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## **Section 6.1 Volume II**

### **FLEXIBLE PIPE (METAL AND PLASTIC)**

#### **6.1.1 PURPOSE**

This procedure provides guidance for the development and implementation of the Quality Control Plan for the manufacture, storage, and transportation of flexible pipes for Florida Department of Transportation projects. Flexible Pipes, hereinafter referred to as pipes, include corrugated metal pipes, corrugated high-density polyethylene pipes, corrugated polypropylene pipes, corrugated polyvinyl chloride pipes, and steel reinforced ribbed polyethylene pipes.

#### **6.1.2 AUTHORITY**

Code of Federal Regulations (CFR), Federal-Aid Policy Guide (FAPG), Construction Inspection and Approval, Subpart B – Quality Assurance Procedures for Construction  
334.044(2), 334.044(10)(a), and 334.048 Florida Statutes

#### **6.1.3 REFERENCES**

- A) Design Standards, Topic No. 625-010-003, Florida Department of Transportation.
- B) Florida Department of Transportation Standard Specifications for Road and Bridge Construction.
- C) American Society for Testing and Materials (ASTM) Standard Test Methods and Specifications, Philadelphia, Pennsylvania.
- D) American Association of State Highway and Transportation Officials (AASHTO), Part I Specifications, and Part II Tests, Washington, D.C.
- E) Approved Product List (APL), Florida Department of Transportation.

- F) Field sampling and Testing Manual, Florida Department of Transportation.

## 6.1.4 SCOPE

This procedure is used by the pipe manufacturers (Plants) to perform the required inspections and testing of pipe during and after manufacturing. These requirements and activities pertain to the inspections, measurements and necessary tests to substantiate that materials and pipes are in conformity with the **Contract Documents**. The quality control plans are designed to provide guidelines that are used by the plants to produce pipes in conformance with the **Florida Department of Transportation Specifications** and other **Contract Documents**.

## 6.1.5 GENERAL INFORMATION

Plants are responsible for the production, inspection, documentation, storage and shipment of the pipes. The pipes delivered to the project shall meet the requirements of the **Specifications** and other **Contract Documents**.

## 6.1.6 PLANT QUALIFICATION PROCESS

### 6.1.6.1 General

Prepare the proposed quality control plan in accordance with **Specifications Section 105. Materials Manual Section 5.6** may be used as a guideline.

### 6.1.6.2 Review of Plant's Proposed Quality Control Plan

Submit the proposed quality control plan to the District Materials and Research Office for the District in which the Plant is located. For out-of-state plants, contact the State Materials Office (SMO) to determine the nearest District Materials and Research Office (DMRO) that will be involved in the quality control plan review process. Upon the plant's submittal of a QCP, the SMO and/or the DMRO will review the proposed quality control plan review and make necessary arrangements for the initial plant qualification review in accordance with **Section 6.1.6.3** below.

In the QCP, include the work experience, quality control (QC) training qualifications, and responsibilities of the manufacturing production and quality control personnel. Identify the on-site Production Manager,

General Manager, QC Inspectors/Technicians, and Quality Control Manager (QCM). Identify the responsibilities for monitoring key quality attributes and quality control data. Include the applicable information required in **Specifications Section 105**. In the quality control plan, include a copy of the available minor repair methods for repair of minor deficiencies.

All proposed major field repairs to newly installed pipe shall have an engineering evaluation performed. An engineering evaluation is performed by an independent engineering firm specializing in the deficiency and the proposed major field repair(s) at no cost to the department. The use of a previously approved major repair method is only applicable to the same type of deficiency and pipe material. Any specific major field repair that has been previously approved by Construction and has been added to the plant's quality control plan may be accepted upon review by the Project Administrator. The plant must submit proof to the contractor and the Department prior to beginning any major repairs. All repair material shall meet the requirements of the Department. Consider situations not covered by these specific circumstances on their own individual merit. All field repairs made shall be under the observation of project personnel.

### **6.1.6.3 Plant Qualification Review**

The Department will perform the initial qualification reviews of manufacturing facilities that intend to produce pipes for Department projects. These initial reviews include the reviews of plants that submit their first quality control plan and plants that have not produced for Department projects for more than one year. The Department will also perform routine plant qualification reviews at least annually, on all manufacturing facilities that have continued furnishing pipes for the Department's projects.

