inner container and outer shell due to compaction and movement of the container and shell over the design life of the insulation.
- (j) In the case of vacuum insulation, the forces due to the vacuum.
- (k) In the case of a positive pressure purge, the forces due to the maximum positive pressure of the purge gas.

§ 193.2191 **Stratification.** LNG storage tanks with a capacity of 5,000 barrels or more must be equipped with means to mitigate a potential for rollover and overpressure such as:

- (a) Selective filling at the top and bottom of the tank;
- (b) Circulating liquid from the bottom to the top of the same tank; or
- (c) Transferring liquid selectively from the bottom of the tank to the bottom or top of any adjacent storage tank.

§ 193.2193 **Movement and stress.** (a) Each operator shall determine for normal operations of each LNG storage tank—

- (1) The amount and pattern of predictable movement of components, including transfer piping, and the foundation, which could result from thermal cycling, loading forces, and ambient air changes; and
  - (2) For a storage tank with an inner container, the predictable movement of the inner container and the outer shell in relation to each other.
- (b) Storage tanks must be designed to provide adequate allowance for stress due to movement determined under paragraph (a) of this section, including provisions that—
- (1) Backfill does not cause excessive stresses on the tank structure due to expansion of the storage tank during warmup;
  - (2) Insulation does not settle to a damaging degree or unsafe condition during thermal cycling; and
  - (3) Expansion bends and other expansion or contraction devices are adequate to prevent excessive stress on tank penetrations, especially during cooldown from ambient temperatures.

§ 193.2195 **Penetrations.** (a) All penetrations in an LNG storage tank must be designed in accordance with API 620, including Appendix Q.

(b) The loadings on all penetrations must be determined by an analysis of all contributing forces, including those from tank thermal movements, connecting piping thermal movements, hydraulic forces, applicable wind and earthquake forces, and the forces resulting from settlement or movement of the tank foundation or pipe supports.

(c) All penetrations in an LNG storage tank below the design liquid level must be fitted with an internal shutoff valve which is designed and installed so that any failure of the nozzle penetrating the tank will be outside the tank.

(d) The requirements of paragraphs (a) and (c) of this section do not apply to shop fabricated tanks of 70,000 gallons or less capacity. All penetrations in such tanks must be designed and installed in accordance with the applicable provisions of Section VIII, Division I of the ASME Boiler and Pressure Vessel Code.

§ 193.2197 **Internal design pressure.** (a) Each operator shall establish the internal design pressure at the top of each LNG storage tank, including a suitable margin above the maximum allowable working pressure.

(b) The internal design pressure of a storage tank may not be lower than the highest pressure in the vapor space resulting from each of the following events or combination thereof that predictably might occur, giving consideration to vapor handling equipment, relief devices in accordance with § 193.2429, and any other mitigating measures:

(1) Filling the tank with LNG including effects of increased vaporization rate due to superheat and sensible heat of the added liquid;

(2) Rollover.

(3) Fall in barometric pressure, using the worst combination of amount of fall and rate of fall which might predictably occur;

(4) Loss of effective insulation that may result from an adjacent fire, leak of liquid into the intertank space, or other predictable accident; and

(5) Flash vaporization resulting from pump recirculation.

§ 193.2199 **External design pressure.** (a) Each operator shall establish the external design pressure at the top of each LNG storage tank, including a suitable margin below the minimum allowable working pressure.

(b) The external design pressure may not be higher than the lowest vapor pressure in the vapor space resulting from each of the following events or combinations thereof that predictably might occur, giving consideration to gas makeup systems, vacuum relief devices in accordance with § 193.2429, and any other mitigating measures.

(1) Withdrawing liquid from the tank;

(2) Withdrawing gas from the tank;

(3) Adding subcooled LNG to the tank; and

(4) Rise in barometric pressure, based on the worst combination of amount of rise and rate of rise which predictably might occur.

§ 193.2201 **Internal temperature.** The liquid container of each LNG storage tank and all tank parts used in contact with LNG or its cold vapor shall be designed for the lowest bulk liquid temperature which can be attained in the LNG storage tank.

§ 193.3203 **Foundation.** (a) Each LNG storage tank must have a stable foundation designed in accordance with generally accepted structural engineering practices.

(b) Each foundation must support design loading forces without detrimental settling that could impair the structural integrity of the tank.

§ 193.2206 **Frost heave.** If the protection provided for LNG storage tank foundations from frost heave under § 193.2137 (a) includes heating the foundation area—

(a) An instrumentation and alarm system must be provided to warn of malfunction of the heating system; and

(b) A means to correct the malfunction must be provided.

§ 193.2207 **Insulation.** (a) Insulation on the outside of the outer shell of an LNG storage tank may not be used to maintain stored LNG at an operating temperature during normal operation.

(b) Insulation between an inner container and the outer shell of an LNG storage tank must—

(1) Be compatible with the contained liquid and its vapor;

(2) In its installed condition, be noncombustible; and

(3) Not significantly lose insulating properties by melting, settling, or other means due to a fire resulting from a spill that covers the floor of the impounding space around the tank.

§ 193.2209 **Instrumentation for LNG storage tanks.** (a) LNG storage tank having a capacity over 70,000 gallons must be equipped with a sufficient number of sensing devices and personnel warning devices, as prescribed, which operate continuously while the tank is in operation to assure that each of the following conditions is not a potential hazard to the structural integrity or safety of the tank:

Condition	Instrumentation
(1) Amount of liquid in the tank.	Redundant liquid level gages and recorders with high level alarms, and a minimum of one independent high level alarm.
(2) Vapor pressure within the tank.	Redundant gages and recorders with high and low pressure alarms.
(3) Temperatures at representative critical points in the foundation.	Temperature indicating and recording devices with alarm.
(4) Temperature of contained liquid at various vertical intervals.	Temperature recorders.
(5) Abnormal temperature in tank structure.	Thermocouples located at representative critical points with recorders.
(6) Excessive relative movement of inner container and outer shell.	Linear and rotational movement indicators located between inner container and outer shell with recorders.

(b) LNG storage tanks with a capacity of 70,000 gallons or less must be equipped with the following:

- (1) LNG liquid trycocks, when attended during the filling operation.
- (2) Pressure gages and recorders with high pressure alarm.
- (3) Differential pressure liquid level gage.

(c) Each storage tank must be designed as appropriate to provide for compliance with the inspection requirements of this part.

§ 193.2211 **Metal storage tanks.** (a) Metal storage tanks with internal design pressures of not more than 15 psig must be designed and constructed in accordance with API Standard 620 and, where applicable, Appendix Q of that standard.

(b) Metal storage tanks with internal design pressures above 15 psig must be designed in accordance with the applicable division of Section VIII of the ASME Boiler and Pressure Vessel Code.

§ 193.2213 **Concrete storage tanks.** Concrete storage tanks must be designed and constructed in accordance with Section 4-3 of NFPA-59A.

§ 193.2215 **Thermal barriers.** Thermal barriers must be provided between piping and an outer shell from being exposed during normal operation to temperatures lower than its design temperature.

§ 193.2217 **Support system.** (a) Saddles and legs must be designed in accordance with generally accepted structural engineering practices, taking into account loads during transportation, erection loads, and thermal loads.

(b) Storage tank stress concentrations from support systems must be minimized by distribution of loads using pads, load rings, or other means.

(c) For a storage tank with an inner container, support systems must be designed to—

(1) Minimize thermal stresses imparted to the inner container and outer shell from expansion and contraction; and

(2) Sustain the maximum applicable loading from shipping and operating conditions.

(d) LNG storage tanks with an air space beneath the tank bottom or its foundation must be designed to withstand without loss of functional or structural integrity, the forces caused by the ignition of a combustible vapor cloud in this space.

§ 193.2219 **Internal piping.** Piping connected to an inner container that is located in the space between the inner container and outer shell must be designed for not less than the pressure rating of the inner container. The piping must contain expansion loops where necessary to protect against thermal and other secondary stresses created by operation of the tank. Bellows may not be used within the space between the inner container and outer shell.

§ 193.2221 **Marking.** (a) Each operator shall install and maintain a name plate in an accessible place on each storage tank and mark it in Register, December, 1982, No. 324



accordance with the applicable code or standard incorporated by reference in §§ 193.2211 or 193.2213.

