

INVESTIGATION OF MAXIMUM TEMPERATURES ATTAINED BY PLASTIC FUEL GAS PIPE INSIDE SERVICE RISERS

TR-30

2010



105 Decker Court, Suite 825, Irving, TX 75062 · P: 469-499-1044 · F: 469-499-1063 · www.plasticpipe.org

Documents
Document Sharing Hub

Foreword

INVESTIGATION OF MAXIMUM TEMPERATURES ATTAINED BY PLASTIC FUEL GAS PIPE INSIDE SERVICE RISERS

This report was developed and published with the technical help and financial support of the members of the PPI (Plastics Pipe Institute). The members have shown their interest in quality products by assisting independent standards-making and user organizations in the development of standards, and also by developing reports on an industry-wide basis to help engineers, code officials, specifying groups, and users.

The purpose of this technical report is to provide essential information on a particular aspect of thermoplastic piping to engineers, users, contractors, code officials and other interested parties.

This report has been prepared by PPI as a service of the industry. The information in this report is offered in good faith and believed to be accurate at the time of its preparation, but is offered without any warranty, expressed or implied, including WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Any reference to or testing of a particular proprietary product should not be construed as an endorsement by PPI, which does not endorse the proprietary products or processes of any manufacturer. The information in this report is offered for consideration by industry members in fulfilling their own compliance responsibilities. PPI assumes no responsibility for compliance with applicable laws and regulations.

PPI intends to revise this report from time to time, in response to comments and suggestions from users of the report. Please send suggestions of improvements to the address below. Information on other publications can be obtained by contacting PPI directly or visiting the web site. This report was reviewed and republished with editorial corrections in December, 2010.

The Plastics Pipe Institute
(469) 499-1044
<http://www.plasticpipe.org>

This Technical Report, TR-30, was first issued in May 1978 and was revised in September 1980, in October 1988, in December 2006, and December 2010.

INVESTIGATION OF MAXIMUM TEMPERATURES ATTAINED BY PLASTIC FUEL GAS PIPE INSIDE SERVICE RISERS

1.0 INTRODUCTION

- 1.1 The maximum allowable temperatures for plastic piping systems used for fuel gas distribution are defined by Part 192, *Transportation of Natural Gas and Other Gas by Pipeline: Minimum Safety Standards*, Subchapter I), *Pipeline Safety*, of Title 49, *Transportation*, of the U. S. Code of Federal Regulations. By an act of Congress, the U. S. Department of Transportation regulates pipeline safety.
- 1.2 Section 375, *Service Lines: Plastic*, of Part 192 of the U. S. Pipeline Safety Regulations allows the use of properly designed metal-sleeved plastic riser pipe. A point that must be considered in proper design is the maximum temperature that can develop in the above-ground portion of the metal riser and its effect on the strength properties of the plastics gas carrier pipe. Section 121, *Design of Plastic Pipe*, of Part 192 limits the allowable operating temperature of a thermoplastic pipe to the highest value for which the pipes long-term hydrostatic strength has been established, except that it may not exceed 140°F.
- 1.3 There has been some concern that the portion of a plastic riser pipe that is brought up out of the ground inside a protective metal sleeve for connection to a gas meter located outdoors may experience considerably higher temperatures than buried pipe, possibly even above the 140°F limit. Since metal-sleeved risers may be exposed to direct sunlight, they could become heated to higher than ambient temperatures. This report presents test data showing the maximum temperatures that may be obtained by thermoplastics pipe installed inside a metal protective sleeve and the conditions under which the maximum temperatures occur. The report includes:
 - 1.3.1 A description of the test equipment, the environment, and the results obtained when evaluating for the effects of:
 - a. wall contact;
 - b. venting;
 - c. shading;
 - d. various insulating materials;
 - e. geographical location.
 - 1.3.2 A correlation of actual and estimated service riser temperatures across the U.S.A.

- 1.3.3 An evaluation of the influence of temperature cycling on the hydrostatic strength of polyethylene pipe.
- 1.3.4 A description of a plastic-pipe/metal-sleeve riser assembly design that minimizes temperatures in the plastic pipe.
- 1.3.5 A list of plastic pipe materials that can be operated safely at the temperatures encountered in a properly-designed service riser.