### **6.1.6.4 Maintenance of Plant Qualification**

Upon the Department's satisfactory review of the proposed quality control plan, in compliance with **Materials Manual Section 5.6**, and satisfactory plant qualification reviews, the District Materials and Research Office will accept the proposed quality control plan and include the plant on the Department's list of plants with an Accepted Quality Control Plan. Advise the District Materials and Research Office of any changes in the quality control plan. In case of change(s), revise the quality control plan annually in the form of addenda or complete revision of the entire document.

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Submit the revised quality control plan or its addenda to the District Materials and Research Office annually.

Plants that are on the Department's list of plants with an Accepted Quality Control Plan will be subject to the plant qualification review process at any time. The Department will perform at least one annual review of the plants that are producing for the Department projects. Approved plants that are producing pipe on an infrequent basis shall contact the District Materials and Research Office to inform them of their next production date. This is required in order to allow verification inspection to be conducted.

## 6.1.7 PLANT FUNCTIONS AND RESPONSIBILITIES

### 6.1.7.1 General

Plants are responsible for the quality of the finished pipes. Provide facilities and qualified personnel to perform specified inspections and tests and maintain an acceptable Quality Control Plan in compliance with the requirements specified herein and in ***Specifications Sections 105 and 948***.

### 6.1.7.2 Quality Control Manager

The Quality Control Manager (QCM) shall ensure that the quality of the products at each plant meets the quality requirements of the ***Contract Documents***. The QCM may serve in more than one plant. The responsibilities of the QCM include, but are not limited to, the following:

- 1) Maintain the Quality Control Stamps/Labels and apply it to acceptable pipes, or designate a qualified quality control technician, who is working under the direct supervision of the QCM to apply the plant QC Stamps/Labels.
- 2) Be present, or designates a technician/inspector working under the direct supervision of the QCM to be present during the production of all pipes that will be shipped to Department projects.
- 3) Perform and/or supervise the quality control testing and inspection.
- 4) Ensure that the plant has a sufficient number of QC trained quality control technician(s)/inspector(s) to maintain adequate inspection and testing during the production of pipes for Department projects.

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In lieu of a permanent staff, the plant may retain the services of an engineering consulting firm or laboratory meeting the requirements of **Specifications Section 105**.

- 5) Ensure that the testing equipment is maintained and calibrated in accordance with the applicable test methods and the **Specifications**.
- 6) Visually inspect or ensure that a qualified QC technician inspects each pipe before it is shipped to the project site.
- 7) Ensures that all materials used in the manufacture of the pipes are from sources that meet **Specification** requirements.
- 8) Maintain a daily production log of the pipes showing coil numbers or resin lot numbers, pipe lot numbers, sizes and number of pipes produced. The production log shall be used as a means of successfully tracing any pipe produced from that plant.
- 9) Ensure that all pipes are properly stored and marked with the plant's name and other information that is required in the applicable **ASTM** or **AASHTO Standards**.
- 10) Maintain the files of material certifications, test data, QC inspections performed, Notarized Certification Statements and QC signed/stamped shipping tickets.
- 11) Arrange quarterly meetings with the Verification Inspector and representatives of the plant's QC personnel.  
  
Execute certifications attesting to applicable specification compliance and include a detailed listing of the pipe type, size and quantities.
- 12) Completes and QC signs/stamps detailed shipping tickets or an authorized representative identified in the plant's quality control plan may be allowed to complete shipping tickets.
- 13) Ensure that pipe joints comply with the requirements of **Section 6.1.8.4** and that the required hydrostatic testing is conducted on a periodic basis to ensure continuing compliance. Ensure that hydrostatic tests required by **ASTM D3212** are conducted by a

qualified independent testing laboratory or by the plant in the presence of the Engineer. The Department's requirement to be present at time of the test can be replaced by an independent engineering firm at the Plant's cost.