(b) Each penetration in a storage tank must be marked indicating the function of the penetration.

(c) Marking required by this section must not be obscured by frosting.

### Design of Transfer Systems

§ 193.2223 General. (a) Transfer systems must comply with the requirements of this subpart and other applicable requirements of this part.

(b) The design of transfer systems must provide for stress due to the frequency of thermal cycling and intermittent use to which the transfer system may be subjected.

(c) Slip type expansion joints are prohibited and packing-type joints may not be used in transfer systems for LNG or flammable refrigerants.

(d) A suitable means must be provided to precool the piping in a manner that prevents excessive stress prior to normal transfer of cold fluids.

(e) Stresses due to thermal and hydraulic shock in the piping system must be determined and accommodated by design to avoid damage to piping.

§ 193.2227 Backflow. (a) Each transfer system must operate with a means to—

(1) Prevent backflow of liquid from a receiving container, tank car, or tank truck from causing a hazardous condition; and

(2) Maintain one-way flow where necessary for the integrity or safe operation of the LNG facility.

(b) The means provided under paragraph (a) (1) of this section must be located as close as practical to the point of connection of the transfer system and the receiving container, tank car, or tank truck.

§ 193.2229 Cargo transfer systems. (a) Each cargo transfer system must have—

(1) A means of safely depressurizing and venting that system before disconnection;

(2) A means to provide for safe vapor displacement during transfer;

(3) Transfer piping, pumps, and compressors located or protected by suitable barriers so that they are safe from damage by tank car or tank truck movements;

(4) A signal light at each control location or remotely located pumps or compressors used for transfer which indicates whether the pump or compressor is off or in operation; and

(5) A means of communication between loading or unloading areas and other areas in which personnel are associated with the transfer operations.

(b) Hoses and arms for cargo transfer systems must be designed as follows—

(1) The design must accommodate operating pressures and temperatures encountered during the transfers;

(2) Hoses must have a bursting pressure of not less than five times the operating pressure.

(3) Arms must meet the requirements of ANSI B31.3.

(4) Adequate support must be provided, taking into account ice formation.

(5) Couplings must be designed for the frequency of any coupling or uncoupling.

§ 193.2231 **Cargo transfer area.** The transfer area of a cargo transfer system must be designed—

(a) To accommodate tank cars and tank trucks without excessive maneuvering; and

(b) To permit tank trucks to enter or exit the transfer area without backing.

§ 193.2233 **Shutoff valves.** (a) Shutoff valves on a transfer systems must be located—

(1) On each liquid supply line, or common line to multiple supply lines, to a storage tank, or to a cargo transfer system;

(2) On each vapor or liquid return line from multiple return lines, used in a cargo transfer system;

(3) At the connection of a transfer system with a pipeline subject to Part 192 of this chapter; and

(4) To provide for proper operation and maintenance of each transfer system.

(b) Transfer system shutoff valves that are designated for operation in the emergency procedures must be manually operable at the valve and power operable at the valve and at a remote location at least 50 feet from the valve.

### **Subpart D—Construction**

§ 193.2301 **Scope.** This subpart prescribes requirements for the construction or installation of components.

§ 193.2303 **Construction acceptance.** No person may place in service any component until it passes all applicable inspections and tests prescribed by this subpart.

§ 193.2204 **Corrosion control overview.** (a) Subject to paragraph (b) of this section, components may not be constructed, repaired, replaced, or significantly altered until a person qualified under § 193.2707 (c) reviews the applicable design drawings and materials specifications from a corrosion control, viewpoint and determines that the Register, December, 1982, No. 324

materials involved will not impair the safety or reliability of the component or any associated components.

(b) The repair, replacement, or significant alteration of components must be reviewed only if the action to be taken—

(1) Involves a change in the original materials specified;

(2) Is due to a failure caused by corrosion or

(3) Is occasioned by inspection revealing a significant deterioration of the component due to corrosion.

**§ 193.2305 Procedures.** (a) In performing construction, installation, inspection, or testing, an operator must follow written specifications, procedures, and drawings, as appropriate, that are consistent with this part, taking into account relevant mechanical, chemical, and thermal properties, component functions, and environmental effects that are involved.

(b) All procedures, including any field revisions, must be substantiated by testing or experience to produce a component that is reliable and complies with the design and installation requirements of this part.

**§ 193.2307 Inspection.** (a) All construction, installation, and testing activities must be inspected as frequently as necessary in accordance with a written plan to assure that—

(1) Activities are in compliance with all applicable requirements of this subpart; and

(2) Components comply with the applicable material, design, fabrication, installation, and construction requirements of this part.

(b) In addition to the requirements of paragraph (a) of this section, the construction of concrete storage tanks must be inspected in accordance with ACI-311-75.

(c) Each operator shall have a quality assurance inspection program to verify that components comply with their design specifications and drawings, including any field design changes, before they are placed in service.

**§ 193.2309 Inspection and testing methods** Except as otherwise provided by this subpart, each operator shall determine, commensurate with the hazard that would result from failure of the component concerned, the scope and nature of—

(a) Inspections and tests required by this subpart; and

(b) Inspection and testing procedures required by § 193.2305.

**§ 193.2311 Cleanup.** After construction or installation, as the case may be, all components must be cleaned to remove all detrimental contaminants which could cause a hazard during operation, including the following:

(a) All flux residues used in brazing or soldering must be removed from the joints and the base metal to prevent corrosive solutions from being formed.

(b) All solvent type cleaners must be tested to ensure that they will not damage equipment integrity or reliability.

(c) Incompatible chemicals must be removed.

(d) All contaminants must be captured and disposed of in a manner that does not reduce the effectiveness of corrosion protection and monitoring provided as required by this part.

**§ 193.2313 Pipe welding.** (a) Each operator shall provide the following for welding on pressurized piping for LNG and other hazardous fluids:

(1) Welding procedures and welders qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code or API 1104, as applicable;

(2) When welding materials that are qualified by impact testing, welding procedures selected to minimize degradation of low temperature properties of the pipe material; and

(3) When welding attachments to pipe, procedures and techniques selected to minimize the danger of burn-throughs and stress intensification.

(b) Oxygen fuel gas welding is not permitted on flammable fluid piping with a service temperature below  $-20^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ).

(c) Marking materials for identifying welds on pipe must be compatible with the basic pipe material.

(d) Surfaces of components that are less than 6.35 mm (0.25 in.) thick may not be field die stamped.

(e) Where die stamping is permitted, any identification marks must be made with a die having blunt edges to minimize stress concentration.

**§ 193.2315 Piping connections.** (a) Piping more than 2 inches nominal diameter must be joined by welding, except that—

(1) Threaded or flanged connections may be used where necessary for special connections, including connections for material transitions, instrument connections, testing, and maintenance;

(2) Copper piping in nonflammable service may be joined by silver brazing; and

(3) Material transitions may be made by any joining technique proven reliable under § 193.2305 (b).

(b) If socket fittings are used, a clearance of 1.6 to 3.2 mm (0.063 to 0.126 in.) between the pipe end and the bottom of the socket recess must be provided and appropriate measurement reference marks made on the piping for the purpose of inspection.

(c) Threaded joints must be—

(1) Free of stress from external loading; and

(2) Seal welded, or sealed by other means which have been tested and proven reliable.

(d) Compression type couplings must meet the requirements of ANSI B31.3.

(e) Care shall be taken to ensure the tightness of all bolted connections. Spring washers or other such devices designed to compensate for the contraction and expansion of bolted connections during operating cycles shall be used where required.

(f) The selection of gasket material shall include the consideration of fire.

§ 193.2317 **Retesting.** After testing required by this subpart is completed on a component to contain a hazardous fluid, the component must be retested whenever—

- (a) Penetration welding other than tie-in welding is performed; or
- (b) The structural integrity of the component is disturbed.

§ 193.2319 **Strength tests.** (a) A strength test must be performed on each piping system and container to determine whether the component is capable of performing its design function, taking into account—

- (1) The maximum allowable working pressure;
- (2) The maximum weight of product which the component may contain or support;

(b) For piping, the test required by paragraph (a) of this section must include a pressure test conducted in accordance with Section 337 of ANSI B31.3, except that test pressures must be based on the design pressure. Carbon and low alloy steel piping must be pressure tested above their nil ductility transition temperature.

