

(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, unless that pipeline has been designed, installed, constructed, initially inspected, and initially tested in accordance with this part.

(b) No person may operate a segment of pipeline that is replaced, relocated, or otherwise changed after November 12, 1970, 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.

### 192.15 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.

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 to 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 customers' 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 prevent—

(1) The pressure from exceeding the maximum allowable operating pressure plus 10 percent or the pressure that produces a hoop stress of 75% of SMYS, whichever is lower; or

(2) In a low-pressure distribution system, a pressure that would cause the unsafe operation of any connected and properly adjusted gas utilization equipment.

(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.

(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, 1972; 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, at intervals not exceeding 1 year, 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 the patrol must be determined by the size of the line, the operating pressures, the class location, terrain, weather, and other relevant factors.

(c) Highway and railroad crossings must be patrolled more often and in greater detail than transmission lines in open country.

#### 192.707 Transmission lines: markers.

Each operator shall install signs or markers wherever necessary to identify the location of a transmission line in order to reduce the possibility of damage or interference.

#### 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 (c), no operator may use a welded patch as a means of repair.

#### 192.713 Transmission lines: permanent field repair of imperfections and damage.

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:

(a) 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.

(b) 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.

(c) 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** (d) *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.*

**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  $\frac{1}{8}$ -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.

Each permanent field repair of a leak must be made as follows:

(a) 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.

(b) If it is not feasible to take the segment of transmission line out of service, it must be repaired by installing a full encirclement welded split sleeve of appropriate design.

(c) 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 p.s.i. 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 the diameter of the pipe in size.

**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 butt 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.**

Each operator shall provide for abandonment or inactivation of facilities in its operating and maintenance plan, including the following provisions:

(a) Each facility abandoned in place, or, except when undergoing maintenance, each line not subject to gas pressure, must be disconnected from all sources and supplies of gas, purged of gas, and the ends sealed; however, the line need not be purged when the volume of gas is so small that there is no potential hazard.

(b) If air is used for purging, the operator shall ensure that a combustible mixture is not present after purging.

(c) Each abandoned vault must be filled with a suitable compacted material.

*PSC 192.727 (d) 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.

11. ASTM Specification A381 "Standard Specification for Metal-Arc-Welded Steel Pipe for High-Pressure Transmission Service" (A381-66, A381-68).
12. ASTM Specification A539 "Standard Specification for Electric-Resistance Welded Coiled Steel Tubing for Gas and Fuel Oil Lines" (A539-65).
13. ASTM Specification B42 "Standard Specification for Seamless Copper Pipe, Standard Sizes" (B42-62, B42-66).
14. ASTM Specification B68 "Standard Specification for Seamless Copper Tube Bright Annealed" (B68-65, B68-68).
15. ASTM Specification B75 "Standard Specification for Seamless Copper Tube" (B75-65, B75-68).
16. ASTM Specification B88 "Standard Specification for Seamless Copper Water Tube" (B88-66).
17. ASTM Specification B251 "Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube" (B251-66, B251-68).
18. ASTM Specification D2513 "Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings" (D2513-66T, D2513-68).
19. ASTM Specification D2517 "Standard Specification for Reinforced Thermosetting Plastic Gas Pressure Piping and Fittings" (D2517-66T, D2517-67).
20. ASTM Specification A372 "Standard Specification for Carbon and Alloy Steel Forgings for Pressure Vessel Shells" (A372-67).

C. The American National Standards Institute, Inc.:

1. ANSI A21.1 "Thickness Design of Cast-Iron Pipe" (A21.1-1967).
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 is titled "Cast-Iron Pipe Centrifugally Cast in Sand-Lined Molds for Gas" (A21.9-1962).
5. ANSI A21.11 "Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings" (A21.11-1964).
6. ANSI 21.50 "Thickness Design of Ductile-Iron Pipe" (A21.50-1965).
- 6a. ANSI A21.52 "Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Gas" (A21.52-1965).
7. ANSI B16.1 "Cast Iron Pipe Flanges and Flanged Fittings" (B16.1-1967).
8. ANSI B16.5 "Steel Pipe Flanges and Flanged Fittings (B16.5-1968).
9. ANSI B16.24 "Bronze Flanges and Flanged Fittings" (B16.24-1962).
10. ANSI B36.10 "Wrought-Steel and Wrought-Iron Pipe" (B36.10-1959).
11. ANSI C1 "National Electrical Code, 1968" (C1-1968).

D. The American Society of Mechanical Engineers:

1. ASME Boiler and Pressure Vessel Code, section VIII is titled "Pressure Vessels, Division 1" (1968 edition).
2. ASME Boiler and Pressure Vessel Code, section IX is titled "Welding Qualifications" (1968 edition).

E. Manufacturer's Standardization Society of the Valve and Fittings Industry:

1. MSS SP-25 "Standard Marking System for Valves, Fittings, Flanges and Union" (1964 edition).
2. MSS SP-44 "Steel Pipe Line Flanges" (1955 edition).
3. MSS SP-52 "Cast Iron Pipe Line Valves" (1957 edition).

F. National Fire Protection Association:

1. NFPA Standard 30 "Flammable and Combustible Liquids Code" (1969 edition).
2. NFPA Standard 58 "Storage and Handling, Liquefied Petroleum Gases" (1969 edition).
3. NFPA Standard 59 "LP Gases at Utility Gas Plants" (1968 edition).

## APPENDIX B—QUALIFICATION OF PIPE

I. *Listed Pipe Specifications.* Numbers in parentheses indicate applicable editions.

- API 5L—Steel and iron pipe (1967, 1970).
- API 5LS—Steel pipe (1967, 1970).
- API 5LX—Steel pipe (1967, 1970).
- ASTM A53—Steel pipe (1965, 1968).
- ASTM A106—Steel pipe (1966, 1968).
- ASTM A134—Steel pipe (1964, 1968).
- ASTM A135—Steel pipe (1963T, 1968).
- ASTM A139—Steel pipe (1964, 1968).
- ASTM A155—Steel pipe (1965, 1968).
- ASTM A211—Steel and iron pipe (1963, 1968).
- ASTM A333—Steel pipe (1964, 1967).
- ASTM A377—Cast iron pipe (1966).
- ASTM A381—Steel pipe (1966, 1968).
- ASTM A539—Steel tubing (1965).
- 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).
- ASTM A72—Wrought iron pipe (1964T, 1968).
- ASTM B42—Copper pipe (1962, 1966).
- ASTM B68—Copper tubing (1965, 1968).
- ASTM B75—Copper tubing (1965, 1968).
- ASTM B88—Copper tubing (1966).
- ASTM B251—Copper pipe and tubing (1966, 1968).
- ASTM D2513—Thermosplastic pipe and tubing (1966T, 1968).
- ASTM D2517—Thermosetting plastic pipe and tubing (1966T, 1967).

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

(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.

**Note:** 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 192.753.

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

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