#### **6.1.7.2.1 Technicians/Inspectors**

The quality control technicians may perform any or all of the inspections, sampling, or testing as directed by the QCM, and may apply the QC stamp/label to the approved pipes, when directed by the QCM.

### **6.1.8 QUALITY CONTROL OF CERTIFIED MATERIALS**

#### **6.1.8.1 General**

Ensure that all materials used to manufacture pipes are from approved sources and comply with requirements as specified herein.

#### **6.1.8.2 Metal Coil**

The quality control technicians shall obtain metal coil manufacturer's certifications for all metal coils that are used to manufacture pipes. The delivered metal coil shall be accepted on the basis of the metal coil manufacturer's certification indicating compliance with applicable **ASTM** or **AASHTO Specifications**. The Department Verification Inspectors will take samples, at each plant, from at least two randomly selected LOT per year. A LOT is the entire volume of metal coil represented by the coil manufacturer's heat number.

#### **6.1.8.3 Plastic Resins**

The QC technicians shall obtain the plastic resin manufacturer's certifications for all plastic resins and resin additives that are used to manufacture pipes. The delivered plastic resins shall be accepted on the basis of the resin manufacturer's certification indicating compliance with appropriate **ASTM** or **AASHTO Specifications**. A certification for each container of resin is required. The District Materials and Research Engineer shall obtain verification samples at the source or at the pipe plant. Sampling shall be witnessed by the Verification Inspector. The plastic resins shall be stored such that mingling and contamination are avoided. All resins shall be identified in designated storage compartments.

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Resins shall be identified by the resin manufacturer's LOT number. LOT is defined as the entire volume of material represented by the lot number.

#### **6.1.8.4 Gasket Material**

The gasket materials shall conform to the requirements of **Specifications Section 942** when applicable. A copy of the mill certification of compliance shall be maintained in the quality control file and identified in the quality control plan. The verification inspector may sample the rubber gasket material at the discretion of the District Materials and Research Engineer. Gaskets will be approved upon successful completion of hydrostatic tests performed on pipe joints. Each gasket manufacturer identified in the quality control plan will have successfully completed, at a minimum, one hydrostatic test per **ASTM D3212** for the following diameter sizes, (0 to 30"), (32" to 48") and (50" to 62"). All hydrostatic test results shall determine continued approval of flexible pipe gaskets. The Department's requirement to be present at time of the test can be replaced by an independent engineering firm at the plant's cost.

#### **6.1.8.5 Gasket Lubricants and Adhesives**

The manufacturer of the gasket lubricant and/or adhesives shall provide a manufacturer's certification statement indicating compliance with requirements of the **Specifications**. All lubricants and adhesives shall be included in the plant's quality control plan.

### **6.1.9 QUALITY CONTROL OF PIPE PRODUCTION EQUIPMENT**

Ensure that pipe production equipment is capable of properly forming, shaping or blending materials into pipe that meet the requirements of applicable **Specifications**.

#### **6.1.9.1 Calibration of Equipment**

Ensure that all testing apparatus is checked and calibrated for compliance with the requirements of applicable **Specifications**. Use a calibration agency acceptable to the Department. Calibrations must be performed at least annually or more frequently if conditions merit. All calibration records shall be kept on file at the office of the QCM, or added to the quality control plan as an amendment.

## **6.1.9.2 Quality Control of Pipe Manufacturing Process**

Periodically check the fabrication process to ensure that pipe geometry meets **Specifications**. The quality control inspection shall include the measurements of pipe diameter and length, dimensions of the corrugations and pitch of the corrugations and recording of the results. Gage thickness and coating thickness shall be checked for metal pipe. The inner and outer wall thickness shall be checked for plastic pipe.

## **6.1.10 PIPE DESIGN, FABRICATION EQUIPMENT AND PRODUCTION RATES**

### **6.1.10.1 Pipe Design**

Prior to production, provide documentation that the design of the pipe satisfies all applicable portions of **ASTM** and **AASHTO** Materials and Design Specifications, including **Contract Document** amendments thereto.

### **6.1.10.2 Pipe Fabrication Equipment**

Inspect pipe manufacturing equipment daily and at the beginning of each production run. Inspect all components that are an integral part of the manufacturing equipment. Check all adjustable components for proper adjustment for the type and size of pipe being produced.

