
Standard Practice for

NTPEP Evaluation of Profile Wall Polyvinyl Chloride Drainage Pipe

AASHTO Designation: [Number]



**American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1 This standard practice covers the requirements, auditing and testing criteria for the National Transportation Product Evaluation Program (NTPEP) evaluation of profile wall polyvinyl chloride (PVC) drainage pipe Manufacturer Manufacturers. The National Transportation Product Evaluation Program (NTPEP) serves the member departments of the American Association of State Highway and Transportation Officials (AASHTO).
- 1.2 The purpose of the program is to establish a list of manufacturing plants that conform to the quality control and product testing requirements of this program. AASHTO member departments can then use this information in their quality assurance program for Manufacturer/product acceptance. This may include utilizing this information to establish a qualified Manufacturer list, a qualified products list, or both. By participating in this program, the Manufacturer agrees to produce product that meets or exceeds the requirements in the required AASHTO Specification(s) and follow the minimum quality control provisions of their Quality Program.
- 1.3 NTPEP validates this program through testing the Manufacturer's product(s) to verify compliance with the applicable standard and auditing the Manufacturer's in-plant quality control facilities and procedures. The Manufacturer agrees that NTPEP may use the test results and audit reports along with other relevant information for review and verification of compliance with this NTPEP program and the applicable AASHTO Specification(s).
- 1.4 *This standard practice may involve hazardous materials, operations, and equipment. It does not purport to address all safety problems associated with its use. It is the responsibility of the user of this standard practice to establish the appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

- 2.1 AASHTO Standards:
- AASHTO M304, Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
- 2.2 ASTM Standards:
- ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
 - ASTM D618, Standard Practice for Conditioning Plastics for Testing
 - ASTM D638, Standard Test Method for Tensile Properties of Plastics
 - ASTM D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
 - ASTM D883, Standard Terminology Relating to Plastics

- ASTM D1600, Standard Terminology for Abbreviated Terms Relating to Plastics
- ASTM D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- ASTM D2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- ASTM D2152, Standard Test Method for the Degree of Fusion for Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- ASTM D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- ASTM D2444, Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- ASTM D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- ASTM F412, Standard Terminology Relating to Plastic Piping Systems
- ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

3. TERMINOLOGY

- 3.1 *Auditor* – A NTPEP representative to review submittals, coordinate auditing and testing, and report audit findings.
- 3.2 *Audits* – Documented reviews of a Manufacturer’s plant and associated test facilities by a NTPEP Auditor and any AASHTO member department co-auditor that wishes to participate.
- 3.3 *Cell Classification*- The nomenclature used to define characteristics of PVC plastics. Pipe, internal sleeves, and fittings made of PVC plastic having a minimum cell classification of 12454 or 12364 as defined in ASTM D 1784. Homopolymer PVC compounds will meet or exceed the requirements of the above listed
- 3.4 *Compound*- The combination of raw materials from which PVC pipe covered by this Standard Practice is made. Compounds may include one or more resins, fillers, UV inhibitors and other components which are blended together in order to prepare plaques from which test specimen are made to qualify the compound and verify that it meets the cell classification required by AASHTO M304 prior to pipe being manufactured.
- 3.5 *Gaskets*- Elastomeric material used in pipe connections. Gaskets will comply with low head-application requirements described in ASTM F 477.
- 3.6 *Independent Laboratory* – An outside laboratory that performs raw material or finished product tests for the Manufacturer. NTPEP reserves the right to audit the independent laboratory for the tests that are being performed for the Manufacturer.
- 3.7 *Initial Audit*- The first audit conducted at a Manufacturer, which has not had an audit conducted by another independent agency.
- 3.8 *Lubricant*- Material used to facilitate the assembly of a pipe connection utilizing a gasket. The lubricant used for assembly will have no detrimental effect on the gasket or on the pipe. Only lubricant recommended by the Manufacturer will be used.
- 3.9 *Manufacturer*- An individual producer of profile wall polyvinyl chloride (PVC) drainage pipe. The corporate name (actual location) will be included in the NTPEP program.

