MANDATORY APPENDIX XXVI
RULES FOR CONSTRUCTION OF CLASS 3 BURIED POLYETHYLENE PRESSURE PIPING

ARTICLE XXVI-1000
GENERAL REQUIREMENTS

XXVI-1100 SCOPE

(a) This Appendix contains rules for the construction of Class 3 polyethylene pressure piping systems. The scope is limited to buried portions of Class 3 service water or buried portions of Class 3 cooling water systems, consisting of PE4710 High Density Polyethylene (HDPE) materials at maximum Design and Service Levels A, B, and C temperatures of 140°F (60°C), and a maximum temperature of 176°F (80°C) for Service Level D, with temperatures not exceeding those for which allowable stresses are provided in this Appendix.

(b) Terms relating to polyethylene as used in this Appendix are defined in Article XXVI-9000.

(c) All applicable requirements of Subsection ND shall be met unless modified by this Appendix.

XXVI-1200 QUALIFICATION OF POLYETHYLENE MATERIAL ORGANIZATIONS

The polyethylene material shall be procured in accordance with the requirements of NCA-3970 and this Appendix.

XXVI-1300 CERTIFICATE HOLDER RESPONSIBILITIES

(a) The Certificate Holder shall comply with the requirements of NCA-3970.

(b) The responsible Certificate Holder shall assure that the material complies with the Design Specification and this Appendix.

(c) A Certificate Holder may furnish material when stated in the scope of his certificate. In this case, a Quality System Certificate is not required, nor is the user of the material required to survey, qualify, or audit such a Certificate Holder.

(d) The Certificate Holder shall be responsible for surveying, qualification, and auditing of the Polyethylene Material Organization in accordance with NCA-3970.

(e) The survey and audit of the Polyethylene Material Organization shall establish that the Quality System Program conforms to the Certificate Holder’s quality program requirements.

(f) Satisfactory completion of the survey and audit shall allow the Polyethylene Material Organization to supply material to the Certificate Holder for a period of 3 yr. After the 3-yr period, an audit shall be performed to ensure continued program maintenance.

(g) The Certificate Holder shall perform any of the functions specified by his respective Quality Assurance Program that are not performed by the Polyethylene Material Organization. It may elect to perform any other quality program functions, which would normally be the responsibility of the Polyethylene Material Organization. These functions shall be clearly defined in the Certificate Holder’s Quality Assurance Program.

(h) The Certificate Holder shall make all necessary provisions so that his Authorized Inspection Agency can perform the inspections necessary to comply with this Appendix.

(i) In accordance with NCA-8120(b), a Certificate of Authorization may be issued by the Society to an organization certifying joining by fusing in accordance with this Appendix.
ARTICLE XXVI-2000
MATERIALS

XXVI-2100 GENERAL REQUIREMENTS FOR MATERIALS

XXVI-2110 SCOPE

All polyethylene material shall conform to the requirements of this Article.

(a) Polyethylene material shall be selected from specifications listed in Supplement XXVI-I and shall be PE4710 HDPE with material properties as specified in XXVI-2200.

(b) All metallic pressure boundary materials shall conform to the requirements of Article ND-2000.

XXVI-2120 DETERIORATION OF MATERIAL IN SERVICE

Consideration of deterioration of material during service is generally outside the scope of this Appendix. It shall be the responsibility of the Certificate Holder to select material suitable for the conditions stated in the Design Specifications, with specific attention being given to the effects of service conditions on the properties of the material.

XXVI-2200 POLYETHYLENE COMPOUND AND MATERIAL REQUIREMENTS

XXVI-2210 GENERAL REQUIREMENTS

(a) Natural compound, pigment concentrate compound, and polyethylene compound and material shall conform to the requirements of this Article.

(b) Conformance with ASTM Standards referenced in Supplement XXVI-I and herein shall be limited as specified in this Article. In the event of conflict between a referenced standard and this Article, the requirements of this Article shall take precedence.

(c) Natural compound, pigment concentrate compound, and polyethylene compound and material shall be marked in accordance with the marking requirements in Article XXVI-8000 and the applicable ASTM Standard.

XXVI-2220 SPECIFIC COMPOUND REQUIREMENTS

XXVI-2221 Requirements for Certification of Polyethylene Compound

(a) General

(1) Polyethylene compound shall comply with, and be certified in accordance with, this Article and Table XXVI-2221-1.

(2) The required value for each property shall be as specified in Table XXVI-2221-1.

(3) The standard for determining the required value for properties shall be as specified in Table XXVI-2221-1.

