MATERIALS AND EQUIPMENT QUALIFIED FOR USE IN NATURAL GAS SYSTEMS

The pipeline safety regulations list many different materials that are qualified for gas service. The materials and specifications listed in this manual are those most commonly used in natural gas distribution systems. Not all qualified materials or specifications are included in this section. The operator of a small natural gas system is referred to 49 CFR Part 192 for further information.

It is important for an operator to know the material make-up and operating pressure of an existing gas pipeline system. The operator must develop, or have a consultant develop, a list of qualified materials for construction and repair of the system. Installation procedures must be included for each type of material used in the system. This can be accomplished by including or referencing manufacturers' "gas product installation manuals" in the operations and maintenance plan.

When purchasing material for use in a natural gas pipeline system, it is important to check the marking of the material. The marking on the material will help identify whether the material is qualified for gas service. Of course, a natural gas pipeline system consists of both pipe and fittings. Therefore, an operator must select materials that are compatible with each other. This chapter will cover the most common specifications and standards used by manufacturers for pipes, valves, flanges, regulators, and other equipment commonly used in natural gas distribution systems.

PIPE

Steel and plastic pipe specifications applicable to operators of small natural gas systems are included in this manual. Pipe specifications are listed below. Be sure to check Appendix A of 49 CFR Part 192 for the current specifications and standards.

API 5L - Steel pipe

ASTM A53 - Steel pipe

ASTM D2513 - Thermoplastic pipe and tubing

Operators are cautioned that the actual maximum allowable operating pressure (MAOP) of a new or replacement pipe in a natural gas system is determined by a pressure test performed on the pipeline system by the operator before it is put in service. It is also recommended that threaded pipe not be installed underground.

When purchasing PE plastic pipe, the pipe must be marked ASTM D2513. Plastic pipe with this marking is the only PE pipe suitable for gas service.

Plastic pipe and tubing should be protected at all times from damage by crushing, piercing, or extended exposure to direct sunlight. As a rule of thumb, never store plastic pipe outdoors for more than six months. It should be placed inside or covered to protect it from exposure to direct

sunlight. It is a good idea to obtain the manufacturer's recommendation on how long the pipe can be exposed to sunlight before it loses physical strength (see 49 CFR §192.321 for more information).

In recent years, the vast majority of natural gas companies and operators of natural gas system have been installing ASTM D2513, PE pipe. Some of the reasons PE pipe is being installed are flexibility, good joining characteristics, durability, ease of installation, and cost. The PE type designations most often used are PE 2406, and PE 3408 (see FIGURE VI-14).

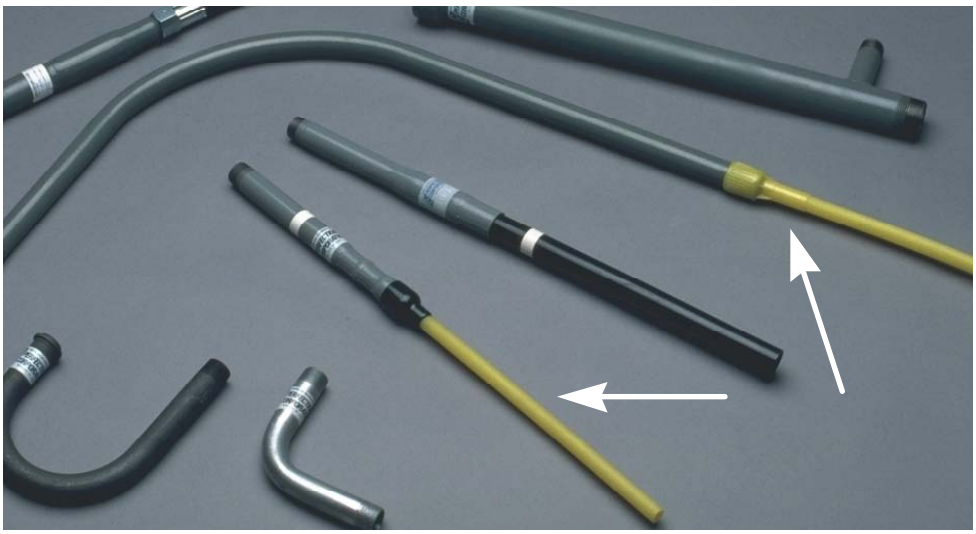
FIGURE VI-14

Below is a picture of 4-inch SDR 11 PE pipe manufactured according to ASTM D2513. When using plastic pipe in the underground piping system, make sure it has ASTM D2513 stamped on it.