(c) All shells and internal parts of heat exchangers to which Section VIII, Division 1, or Division 2 of the ASME Boiler and Pressure Vessel Code, applies must be pressure tested, inspected, and stamped in accordance therewith.

§ 193.2221 **Nondestructive tests.** (a) The following percentages of each day's circumferentially welded pipe joints for hazardous fluid piping, selected at random, must be nondestructively tested over the entire circumference to indicate any defects which could adversely affect the integrity of the weld or pipe:

Weld type	Cyogenic' Other piping	Test method
Butt welds more than 2 inches in normal stress.	100	30 Radiographic or ultrasonic.
Butt welds 2 inches or less in nominal stress.	100	30 Radiographic, ultrasonic, liquid penetrate, or magnetic particle.
Filled and socket welds.	100	30 Liquid penetrant or magnetic particle.

(b) Evaluation of weld tests and repair of defects must be in accordance with the requirements of ANSI B31.3 or API 1104, as applicable.

(c) Where longitudinally or spiral welded pipe is used in transfer systems, 100 percent of the seam weld must be examined by radiographic or ultrasonic inspection.

(d) The butt welds in metal shells of storage tanks with internal design pressure of not more than 15 psig must be radiographically tested in accordance with Section 0.7.6, API 620, Appendix Q, except that for hydraulic load bearing shells with curved surfaces that are subject to cryogenic temperatures, 100 percent of both longitudinal (or meridional) and circumferential or (or latitudinal) welds must be radiographically tested.

(e) The butt welds in metal shells of storage tanks with internal design pressure above 15 psig must be radiographically tested in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, except that for hydraulic load bearing shells with curved surfaces that are subject to cryogenic temperatures, 100 percent of both longitudinal (or meridional) and circumferential (or latitudinal) welds must be radiographically tested.

§ 193.2323 **Leak tests.** (a) Each container and piping system must be initially tested to assure that the component will contain the product for which it is designed without leakage.

(b) Shop fabricated containers and all flammable fluid piping must be leak tested to a minimum of design pressure after installation but before placing it in service.

(c) For a storage tank with vacuum insulation, the inner container, outer shell, and all internal piping must be tested for vacuum leaks in accordance with an appropriate procedure.

§ 193.2326 **Testing control systems.** Each control system must be tested before being placed in service to assure that it has been installed properly and will function as required by this part.

§ 193.2327 **Storage tank tests.** (a) In addition to other applicable requirements of this subpart, storage tanks for cryogenic fluids with internal design pressures of not more than 15 psig must be tested in accordance with Sections Q8 and Q9 of API 620, Appendix Q, as applicable.

(b) Metal storage tanks for cryogenic fluids with internal design pressures above 15 psig must be tested in accordance with the applicable division of Section VIII of the ASME Boiler and Pressure Vessel Code.

(c) Reference measurements must be made with appropriate precise instruments to assure that the tank is gas tight and lateral and vertical movement of the storage tank does not exceed predetermined design tolerances.

§ 193.2329 **Construction records.** For the service life of the component concerned, each operator shall retain appropriate records of the following:

(a) Specifications, procedures, and drawings prepared for compliance with § 193.2305; and

(b) Results of tests, inspections, and the quality assurance program required by this subpart.

### Subpart E—Equipment

§ 193.2401 **Scope.** This subpart prescribes requirements for the design, fabrication, and installation of vaporization equipment, liquifaction equipment, and control systems.

#### Vaporization Equipment

§ 193.2403 **General.** Vaporizers must comply with the requirements of this subpart and the other applicable requirements of this part.

§ 193.2405 **Vaporizer design.** (a) Vaporizers must be designed and fabricated in accordance with applicable provisions of Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.

(b) Each vaporizer must be designed for the maximum allowable working pressure at least equal to the maximum discharge pressure of the pump or pressurized container system supplying it, whichever is greater.

§ 193.2407 **Operational control.** (a) Vaporizers must be equipped with devices which monitor the inlet pressure of the LNG, the outlet temperature, and the pressure of the vaporized gas, and the inlet pressure of the heating medium fluids.

(b) Manifolder vaporizers must be equipped with:

(1) Two inlet valves in series to prevent LNG from entering an idle vaporizer; and

(2) A means to remove LNG or gas which accumulates between the valves.

§ 193.2409 **Shutoff valves.** (a) A shutoff valve must be located on transfer piping supplying LNG to a vaporizer. The shutoff valve must be located at a sufficient distance from the vaporizer to minimize potential for damage from explosion or fire at the vaporizer. If the vaporizer is installed in a building, the shutoff valve must be located outside the building.

(b) A shutoff valve must be located on each outlet of a vaporizer.

(c) For vaporizers designed to use a flammable intermediate fluid, a shutoff valve must be located on the inlet and outlet line of the intermediate fluid piping system where they will be operable during a controllable emergency involving the vaporizer.

§ 193.2411 **Relief devices.** The capacity of pressure relief devices required for vaporizers by § 193.2429 is governed by the following:

(a) For heated vaporizers, the capacity must be at least 110 percent of rated natural gas flow capacity without allowing the pressure to rise more than 10 percent above the vaporizer's maximum allowable working pressure.

(b) For ambient vaporizers, the capacity must be at least 150 percent of rated natural gas flow capacity without allowing the pressure to rise more than 10 percent above the vaporizer's maximum allowable working pressure.

§ 193.2413 **Combustion air intakers.** (a) Combustion air intakes to vaporizers must be equipped with sensing devices to detect the induction of a flammable vapor.

(b) If a heated vaporizer or vaporizer heater is located in a building, the combustion air intake must be located outside the building.

### **Liquefaction Equipment**

§ 193.2415 **General.** Liquefaction equipment must comply with the requirements of this subpart and the other applicable requirements of this part.

§ 193.2417 **Control of incoming gas.** A shutoff valve must be located on piping delivering natural gas to each liquefaction system.

§ 193.2419 **Backflow.**

Each multiple parallel piping system connected to liquefaction equipment must have devices to prevent backflow from causing a hazardous condition.

§ 193.2421 **Cold boxes.** (a) Each cold box in a liquefaction system must be equipped with a means of monitoring or detecting, as appropriate, the concentration of natural gas in the insulation space.

(b) If the insulation space in a cold box is designed to operate with a gas rich atmosphere, additional natural gas must be introduced when the concentration of gas falls to 30 percent.

(c) If the insulation space of a cold box is designed to operate with a gas free atmosphere, additional air or inert gas, as appropriate, must be introduced when the concentration of gas is 25 percent of the lower flammable limit.

§ 193.2423 **Air in gas.** Where incoming gas to liquefaction equipment contains air, each operator shall provide a means of preventing a flammable mixture from occurring under any operating condition.

### **Control Systems**

§ 193.2427 **General.** (a) Control systems must comply with the requirements of this subpart and other applicable requirements of this part.

(b) Each control system must be capable of performing its design function under normal operating conditions.

(c) Control systems must be designed and installed in a manner to permit maintenance, including inspection or testing, in accordance with this part.

(d) Local, remote, and redundant signal lines installed for control systems that can affect the operation of a component that does not fail safe must be routed separately or in separate underground conduits installed in accordance with NFPA-70.

§ 193.2429 **Relief devices.** (a) Each component containing a hazardous fluid must be equipped with a system of automatic relief devices which will release the contained fluid at a rate sufficient to prevent pressure buildup.



tures from exceeding 110 percent of the maximum allowable working pressure. In establishing relief capacity, each operator shall consider trapping of fluid between valves; the maximum rates of boiloff and expansion of fluid which may occur during normal operation, particularly cooldown; and controllable emergencies.

(b) A component in which internal vacuum conditions can occur must be equipped with a system of relief devices or other control system to prevent development in the component of a vacuum that might create a hazardous condition. Introduction of gas into a component must not create a flammable mixture within the component.

(c) In addition to the control system required by paragraphs (a) and (b) of this section—

(1) Each LNG Storage tank must be equipped with relief devices to assure that design pressure and vacuum relief capacity is available during maintenance of the system; and

(2) A manual means must be provided to relieve pressure and vacuum in an emergency.

(d) Relief devices must be installed in a manner to minimize the possibility that release of fluid could—

(1) Cause an emergency; or

(2) Worsen a controllable emergency.