### **6.1.10.3 Production Rates**

Operate the pipe manufacturing equipment such that the production speed is within the limitations set by the equipment manufacturer.

## **6.1.11 QUALITY CONTROL TESTING AND INSPECTION OF PIPES**

### **6.1.11.1 General**

Perform the applicable quality control inspections and/or tests specified in the following **AASHTO** and **ASTM Standards** for each type of pipe, unless modified by the **Specifications**. Additionally, for Class II high density polyethylene and polypropylene pipes as defined in **Specifications Section 948**, perform QC/QA functions in accordance with the Plastic Pipe Institute's "*Corrugated Polyethylene Pipe Design Manual*



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*& Installation Guide.”*

### **6.1.11.2 Steel Pipe**

- (1) AASHTO M 190, Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
- (2) AASHTO M 36, Standard Specification for Corrugated Steel Pipe, Metallic Coated, for Sewers and Drains.
- (3) AASHTO M 218, Steel Sheet, Zinc Coated (Galvanized) for Corrugated Steel Pipe.
- (4) AASHTO M 232, Zinc Coating (Hot Dip) on Iron and Steel Hardware
- (5) AASHTO M 245, Corrugated Steel Pipe, Polymer-Precoated, for Sewers and Drains
- (6) AASHTO M 274, Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.
- (7) AASHTO T 65, Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
- (8) AASHTO T 213, Mass [Weight] of Coating on Aluminum-Coated Iron or Steel Articles.
- (9) AASHTO M 291, Carbon and Alloy Steel Nuts
- (10) AASHTO T 241, Helical Continuously Welded Seam Corrugated Steel Pipe.
- (11) AASHTO M 249, Helical Lock Seam Corrugated Pipe
- (12) ASTM A 780, Repair of Damaged Hot-Dip Galvanized Coatings.
- (13) ASTM A796, Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers.
- (14) ASTM A 885, Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Pipe

- (15) ASTM A 929, Steel Sheet, Metallic-Coated by the Hot Dip Process for Corrugated Steel Pipe.
- (16) ASTM D 1056, Flexible Cellular Materials-Sponge or Expanded Rubber
- (17) AASHTO Standard Specifications for Highway Bridges, LRFD Section 12.

### **6.1.11.3 Aluminum Pipe**

- (1) AASHTO M 196, Corrugated Aluminum Pipe for Sewers and Drains
- (2) AASHTO M 197, Aluminum Alloy Sheet for Corrugated Aluminum Pipe
- (3) AASHTO M 232, Zinc Coating (Hot Dip) on Iron and Steel Hardware
- (4) AASHTO M 291, Carbon and Alloy Steel Nuts
- (5) AASHTO M 298, Coatings of Zinc Mechanically Deposited
- (6) AASHTO M249, Helical Lock Seam Corrugated Pipe
- (7) ASTM B 209, Specification for Aluminum-Alloy Sheet and Plate
- (8) ASTM B 666, Practice for Identification Markings of Aluminum Products
- (9) American National Standards, H35.2 Dimensional Tolerances for Aluminum Mill Products
- (10) ASTM B221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
- (11) ASTM B 316/B, Specification for Aluminum-Alloy Rivet, and Cold Heading Wire and Rods
- (12) ASTM B 633, Specification for Electrodeposited Coatings of Zinc on

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Iron and Steel

- (13) ASTM B 666/B, Practice for Identification Markings on Aluminum Products
- (14) ASTM D 1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
- (15) ASTM F 467, Specification for Nonferrous Nuts for General Use
- (16) ASTM F 468, Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
- (17) ASTM F 568, Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
- (18) ASTM F 593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- (19) ASTM F 594, Specification for Stainless Steel Nuts
- (20) ASTM F 738, Specification for Stainless Steel Metric Bolts, Screws, and Studs
- (21) ASTM F 836, Specification for Stainless Steel Metric Nuts
- (22) AASHTO Standard Specifications for Highway Bridges, LRFD Section 12.