(4) The test method for determination of the required value for the physical property shall be as specified in Table XXVI-2221-1.

(b) Polyethylene compound used for the manufacture of polyethylene material shall meet the requirements of the polyethylene compound manufacturer and Table XXVI-2221-1.

(c) Polyethylene compound shall be black except as provided in XXVI-2231(b).

(d) Polyethylene compound is the combination of natural compound and pigment concentrate compound as follows:

(1) When polyethylene compound is combined by the Polyethylene Compound Manufacturer, polyethylene compound is the polyethylene source material.

(2) When polyethylene compound is combined by the Polyethylene Material Manufacturer, natural compound and pigment concentrate compound are the polyethylene source materials.

(3) When polyethylene compound is combined by the Polyethylene Material Manufacturer, the Natural Compound Manufacturer shall provide the Polyethylene Material Manufacturer with a formulation that specifies the weight ratio (proportions) of natural and pigment concentrate compound and with processing equipment setting recommendations that produce polyethylene compound in accordance with Table XXVI-2221-1.

(e) Polyethylene compound shall have an independent listing that is published in PPI TR-4, Table I.A.13. The independent listing shall identify the following:

(1) a standard grade hydrostatic design basis (HDB) rating of at least 1,600 psi (11.03 MPa) at 73°F (23°C)

(2) a standard grade HDB rating of at least 1,000 psi (6.90 MPa) at 140°F (60°C)
The Design Specification shall specify the design life of the system.

(b) The duration of load shall be specified for each load case, and the polyethylene pipe physical and mechanical properties shall be based on the duration of load.

**XXVI-3125 Examination Access**

Accessibility to permit the examinations required by the Edition and Addenda of Section XI as specified in the Design Specification for the piping system shall be provided in the design of the piping system.

**XXVI-3130 DESIGN AND SERVICE LOADINGS**

Design loads shall be as defined in **ND-3112.1** through **ND-3112.3**. Loads applied to buried polyethylene pipe shall be defined in the Design Specification and shall include, as a minimum, the following:

(a) Maximum internal Design Pressure, $P_D$, for pressure design in accordance with **XXVI-3131** and **XXVI-3132** and, if applicable, maximum negative internal pressure for evaluation in accordance with **XXVI-3221.2**.

(b) Maximum and minimum temperature, $T$, and the number of equivalent full range temperature cycles ($N$) for the selection of allowable stress and design for temperature effects in accordance with **XXVI-3300**.

(c) Vertical soil pressure, $P_E$, due to saturated soil, buoyancy, and flotation for the designs in accordance with **XXVI-3200**.

(d) Vertical pressure due to surcharge loads, $P_L$, for the design in accordance with **XXVI-3200**.

(e) Permanent ground movement and soil settlement for design as nonrepeated anchor movements in accordance with **XXVI-3300**.

(f) Seismic wave passage and seismic soil movement, building anchor motions, and number of seismic cycles for seismic design in accordance with **XXVI-3400**.

(g) Ground movement caused by frost heave for design for expansion and contraction in accordance with **XXVI-3311**.

**XXVI-3131 Pressure Design of Pipe**

**XXVI-3131.1 Minimum Required Wall Thickness.**

The minimum required wall thickness of straight sections of pipe for pressure design shall be determined by the following:

$$t_{\text{Design}} = t_{\text{min}} + c$$

The value of $c$ shall include an allowance for anticipated surface damage during installation.

$$t_{\text{min}} = \frac{P_D D}{2S + P_D}$$

The value of $t_{\text{fab min}}$ shall be greater than or equal to $t_{\text{Design}}$.

**XXVI-3131.2 Allowable Service Level Spikes Due to Transient Pressures.**

The sum of the maximum anticipated operating pressure plus the maximum anticipated Service Level B pressure spikes due to transients shall be no greater than 1.2 times the piping system Design Pressure, $P_D$. The sum of the maximum anticipated operating pressure plus the maximum anticipated Service Level C or D pressure spikes due to transients shall be no greater than 2 times the piping system Design Pressure, $P_D$.

**XXVI-3132 Pressure Design of Joints and Fittings**

(a) Polyethylene pipe shall be joined using the butt fusion process or by electrofusion. All connections to metallic piping shall be flanged joints. Electrofusion fittings shall be joined to polyethylene pipe using the electrofusion process.

(b) The design of piping items permitted in **XXVI-2200** shall ensure these items have the capacity to withstand a pressure greater than or equal to the Design Pressure, $P_D$, of the attached pipe.