An anodeless riser is a transition fitting that permits plastic service lines to be brought above ground in compliance with 49 CFR §192.375. The regulations require plastic services to be installed below ground level, except that it may terminate above ground, outside of buildings, if the plastic pipe is protected from deterioration and damage and it is not used to support external loads. Anodeless risers are readily available from various manufacturers and suppliers and are either fully fabricated from the manufacturer, or are field-fabricated by the installer, as is the case with service head adapter risers. Typically, the external protective casing is pre-bent, epoxy coated or galvanized, schedule 40 steel pipe. The plastic gas piping (inside the casing) must extend to an aboveground point for the riser to qualify as anodeless. Otherwise, the riser casing becomes a buried steel pipe gas carrier and is required to comply with Subpart I of 49 CFR Part 192. In most cases there is a grade level or “do not bury” label to indicate the bury depth to the installer. The outlet typically is provided with tapered pipe threads, or in the case of commercial or industrial risers, a bolted flange for attachment to the meter valve. The PE piping inlet, designated as the “pigtail,” is provided ready for connection to the service line. This service connection is accomplished either by heat fusion or, if so specified, with a mechanical coupling already attached to the pigtail for additional installation convenience.

FIGURE VI-15

Examples of anodeless service risers. There are many different manufacturers of anodeless risers. The primary advantage of an anodeless riser is that it does not have to be cathodically protected because the outside steel casing is not the gas carrier. The plastic inside the steel casing is the gas carrier. When purchasing anodeless risers, make sure that they meet all DOT requirements. When installing steel risers connected to plastic pipe by a transition fitting, make sure that the steel riser is coated and cathodically protected.



Most PE pipe manufacturers subscribe to the "Standard Dimension Ratio" (SDR) method of rating pressure piping. The SDR is the ratio of pipe diameter to wall thickness. An SDR 11 means the outside diameter (O.D.) of the pipe is eleven times the thickness of the wall.

For high SDR ratios the pipe wall is thin in comparison to the pipe O.D. For low SDR ratios the wall is thick in comparison to the pipe O.D. Given two pipes of the same O.D., the pipe with the thicker wall will be stronger than the one with the thinner wall. High SDR pipe has a low-

pressure rating; low SDR pipe has a high-pressure rating. The operator should check the manufacturer's specific pressure rating for each specific pipe. Do not use pipe with SDR values greater than 11.

PE pipe must be joined by either the heat fusion method (butt, socket, or electrofusion) or by a mechanical coupling. Each joining procedure and each person making joints must be qualified.

For information about local suppliers of plastic gas pipe, contact the local gas utility.

VALVES

A valve may not be used under operating conditions that exceed the applicable pressure-temperature rating. The valve will be stamped with the maximum working pressure rating (psig). Never operate valves at pressures that exceed their rating. The maximum working ratings are applicable at temperatures from -20°F to 100°F. Metal valves will often be stamped with the symbols "WOG." This means that they are suitable for service for water, oil, or gas. Sometimes just the letter "G" (for gas) appears. The valves must be rated for at least 100 psig.

The manufacturer's name or trademark must be included on a valve. Operators must maintain manufacturers' manuals, which include installation, operation, and maintenance procedures, for each type valve in the gas system. These manuals and procedures should be incorporated or referenced in the operations and maintenance plan.

Plastic valves purchased for gas service must comply with the appropriate industry standard. The valves must be compatible with the plastic pipe used in the natural gas system. It is important that operators buy plastic valves only from suppliers who are knowledgeable about gas piping. Supplier information can be obtained from trade journals, local gas associations (state or regional), or local gas utilities (see enclosed handout).