- 3.10 *NTPEP*- The entity responsible for overseeing all areas of the program are being run according to what is noted in this Standard Practice as well as assisting in the resolution of any conflicts which may arise.
- 3.11 *NTPEP Designated Laboratory* – A laboratory qualified by NTPEP to perform the specific tests as outlined in the Standard Practice and has on site qualified technicians and equipment necessary to perform the tests per ASTM and AASHTO standards.
- 3.12 *NTPEP Follow-Up Audit*- An audit of a Manufacturer’s location and associated laboratory which are included in the program. These audits are conducted by NTPEP and/or an AASHTO member department to determine compliance with the program requirements. These audits may be performed due to: an incomplete initial/annual audit where nonconformances are found, reports of noncompliant product from an AASHTO member department, or any other reason deemed significant to NTPEP.
- 3.13 *NTPEP PVC Pipe Technical Committee* – The NTPEP Technical Committee that includes member departments of the AASHTO and members of Industry. The members are volunteers who are interested in the advancement of the product. The Technical Committee appoints a Chairman and a Co-Chairman.
- 3.14 *NTPEP Split Sample Comparison Testing* – Sample(s) selected from the manufacturing line or stockyard to be tested by the Manufacturer and the NTPEP designated laboratory. The results of both testing locations are then compared.
- 3.15 *Pipe Lot* – The amount of pipe produced per type per diameter as defined in the Manufacturer’s Quality Control Plan/Quality Management System.
- 3.16 *Profile Wall Pipe*- A pipe product consisting of a smooth wall waterway braced with annular or helical projections or ribs on the outside of the pipe, or with annular or helical bracing between smooth outer and inner walls.
- 3.17 *QMS Desktop Audit* – Complete review of the Manufacturer’s Quality Management System (QMS) and the corresponding documentation by NTPEP or its designee.
- 3.18 *Quality Management System (QMS)* – The documented process used by the Manufacturer for quality control/quality assurance.
- 3.19 *Recycled Material*- Material from a source other than the Manufacturer’s production line, which may not meet the requirements for minimum cell classification or has unknown properties.
- 3.20 *Regrind*- Reworked material that is processed for introduction into the feed stream.
- 3.21 *Reworked Material* – Clean PVC material generated from the Manufacturer’s own production not suitable for use or sale. When used by the Manufacturer, it meets the requirements for minimum cell classification as described in AASHTO M 304.
- 3.22 *Soiltight Joints*- Connections that do not allow soil migration through the joint into the pipe in accordance with AASHTO M304 Section 7.6
- 3.23 *Surveillance Audit*- An audit of any Manufacturer’s plant and associated laboratory included in the program by AASHTO member departments to determine compliance with the program requirements
- 3.24 Additional terminology can be found in applicable AASHTO and ASTM Standards.

4. OVERVIEW OF THE PROGRAM

The program for PVC Thermoplastic Pipe assesses the conformance of both manufacturing plants and products. The program includes the following:

- 4.1 Manufacturer's Quality Management System Desk Top Audit:
 - 4.1.1 A complete review of the Manufacturer's Quality Management System (QMS) written procedures is performed by NTPEP prior to the on-site audit. The requirements for this document are referenced in Section 6.
- 4.2 Initial and Annual NTPEP Audits:
 - 4.2.1 NTPEP will perform initial and annual quality control audits of each facility that a Manufacturer desires to be included in the program. These audits will include evaluation of production and testing associated with the product along with review of the following documents: Quality Management System (QMS) implementation, test reports, equipment calibration, verification of results, and check records. The Qualification Agency will conduct these audits assisted by co-auditor(s) from any AASHTO member department(s) that want to participate.
- 4.3 Split Sample Comparison Testing of Pipe and Compound Samples:
 - 4.3.1 Samples of component material and finished product will be taken from production and/or stock and tested, in accordance with the appropriate AASHTO/ASTM specifications, at the Manufacturer's testing facility.
 - 4.3.2 Companion samples will also be obtained for testing by the NTPEP designated laboratory.
- 4.4 The NTPEP Website Listing:
 - 4.4.1 A listing of PVC pipe products, by diameter and Manufacturer, tested and found to conform to the requirements of the AASHTO M 304 Material Specification and this Standard Practice.
 - 4.4.2 A listing of every Manufacturer with a QMS found to be compliant to this Standard Practice.
 - 4.4.3 A document library containing this Standard Practice and a secure area where AASHTO member departments can view the Manufacturer's: QMS, audit results, and all sample test results for AASHTO M 304 pipe and raw materials.

5. APPLICATION FOR PLANT AUDIT AND PRODUCT TESTING

- 5.1 Any Manufacturer of PVC thermoplastic pipe as defined in AASHTO M304 may participate in the program. All costs for participation in the program, including sample shipping and testing and other NTPEP auditing and administrative fees are to be borne by the Manufacturer. Any testing above and beyond the basic NTPEP program requirements will be at the expense of the state DOT/transportation agency or as provided in its specifications.
- 5.2 The Manufacturer will make a formal request through the NTPEP website to participate in the program (<http://data.ntpep.org>). The request will list the Manufacturer's location(s) and products to be evaluated and describe the Manufacturer's Quality Management System (QMS).
- 5.3 Log onto the NTPEP website, <http://data.ntpep.org/nap> to review and download the following documents:
 - Pre-Audit Application
 - Audit Worksheet

- 5.4 Once the QMS is found to conform, the Manufacturer and all associated testing facilities the Manufacturer desires to qualify will be scheduled for audit.
- 5.5 The on-site audit will be scheduled approximately 4 weeks in advance of the actual audit. The Manufacturer will receive an Announcement Letter from NTPEP showing the anticipated date of the audit.