(c) The design of pipe fittings other than electrofusion fittings shall ensure the fitting has the capacity to withstand a pressure greater than or equal to the Design Pressure, $P_D$, of the attached pipe. The pressure rating (PR) of the fitting shall be determined as follows:

$$\text{GSR} \times \frac{2S}{DR - 1} \geq P_D$$

where GSR is the geometric shape rating per Table **XXVI-3132-1**.
(d) Flanged connections shall include a metallic backup ring and shall provide a leak tight joint up to and including the piping hydrostatic test pressure. In addition, the maximum surge pressure per XXVI-3131.2 shall not cause permanent deformation of the pipe.

(e) The design of electrofusion fittings shall ensure the fitting has the capacity to withstand a pressure greater than or equal to the Design Pressure, \( P_D \), of the attached pipe. The pressure rating of the fitting shall be determined by testing as required by XXVI-2236.

**XXVI-3132.1 Pressure Design of Miter Elbows.**

(a) The design pressure rating of the mitered elbow, \( P_m \), shall be calculated as the lesser of eqs. (1) and (2) (see Figure XXVI-3132-1).

\[
P_m = \frac{S_{\text{elbow}}}{r_2} \left( \frac{t_{\text{elbow}}}{0.622 \tan \theta \sqrt{t_{\text{elbow}}^2 + r_2^2}} \right)
\]

or

\[
P_m = \frac{S_{\text{elbow}}}{r_2} \left( \frac{R_1 - r_2}{R_1 - 0.5r_2} \right)
\]

(b) \( P_m \) shall be greater than or equal to \( P_D \). Alternatively, the mitered elbow shall be at least one standard dimension ratio (SDR) lower than that of the attached straight pipe. The maximum DR permitted for mitered elbow segments is 13.5.

(c) The minimum fabricated wall thickness of the reinforced sections of the mitered elbow, \( t_{\text{elbow}} \), shall be \( \geq 1.25 \ t_{\text{tab min}} \) of the attached straight pipe. The additional wall thickness shall be provided by enlarging the pipe O.D. while maintaining the pipeline I.D. or by reducing the pipe I.D. while maintaining the pipeline O.D.

(d) The fabrication tolerance of the fitting angular direction shall be \( \pm 3 \) deg. Mitered joints of 3 deg or less (angle \( \alpha_{\text{elb}} \) in Figure XXVI-3132-1) do not require redesign consideration as mitered elbows.

(e) Mitered elbows shall comply with the requirements of NCD-3644 with the following exceptions:

1. Wall thickness shall be determined as outlined in (c).
2. NCD-3644(e) shall be replaced with butt fusion joints in accordance with this Appendix.

**XXVI-3133 Allowable Stress Range for Secondary Stress**

The allowable secondary stress range, \( S_A \), is given in Table XXVI-3133-1 or Table XXVI-3133-1M.

(a) The \( S_A \) value shall be based on the higher of the Design Temperature or the maximum Service Level A or B temperature.

(b) The \( S_A \) shall be selected based on

1. the total number of temperature cycles, or
2. the number of equivalent full range temperature cycles, \( N \), as determined in (d).

(c) The maximum number of permitted equivalent full range temperature cycles, \( N \), is 100,000.

(d) The number of equivalent full range temperature cycles, \( N \), is determined as follows:

\[
N = N_E + N_1 \left( \frac{\Delta T_1}{\Delta T_E} \right)^5 + N_2 \left( \frac{\Delta T_2}{\Delta T_E} \right)^5 + \ldots + N_n \left( \frac{\Delta T_n}{\Delta T_E} \right)^5
\]

where

\[
\Delta T_E = \text{maximum temperature change experienced by the pipe, °F (°C)}
\]

\[
N_E = \text{number of cycles at maximum temperature change, ΔT_E}
\]

\[
N_1, N_2, \ldots N_n = \text{number of cycles at lesser temperature changes, ΔT_1, ΔT_2, ... ΔT_n}
\]

\[
\Delta T_1, \Delta T_2, \ldots \Delta T_n = \text{the lesser temperature changes experienced by the pipe, F (°C)}
\]

**XXVI-3134 Flange Connection Consideration**

(a) Flanged connections are permitted only for the joining of polyethylene pipe to steel piping or for joining polyethylene to polyethylene. See Figure XXVI-4520-1 for a typical flange configuration.

(b) Flange installation shall meet the requirements of XXVI-4520.