FLANGES AND FLANGE ACCESSORIES

Each flange or flange accessory must meet the minimum requirements found in 49 CFR §192.147. Operators must verify that metal flanges purchased for their system meet these requirements. This can be done by checking the markings on the flange. The markings are similar to those on the valves.

REGULATORS AND OVERPRESSURE PROTECTION EQUIPMENT

There are many different manufacturers and models of gas regulators and overpressure equipment (relief valves) for use in gas pipeline systems.

Regulators and overpressure protection equipment must be sized to ensure that overpressure or low-pressure conditions do not occur in the gas system. Manufacturers of gas regulators and relief valves have manuals that contain formulas and charts for each of their models or types of equipment. These formulas and charts are necessary to properly size regulators and relief valves. A qualified person must install the equipment. Operators who do not have a technical background should rely on a consultant or the equipment manufacturer representative to size the equipment. Check with the state for additional local requirements. See the enclosed handout for further information.

It is important to obtain the manufacturer's operation and maintenance instructions for each type of regulator and relief valve used in the gas pipeline system. The instructions must be incorporated into the operations and maintenance plan. CHAPTER II is a primer on basic concepts on pressure regulation, regulators, and relief devices.

OTHER EQUIPMENT

A natural gas operator may need additional equipment to operate a natural gas system. This additional equipment may include:

- pipe-to-soil meters;
- pipe locators;
- gas leak detection equipment;
- industry publications.

An illustration of a pipe-to-soil meter is in CHAPTER III. Additional information on gas leak detection equipment and pipe locators is found in CHAPTER IV. The local gas utility or gas association is a good source of assistance.

WELDING REQUIREMENTS

How can an operator determine whether pipeline welding is performed as required?

1. Welding must be performed in accordance with written welding procedures qualified to produce acceptable welds. For typical pipeline welding, standard API 1104 is most often relied on. The welding procedures should include:
   a. Records of the complete results of the procedural qualification test
   b. Procedural specification
      (1) Identifying the process
      (2) Identifying the materials
      (3) Identifying the wall thickness groups
      (4) Identifying the pipe diameter groups
      (5) Showing a joint design sketch
      (6) Designating filler metal and number of beads
      (7) Designating electrical characteristics
      (8) Designating flame characteristics
      (9) Designating positions or roll welding
      (10) Designating direction of welding
      (11) Designating maximum time lapse between passes
      (12) Designating type of line-up clamp and removal criteria
      (13) Designating type of cleaning tool used
      (14) Specifying preheat and post heat practices
      (15) Designating composition of gas and range of flow rate
      (16) Designating type and size of shielding flux
      (17) Designating range of speed of travel for each pass
   c. Essential variables
      Most changes in b. require requalification of the welding procedure. (Refer to API 1104, paragraph 2.4.)
   d. Welding and testing of test joint
      (1) Preparation of specimen
      (2) Destructive tests - butt welds
         (a) Tensile strength test
         (b) Nick break test
         (c) Root and face bend test
         (d) Side bend test
      (3) Destructive test - fillet welds: Break in weld as specified

2. Welders who are qualified for the welding procedure to be used must perform welding.
   a. The welder shall be qualified under one of the applicable requirements specified.
      (1) Transmission pipelines
         (a) API 1104, Section 3; or
         (b) ASME Boiler and Pressure Vessel Code, Section IX
      (2) Distribution pipeline

         (a) API 1104, Section 3;

(b) ASME Boiler and Pressure Vessel Code, Section IX; or
(c) 49 CFR Part 192, Appendix C, Section I (not acceptable for service line to main connection welding).