2.0 CONCLUSIONS

- 2.1 The results of this study, in which a separation of at least 1/6 inch was maintained between plastic and metal, point to the following conclusions regarding proper design and installation of thermoplastic pipe gas service risers:
 - 2.1.1 The plastic pipe must not touch the wall of the metal sleeve. Provisions must be included to assure that an annular space of at least 1/6-inch is maintained.
 - 2.1.2 In all areas of the U.S. except the desert southwest, 120°F is an appropriate temperature to use as the hydrostatic design basis for the plastic pipe.
 - 2.1.3 In the desert areas of southwestern U.S., 140°F should be used as the appropriate temperature for this purpose.
 - 2.1.4 Thermoplastic pipe may be utilized safely and effectively in metal-sleeved risers when the above provisions are observed and when pipe selection and design are based upon appropriately established hydrostatic design ratings and the applicable design factors identified in DOT Document 192.

Note

If an installation has less than the 1/6-inch separation used in this study, check the plastic pipe temperature to insure that it does not exceed either the pipe material limitations or the applicable code requirements.

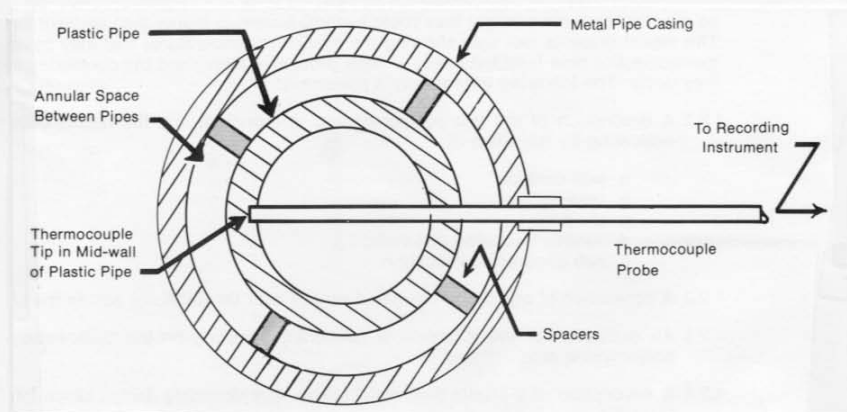


Figure 1. Top Cross-Sectional View of Plastic Pipe in Metal Casing Showing Thermocouple Arrangement

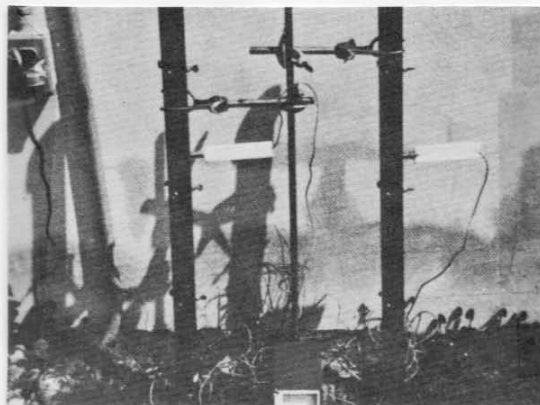


Figure 2. Photograph of Testing Arrangement with Two Test Riser Assemblies and a Temperature Recorder

65

3.0 TEST ASSEMBLIES

- 3.1 The assemblies used for these tests consisted of 3-foot pipe lengths of 3/4-inch IPS polyethylene pipe installed in a 1-1/4-inch metal pipe. The two ends of the plastic pipe were stoppered and the ends of the metal pipe were capped. The plastic pipe was secured in the metal pipe by thumbscrews, so the annular space could be maintained at about 1/6 inch at all points and the plastic did not touch the metal pipe. By adjusting the thumbscrews, the plastic pipe could be brought into contact with the metal pipe when desired.
- 3.2 The assembly included a thermocouple with the sensing element at the mid-wall of the plastic pipe. A continuous strip-chart recorder measured the temperature. Figure 1 shows a cross section of the assembly, in which the thumbscrews are identified as spacers. Two of these complete test assemblies were used for tests that were carried out at various locations throughout the United States. Figure 2 is a photograph of a typical test arrangement, showing both test assemblies and the recorder.

4.0 SUMMARY OF TEST RESULTS AND OBSERVATIONS

- 4.1 **The effect of wall contact** - In assemblies where the plastic pipe touches the metal pipe, temperatures in excess of 140°F are possible. Examples of several measured temperatures are shown in Table 1.

Table 1 Effect of Wall Contact

Location	Plastic Pipe Touching Metal Wall Temp. °F	Plastic Pipe Controlled (Not Touching) Temp. °F	Ambient Air Temp. °F Unshaded
Wilmington, DE	143	110	94
Orange, TX	149	116	96
Phoenix, AZ	156	122	107
San Francisco, CA	144; 140	-	95