(c) Steel flanges attached to the steel mating pipe shall conform to the requirement standards listed in Table NCA-7100-1 and shall be used within the limits of pressure-temperature ratings specified in such standards.

(d) Polyethylene flange connections shall be in compliance with XXVI-2220 and shall be butt-fused to the attached polyethylene piping. Polyethylene flange adapters shall be connected to the steel using a steel backup ring having, at a minimum, the same pressure rating as the mating steel flange.

(e) Gasket material, if used, shall be selected to be consistent and compatible with the service requirements of the piping system.

(f) Flanged joints shall be pressure tested in accordance with Article XXVI-6000 prior to the piping system being placed in service.

(g) Flanged joints shall use bolts made of a material listed in Section II, Part D, Table 3 and of a size and strength that conforms to the requirement standards listed in Table NCA-7100-1. The tensile stress in the bolts, \( \sigma_b \), shall not exceed \( S_b \) per Section II, Part D, Table 3.

\[
\sigma_b = \frac{F_b}{n_b} \leq S_b
\]

where

\[
F_b = \frac{W_b}{n_b}
\]
divided, the same marks shall either be transferred to the items cut or a coded marking shall be used to ensure identification of each piece of material during subsequent fabrication or installation. In either case, an as-built sketch or a tabulation of materials shall be prepared identifying each piece of material with the CPTRs and C of A Reports, where applicable, and the coded marking. Studs, bolts, nuts, flange rings, and other metallic items shall be identified and certified as required by Article ND-4000.

(b) Material from which the identification marking is lost shall be treated as nonconforming material until appropriate verifications are performed and documented to ensure proper material identification. Positive identification shall be made through appropriate evidence, and the material may then be marked; otherwise, it shall be scrapped.

XXVI-4122.1 Marking Material. Material shall be marked in accordance with Article XXVI-8000, as follows:

(a) No indentation stamping is allowed on the polyethylene surface; all marking shall be performed with a metallic paint marker or stenciling marker.

(b) The Polyethylene Material Manufacturer is permitted to apply the standard print line identifier to his piping product using a thermal process in accordance with XXVI-2231(c).

XXVI-4123 Examinations

Visual examination activities that are not specified for examination by XXVI-4130 or Article XXVI-5000, and are performed solely to verify compliance with requirements of Article XXVI-4000, may be performed by the persons who perform or supervise the work. These visual examinations are not required to be performed by personnel and procedures qualified in accordance with the Manufacturer’s Quality Assurance Program (XXVI-2500) or to XXVI-5500 unless so specified.

XXVI-4130 REPAIR OF MATERIAL

All polyethylene material shall be inspected upon receipt. Any material with gouges, cuts, and similar surface conditions in excess of the surface acceptance criteria of XXVI-2400 upon receipt by the fabricator or installer or that occur during fabrication or installation shall either be scrapped or repaired in accordance with this paragraph. All polyethylene material external surfaces shall be given an additional visual examination prior to installation.

replace with "Article NCD-4000."
Personnel performing nondestructive examinations required by this Article shall be qualified in accordance with ND-5521, as applicable for the examination method, in addition to the requirements herein.

XXVI-5420 PERSONNEL QUALIFICATION REQUIREMENTS

XXVI-5421 Visual Examination

(a) Personnel performing visual examinations on material receipt and of completed fused joints shall be qualified in accordance with XXVI-5410(b) and trained in accordance with (b).

(b) All personnel performing visual examinations required by this Article shall receive the following training, which shall be documented on a qualification record:

(1) For butt-fused piping, they shall receive the same training as required for the fusing machine operator as described in Supplement XXVI-A. This training shall include the use of a fusing machine to make a fused joint. This joint is not required to be tested for qualification.

(2) For electrofusion joints, they shall receive the same training as required for the fusing operator as described in Supplement XXVI-D. This training shall include set-up and witnessing, but need not include performance, of the electrofusion process.

(c) All personnel performing visual examinations required by this Appendix shall be given a practical examination of physical samples of visually acceptable and unacceptable fused joints. A sample set including flaws representative of unacceptable conditions (e.g., Figure XXVI-5321-1, Supplement XXVI-B) shall be used. The visual examination procedure shall be used, and a passing
grade of 80% detection of the intended flaws within the demonstration set is required. The practical examination shall be administered by an individual qualified to Level III for Visual Examination (in accordance with ND-5520) or their designee. The practical examination results shall be documented on a qualification record.

**XXVI-5422 Volumetric Examination**

(a) Personnel performing volumetric examinations required by this Appendix shall be qualified in accordance with XXVI-5410(b).