6. QUALITY MANAGEMENT SYSTEM (QMS) REQUIREMENTS

6.1 NTPEP Audits will be based on the Manufacturer following an established quality control program that provides assurance that the products produced meet the requirements of the AASHTO/ASTM Materials Specifications and that these products conform to this NTPEP Standard Practice. The Manufacturer will implement a documented Quality Management System (QMS). Each Manufacturer will include elements that it considers necessary to assure that products meet AASHTO M 304 requirements, but as a minimum the QMS will include or address the following:

- Organization and Organizational Policies
- Quality Mission Statement
- Position Descriptions
- Quality Control Personnel Training and Competency Evaluation
- Contract Review
- Customer Feedback
- Internal Quality Audits of Each Facility Producing Product
- Management Reviews of Each Facility Producing Product
- Corrective Action Procedures
- Sampling Plan for Quality Control and Quality Assurance
- Testing Plan for Quality Control and Quality Assurance
- Retesting Plan for Quality Control and Quality Assurance
- A List of Physical and Chemical Test Equipment
- Lab Equipment Plan for Calibrating and Standardizing Equipment
- Recording and Maintaining Product Information and Test Results
- Handling Raw Material and Finished Product for DOT Products
- Quality Control Inspection
- Labeling and Storage of Finished Product
- Control of Nonconforming Product

6.1.1 *Organization and Organizational Policies* – The QMS will indicate the line of authority from the QC testing technicians to the QC manager, ensure that QC testing technicians have the authority to require corrective action, and ensure that the QC manager is independent of production management and of equal status.

6.1.2 *Quality Mission Statement* - The quality mission statement will describe the Manufacturer’s mission and be endorsed by the Manufacturer’s Chief Executive Officer. It will also be made available to all employees.

6.1.3 *Position Descriptions* - The QMS will describe the duties associated with each position included on the organization chart. These descriptions will also include the required skills, education, and experience associated with each specific position and indicate the supervision exercised and received.

6.1.4 *Quality Control Personnel Training and Competency Evaluation* -

6.1.4.1 The QMS will ensure that:

- Manufacturer’s QC manager meets the requirements established by the Manufacturer;
- QC manager qualifies technicians performing QC testing;

- QC personnel are familiar with the tests they perform; and
- QC personnel have sufficient authority to assure that corrective actions are carried out when necessary.

6.1.4.2 The QMS will describe the Manufacturer's QC technician qualification program. As a minimum the program will include:

- Training in the AASHTO, ASTM, or Manufacturer test procedures, operation of equipment, the procedures to be used, calculations required, and reporting;
- Demonstration of competency in each required test;
- Demonstration of ability to properly document test results;
- Annual auditing of each technician's ability to satisfactorily perform the required tests; and
- Retraining when a test method is revised.

Training and competency reviews will be documented in such a way that compliance with the requirements for the initial and updated training and the initial and annual competency reviews can be demonstrated for each technician and for each test the technician performs. The documentation will include the date of the training or competency review and contain the hand written signature or initials of the trainer/reviewer and the technician. This documentation will be retained, for a minimum period of 5 years, at each location where quality control testing occurs, and will be made available to NTPEP for review upon request.

6.1.5 *Contract Review* -The QMS will include a procedure for processing PVC thermoplastic pipe orders and the review of contracts for producing PVC thermoplastic pipe. This procedure will ensure that:

- The requirements are adequately defined, documented and understood
- Records of contract reviews are maintained
- The client will be informed of any deviations from the contract

6.1.6 *Customer Feedback* - The QMS will include a procedure describing the customer feedback system. This procedure will indicate the following:

- What position(s) or employee(s) are responsible for customer feedback
- Methods used to solicit, evaluate and respond to customer feedback
- Conditions under which corrective action will be implemented

6.1.7 *Internal Quality Audits of Each Facility Producing Product* -

6.1.7.1 The QMS will include a description of the procedures used to conduct internal audits. The Manufacturer, or an independent auditor hired by the Manufacturer, will perform these audits at least annually unless problems in the quality control program or with the quality of the product indicate more frequent audits are necessary. The internal audit procedures will include the following as a minimum:

- What position(s) or employee(s) are responsible for ensuring the internal audits are performed;
- Frequency, scope, and criteria used for performing the audits;
- Conditions under which corrective action will be implemented;
- Evaluation of plant inspection;
- Inspection of testing equipment and calibrations;
- Observation of resin and compound sampling and lot control procedures;
- Observation of product sampling and testing procedures;
- Review of product certification procedures;
- Review of inspection and testing report documentation; and
- Review of nonconforming product documentation and actions taken.

- 6.1.7.2 The QMS will ensure that:
- Audit findings are discussed with management and testing technicians and documented in a report;
 - Corrective actions are taken as necessary and documented in the report; and
 - Most recent report is included in QMS documentation submissions.
- 6.1.8 *Management Reviews of Each Facility Producing Product* - The QMS will include written procedures for performing management reviews. The procedures should indicate the following:
- What position(s) or employee(s) are responsible for ensuring that management reviews are performed;
 - The frequency, scope and criteria used for performing the management review(s); and
 - Conditions under which corrective action will be implemented.
- 6.1.9 *Corrective Action Procedures* - The QMS will include procedures describing the actions taken when failures or nonconformities exist in any of the following areas: product, equipment, customer feedback, internal and external audits, and management reviews. These procedures will indicate what position(s) or employee(s) are responsible for implementing corrective action and the methods used to identify and implement corrective action(s).
- 6.1.10 *Sampling Plan for Quality Control and Quality Assurance* - The QMS will include procedures describing sampling for quality control and quality assurance. These procedures will include the following details:
- Number and frequency of samples taken;
 - Sample selection process, including sampling required for retesting;
 - The position(s) or employee(s) responsible for sampling; and
 - Required sample preparation.
- 6.1.11 *Testing Plan for Quality Control and Quality Assurance* - The QMS will include procedures describing testing for quality control and quality assurance. These procedures will include the following details:
- Number of samples required for testing;
 - Tests required to be performed;
 - The position(s) or employee(s) responsible for testing;
 - How test results are interpreted;
 - The position(s) or employee(s) responsible for approving test results; and
 - Criteria and procedures for retesting.
- 6.1.12 *Retesting Plan for Quality Control and Quality Assurance* - The QMS will include procedures describing retesting for quality control and quality assurance. These procedures will include the following details:
- When retesting is performed;
 - Retest sampling requirements;
 - Special retesting conditions;
 - Criteria for acceptance of test results; and
 - Instructions for reporting original test results and retest results.
- 6.1.13 *A List of Physical and Chemical Test Equipment* - The QMS will include a list(s) giving a general description of physical and chemical test equipment requiring standardization or checks. The following information will be included for each piece of equipment:
- Interval between standardization or check;
 - Reference to standardization or check procedure; and