**6.1.11.4 Polyvinyl-chloride (PVC) Pipe**

- (1) AASHTO Standard for Highway Bridges, LRFD Section 12.
- (2) ASTM D 949, Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
- (3) ASTM D 618, Method of Conditioning Plastics and Electrical Insulating Materials for Testing
- (4) ASTM D 883, Terminology Relating to Plastics
- (5) ASTM D 1600, Abbreviations of Terms Relating to Plastic

- (6) ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- (7) ASTM D 2122, Method of Determining Dimensions of Thermoplastic Pipe and Fittings
- (8) ASTM D 2152, Test Method for Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- (9) ASTM D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- (10) ASTM D 2412, Test Method for Determining External Loading Characteristics of Plastic Pipe by Parallel Plate Loading
- (11) ASTM D 2444, Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- (12) ASTM D 3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- (13) ASTM F 312, Terminology Relating to Plastic Piping Systems
- (14) ASTM F 477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

#### **6.1.11.5 High Density Polyethylene (HDPE) Pipe**

- (1) AASHTO Standard Specifications for Highway Bridges, LRFD Section 12
- (2) AASHTO M 252 Standard Specification for Corrugated Polyethylene Drainage Pipe
- (3) AASHTO M 294, Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm
- (4) ASTM D 618, Conditioning Plastics and Electrical Insulating Materials for Testing
- (5) ASTM D 883, Terms Relating to Plastics

- (6) ASTM D 1693, Environmental Stress Cracking of Plastics
- (7) ASTM D 1928, Practice for Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens
- (8) ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings
- (9) ASTM D 2412, Determining of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- (10) ASTM D 2444, Test for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- (11) ASTM D 3212, Joints for Drain Sewer Pipes Using Flexible Elastomeric Seals
- (12) ASTM D 3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- (13) ASTM D 5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolephin Geomembranes Using Notched Constant Tensile Load Stress
- (14) ASTM F 412, Terms Relating to Plastic Piping Systems
- (15) ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- (16) Florida Method of Test, FM 5-572, Standard Test for Determining Slow Crack Growth Resistance of High Density Polyethylene Pipes
- (17) Florida Method of Test, FM 5-573, Standard Test for Predicting the Crack-Free Service Life of High Density Corrugated Polyethylene Pipes
- (18) Florida Method of Test, FM 5-574, Standard Test for Predicting the Lifetime of Antioxidants and Corrugated High Density Polyethylene Pipes
- (19) *Florida Method of Test, FM 5-575*, Standard Test for Determining Creep Rupture of Corrugated High Density Polyethylene Pipes

- (20) Florida Method of Test, FM 5-576, Standard Test for Predicting the Long-Term Tensile Strength of Corrugated High Density Polyethylene Pipes
- (21) Florida Method of Test, FM 5-577, Standard Test for Predicting the Long-Term Flexural Modulus of Corrugated High Density Polyethylene Pipes

#### **6.1.11.6 Polypropylene Pipe**

- (1) AASHTO Standard Specifications for Highway Bridges, LRFD Section 12
- (2) AASHTO M 330, Standard Specification for Polypropylene Pipe, 12- to 60-in. Diameter
- (3) ASTM F 2881, Standard Specification for 12 to 60 in. Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
- (4) ASTM D 618, Conditioning Plastics and Electrical Insulating Materials for Testing
- (5) ASTM D 883, Terms Relating to Plastics
- (6) ASTM D 1693, Environmental Stress Cracking of Plastics
- (7) ASTM D 1928, Practice for Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens
- (8) ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings
- (9) ASTM D 2412, Determining of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- (10) ASTM D 2444, Test for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- (11) ASTM D 3212, Joints for Drain Sewer Pipes Using Flexible Elastomeric Seals