(b) Volumetric examination personnel shall demonstrate their capability to detect flaws by performance demonstration using the qualified procedure in accordance with the following requirements:

1. The demonstration specimens shall be in accordance with XXVI-5114(a).

2. The demonstration specimen set shall, as a minimum, contain flaws meeting the requirements of XXVI-5114(b).

(c) The Certificate Holder shall be responsible for reviewing the procedure and demonstration results to validate that the range of the essential variables of the procedure were included in the demonstration.

(d) This examination shall be administered by a Level III for volumetric examination (in accordance with ND-5520) or designee. The practical examination results shall be documented on a qualification record.

**XXVI-5423 Certification of Personnel**

Certification of NDE personnel shall be in accordance with ND-5522.

**XXVI-5424 Verification of NDE Personnel Certification**

Verification of NDE personnel shall be in accordance with ND-5523.

**XXVI-5500 RECORDS**

The following NDE records shall be retained by the Certificate Holder and provided to the Owner upon completion of construction:

(a) all NDE procedure qualification records

(b) visual NDE personnel qualification records and certifications

(c) volumetric NDE personnel qualification records identified in SNT-TC-1A para. 9.4 including certifications

(d) all visual NDE examination records and results

(e) all volumetric NDE examination records and results, including encoded data
ARTICLE XXVI-6000
TESTING

XXVI-6100 GENERAL REQUIREMENTS

XXVI-6110 PRESSURE TESTING

XXVI-6111 Scope of Pressure Testing

All pressure-retaining portions of completed piping systems not exempted by ND-6111 shall be pressure tested except as specified below. Portions of piping systems that are exempt shall be identified in the Design Specification and Data Report Form. The Design Specification shall be available to the Inspector when the balance of the system is hydrostatically tested.

XXVI-6112 Pneumatic Testing

A pneumatic test shall not be permitted.

XXVI-6113 Witnessing of Pressure Tests

Pressure testing shall be performed in the presence of the Inspector.

XXVI-6114 Time of Pressure Testing

XXVI-6114.1 Piping System Pressure Test. The pressure-retaining portion of the system shall be pressure tested prior to initial operation. The pressure test may be performed progressively on installed portions of the system, which may then be buried, provided this is documented in the Certificate Holder’s Quality Assurance Program and is acceptable to the Inspector.

XXVI-6114.2 Piping Subassembly Pressure Test. Piping subassemblies may be tested provided

(a) the test pressure is in accordance with the requirements of XXVI-6221(a)

(b) the pressure test is performed in a manner that, in the subassembly under test, will simulate the loadings present when the completed piping system is installed and pressurized

(c) each piping subassembly pressure test is performed by a Certificate Holder and performed in the presence of the Inspector

XXVI-6115 Machining After Pressure Test

Provided there is no infringement on $t_{\text{Design, min}}$, removal of an additional amount of material less than or equal to 5% of $t_{\text{tab, min}}$ in pipe IPS 4 (DN 100) and smaller and less than or equal to 0.040 in. (1.0 mm) in pipe greater than IPS 4 (DN 100) shall be permitted after pressure test.

XXVI-6120 PREPARATION FOR TESTING

XXVI-6121 Exposure of the Piping

All pressure-retaining portions of the piping system, including the fused joints, shall be uninsulated and exposed (not buried) for inspection during the test.

XXVI-6122 Restraint or Isolation of Expansion Joints

Expansion joints shall be provided with temporary restraints, if required, for the additional pressure load under test.

XXVI-6123 Isolation of Equipment Not Subjected to Pressure Test

Equipment that is not to be subjected to the pressure test shall be either disconnected from the piping subassembly or system or isolated during the test by a blind flange or similar means. Valves may be used for isolation.

XXVI-6124 Treatment of Flanged Joints Containing Blanks

Flanged joints at which blanks are inserted to isolate other equipment during the test shall not be required to be retested.

XXVI-6125 Precautions Against Test Medium Expansion

If a pressure test is to be maintained for a period of time and the test medium in the system fluid is subject to thermal expansion, precautions shall be taken to avoid excessive test pressure.

XXVI-6126 Check of Test Equipment Before Applying Pressure

The test equipment shall be examined before pressure is applied to ensure that it is tight and that all low-pressure filling lines and other items that should not be subjected to the test pressure have been disconnected or isolated.