- Location of standardization or check record.

6.1.14 *Lab Equipment Plan for Calibrating and Standardizing Equipment* - The QMS will include written procedures for ensuring that equipment standardizations and checks are performed for all required equipment at specified intervals. These procedures will indicate the following:

- Position(s) or employee(s) responsible for standardization and check activities;
- How to handle equipment which is newly acquired, removed from service, or does not meet accuracy requirements;
- In-house equipment standardization and check procedures, when they cannot be referenced in applicable standards; and
- Certificates or other documents that establish traceability of in-house equipment or reference standards used for standardization and checks.

6.1.15 *Recording and Maintaining Product Information and Test Results* - The QMS will include written procedures used to produce, check and amend test reports. These procedures will include the following details:

- Identify position(s) or employee(s) responsible for maintaining test reports;
- Describe distribution of test reports;
- Identify location of test reports;
- Retention of: resin test reports, resin Manufacturer’s lot bulk density and melt index data, certificate of analysis (C of A), and supporting test reports for every lot of resin;
- Retention of compound test reports and the certificate of analysis (C of A) with supporting test reports for every lot of compound; and
- Process for maintaining the above referenced information for a minimum period of 5 years and how they are made available to NTPEP for review.

6.1.16 *Handling Raw Materials and Finished Product for DOT Products* - The QMS will include a written procedure for handling raw materials and finished product.

6.1.16.1 Raw Materials - Quality control testing of resins or compounds as specified in AASHTO M 304. The pipe Manufacturer will test the resin or compound, or have it tested at an independent laboratory acceptable to NTPEP, as specified in Table 1. For every lot of resin, the pipe Manufacturer will maintain, for a minimum period of 5 years, resin verification test reports and the resin Manufacturer’s lot bulk density data, certificate of analysis (C of A), and supporting test reports. For every unique compound, the Manufacturer will maintain, for a minimum period of 5 years, compound verification test reports and the compound’s cell classification and bulk density data, certificate of analysis (C of A), and supporting test reports. The Manufacturer will establish a lot number for each lot of compound and carry it through to the finished product. The QMS will include the location and method for sampling compounds.

Table 1: Compound Test Requirements

Test Property	Test Designation	Test Frequency
Tensile Strength and Modulus of Elasticity	ASTM D 638	once per year per formulation
Impact Resistance (izod)	ASTM D 256	once per year per formulation
Deflection Temperature	ASTM D 648 – Method A	once per year per formulation
Flammability	ASTM D 635	once per year per formulation

6.1.16.1.1 Single-Stream Compound - Reworked material may be added to a single-stream compound, but **recycled plastic is not allowed.**

6.1.16.1.2 Additional Compound Requirements for M304 Products:

- When pipe is produced from a single stream compound there will be a C of A indicating the virgin compound meets the requirements of M304.
- The full cell classification testing of a compound will be performed with the initial use of any formulation and then annually with the continued use of that formulation.
- Each compound will be provided to the NTPEP auditor so that it can be verified it is an approved compound being used to produce the M304 product.

6.1.16.1.3 M304 Fittings and Coupling Requirements:

- The QMS will document where fittings and couplings are manufactured, the source of the components, and the fabrication process used.
- All (blow-molded and fabricated) fittings will include indelible markings with the designation number of the specification, M304, and with the Manufacturer's identification symbol. This procedure will also be included in the QMS.
- The QMS will also document the process used to assure that all compounds used to manufacture fittings and couplings meet the material requirements of M304, including those components purchased from another party.
- The QMS will require that the plant maintain records establishing traceability from the fitting or coupling back to the compound lot used to manufacture the fitting or coupling. Documentation establishing traceability will be maintained along with the inventory.

6.1.16.2 Finished Product – As a minimum the QMS will describe the Manufacturer's inspection process to conduct visual inspections of: the exterior and interior walls for visible cracks, holes, foreign inclusions, or other defects as described in AASHTO M 304, during production. The procedure will require the Manufacturer to monitor the process and finished product and perform and record the results of the following inspections at the minimum frequency indicated:

Inspection	Frequency
Workmanship (per AASHTO M 304)	continuous, recorded at least once per shift
Markings (per AASHTO M 304)	one per shift

6.1.17 *Quality Control Inspection* - The QMS will include an example of a quality control test report form. . The QMS will reference the AASHTO, ASTM, or in house procedures and calibrations. The QMS will describe any company procedure used.