(e) The means for adjusting the setpoint pressure of all adjustable relief devices must be sealed.

(f) Relief devices which are installed to limit minimum or maximum pressure may not be used to handle boiloff and flash gases during normal operation.

**§ 193.2431 Vents.** (a) Hazardous fluids may not be relieved into the atmosphere of a building or other confined space.

(b) Boiloff vents for hazardous fluids may not draw in air during operation.

(c) Venting of natural gas/vapor under operational control which could produce a hazardous gas atmosphere must be directed to a flare stack or heat exchanger in order to raise its temperature to achieve positive buoyancy and safe venting.

**§ 193.2433 Sensing devices.** Each operator shall determine the appropriate location for and install sensing devices as necessary to—

(1) Monitor the operation of components to detect a malfunction which could cause a hazardous condition if permitted to continue; and

(2) Detect the presence of fire or combustible gas in areas determined in accordance with Section 500-4 of NFPA 70 to have a potential for the presence of flammable fluids.

(b) Buildings in which potentially hazardous quantities of flammable fluids are used or handled must be continuously monitored by gas sensing devices set to activate audible and visual alarms in the building and

at the control center when the concentration of the fluid in air is not more than 25 percent of the lower flammable limit.

§ 193.2435 **Warning devices.** Each operator shall install warning devices in the control center to warn of hazardous conditions detected by all sensing devices required by this part. Warnings must be given both audibly and visibly and must be designed to gain the attention of personnel. Warnings must indicate the location and nature of the existing or potential hazard.

§ 193.2437 **Pump and compressor control.** (a) Each pump and compressor for hazardous fluids must be equipped with—

(1) A control system, operable locally and remotely, to shut down the pump or compressor in a controllable emergency;

(2) A signal light at the pump or compressor and the remote control location which indicates whether the pump or compressor is in operation or off;

(3) Adequate valving to ensure that the pump or compressor can be isolated for maintenance; and

(4) A check valve on each discharge line where pumps or compressors operate in parallel.

(b) Pumps or compressors in a cargo transfer system must have shutdown controls at the loading or unloading area and at the pump or compressor site.

§ 193.2439 **Emergency shutdown control systems.** (a) Each transfer system, vaporizer, liquefaction system, and storage system tank must be equipped with an emergency shutdown control system. The control must automatically actuate the shutdown of the component (providing pressure relief as necessary) when any of the following occurs:

(1) Temperatures of the component exceed the limits determined under § 193.2105;

(2) Pressure outside the limits of the maximum and minimum design pressure;

(3) Liquid in receiving vessel reaches the design maximum liquid level;

(4) Gas concentrations in the area of the component exceed 40 percent of the lower flammable limit;

(5) A sudden excessive pressure change or other condition indicating a potentially dangerous condition; and

(6) Presence of fire in area of component.

(b) For cargo transfer systems where all transfer operations are continuously manned and visually supervised by qualified personnel, actuation of the emergency shutdown control system may be manual after devices warn of the events listed in paragraph (a) of this section.

(c) Except for components that operate unattended and are remote from the control center, a reasonable delay may be programmed in Register, December, 1982, No. 324

emergency shutdown control systems required by this section between warning and automated shutdown to provide for manual response.

(d) Each LNG plant must have a shutdown control system to shut down all operations of the plant safely. The system must be operable at—

(1) The control center; and

(2) In the case of a plant where LNG facilities other than the control center are designed to operate unattended at the site of these facilities.

§ 193.2441 Control center. Each LNG plant must have a control center from which operations and warning devices are monitored as required by this part. A control center must have the following capabilities and characteristics—

(a) It must be located apart or protected from other LNG facilities so that it is operational during a controllable emergency.

(b) Each remotely actuated control system and each automatic shutdown control system required by this part must be operable from the control center.

(c) Each control center must have personnel in continuous attendance while any of the components under its control are in operation, unless the control is being performed from another control center which has personnel in continuous attendance.

(d) If more than one control center is located at an LNG Plant, each control center must have more than one means of communication with each other center.

(e) Each control center must have a means of communicating a warning of hazardous conditions to other locations within the plant frequented by personnel.

§ 193.2443 Full-safe control. Control systems for components must have a fail-safe design. A safe condition must be maintained until personnel take appropriate action either to reactivate the component served or to prevent a hazard from occurring.

§ 193.2445 Sources of power. (a) Electrical control systems, means of communication, emergency lighting, and firefighting systems must have at least two sources of power which function so that failure of one source does not affect the capability of the other source.

(b) Where auxiliary generators are used as a second source of electrical power—

(1) They must be located apart or protected from components so that they are not unusable during a controllable emergency; and

(2) Fuel supply must be protected from hazards.

### Subpart F—Operations

§ 193.2501 Scope. This subpart prescribes requirements for the operation of LNG facilities.

§ 193.2503 **Operating procedures.** Each operator shall follow one or more manuals of written procedures to provide safety in normal operation and in responding to an abnormal operation that would affect safety. The procedures must include provisions for—

(a) Monitoring components or buildings according to the requirements of § 193.2507.

(b) Startup and shutdown, including for initial startup, performance testing to demonstrate that components will operate satisfactory in service.

(c) Recognizing abnormal operating conditions.

(d) Purging and inerting components according to the requirements of § 193.2517.

(e) In the case of vaporization, maintaining the vaporization rate, temperature and pressure so that the resultant gas is within limits established for the vaporizer and the downstream piping;

(f) In the case of liquefactions, maintaining temperatures, pressures, pressured differentials and flow rates as applicable, within their design limits for:

(1) Boilers;

(2) Turbines and other prime movers;

(3) Pumps, compressors, and expanders;

(4) Purification and regeneration equipment, and

(5) Equipment within cold boxes.

(g) Cooldown of components according to the requirements of § 193.2505; and

(h) Compliance with § 193.2005 (b).

§ 193.2505 **Cooldown.** (a) The cooldown of each system of components that is subjected to cryogenic temperatures must be limited to a rate and distribution pattern that keeps thermal stresses within design limits during the cooldown period, paying particular attention to the performance of expansion and contraction devices.

(b) After cooldown stabilization is reached, cryogenic piping systems must be checked for leaks in areas of flanges, valves, and seals.

§ 193.2507 **Monitoring operations.** Each component in operation or building determined under § 193.2005 (a) (2) in which a hazard to persons or property could exist must be monitored to detect fire or any malfunctions or flammable fluid which could cause a hazardous condition. Monitoring must be accomplished by watching or listening from an attended control center for warning alarms, such as gas, temperature, pressure, vacuum, and flow alarms, or by conducting an inspection or test at intervals specified in the operating procedures.

§ 193.2509 **Emergency procedures.** (a) Each operator shall determine the types and places of emergencies other than fires that may reasonably be expected to occur at an LNG plant due to operating malfunction. Register, December, 1982, No. 324

tions, structural collapse, personnel error, forces of nature, and activities adjacent to the plant.

(b) To adequately handle each type of emergency identified under paragraph (a) of this section and each fire emergency identified under § 193.2817 (a), each operator shall follow one or more manuals of written procedures. The procedures must provide for the following:

(1) Responding to controllable emergencies, including notifying personnel and using equipment appropriate for handling the emergency.

(2) Recognizing an uncontrollable emergency and taking action to minimize harm to the public and personnel, including prompt notification of appropriate local officials of the emergency and possible need for evacuation of the public in the vicinity of the LNG plant.

(3) Coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank.

(4) Cooperating with appropriate local officials in evacuations and emergencies requiring mutual assistance and keeping these officials advised of—

(i) The LNG plant fire control equipment, its location, and quantity of units located throughout the plant;

(ii) Potential hazards at the plant, including fires:

(iii) Communication and emergency control capabilities at the LNG plant and

(iv) The status of each emergency.

§ 193.2511 **Personnel safety.** (a) Each operator shall provide any special protective clothing and equipment necessary for the safety of personnel while they are performing emergency response duties.

(b) All personnel who are normally on duty at a fixed location, such as a building or yard, where they could be harmed by thermal radiation from a burning pool of impounded liquid, must be provided a means of protection at that location from the harmful effects of thermal radiation or a means of escape.