- (12) ASTM D 5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolephin Geomembranes Using Notched Constant Tensile Load Stress
- (13) ASTM F 412, Terms Relating to Plastic Piping Systems
- (14) ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- (15) Florida Method of Test, FM 5-572, Standard Test for Determining Slow Crack Growth Resistance of High Density Polyethylene Pipes
- (16) Florida Method of Test, FM 5-573, Standard Test for Predicting the Crack-Free Service Life of High Density Corrugated Polyethylene Pipes
- (17) Florida Method of Test, FM 5-574, Standard Test for Predicting the Lifetime of Antioxidants and Corrugated High Density Polyethylene Pipes
- (18) Florida Method of Test, FM 5-575, Standard Test for Determining Creep Rupture of Corrugated High Density Polyethylene Pipes
- (19) Florida Method of Test, FM 5-576, Standard Test for Predicting the Long-Term Tensile Strength of Corrugated High Density Polyethylene Pipes
- (20) Florida Method of Test, FM 5-577, Standard Test for Predicting the Long-Term Flexural Modulus of Corrugated High Density Polyethylene Pipes

#### **6.1.11.7 Quality Control Tests**

The quality control plan shall include the quality control test methods, inspections, and minimum frequency of tests that are used as the basis of acceptance of each type of pipes. Dimensional checks of corrugations, wall thickness, pipe length and diameter shall be made and recorded at the minimum frequency of twice daily. For plastic pipe, pipe density (weight per linear foot) shall be either continuously monitored or determined twice daily. For plastic pipe, tests of pipe stiffness, environmental crack resistance and impact resistance shall be made for each production run or at any time the materials LOT or source of supply

changes or when the manufacturing process changes. For lock seam metal pipe, the joint cross section shall be visually examined daily to ensure proper forming. Additionally, the tensile strength of lock seam pipe must be determined monthly or at any time visual inspection reveals discrepancies in joint forming. The plant shall ensure that the manufacturing process is such that metal claddings are not visibly damaged in any manner. Pipe with visible damage to the cladding shall be marked, rejected and stored separately. The cause of such damage shall be immediately identified and eliminated. The District Materials and Research Engineer may approve or direct modifications to the frequency of tests based on the performance history of the plant.

Index tests derived from existing test methods may be developed and implemented by the plant for QC/QA purposes subject to the approval of the Director, Office of Materials.

Each LOT of the flexible pipe components is accepted when all of the following requirements are satisfied:

- A) Prior to the first shipment of pipe to each project, a Notarized Certification Statement is sent to the project indicating that the pipes meet applicable **Specifications** (Appropriate **Specifications** must be cited)
- B) The QC test results and inspections meet the requirements as specified herein and in the **Specifications**.
- C) The plant has completed all patching and minor repair work.
- D) The Quality Control Manager or the designated QC technician has applied QC stamps/labels to the pipes.
- E) Each shipment includes a QC signed/stamped shipping ticket on the plant's letterhead detailing the sizes, type, lengths, and mean inside diameter for each LOT of pipe.

A LOT of pipe is defined as a single production run or a maximum of one week production whichever is sooner. Smaller LOTS are acceptable. Each pipe must bear legible markings identifying the pipe lot number.



### **6.1.11.8 Hydrostatic Test on Pipe Joints**

When requested by the Department, perform a hydrostatic test in accordance with **ASTM D 3212** at the pressures appropriate for the application (normally 5psi). Perform such tests in the presence of the quality control and verification inspectors or as otherwise deemed appropriate by the District Materials and Research Engineer. All hydrostatic test reports will include the pipe size, type of gasket, gasket size, and manufacturer of gasket, serial number of gasket, date of test and who witnessed the tests. Successful hydrostatic tests will support continued usage of gaskets identified and tested. All successful tests shall be included in the quality control plan for each pipe diameter. New gaskets shall have a hydrostatic test performed for size groups noted in **Section 6.1.8.4**.

### **6.1.12 APPEARANCE AND INSPECTION OF FINAL FINISHED PIPES**

Perform final inspection of the finished pipes, before the application of the QC stamp/label. Pipes may be repaired if necessitated by occasional minor imperfections during manufacturing, or damage during handling, and will be considered acceptable if the repairs are in accordance with the accepted quality control plan and are sound and properly finished to conform to the dimensional tolerances of the **Specifications**. Comply with dimensional tolerances in conformity with the requirements of the applicable AASHTO and ASTM Standards as appropriate.