(3) Service line to main connections
(a) API 1104, Section 3;
(b) ASME Boiler and Pressure Vessel Code, Section IX; or
(c) 49 CFR Part 192, Appendix C, Sections I and II.

b. Welder qualification under API 1104, Section 3.
(1) Perform qualification test as specified in the written welding procedure in the presence of the company's representative.
(2) Essential variables (certain changes require re-qualification).
(a) For single qualification refer to API 1104, paragraph 3.11; or
(b) For multiple qualification refer to API 1104, paragraph 3.21.
(3) Welding and testing of test joint
(a) Preparation of specimen(s)
(b) Visual examination
(c) Destructive test - butt welds
Determine if all or part of these tests is required:
1 Tensile strength test *(optional)*
2 Nick break test
3 Root and face bend test
4 Side bend test
(d) Destructive tests - fillet welds: Break in weld as specified.
(e) Visual inspection

NOTE: Nondestructive radiographic inspection of butt welds only can be done in lieu of (3)(c) above. This is the operator's option. The standards of acceptability for radiographic inspection are specified in API 1104, paragraph 6.0.

(4) Keep the following records:
(a) Detailed test results for each welder.
(b) List of qualified welders and the procedures(s) for which they are qualified.

c. Welder qualification under 49 CFR Part 192, Appendix C, Section I
(1) Perform qualification test on pipe 12 inches or less in diameter
(2) Use position welding
(3) Preparation must conform to written welding procedure
(4) Destructive test. - root bend test
(5) Visually inspect
(6) Keep the following records:
(a) Detailed test results for each welder
(b) List of qualified welders under this procedure

d. Welder qualification under of 49 CFR Part 192, Appendix C, Sections I and II
(1) Perform c. above
(2) Weld service line connection fitting to a pipe typical of the main using similar position as one would in actual production welding
(3) Destructive test - break, or attempt to break, the fitting off the run pipe

(4) Keep the following records:
(a) Detailed test results for each welder
(b) List of qualified welders under this procedure

e. Remain qualified under API 1104, Section 3 or ASME Boiler and Pressure Vessel Code, Section IX, if:
(1) Within the preceding six months, welder has welded with the particular welding process (either test or production welding is acceptable), and welder has made a weld and had it tested satisfactorily either destructively or nondestructively. (Refer to 2b(3) for required procedure.)

f. Remain qualified under either 49 CFR Part 192, Appendix C, Section I or II, if:
(1) Within the preceding 7½ months but at least twice each year, welder has had one production weld cut out, tested, and found acceptable in accordance with the initial qualification test; or,

NOTE: Welders who work only on service lines 2 inches or smaller in diameter may be tested in each 6-month period under 49 CFR Part 192, Section III, Appendix C in lieu of f(1) above, but at the same intervals.

(2) Within the preceding 15 months, but at least once each year, welder has requalified under 49 CFR Part 192 Appendix C

3. Production welding
a. Use a welder qualified in a qualified welding procedure.
b. The following items should be part of the written welding procedure:
(1) Weather protection - 49 CFR §192.231
(2) Preparation - 49 CFR §192.235
(3) Visual Inspection - 49 CFR §192.241
(4) Nondestructive Testing (under specified conditions) - 49 CFR §192.243. Must meet standards of acceptability in API 1104, Section 6.

c. Miter joint restrictions
The use of miter joints is restricted as follows:
(1) If MAOP produces a hoop stress of 30 percent or more SMYS, the joint cannot deflect the pipe more than 3 degrees.
(2) If MAOP produces a hoop stress of more than 10 percent SMYS but less than 30 percent, the joint cannot deflect the pipe more than 12.5 degrees and must have at least one pipe diameter separation from another miter joint.
(3) If MAOP produces a hoop stress of 10 percent of SMYS or less, the joint cannot deflect the pipe more than 90 degrees.

d. Repair or removal of defect requirements is as follows:
(1) Remove or repair all welds that fail to pass the nondestructive test requirements (standards of acceptability in API 1104, Section 6).
(2) Remove all welds that contain cracks that are more than 8 percent of the weld length.
(3) Repairs must have the defect removed down to clean metal and the segment to be repaired must be preheated if conditions exist which would adversely affect the quality of the weld repair. Inspect the repaired weld.

(4) Repair of a crack, or any defect in a previously repaired area, must be in accordance with written weld repair procedures that have been qualified under this guidance manual.