Note 1 - Company procedures are subject to approval. The company test procedures which pertain to the tests providing useful information to evaluate the product are included in this requirement.

6.1.17.1 The QMS will include a description of the Manufacturer's statistical process control plan. The plan will use methods such as statistical control charts to monitor production facility quality control test results for the purpose of identifying trends and being able to make production adjustments as necessary. The plan will monitor each production plant separately and total Manufacturer product quality trends.

6.1.17.2 The QMS will require that the Manufacturer perform and record the results of at least the following quality control measurements and tests, at the minimum frequency indicated on each lot of pipe:

Measurements and Tests	Frequency
Wall Thickness	one per hour per line
Inside Diameter	one per hour per line
Perforation Locations and Dimensions	one per hour per line
Pipe Stiffness	one per day per line
Pipe Flattening	one per day per line
Impact Resistance (Tup)	one per day per line
Acetone Immersion	one per lot per line
Soiltightness*	one per year
Watertightness*	one per year

**The pipe will be identified in the QMS as either soiltight or watertight. Only the applicable test will be performed at the required frequency.*

- 6.1.17.3 The QMS will ensure that:
- Each sample selected for quality control inspection and testing is designated with a sample control number for record keeping and traceability;
 - Test report for each sample identifies the plant, date, shift of manufacture, production line, and lot designation for the PVC compound; and that
 - Quality control test reports (not samples) are maintained and available for review for 3 years.

- 6.1.17.4 The QC testing facility will:
- Maintain current versions of all AASHTO, ASTM, and Company test procedures for all tests performed and a current version of the Company’s QMS documentation;
 - Adequately house and allow proper operation of all required testing equipment; and
 - Maintain records of all NTPEP reviews and actions taken to resolve any noted deficiencies.
 - Perform calibrations and verifications on testing equipment in accordance with the Manufacturer’s recommendations, but at least once every 12 months. These activities will be performed by the individuals who routinely use the equipment and are familiar with its use or by technicians of an accredited calibration/verification facility familiar with the equipment.

6.1.17.5 The QMS will describe in detail the requirements for the QC test facility(ies) and include, as a minimum, a description of how the Manufacturer will cover QC responsibilities at all times, including when the QC Manager is away from the plant for any reason.

Note 2 - Audits may be unannounced and will proceed regardless of the availability of key QC staff.

6.1.17.6 The Manufacturer’s QC manager will be responsible for QC testing at all facilities and assure that all sampling and testing is done by technicians meeting the requirements of the Manufacturer’s technician qualification program. In the event the Manufacturer utilizes an independent laboratory for testing, the independent laboratory will be NTPEP compliant.

- 6.1.18 *Labeling and Storage of Finished Product* - The QMS will include a written procedure describing how finished product is labeled, packaged and stored to include:
- The Manufacturer’s method for permanently marking the pipe in accordance with the minimum requirements of AASHTO M 304;
 - Detailed explanation of any coding used to mark the pipe; and
 - The procedures used to ensure that product handling, storage, and shipping processes will not adversely affect the material composition, characteristics, or product quality.

- 6.1.19 *Control of Nonconforming Product* - The QMS will include written procedures describing the actions to take when product does not conform to the specification requirements. These procedures should include the following details:
- What position(s) or employee(s) is responsible for making decisions related to non-conforming product;
 - How nonconforming product is identified, and labeled.
 - What happens in the event it is shipped;
 - What is done with the nonconforming product;
 - Who is responsible for taking corrective action;
 - How test reports clearly identify the deficiencies;
 - How products produced subsequent to the previous testing, are identified and quarantined pending investigation of the failure; and
 - The process for obtaining and testing check samples.
- 6.2 In the event the Manufacturer utilizes an independent laboratory for testing and the results are utilized in the generation of the test report, then that location will meet all requirements listed above. The QMS will also contain the required information for the independent laboratory location.
- 6.3 After the initial audit, a complete thorough desktop review will be performed every 5 years. Updates made to the QMS within the previous 12 months will be required to be sent to AASHTO annually.

7. NTPEP ON-SITE AUDITS

- 7.1 *The NTPEP Audit Team* - The NTPEP audit team will consist of a NTPEP Auditor and an AASHTO member department co-auditor(s) from any state invited to participate in the on-site audit. The NTPEP Auditor will produce a single audit report, which will include findings from both the NTPEP Auditor and AASHTO Member Department co-auditor(s), if present.
- 7.2 *Initial/Annual Audit* - Once the QMS is found to conform, the specific location the Manufacturer desires to qualify will be audited. The on-site audits include the following:
- 7.2.1 *Documentation Review* - The auditor(s) will check the availability of the most current AASHTO and ASTM standards, review training and competency records, and evaluate the most current Quality Manual documentation and equipment records to verify implementation of the plant's QMS.
- 7.2.2 *Production Line Inspection* - During the production line inspection, the auditor(s) will walk through the manufacturing process to observe the conditions of the lines. During this process, the auditor will identify samples to be collected for split-sample testing purposes.
- 7.2.3 *Storage Yard Inspection* - The auditor(s) will inspect the condition of product in the Manufacturer's yard. Additionally, the auditor(s) may select various samples from the storage yard for testing.
- 7.2.4 *Quality Control Testing Evaluation* - Each Manufacturer will be asked to demonstrate the quality control tests they perform as stated in their QMS. While performing each test, the most current AASHTO or ASTM test methods will be referenced. The equipment used for each test will be examined and applicable records will be reviewed. The auditor will also select three random weeks (within the previous 12 months) of test reports for resin and pipe produced in accordance with AASHTO M304 to review.