Perform visual inspection of all finished pipes. Measure the dimensions of at least five percent of the randomly selected units in each LOT and maintain a record of the inspections, including the deficiencies. Minor deficiencies may be repaired in accordance with repair methods approved by the Department and included as part of the quality control or as may be approved by the District Materials and Research Engineer. Determine the cause of the repetitive nonconformance and develop a corrective action plan for immediate implementation. Revise the quality control plan to address the type of deficiencies and the corrective action that will be taken to prevent or minimize the deficiencies.

### **6.1.13 HANDLING AND STORAGE**

Handle and store pipes to prevent damage and contamination. Inspect the pipe handling operations and implement appropriate practices that prevent damage. Inspect pipes in storage to ensure that they are stored in the correct

stack and are not being damaged by point loading, cladding damage, or stacking too high. Do not store rejected pipes in the same area with the acceptable pipes. Store gaskets in accordance with the **Specifications Section 942**.

### 6.1.14 Quality Control Stamps/Labels

The plant shall affix a QC stamp/label to each section of pipe, indicating that the pipe meets the requirements of the **Contract Documents**. The plant's QC stamp/label shall be indelible and legible, and applied to each pipe before its shipment from the plant to the project site. LOT manufacturing dates shall be applied to QC stamp/label or other means approved by the Department.

The QC stamp/label shall include the plant's identity, LOT number, assigned plant number, and the date of final quality control inspection. At the time of final quality control inspection, the LOT manufacturing date shall be written in indelible ink or be mechanically imprinted. The label shall consist of a pre-printed polymer sticker or as may be approved by the District Materials and Research Engineer. A signed statement of compliance with all quality requirements from the Plant General Manger shall be included in the quality control plan . An example of the QC stamp/label shall be included in the quality control plan.

### 6.1.15 SHIPMENT

Address the plant's shipping policy as part of the quality control plan.

Ensure that at the beginning of each project, the plant provides a Notarized Certification Statement to the Project Administrator from a responsible company representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the **Contract Documents** and the plant's accepted quality control plan.

An example Notarized Certification Statement form is provided in Appendix A.

An example Hydrostatic Test Report form is provided in Appendix B.

Ensure that each shipment of pipe to the project site is accompanied with a QC signed or stamped delivery ticket providing the description and the list of the products. The list of the products with each delivery ticket shall be on the plant's letterhead and shall include as a minimum, project number, date shipped, identification and number of pipes and mean diameter of the pipes.

The QCM or other designated QC personnel working under the direct supervision of the QCM shall affix QC stamps/labels to the pipes prior to their shipment to the project site. The QC stamp/label indicates that the plant certifies that the pipes are manufactured in conformance with the plant's accepted quality control plan. Each original shipment ticket of pipes sent to the project site shall include all required information and shall be on the plant's letterhead.

### **6.1.16 DOCUMENTATION**

The Quality Control Manager shall maintain QC documentation files at the plant. These documents shall be retained for a minimum of three years after final acceptance of the pipes for each specific project site. All QC documentation shall be made to readily available and accessible upon the Department's request. The documentation shall, as a minimum, include the following items:

- A) A copy of the currently approved quality control plan including all amendments
- B) Approved shop drawings (if applicable)
- C) Applicable ASTM and AASHTO standards
- D) FDOT Standard Specification and Design Standards
- E) Quality Control Personnel names and Department approved training courses with current qualifications
- F) Materials certification records for pipe materials
- G) Equipment calibration, including pipe forming machines and test equipment
- H) LOT numbers for materials and pipes
- I) Number and type of pipes in each LOT
- J) Applicable test data
- K) Disposition of all pipes

- L) Record of the list of the delivered pipes
- M) Record all deficiencies found as a result of Plant Qualification Review Team (PQRT) or quarterly verification inspection. . A copy of the deficiency reports shall also be maintained in the Plant's permanent file.
- N) Plant layout sheet denoting QC office, production area, storage area, material storage, entrances into plant, etc.

### 6.1.17 Training

The plant shall utilize only quality control personnel who have met the training and certification requirements of **Specifications Section 105**. The plant's training course must be approved by the Department.

#### 6.1.17.1 Level I Quality Control Inspectors:

Level I Inspectors are those who are performing routine inspection and testing of pipe products, including, materials, materials processing, manufacturing equipment operation and finished product inspection. The inspectors shall be familiar with flexible pipe related plans and specifications and have completed a minimum of eight-hour, Department approved, training course and examination.