(c) Each LNG plant must be equipped with suitable first-aid material, the location of which is clearly marked and readily available to personnel.

§ 193.2513 **Transfer procedures.** (a) Each transfer of LNG or other hazardous fluid must be conducted in accordance with one or more manuals of written procedures to provide for safe transfers.

(b) The transfer procedures must include provisions for personnel to:

(1) Before transfer, verify that the transfer system is ready for use, with connections and controls in proper positions, including if the system could contain a combustible mixture, verifying that it has been adequately purged in accordance with a procedure which meets the requirements of AGA. "Purging Principles and Practice."

(2) Before transfer, verify that each receiving container or tank vehicle does not contain any substance that would be incompatible with the incoming fluid and that there is sufficient capacity available to receive the amount of fluid to be transferred;

(3) Before transfer, verify the maximum filling volume of each receiving container or tank vehicle to ensure that expansion of the incoming fluid due to warming will not result in overfilling or overpressure;

(4) When making bulk transfer of LNG into a partially filled (excluding cooldown heel) container, determine any differences in temperature or specific gravity between the LNG being transferred and the LNG already in the container and, if necessary, provide a means to prevent rollover due to stratification.

(5) Verify that the transfer operations are proceeding within design conditions and that overpressure or overfilling does not occur by monitoring applicable flow rates, liquid levels, and vapor returns.

(6) Manually terminate the flow before overfilling or overpressure occurs; and

(7) Deactivate cargo transfer systems in a safe manner by depressurizing, venting, and disconnecting lines and conducting any other appropriate operations.

(c) In addition to the requirements of paragraph (b) of this section, the procedures for cargo transfer must be located at the transfer area and include provisions for personnel to:

(1) Be in constant attendance during all cargo transfer operations;

(2) Prohibit the backing of tank trucks in the transfer area, except when a person is positioned at the rear of the truck giving instructions to the driver;

(3) Before transfer, verify that—

(i) Each tank car or tank truck complies with applicable regulations governing its use;

(ii) All transfer hoses have been visually inspected for damage and defects;

(iii) Each tank truck is properly immobilized with chock wheels, and electrically grounded; and

(iv) Each tank truck engine is shut off unless it is required for transfer operations;

(4) Prevent a tank truck engine that is off during transfer operations from being restarted until the transfer lines have been disconnected and any released vapors have dissipated;

(5) Prevent loading LNG into a tank car or tank truck that is not in exclusive LNG service or that does not contain a positive pressure if it is in exclusive LNG service, until after the oxygen content in the tank is tested and if it exceeds 2 percent by volume, purged in accordance with a procedure that meets the requirements of AGA "Purging Principles and Practice."

(6) Verify that all transfer lines have been disconnected and equipment cleared before the tank car or tank truck is moved from the transfer position; and

(7) Verify that transfers into a pipeline system will not exceed the pressure or temperature limits of the system.

**§ 193.2515 Investigations of failures.** (a) Each operator shall investigate the cause of each explosion, fire, or LNG spill or leak which results in—

(1) Death or injury requiring hospitalization; or

(2) Property damage exceeding \$10,000.

(b) As a result of the investigation, appropriate action must be taken to minimize reoccurrence of the incident.

(c) If the Director or relevant state agency under section 5 of the Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 1674) investigates an incident, the operator involved shall make available all relevant information and provide reasonable assistance in conducting the investigation. Unless necessary to restore or maintain service, or for safety, no component involved in the incident may be moved from its location or otherwise altered until the investigation is complete or the investigating agency otherwise provides. Where components must be moved for operational or safety reasons, they must not be removed from the plant site and must be maintained intact to the extent practicable until the investigation is complete or the investigating agency otherwise provides.

**§ 193.2517 Purging.** When necessary for safety, components that could accumulate significant amounts of combustible mixtures must be purged in accordance with a procedure which meets the provisions of the AGA "Purging Principles and Practice" after being taken out of service and before being returned to service.

**§ 193.2519 Communication systems.** (a) Each LNG plant must have a primary communication system that provides for verbal communications between all operating personnel at their work stations in the LNG plant.

(b) Each LNG plant in excess of 70,000 gallons storage capacity must have an emergency communication system that provides for verbal communications between all persons and locations necessary for the orderly shutdown of operating equipment and the operation of safety equipment in time of emergency. The emergency communication system must be independent of and physically separated from the primary communication system and the security communication system under § 193.2909.

(c) Each communication system required by this part must have an auxiliary source of power, except sound-powered equipment.

**§ 193.2521 Operating records.** Each operator shall maintain a record of the results of each inspection, test, and investigation required by this subpart. Such records must be kept for a period of not less than 5 years.

### Subpart G—Maintenance

§ 193.2601 **Scope.** This subpart prescribes requirements for maintaining components at LNG plants.

§ 193.2603 **General.** (a) Each component in service, including its support system, must be maintained in a condition that is compatible with its operational or safety purpose by repair, replacement, or other means.

(b) An operator may not place, return, or continue in service any component which is not maintained in accordance with this subpart.

(c) Each component taken out of service must be identified in the records kept under § 193.2639.

(d) If a safety device is taken out of service for maintenance, the component being served by the device must be taken out of service unless the same safety function is provided by an alternate means.

(e) If the inadvertent operations of a component taken out of service could cause a hazardous condition, that component must have a tag attached to the controls bearing the words "do not operate" or words of comparable meaning.

§ 193.2606 **Maintenance procedures.** Each operator shall determine and perform, consistent with generally accepted engineering practice, the periodic inspections or tests needed to meet the applicable requirements of this subpart and to verify that components meet the maintenance standards prescribed by this subpart.

(b) Each operator shall follow one or more manuals of written procedures for the maintenance of each component, including any required corrosion control. The procedures must include—

(1) The details of the inspections or tests determined under paragraph (a) of this section and their frequency of performance; and

(2) A description of other actions necessary to maintain the LNG plant in accordance with the requirements of this subpart and § 193.2805.

§ 193.2607 **Foreign material.** (a) The presence of foreign material, contaminants, or ice shall be avoided or controlled to maintain the operational safety of each component.

(b) LNG plant grounds must be free from rubbish, debris, and other material which present a fire hazard. Grass areas on the LNG plant grounds must be maintained in a manner that does not present a fire hazard.

§ 193.2609 **Support systems.** Each support system or foundation of each component must be inspected for any detrimental change that could impair support.

§ 193.2611 **Fire protection.** (a) Maintenance activities on fire control equipment must be scheduled so that a minimum of equipment is taken out of service at any one time and is returned to service in a reasonable period of time.



(b) Access routes for movement of fire control equipment within each LNG plant must be maintained to reasonably provide for use in all weather conditions.

§ 193.2613 **Auxiliary power sources.** Each auxiliary power source must be tested monthly to check its operational capability and tested annually for capacity. The capacity test must take into account the power needed to start up and simultaneously operate equipment that would have to be served by that power source in an emergency.

§ 193.2615 **Isolating and purging.** (a) Before personnel begin maintenance activities on components handling flammable fluids which are isolated for maintenance, the component must be purged in accordance with a procedure which meets the requirements of AGA "Purging Principles and Practices," unless the maintenance procedures under § 193.2605 provide that the activity can be safely performed without purging.

(b) If the component or maintenance activity provides an ignition source, a technique in addition to isolation valves (such as removing spool pieces or valves and blank flanging the piping, or double block and bleed valving) must be used to ensure that the work area is free of flammable fluids.

§ 193.2617 **Repairs.** (a) Repair work on components must be performed and tested in a manner which—

(1) As far as practicable, complies with the applicable requirements of Subpart D of this part; and

(2) Assures the integrity and operational safety of the component being repaired.

(b) For repairs made while a component is operating, each operator shall include in the maintenance procedures under § 193.2605 appropriate precautions to maintain the safety of personnel and property during repair activities.

§ 193.2619 **Control systems.** (a) Each control system must be properly adjusted to operate within design limits.

(b) If a control system is out of service for 30 days or more, it must be inspected and tested for operational capability before returning it to service.

(c) Control systems in service, but not normally in operation (such as relief valves and automatic shutdown devices), must be inspected and tested once each calendar year, but with intervals not exceeding 15 months, with the following exceptions:

(1) Control systems used seasonally, such as for liquefaction or vaporization, must be inspected and tested before use each season.