7.2.5 Split Samples for Comparison Testing – Split samples will be designated by the auditor(s) and will include a variety of lots and sizes of PVC Thermoplastic Pipe available at the time of the audit. All sampling and testing will be in accordance with the appropriate AASHTO/ASTM specifications. The split samples will be for testing at the Manufacturer’s testing facility and NTPEP’s designated laboratory. Manufacturer samples tested during the audit will be observed by the auditor(s).

Note 3- If major deficiencies are noted during an on-site audit, a follow-up audit will be required to be completed.

7.3 *NTPEP Follow-Up Visits and Testing* – NTPEP follow-up visits and audits to a Manufacturer’s location and associated laboratory (if applicable) included in the program, may be conducted to determine compliance with the program requirements. These visits may not necessarily be announced. They may also randomly select samples of product and the resin or resin blend being used in production to be tested in accordance with AASHTO and ASTM specifications.

7.3.1.1 *AASHTO Member Department Surveillance Visits and Testing* - AASHTO member departments using the NTPEP listing have the right to conduct their own surveillance visits and audit any Manufacturer and associated laboratory included in the program to determine compliance with the program requirements. These visits may not necessarily be announced. They may also randomly select samples of product to be tested in accordance with AASHTO and ASTM specifications. Any additional testing (above and beyond what is required by the basic NTPEP program requirements) or costs will be at the AASHTO member’s expense or as provided for in its specifications.

Note 4- If major deficiencies are noted during a surveillance audit, the results of the audit will be forwarded to NTPEP.

8. ANNUAL PRODUCT CONFORMANCE TESTING

8.1 The NTPEP program requires that pipe and compound samples be tested to determine conformance with the appropriate AASHTO/ASTM Materials Specifications.

8.2 The NTPEP Auditor will select three sets of samples (Ref.: Section 9) during each annual Manufacturer audit (one set to be tested by the Manufacturer, one set to be tested by the NTPEP designated laboratory , and one for retesting as required in Section 8.7). All samples will be from the same lot of material.

8.3 Manufacturer Samples:

8.3.1 M 304 Products - Once initial product evaluation has been established, a NTPEP Auditor will sample pipe and compound during each annual plant audit. Samples of two non-adjacent pipe diameters and one compound sample will be taken annually at the time of the plant audit. Subsequent annual pipe samples will not duplicate previously tested diameters until all diameters produced at the plant have been tested.

8.3.2 If the pipe Manufacturer does not have capability to perform the cell class as specified in M304, the compound split samples may be tested at a laboratory acceptable to NTPEP, preferably not at the same laboratory testing the NTPEP portion of the split sample. If requested, a DOT testing facility can be included in the split sampling process.

8.3.3 The Manufacturer will report the results from their testing using the standard format provided by NTPEP within 15 calendar days of testing.

8.4 NTPEP Designated Laboratory Samples:

- 8.4.1 The NTPEP Auditor will instruct the Manufacturer on the proper labeling of the NTPEP designated laboratory samples. These samples will be located adjacent to the previous (Manufacturer) samples and from the same lot(s) and in the same quantities as obtained in Section 8.3. "Manufacturer Samples". The Manufacturer will send (freight paid by the Manufacturer) the samples to the NTPEP designated laboratory for testing (Ref.: Section 9).
- 8.4.2 Once the NTPEP Project Engineer sends the Manufacturer the results from the NTPEP designated laboratory testing, the Manufacturer can provide an explanation of any significant differences between the NTPEP designated laboratory and Manufacturer sample test results, including any corrective actions found necessary in the manufacturing process or testing procedures.
- 8.5 Retest Samples:
- 8.5.1 Additional material (one additional set of samples) will be obtained from the same lot and kept at the Manufacturer's location in the event the NTPEP designated laboratory sample fails. This sample will be tested as directed by NTPEP.
- 8.6 Testing for product conformance performed by an independent laboratory will be witnessed during the audit. All conformance testing will be in accordance with this Section.
- 8.7 If during the testing portion of the audit or during NTPEP designated laboratory testing at least one tested sample fails to meet specification requirements or when the Manufacturer is found during an audit to have neglected one or more aspects of the governing QMS during manufacturing, the nonconformance will be addressed as outlined in Section 10 of this practice.

9. SPLIT SAMPLE COMPARISON TESTING

The NTPEP program utilizes a NTPEP designated laboratory testing to validate the consistency of the testing results for samples tested at the Manufacturer's laboratory.

- 9.1 The comparative results of the NTPEP designated laboratory testing will be posted in the secure area of the NTPEP website, available only to AASHTO member departments and the personnel of the Manufacturer where the samples were tested.
- 9.2 These results will be used by NTPEP to determine if further action needs to take place prior to the determination of whether the Manufacturer is "Compliant" with the program. Nonconformances will require resolution in accordance with Section 10.

