



NATIONAL PETROCHEMICAL COMPANY STANDARDS

CONSTRUCTION STANDARD FOR NON-DESTRUCTIVE TESTING OF PIPING

NPCS-CS-PI-03

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1 GENERAL

1.1 PURPOSE

1.1.1 The purpose of this standard is to define acceptable non-destructive testing methods for application to pipework systems designed in accordance with the ANSI Code for pressure piping.

1.1.2 Any technical requirement in addition to or varying from the code will be noted in this document.

1.2 SCOPE

This standard applies to the -testing of pipework fabricated in accordance with the designated fabrication specification. For inspection of pipework for dimensions, tolerances and welding of pipework see the appropriate fabrication specification.

1.3 JOB REQUIREMENTS

1.3.1 The tests to be applied to pipework fabricated in the "shop" is noted on the detail drawing as "shop test" and shall be in accordance with Appendix 1. In the case of jacketed lines two separate tests may be noted.

1.3.2 The tests to be applied to "field installed" pipework shall be noted in the "line list" for the contract and shall be in accordance with Appendix 1.

1.3.3 The meaning of the abbreviations used to denote the tests are explained in description of test classes in Appendix 1 of this standard.

1.4 DEFINITIONS

1.4.1 The term "Code" used in this standard shall be taken to mean the American National Standards Code for pressure piping, power piping-ANSI B 31.1. and Petroleum Refinery piping-ANSI B 31.3.

1.4.2 The term "Testing" used in this standard shall mean the examination of shop and field installed pipework by means of radiographic, dye penetrant, hardness test, magnetic particle, and ultrasonic methods and pressure testing by means of water, air or flowing medium, for example Nitrogen, steam, etc.

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1.4.3

The term "Shop" used in this standard shall be understood to mean the location where prefabrication work is carried out either in the client's workshop or temporary premises established at site for the purpose.

1.4.4

The term "**Field Installed**" used in this standard shall be understood to mean the joining together in their final position of the plant of fabrications, fittings, flanges, valves, special items, and pipe lengths by welding, bolting or screwing.

STANDARDS AND CODES (LATEST EDITION AND ADDENDA)

- ANSI B 31.1 American National Standard Institute, Pressure Piping, Power Piping.
- ANSI B 31.3 American National Standard Institute, Petroleum Refinery Piping.
- ASTM E164 American Society of Testing Material, Standard Method of Ultrasonic Inspection of Weldment.
- ASTM E109 American Society of Testing Material, Standard Method for Dry Powder Magnetic Particle Inspection.
- ASTM ES4 American Society of Testing Material, Standard Method of Radiographic Inspection.
- NPCS-CS-PI-02 Construction Standard for Piping Fabrication and Erection.
- All Codes Referred to, in this Standard.

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3 TEST PREPARATION

- 3.1 Prior to testing, pipework shall have all foreign matters, for example scale, sand, weld spatter removed.
- 3.2 Prior to commencement of the test, a thorough check shall be made to ensure all fittings, caps, flanges, etc., are in place. All flanges and flanged fittings shall be bolted and bolts properly torqued.
- 3.3 Measuring equipment for pressure and temperature shall be supplied complete with their calibration certificate from a laboratory acceptable to the client.
- 3.4 All block valves shall be in open position throughout the duration of the test to prevent freezing of trapped volume of water in the section, if their presence is inevitable.

4 PRESSURE TESTING

4.1 GENERAL

4.1.1 Pressure testing shall be as called for in Appendix 1 and conducted in accordance with the code.

4.1.2 To avoid the possibility of failure due to "Brittle Fracture" during overload, testing shall not be carried out when metal temperatures are below the following:

- a) Austenitic material - all types and all thicknesses - no restrictions.
- b) Impact tested C.S. - all thicknesses -50°C.
- c) C.S. & Low Alloy materials:

Up to $\frac{1}{4}$ " thick -20°C
10°C*

Above $\frac{1}{4}$ " thick but not)
exceeding $\frac{1}{2}$ " thick) 0°C

Above $\frac{1}{2}$ " thick 10°C

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d) Plastic pipe shall not be pressure tested below 0°C.

* For 5 Cr $\frac{1}{2}$ Moly.

4.1.1.3 Where a pipeline which has been pressure tested requires repairs or additions to be made, it shall be retested. In the case of minor repairs or additions may waive retest requirements when precautionary measures are taken to assure sound construction.

4.1.1.4 Where hydrostatic tests are carried out in freezing conditions a suitable anti-freeze solution approved by the client shall be used.

1.1.1.5 Great care shall be exercised when pneumatic testing is carried out, due to the explosive nature of any failure. This is particularly true when pneumatically testing at temperatures below 20°C.

4.1.1.6 An analysis shall be made of the water to be used for hydraulic testing to ensure that the conditions in paragraphs 3.1.8 and 3.1.9 are met. This test shall be made immediately prior to the hydraulic test. If these conditions cannot be complied with, a sample analysis of the available water shall be submitted to the client for approval.

4.1.1.7 For all pipework other than austenitic Stainless Steel, hydrostatic tests shall be made with filtered water that is free from suspended solids and has a Ph value of 7 or more.

4.1.1.8 For all austenitic Stainless Steel pipework, hydrostatic tests shall be made with water that is free from suspended solids; the combined fluorine and chlorine content shall not exceed 40 ppm, and the Ph value shall lie between 6.0 and 8.0.

4.1.1.9 Salt or brackish water shall not be used for hydraulic testing, except lines that contain such fluids in service conditions.

4.1.1.10 If river water is intended for use, corrosion inhibitor shall be added to the filling water in the suction of water filling pump at the rate recommended by the manufacturer of the inhibitor.

4.1.1.11 Where a hydrostatic test is called for, all pipework shall be drained and thoroughly dried after testing.

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- 1.1.12 All branch reinforcing pads on pressure openings shall be pneumatically tested prior to any hydrostatic test. Tapped holes are provided in the pad for this purpose. The test pressure shall be 3.5 kg/cm² (50 psig), or twice the working pressure, whichever is the lower. All welds shall be swabbed with a soap or another suitable solution to aid in the detection of leaks.
- 1.1.13 On completion of testing, the tapped holes in reinforcing pads shall be filled with grease to prevent the ingress of moisture. These holes must not be permanently plugged.
- 4.1.14 Inclusion of air lends to inaccurate test results. Filling shall be carried out using pigs to give adequate control and efficient removal of air.
- 1.1.15 Filling the pipeline with water shall be made in a controlled way at reasonably slow rate and in a manner that ensures all air is excluded from the system. Air shall be vented at the high points in the system.
- 4.2 SHOP FABRICATED PIPEWORK
- 4.2.1 Hydrostatic testing shall not be carried out on shop fabricated pipework except where the test is specifically indicated on the piping detail drawings or called for on the vendor documents.
- 4.2.2 In the case of shop fabricated pipework the fabricator shall carry out any repair and testing, made necessary by the faults found, at his own expense.
- 4.2.3 Any defect found in pipework and equipment during installation shall be replaced or repaired promptly by fabricator.
All costs arising from the necessity of making such repairs shall be borne by fabricator.
- 4.2.4 Shop fabricated pipework which requires further treatment after fabrication such as galvanizing, pickling or lining, shall be tested as required before any treatment is applied.
- 4.3 FIELD INSTALLED PIPEWORK
- 4.3.1 Field installed pipework shall be pressure tested according to the test class as given on piping line lists and as defined in Appendix 1. Testing shall be carried out in accordance with the code.