(2) Control systems that are intended for fire protection must be inspected and tested at regular intervals not to exceed 6 months.

(d) Control systems that are normally in operation, such as required by a base load system, must be inspected and tested once each calendar year but with intervals not exceeding 15 months.

(e) Relief valves must be inspected and tested for verification of the valve seat lifting pressure and reseating.

**§ 193.2621 Testing transfer hoses.** Hoses used in LNG or flammable refrigerant transfer systems must be—

(a) Tested more each calendar year, but with intervals not exceeding 15 months, to the maximum pump pressure or relief valve setting; and

(b) Visually inspected for damage or defects before each use.

**§ 193.2623 Inspecting LNG storage tanks.** Each LNG storage tank must be inspected or tested to verify that each of the following conditions does not impair the structural integrity or safety of the tank:

(a) Foundation and tank movement during normal operation and after a major meteorological or geophysical disturbance.

(b) Inner tank leakage.

(c) Effectiveness of insulation.

(d) Frost heave.

**§ 193.2625 Corrosion protection.** (a) Each operator shall determine which metallic components could unless corrosion is controlled, have their integrity or reliability adversely affected by external, internal, or atmospheric corrosion during their intended service life.

(b) Components whose integrity or reliability could be adversely affected by corrosion must be either—

(1) Protected from corrosion in accordance with §§ 193.2627 thru 193.2635, as applicable; or

(2) Inspected and replaced under a program of scheduled maintenance in accordance with procedures established under § 193.2605.

**§ 193.2627 Atmospheric corrosion control.** Each exposed component that is subject to atmospheric corrosive attack must be protected from atmospheric corrosion by—

(a) Material that has been designed and selected to resist the corrosive atmosphere involved; or

(b) Suitable coating or jacketing.

**§ 193.2629 External corrosion control; buried or submerged components.** (a) Each buried or submerged component that is subject to external corrosive attack must be protected from external corrosion by—

(1) Material that has been designed and selected to resist the corrosive environment involved; or

(2) The following means:

(i) An external protective coating designed and installed to prevent corrosion attack and to meet the requirements of § 192.461 of this chapter; and

(ii) A cathodic protection system designed to protect components in their entirety in accordance with the requirements of § 192.463 of this chapter and placed in operation before October 23, 1981, or, within 1 year after the component is constructed or installed, whichever is earlier.

(b) Where cathodic protection is applied, components that are electrically interconnected must be protected as a unit.

**§ 193.2631 Internal corrosion control.** Each component that is subject to internal corrosive attack must be protected from internal corrosion by—

(a) Material that has been designed and selected to resist the corrosive fluid involved; or

(b) Suitable coating, inhibitor, or other means.

**§ 193.2633 Interference currents.** (a) Each component that is subject to electrical current interference must be protected by a continuing program to minimize the detrimental effects of currents.

(b) Each cathodic protection system must be designed and installed so as to minimize any adverse effects it might cause to adjacent metal components.

(c) Each impressed current power source must be installed and maintained to prevent adverse interference with communications and control systems.

**§ 193.2635 Monitoring corrosion control.** Corrosion protection provided as required by this subpart must be periodically monitored to give early recognition of ineffective corrosion protection, including the following, as applicable:

(a) Each buried or submerged component under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of § 192.463 of this Chapter.

(b) Each cathodic protection rectifier or other impressed current power source must be inspected at least 6 times each calendar year, but with intervals not exceeding 2½ months, to ensure that it is operating properly.

(c) Each reverse current switch, each diode, and each interference bond whose failure would jeopardize component protection must be electrically checked for proper performance at least 6 times each calendar year, but with intervals not exceeding 2½ months. Each other interference bond must be checked at least once each calendar year, but with intervals not exceeding 15 months.

(d) Each component that is protected from atmospheric corrosion must be inspected at intervals not exceeding 3 years.

(e) If a component is protected from internal corrosion, monitoring devices designed to detect internal corrosion, such as coupons or probes, must be located where corrosion is most likely to occur. However, monitoring is not required for corrosion resistant materials if the operator can demonstrate that the component will not be adversely affected by

internal corrosion during its service life. Internal corrosion control monitoring devices must be checked at least two times each calendar year but with intervals not exceeding 7½ months.

§ 193.2637 **Remedial measures.** Prompt corrective or remedial action must be taken whenever an operator learns by inspection or otherwise that atmospheric, external, or internal corrosion is not controlled as required by this subpart.

§ 193.2639 **Maintenance records.** (a) Each operator shall keep a record at each LNG plant of the data and type of each maintenance activity performed on each component to meet the requirements of this subpart, including periodic tests and inspections, for a period of not less than five years.

(b) Each operator shall maintain records or maps to show the location of cathodically protected components, neighboring structures bonded to the cathodic protection system, and corrosion protection equipment.

(c) Each of the following records must be retained for as long as the LNG facility remains in service:

- (1) Each record or map required by paragraph (b) of this section.
- (2) Records of each test, survey, or inspection required by this subpart in sufficient detail to demonstrate the adequacy of corrosion control measures.

### **Subpart I—Fire Protection**

§ 193.2801 **Scope.** This subpart prescribes requirements for fire prevention and fire control at LNG plants other than waterfront LNG plants.

§ 193.2803 **General.** Each operator shall use sound fire protection engineering principles to minimize the occurrence and consequences of fire.

§ 193.2805 **Fire prevention plan.** (a) Each operator shall determine—

(1) Those potential sources of ignition located inside and adjacent to the LNG plant which could cause fires that affect the safety of the plant; and

(2) These areas, as described in Section 500—4 of MFPA-70, where the potential exists for the presence of flammable fluids in an LNG plant. Determinations made under this paragraph must be kept current.

(b) With respect to areas determined under paragraph (a) (2) of this section, each operator shall include in the operating and maintenance procedures under § 193.2603 and § 193.2605, as appropriate, steps necessary to minimize—

- (1) The leakage or release of flammable fluids; and
- (2) The possibility of flammable fluids being ignited by sources identified under paragraph (a) (1) of this section.

§ 193.2907 **Smoking.** (a) (1) Smoking is prohibited at an LNG plant in areas identified under § 193.2805 (a) (2).

(2) Smoking is permitted only in such locations that the operator designates as a smoking area.

(b) Signs marked with the words "smoking permitted" must be displayed in prominent places in each smoking area designated under paragraph (a) of this section.

(c) Signs marked with the words "NO SMOKING" must be displayed in prominent places in areas where smoking is prohibited.

§ 193.2809 **Open fires.** (a) No open fires are permitted at an LNG plant, except at flare stacks and at times and places designated by the operator.

(b) Whenever an open fire is designated, there must be at the site of the fire—

(1) Trained fire fighting personnel; and

(2) Fire control equipment which has the capability of extinguishing the fire.

(c) The fire fighting personnel and equipment must remain at the fire site until the fire is extinguished and there is no possibility of reignition.

§ 193.2811 **Hotwork, Welding, flame cutting, and similar operations** are prohibited, except at times and places that the operator designates in writing as safe and when constantly supervised in accordance with NFPA-51B.

§ 193.2813 **Storage of flammable fluids.** Flammable fluids may not be stored in areas where ignition sources are present, unless stored in accordance with the requirements of Chapter 4 of NFPA 30.

§ 193.2815 **Motorized equipment.** Use of motor vehicles and other motorized equipment which constitute potential ignition sources is prohibited in an impounding space, in areas within 15 m (49.2 ft) of a storage tank, and in areas within 15 m (49.2 ft) of processing equipment containing a flammable fluid except—

(a) At times the operator designates in writing as safe; and

(b) When the motorized equipment is constantly attended.

§ 193.2817 **Fire equipment.** (a) Each operator shall determine; (1) the types and sizes of fires that may reasonably be expected to occur within and adjacent to each LNG plant that could affect the safety of components; and (2) The foreseeable consequences of these fires, including the failure of components or buildings due to heat exposure.

(b) Each operator shall provide and maintain fire control equipment and supplies in accordance with the applicable requirements of NFPA 59A to protect or cool components that could fail due to heat exposure from fires determined under paragraph (a) of this section and either worsen an emergency or endanger persons or property located outside the plant. Protection or cooling must be provided for as long as the heat exposure exists. The fire control equipment and supplies must include the following;

(1) Portable fire extinguishers suitable for types of fires identified under paragraph (a) of this section; and

(2) If the total inventory of LNG is 265 m<sup>3</sup> (70,000 gal.) or more, a water supply and associated delivery system.