Note 5 - Any inconsistency in results may result in the need for a NTPEP follow-up audit.

10. RESOLUTION OF TESTING /AUDIT NONCONFORMANCES AND DISPUTES

- 10.1 When a designated sample does not meet one or more of the specification requirements when tested or when the Manufacturer is found, during an audit, to not conform with one or more aspects of the governing QMS, then the burden is on the Manufacturer to identify the cause, correct the issue, document the resolution, and revise the QC plan to assure future conformance. All testing and audit results are reported, along with any corrective actions, to NTPEP.
- 10.1.1 Samples, tested at the Manufacturer, that do not meet one or more of the specification requirements are handled as follows:
- 10.1.1.1 The Manufacturer should verify that the manufacturing process is operating correctly, that test equipment is calibrated and operating correctly, and that test procedures are correct. This investigation will be documented and the results sent to NTPEP.

- 10.1.1.2 In addition, the Manufacturer will test another sample from the same lot as the nonconforming test. The results of the testing, along with a companion sample for NTPEP designated laboratory testing, will be sent to the NTPEP designated laboratory.
- 10.1.1.3 If the Manufacturer's and the NTPEP designated laboratory's test results on the second sample are satisfactory, NTPEP will consider the dispute resolved. If this is not the case, the Manufacturer will investigate the cause of the nonconforming test, report the findings and test another sample. The results of the investigation and test results will be sent to the NTPEP liaison for distribution to the committee chair and vice chair for review. Upon a satisfactory review, the results of the testing, along with another companion sample for NTPEP designated laboratory testing, will be sent to the NTPEP designated laboratory.
- 10.1.1.4 Additional retesting or re-auditing will be at the discretion of the NTPEP and the associated costs will be borne by the Manufacturer. All results will be posted in the secure area of the NTPEP website, available only to AASHTO member departments and the Manufacturer's personnel of the location where the samples were tested.
- 10.1.2 When a nonconformance is found during an audit, the burden will be on the Manufacturer to identify the cause; develop, implement and document the resolution; and revise his QC plan to assure future conformance. When the Manufacturer is found to not conform with one or more aspects of the governing QMS, handle it as follows:
- 10.1.2.1 The NTPEP Auditor notifies the Manufacturer of the issue(s).
- 10.1.2.2 The Manufacturer furnishes a Corrective Action Report (CAR) to AASHTO (within 15 business days of the final NTPEP Audit report) to the NTPEP Auditor. The CAR is to contain: the issue being addressed, the course(s) of action to be taken and a timeline showing when these actions will be taken. There should be sufficient detail to adequately explain the processes to be followed.
- 10.1.2.3 If the CAR is not received within 15 business days, NTPEP notifies the Manufacturer that their facility is classified as "non-compliant" with AASHTO's NTPEP Audit Program. The audit is considered completed and all fees paid will not be refunded.
- 10.1.2.4 If the Manufacturer still requests to participate in the program, they will need to reapply (Ref.: Section 5).
- 10.2 When the Manufacturer has a dispute with NTPEP regarding procedural issues, it is handled as follows:
- 10.2.1 The Manufacturer notifies NTPEP in writing of the dispute, providing appropriate documentation for the committee to fully understand the controversy, and requests a resolution. Copies of the dispute and documentation are forwarded by NTPEP to the Technical Committee Chairman and Vice-Chairman and to the AASHTO Technical Committee Liaison. The Technical Committee, less industry representatives, will convene to discuss the dispute and render a decision on the appropriate resolution. Quorum for the purposes of this decision will be either the Chairman or Vice-Chairman, the NTPEP liaison or his/her designee, and one other Technical Committee member. The Chairman or Vice-Chairman will communicate the resolution to the Manufacturer in writing through NTPEP.
- 10.2.2 The Manufacturer may appeal within 30 days of the date of the resolution. If the dispute is not resolved to the Manufacturer's satisfaction, the dispute can be raised to the NTPEP Executive Committee Chairman for resolution by the NTPEP Appeals Board. The decision by the Appeals Board is final.

11. REPORTING OF DATA

- 11.1 NTPEP maintains the results of the audit and testing on their website (<http://data.ntpep.org>). NTPEP will also publish a list showing which Manufacturer locations and product are compliant with the requirements of this Standard Practice. Each DOT then determines whether the Manufacturers are approved or not based upon their established criteria (Ref.: the particular DOT's specification).
- 11.2 NTPEP will also post the PVC thermoplastic pipe test results in the secure area of the NTPEP website, available only to AASHTO member departments and the personnel of the Manufacturer where the samples were tested.

Public Notice - One of the primary reasons for a quality control program is to instill confidence in the end-user and the general public that the materials being used for infrastructure construction are of sufficient quality and to facilitate use of products that have proven to be of sufficient quality. The program will provide for public notice of Manufacturers found to conform with the provisions of this Standard Practice via website postings.