#### 6.1.17.2 Level II Quality Control Inspectors:

Level II inspectors are those who are involved in the verification of materials compliance with **Specifications** including blending of component materials and proper operation of manufacturing equipment. Level II Inspectors evaluate the needed repair method and its implementation. Advanced knowledge of the shop drawings, **Specifications, test methods, and Standard Indices** is required for Level II qualifications. Ensure that Level II Inspectors have Level I Quality Control Inspector certification and have successfully completed a minimum of additional five-hour, Department approved course, including the examination.

#### 6.1.17.3 Quality Control Managers:

The Quality Control Managers shall have a Pipe-Level II Quality Control

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Inspector certification and a minimum of two years of experience, directly related to the type of flexible pipe being manufactured.

**6.1.17.4 Re-qualification of the Quality Control Personnel and Department Inspectors:**

The Level I and II qualifications will expire at the end of five years, during which, the inspectors have the choice of attending the course and retaking the examination or they may elect to only take the examination to be re-qualified for an additional five years. QC personnel with recently expired training qualifications shall not be allowed to continue as a QC function without consent by the District Materials and Research Office. Consent may be granted if the District has verified QC enrollment of an approved training source within 30 days.

Failure to notify the District Materials and Research Office of QC qualifications can result in suspension of the plant's Quality Control Plan.

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**APPENDIX A**  
**Blank Notarized Certification Statement**

“USE ON PLANT’S LETTERHEAD”  
**MATERIAL CERTIFICATION**  
FLORIDA D.O.T.

**MANUFACTURED FLEXIBLE PIPE PRODUCTS**

**Contractor:**

**F.D.O.T. Project Number:**

**F.D.O.T. Contract Number:**

**Project Location:**

**Description of Products:**

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We certify the described flexible pipe products will be manufactured by our plant in accordance with the requirements set forth in the Florida Department of Transportation Contract Documents and the plant's approved quality control plan. The plant's quality control manager or the inspectors under his/her direct supervision will stamp the products prior to their shipment to the project site. The quality control manager's stamp is confirmation of the aforementioned certification. Each shipment of the flexible pipe products to the project site will be accompanied with a signed or stamped delivery ticket, which will provide the description and list of the products.

**Plant Company Officer or Designee:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

*(Notarized)*

Revised 2/19/14

## APPENDIX B Blank Hydrostatic Test Report



### *Florida Department of Transportation*

RICK SCOTT  
GOVERNOR

605 Suwannee Street  
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.  
SECRETARY

## PIPE JOINT HYDROSTATIC PERFORMANCE TEST

**FDOT Inspector:**

**Plant Name:**

**Pipe Diameter Tested:**

**Pipe Manufacture Date:**

**Pipe Diameter Represented:**

**Gasket Identification #:**

**Inspection Date:**

**Plant Location:**

**Type of Pipe:**

**Type of Joint:**

**Gasket Manufacturer:**

**Report Date:**

The visual inspection of the assembly and hydrostatic test of one set of pipes were performed to verify the sealing of the assembled pipes.

### **Standards/Requirements:**

1. Section 948 of the Florida Department of Transportation Standard Specifications.
2. ASTM D-3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
3. Materials Manual Chapter 6.1, Volume II, Section 6.1.8.4.

### **Test Set Up:**

The plant performed hydrostatic pressure test on the joint assembly of two sections of pipes in accordance with the Florida Department of Transportation Standard Specifications and Materials Manual. The assembly was subjected to an internal pressure of 5 psi for 10 minutes, both in the straight alignment and deflected positions, as specified in the Standard Specification.

### **Test Results:**

The results of the inspection indicate that the hydrostatic test of the assembled joint met the requirements of the established standards. There was no visible leakage during the test. Based on the manufacturer's certification and the results of the above performance test, the proposed rubber gasket may be used to seal assembled joints of the type and size of the pipes described above.

cc. District Materials and Research Engineer  
Gasket Manufacturer  
Pipe Manufacturing Plant

Chase C. Knight, Ph.D.  
State Materials Office