(c) Each operator shall determine the type, size, quantity and location of the fire control equipment and supplies required under paragraph (b) of this section.

(d) Each operator shall provide each facility person who may be endangered by exposure to fire or the products of combustion in performing fire control duties protective clothing and equipment, including, if necessary, a self-contained breathing apparatus.

(e) Portable fire control equipment protective clothing and equipment for personnel use controls for fixed fire control equipment, and fire control supplies must be conspicuously located, marked for easy recognition, and readily available for use.

(f) Fire control equipment must have operating instructions. Instructions must be attached to portable equipment and placed at the location of controls for fixed equipment.

§ 193.2819 Gas detection. (a) All areas determined under § 193.2805 (a) (2) in which a hazard to persons or property could exist must be continuously monitored for the presence of flammable gases and vapors with fixed flammable gas detection systems provided and maintained according to the applicable requirements of NFPA 59A.

(b) Each fixed flammable gas detection system must be provided with audible and visible alarms located at an attended control room or control station, and an audible alarm in the area of gas detection.

(c) Flammable gas detection alarms must be set to activate at not more than 25 percent of the lower flammable limit of the gas or vapor being monitored.

(d) Gas detection systems must be installed as that they can be readily tested as required by NFPA 59A.

(e) A minimum of two portable flammable gas detectors capable of measuring the lower flammable limit must be available at the LNG plant for use at all times.

(f) All enclosed buildings located on an LNG plant must be continuously monitored for the presence of flammable gases and vapors with a fixed flammable gas detection system that provides a visible or audible alarm outside the enclosed building. The systems must be provided and maintained according to the applicable requirements of NFPA 59A.

§ 193.2821 Fire detection. (a) Fire detectors that continuously monitor for the presence of either flame, heat, or products of combustion must be provided in all areas determined under § 193.2805 (a) (2) in which a hazard to persons or property could exist and in all other areas that are used for the storage of flammable or combustible material.

(b) Each fire detection systems must be provided with audible and visible alarms located at an attended control room or central station, and an audible alarm in the area of fire detection. The systems must be

Register, December, 1982, No. 324

provided and maintained according to the applicable requirements of NFPA 69A.

### Subpart J—Security

§ 193.2901 **Scope.** This subpart prescribes requirements for security at LNG plants other than waterfront LNG plants.

§ 193.2903 **Security procedures.** Each operator shall prepare and follow one or more manuals of written procedures to provide security for each LNG plant. The procedures must be available at the plant in accordance with § 193.2017 and include at least;

(a) A description and schedule of security inspections and patrols performed in accordance with § 193.2913;

(b) A list of security personnel positions or responsibilities utilized at the LNG plant;

(c) A brief description of the duties associated with each security personnel position or responsibility;

(d) Instructions for actions to be taken, including notification of other appropriate plant personnel and law enforcement officials, where there is any indication of an actual or attempted breach of security;

(e) Methods for determining which persons are allowed access to the LNG plant.

(f) Positive identifications of all persons entering the plant and on the plant, including methods at least as effective as picture badges; and

(g) Liaison with local law enforcement officials to keep them informed about current security procedures under this section.

§ 193.2905 **Protective enclosures.** (a) The following facilities must be surrounded by a protective enclosure:

- (1) Storage tanks;
- (2) Impounding systems;
- (3) Vapor barriers;
- (4) Cargo transfer systems;
- (5) Process, liquefaction, and vaporization equipment;
- (6) Control rooms and stations;
- (7) Control systems;
- (8) Fire control equipment;
- (9) Security communications systems; and
- (10) Alternative power sources.

The protective enclosure may be one or more separate enclosures surrounding a single facility or multiple facilities.

(b) Ground elevations outside a protective enclosure must be graded in a manner that does not impair the effectiveness of the enclosure.

(c) Protective enclosures may not be located near features outside of the facility, such as trees, poles, or buildings, which could be used to breach the security.

(d) At least two accesses must be provided in each protective enclosure and be located to minimize the escape distance in the event of emergency.

(e) Each access must be locked unless it is continuously guarded. During normal operations, an access may be unlocked only by persons designated in writing by the operator. During an emergency, a means must be readily available to all facility personnel within the protective enclosure to open each access.

**§ 193.2907 Protective enclosure construction.** (a) Each protective enclosure must have sufficient strength and configuration to obstruct unauthorized access to the facilities enclosed.

(b) Protective enclosures must be fences or walls constructed as follows:

(1) Fences must be chainlink security fences constructed of No. 11 American wire gauge or heavier metal wire.

(2) Walls must be vertical and constructed of stone, brick, cinder block, concrete, steel or comparable materials.

(3) Protective enclosures must be topped by three or more strands of barbed wire or similar materials on brackets angled outward between 30" and 45" from the vertical, with a height of at least 2.4m (8 ft.) including approximately one foot of barbed topping.

(4) Openings in or under protective enclosures must be secured by grates, doors or covers of construction and fastening of sufficient strength such that the integrity of the protective enclosure is not reduced by any opening.

(c) Paragraphs (b) (1) thru (b) (3) of the section do not apply to protective enclosures constructed before October 23, 1980.

(1) Are made of noncombustible materials:

(2) Are at least 2.1m (7 ft.) in height including approximately one foot of barbed or similar topping; and

(3) Have served to protect the LNG plant without having been breached during their history of service.

**§ 193.2909 Security communications.** A means must be provided for: (a) Prompt communications between personnel having supervisory security duties and law enforcement officials; and

(b) Direct communications between all on-duty personnel having security duties and all control rooms and control stations.

**§ 193.2911 Security lighting.** Where security warning systems are not provided for security monitoring under § 193.2913, the area around the facilities listed under § 193.2905 (a) and each protective enclosure must be illuminated with a minimum in service lighting intensity of not less than 2.2 lux (0.2 ft.) between sunset and sunrise.



§ 193.2913 **Security monitoring.** Each protective enclosure and the area around each facility listed in § 193.2905 (a) must be monitored for the presence of unauthorized persons. Monitoring must be by visual observation in accordance with the schedule in the security procedures under § 193.2903 (a) or by security warning systems that continuously transmit data to an attended location. At an LNG plant with less than 40,000 m<sup>3</sup> (250,000 bbl) of storage capacity, only the protective enclosure must be monitored.

§ 193.2915 **Alternative power sources.** An alternative source of power that meets the requirements of § 193.2445 must be provided for security lighting and security monitoring and warning systems required under §§ 193.2911 and 193.2913.

§ 193.2917 **Warning signs.** (a) Warning signs must be conspicuously placed along each protective enclosure at intervals so that at least one sign is recognizable at night from a distance of 39m (100 ft.) from any way that could reasonably be used to approach the enclosure.

(b) Signs must be marked with at least the following on a background of sharply contrasting color:

The words "NO TRESPASSING," or words of comparable meaning.

### **Subpart H—Personnel Qualification and Training**

§ 193.2701 **Scope.** This subpart prescribes requirements for personnel qualifications and training.

§ 193.2703 **Design and fabrication.** For the design and fabrication of components, each operator shall use—

(a) With respect to design, persons who have demonstrated competence by training or experience in the design of comparable components.

(b) With respect to fabrication, persons who have demonstrated competence by training or experience in the fabrication of comparable components.

§ 193.2705 **Construction, Installation, Inspection, and testing.** (a) Supervisors and other personnel utilized for construction, installation, inspection, or testing must have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments.

(b) Each operator must periodically determine whether inspectors performing duties under § 193.2307 are satisfactorily performing their assigned function.

§ 193.2707 **Operations and maintenance.** (a) Each operator shall utilize for operation or maintenance of components only those personnel who have demonstrated their capability to perform their assigned functions by—

(1) Successful completion of the training required by §§ 193.2713 and 193.2717; and

(2) Experience related to the assigned operation or maintenance function; and

(3) Acceptable performance on a proficiency test relevant to the assigned function.

(b) A person who does not meet the requirements of paragraph (a) of this section may operate or maintain a component when accompanied and directed by an individual who meets the requirements.