12. MANUFACTURER DISQUALIFICATION

- 12.1 Manufacturers will ensure all participating locations, associated quality control testing facilities, personnel, and sampling and testing activities are in continuous conformance with the NTPEP requirements.
- 12.2 NTPEP, based on results of their audits or the acceptance or other testing done by individual states, may rescind a Manufacturer's listing if a facility is determined not to comply with the NTPEP requirements.
- 12.3 The NTPEP Auditor will forward a letter of explanation to the affected Manufacturer and all AASHTO member departments detailing the reason(s) for revocation of the qualification. The NTPEP Auditor will handle appeals of such revocation.

13. RESUBMITTAL TESTING FREQUENCY

- 13.1 Product design may change over time as Manufacturers improve their products and optimize their manufacturing processes. When a design change is made in a NTPEP listed product, the Manufacturer will notify the NTPEP of the change and submit samples for re-consideration of conformance with this Standard Practice. Any changes in a manufacturing method, product weight, or pipe wall design will be considered design changes.

14. KEYWORDS

- 14.1 NTPEP; PVC pipe; plastic pipe; profile wall PVC pipe; Manufacturer

APPENDIXES (NONMANDATORY INFORMATION)

X1. NTPEP QA PROGRAM FOR POLYVINYL CHLORIDE DRAINAGE PIPE - PARTICIPANT RESPONSIBILITIES

X1.1. **Background:** This section summarizes the responsibilities for the different parties, which can be found in more detail in the following sections titled, “Operating Procedures” and “Quality Control Polyvinyl Chloride (PVC) Drainage Pipe Manufacturers”.

X1.2. **Manufacturers’ Responsibilities:** Participating Manufacturers will develop and implement a Quality Management System (QMS) outlining their quality control testing program for production of Polyvinyl Chloride (PVC) Drainage Pipe. In addition, the manual will address the following general program, testing facilities, personnel qualification, and record keeping requirements:

X1.2.1. **General Requirements:**

X1.2.1.1. Each Manufacturer will be prepared to accommodate Manufacturer and testing facility audits (scheduled and follow-up) by NTPEP representatives when submitting its initial Quality Management System (QMS), or updated QMS in the case of the annual re-evaluation, to NTPEP.

X1.2.1.2. Each Manufacturer’s facility is responsible for ensuring continuous compliance with all NTPEP quality control requirements. Failure to do so may result in revocation of the listing on the NTPEP website.

X1.2.2. **Testing Facilities:**

X1.2.2.1. The Manufacturer’s quality control manager will be responsible for quality control testing at all facilities and will assure that all sampling and testing is done by qualified technicians.

X1.2.2.2. The testing facilities will maintain current versions of all AASHTO, ASTM, and Manufacturer’s test procedures for all tests performed and a current version of the Manufacturer’s QMS.

X1.2.2.3. The facilities will adequately house and allow proper operation of all required testing equipment.

X1.2.2.4. The testing equipment will be calibrated/verified/checked in accordance with the Manufacturer’s recommendations at least once every 12 months by personnel customarily involved in such work as documented in the QMS.

X1.2.2.5. The testing facilities will maintain records of all test results and all NTPEP reviews and actions taken to resolve any noted deficiencies.

X1.2.2.6. Records of equipment calibration and verification will be maintained and available to NTPEP and AASHTO member departments upon request.

X1.2.3. **Testing Personnel:**

X1.2.3.1. The Manufacturer’s quality control manager will meet the requirements established by the company for the position.

X1.2.3.2. Documentation will show that the technician has been trained in the test procedures to be performed.

X1.2.3.3. Documentation will show that the technician has satisfactorily demonstrated competency to perform the required testing and that this demonstration is repeated annually.

- X1.2.3.4. Documentation will show that technician training has been updated when revisions in test methods occur.
- X1.2.3.5. Review of reports will show the technician can properly perform test procedure calculations and properly record information.
- X1.2.3.6. Technicians-in-training may perform sampling and testing at qualified facilities provided they are working under the direct supervision of a technician fully qualified under NTPEP requirements.
- X1.2.3.7. If requested, technicians will perform sampling and testing for NTPEP observers.
- X1.2.4. **Testing Documentation**
- X1.2.4.1. All quality control test results for Polyvinyl Chloride Drainage Pipe will be documented in reports of the same format as the sample forms submitted in the QMS and will be kept for a minimum of three years.
- X1.2.4.2. The reports will document the actions taken in the event of product test failures.
- X1.2.4.3. The reports will show the manufacture location, date of manufacture, physical and chemical test results. Identification will be such that the test reports for any product can be located.



On-Site Pipe Audit

Opening Meeting

- Introductions
- Address Any Safety or Security Concerns
- Address Confidentiality
- Questions, Comments, or Concerns?

Summary of Desktop Review

- Resolved Findings
- Unresolved Findings
- Most Current Quality Manual

Yard Walk Through

- Inspect Pipe, Fittings, and Couplings
- Record Product Information for Traceability Purposes

Manufacturing Line Walk Through

- Process and Conditions
- Collect Pipe and Resin Samples for Split-Sample Testing

Review of Documentation

- Review and Collect Certificates of Analysis
- AASHTO and ASTM Standards
- Training and Competency Evaluations
- Internal Audits
- Management Reviews
- Equipment Records

Quality Control Testing

- Demonstration of In-House Testing Methods
- Inspection of Equipment

Audit Summary Close-Out Meeting

- Review of Audit Findings
 - Questions/Concerns?
 - Closing Remarks
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