XXVI-6200 HYDROSTATIC TESTS

The requirements of this subarticle apply to all piping systems or piping subassemblies.
XXVI-6210 HYDROSTATIC TEST PROCEDURE

XXVI-6211 Venting During Fill Operation

The piping subassembly or piping system in which the test is to be conducted shall be vented during the filling operation to minimize air pocketing.

XXVI-6212 Test Medium and Test Temperature

(a) Water shall be used for the hydrostatic test.

(b) The test shall be conducted at an ambient temperature that is within the temperature limits of the system design. The test pressure shall not be applied until the piping and pressurizing fluid are at approximately the same temperature.

XXVI-6220 HYDROSTATIC TEST PRESSURE REQUIREMENTS

XXVI-6221 Minimum Hydrostatic Test Pressure

(a) The system shall be hydrostatically tested at no less than 1.5 times the Design Pressure + 10 psi (70 KPa) for 4 hr prior to leakage inspection.

(b) Valves shall be hydrostatically tested in accordance with the rules of ND-3500.

(c) As an alternative to (a), piping between the discharge side of a centrifugal pump and the first shutoff valve may be hydrostatically tested at the shutoff head of the pump. The pressure shall be maintained for a sufficient time to permit examination of all fused joints.

XXVI-6222 Maximum Permissible Pressure

When pressure testing a system, the induced stresses shall not exceed the minimum specified Hydrostatic Design Basis (HDB) for any item in the system.

XXVI-6223 Hydrostatic Test Pressurization and Holding Time

(a) The pressure in the test section shall be gradually increased at a rate not to exceed 20 psig/min (140 KPa gage/min). Pressure shall be held at the test pressure for 4 hr, during which time make-up water may be added to maintain pressure due to initial expansion.

(b) After the 4-hr hold time, the test pressure shall be reduced by 10 psig (70 KPa), and make-up water may no longer be added to maintain pressure. The system pressure shall then be monitored for at least 1 hr, during which time there shall be no reduction in pressure greater than 5% of the test pressure.

(c) The total elevated test time greater than normal operating pressure, including initial expansion and time at test pressure, shall not exceed 8 hr. If the pressure test is not completed in that time, the section shall be depressurized and not repressurized for at least 8 hr.

XXVI-6224 Examination for Leakage After Application of Pressure

Following the application of the hydrostatic test pressure for the required time in accordance with XXVI-6223(a), and upon reduction in test pressure in XXVI-6223(b), examination for leakage shall be performed.

(a) All external pressure-retaining surfaces of the piping system and all fusion joints shall be examined for leakage while at the hydrostatic test pressure.

(b) There shall be no leakage at fused joints or through the pressure boundary except as permitted in (c).

(c) Leakage of temporary gaskets and seals, installed for the purpose of conducting the hydrostatic test that will later be replaced, may be permitted unless the leakage exceeds the capacity to maintain system test pressure during the required examination. Other leaks, such as from permanent seals, seats, and gasketed joints may be permitted when specifically allowed by the Design Specifications. Leakage from temporary seals or leakage permitted by the Design Specification shall be directed away from the surface of the piping to avoid masking leaks from other portions of the piping system.

(d) The examination shall be witnessed by the Inspector.

XXVI-6300 PRESSURE TEST GAGES

XXVI-6310 REQUIREMENTS FOR PRESSURE TEST GAGES

XXVI-6311 Types of Gages to Be Used and Their Location

Pressure test gages used in pressure testing shall be indicating pressure gages and shall be connected directly to the piping. If the indicating gage is not readily visible to the operator controlling the pressure applied, an additional indicating gage shall be provided where it will be visible to the operator throughout the duration of the test. For systems with a large volumetric content, it is recommended that a recording gage be used in addition to the indicating gage.

XXVI-6312 Range of Indicating Pressure Gages

(a) Analog-type indicating pressure gages used in testing shall be graduated over a range no less than 1.5 times nor more than four times the test pressure.

(b) Digital-type pressure gages may be used without range restriction provided the combined error due to calibration and readability does not exceed 1% of the test pressure.

XXVI-6313 Calibration of Pressure Gages

(a) All test gages shall be calibrated against a standard dead weight tester or a calibrated master gage. The test gages shall be calibrated before each test or series of tests.
A series of tests is that group of tests, using the same pressure test gage or gages, which is conducted within a period not exceeding 2 weeks.

(b) The test gages shall be postcalibrated or verified against a standard dead weight tester or a calibrated master gage after each successful test or series of tests and prior to placing the system in service.
ARTICLE XXVI-7000
OVERPRESSURE PROTECTION

The requirements of Article ND-7000 shall be met.

replace with "Article NCD-7000"