(c) Corrosion control procedures under § 193.2605 (b), including those for the design, installation, operation, and maintenance of cathodic protection systems, must be carried out by, or under the direction of a person qualified by experience and training in corrosion control technology.

§ 193.2709 **Security.** Personnel having security duties must be qualified to perform their assigned duties by successful completion of the training required under § 193.2715.

§ 193.2711 **Personnel health.** Each operator shall follow a written plan to verify that personnel assigned operating, maintenance, security, or fire protection duties at the LNG plant do not have any physical condition that would impair performance of their assigned duties. The plan must be designed to detect both readily observable disorders, such as physical handicaps or injury, and conditions requiring professional examination for discovery.

§ 193.2713 **Training; operations and maintenance.** (a) Each operator shall provide and implement a written plan of initial training to instruct—

(1) All permanent maintenance, operating, and supervisory personnel—

(i) About the characteristics and hazards of LNG and other flammable fluids used or handled at the facility, including, with regard to LNG, low temperatures, flammability of mixtures with air, odorless vapor, boiloff characteristics, and reaction to water and water spray;

(ii) About the potential hazards involved in operating and maintenance activities; and

(iii) To carry out aspects of the operating and maintenance procedures under §§ 193.2503 and 193.2605 that relate to their assigned functions; and

(2) All personnel—

(i) To carry out the emergency procedures under § 193.2509 that relate to their assigned functions; and

(ii) To give first-aid; and

(3) All operating and appropriate supervisory personnel—

(i) To understand detailed instruction on the facility operations, including controls, functions, and operating procedures; and

(ii) To understand the LNG transfer procedures provided under § 193.2513.

(b) A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel current on the knowledge and skills they gained in the program of initial instruction.

**§ 193.2715 Training; security.** (a) Personnel responsible for security at an LNG plant must be trained in accordance with a written plan of initial instruction to:

- (1) Recognize breaches of security;
- (2) Carry out the security procedures under § 193.2903 that relate to their assigned duties;
- (3) Be familiar with basic plant operations and emergency procedures, as necessary to effectively perform their assigned duties; and
- (4) Recognize conditions where security assistance is needed.

(b) A written plan of continuing instruction must be conducted at intervals of not more than two years to keep all personnel having security duties current on the knowledge and skills they gained in the program of initial instruction.

**§ 193.2717 Training; fire protection.** (a) All personnel involved in maintenance and operations of an LNG plant, including their immediate supervisors, must be trained in accordance with a written plan of initial instruction, including plant fire drills, to:

- (1) Know and follow the fire prevention procedures under § 193.2805 (b);
- (2) Know the potential causes and areas of fire determined under § 193.2805 (a);
- (3) Know the types, sizes, and predictable consequences of fire determined under § 193.2817 (a); and
- (4) Know and be able to perform their assigned fire control duties according to the procedures established under § 193.2509 and by proper use of equipment provided under § 193.2817.

(b) A written plan of continuing instruction, including plant fire drills, must be conducted at intervals of not more than two years to keep personnel current on the knowledge and skills they gained in the instruction under paragraph (a) of the section.

**§ 193.2719 Training; records.** (a) Each operator shall maintain a system of records which—

- (1) Provide evidence that the training programs required by this subpart have been implemented; and
- (2) Provide evidence that personnel have undergone and satisfactorily completed the required training programs.

(b) Records must be maintained for one year after personnel are no longer assigned duties at the LNG plant.

## **Appendix A to Part 193—Incorporation by Reference**

### *1. List of Organizations and Addresses*

Register, December, 1982, No. 324

A. American Concrete Institute (ACI), P.O. Box 19150, Redford Station, Detroit, Michigan 48219.

B. American Gas Association (AGA), 1515 Wilson Boulevard, Arlington, Virginia 22209.

C. American National Standards Institute (ANSI), 1430 Broadway, New York, New York 10018.

D. American Petroleum Institute (API), 2101 L. Street, NW., Washington, D.C. 20037.

E. American Society of Mechanical Engineers (ASME), United Engineering Center, 345 East 47th Street, New York, New York 10017.

F. National Fire Protection Association (NFPA), 470 Atlantic Avenue, Boston, Massachusetts 02210.

G. International Conference of Building Officials, 5360 South Workman Hill Road, Whittier, California 90601.

## *II. Documents Incorporated by Reference*

### A. American Concrete Institute (ACI)

1. ACI Standard 311-75—Recommended Practice for Concrete Inspection, (1975 edition).

### B. American Gas Association (AGA)

1. Evaluation of LNG Vapor control Methods. (October 1974 edition).

2. Purgig Principles and Practice (1975 edition).

### C. American National Standards Institute (ANSI)

1. ANSI A 58.1 Building Code Requirements for Minimum Design Loads in Buildings and Other Structures.

### D. American Petroleum Institute (API)

1. API 620—Recommended Rules for Design and Construction of Large, Welded, Low Pressure Storage Tanks (6th edition, Dec. 1978)

2. API 1104 Standard for Welding Pipelines and Related Facilities (15th edition, 1980)

3. API 6D Specifications for Pipeline Valves (17 edition, 1977).

### E. American Society of Mechanical Engineers (ASME)

1. ANSI B31.32 Chemical and Plant Petroleum Refinery Piping (1976 edition).

2. ASME Boiler and Pressure Vessel Code, Section 1 Power Boilers (1977 edition).

3. ASME Boiler and Pressure Vessel Code, Section 8 Division 1 (1977 edition).

4. ASME Boiler and Pressure Vessel Code, Section 8 Division 2, Alternative Rules (1977 edition).

5. ASME Boiler and Pressure Vessel Code, Section 9 Welding and Brazing Qualifications (1977 edition).

6. ASME Boiler and Pressure Vessel Code, Section 4 Heating Boilers.

7. ANSI B31.5 Refrigeration Piping (1974 edition).

8. ANSI B31.8 Gas Transmission and Distribution Piping Systems (1975 edition).

F. International Conference of Building Officials

1. UBC, Uniform Building Code (1979 edition).

G. National Fire Protection Association (NFPA)

1. NFPA No. 37 Stationary Combustion Engine and Gas Turbines (1979 edition).

2. NFPA No. 59A. Storage and Handling of LNG (1972 edition for § 193.2005 (c), otherwise 1979 edition).

3. NFPA No. 70 National Electric Code (1978 edition).

4. NFPA No. 30. Flammable Liquids (1981 edition).

5. NFPA No. 51 B. Cutting and Welding Processes (1977 edition).

**History:** Cr. Register, May, 1972, No. 197, eff. 6-1-72; cr. 192.12, 192.379, appendix A-II F 4; am. 192.201 (a), 192.625 (g) (1), 192.717 (b), 192.727, Register, February, 1973, No. 206, eff. 3-1-73; am. PSC 192.457 (d), PSC 192.613 (c) (1), Register, June, 1974, No. 222, eff. 7-1-74; am. 192.3, 192.55 (a) (2) and (b) (2), 192.65, 192.197 (a), 192.625 (g) (1), appendix A-I, B, and II A, 1., 2., 3., and 5., appendix B, I, cr. appendix B, III, Register, December, 1974, No. 228, eff. 1-1-75; am. 192.59 (a) (1), (b) (1) and cr. (c), am. 192.65 (a), 192.225 (a), 192.227 (a) (2), 192.229 (c), 192.241 (c), 192.625 (a) and (b), 192.625 (g) (1), 192.705 (a) and (b), r. 192.705 (c), cr. 192.706, am. 192.707, appendix A II and appendix B I, Register, March, 1976, No. 243, eff. 4-1-76; revised, Register, April, 1977, No. 256, eff. 5-1-77; am. 192.13 (2), 192.313 (a) (4), 192.455 (f), 192.619 (a) (2) (ii), 192.707 (d) (1) and (e) (2) (i), cr. 192.14, 192.462 and 192.455 (f), Register, May, 1978, No. 269, eff. 6-1-78; cr. 192.283, 192.285, 192.287 and part 193., am. (1), 192.121, PSC 192.375, PSC 192.727, Appendix A, IIA and IIB, Appendix B, I, 192.231, 192.465 (a), 192.711 (b) and 192.713, r. 192.12, Register, December, 1981, No. 312, eff. 1-1-82.