

3201 SATURATED FABRIC FOR WATERPROOFING

3201.1 SCOPE

Provide asphalt saturated fabric for waterproofing.

3201.2 REQUIREMENTS

Provide fabric meeting the requirements of AASHTO M 117 and saturated with asphalt. Use the asphalt saturated fabric in conjunction with asphalt for waterproofing in accordance with 3166, "Asphalt for Dampproofing and Waterproofing."

3201.3 SAMPLING AND TESTING — (BLANK)

3204 PREMOLDED ASPHALT PLANK

3204.1 SCOPE

Provide premolded asphalt plank.

3204.2 REQUIREMENTS

Provide asphalt plank meeting the requirements of ASTM D 517 for the type required by the contract.

3204.3 SAMPLING AND TESTING — (BLANK)

3222 CORRUGATED ALUMINIZED STEEL PIPE (TYPE 2)

3222.1 SCOPE

Provide corrugated aluminized steel (CAS) pipe and pipe arches for use in the construction of culverts, underdrains, and sewers.

3222.2 REQUIREMENTS

Use Type 2 aluminum-coated steel sheets meeting the requirements of AASHTO M 274 to fabricate pipe in accordance with AASHTO M 36M and as specified in 3226, "Corrugated Steel Pipe."

Use pipe sections with identification marks meeting the requirements of AASHTO M 274.

3222.3 SAMPLING AND TESTING — (BLANK)

3225 CORRUGATED ALUMINUM PIPE

3225.1 SCOPE

Provide corrugated aluminum alloy (CA) pipe for use as culverts and underdrains.

The Department will designate the size of circular pipes by the nominal inside diameter and the size of pipe-arches by the span width.

3225.2 REQUIREMENTS

Provide pipe meeting the requirements of AASHTO M 196 and the following:

A Physical Properties

The Contractor may provide pipe in the least thickness of metal listed for a specified diameter, unless otherwise shown on the plans or special provisions.

B Coupling Bands

Use aluminum alloy coupling bands meeting the requirements of AASHTO M 196 and as shown on the plans to make field joints.

C Aprons

Provide aluminum aprons for circular pipes manufactured in accordance with this specification for corrugated aluminum pipe and as shown on the plans.

D Identification Marks

Mark each pipe section with identification meeting the requirements of AASHTO M 196.

3225.3 SAMPLING AND TESTING

The Engineer will inspect corrugated aluminum pipe in accordance with AASHTO M 196.

3226 CORRUGATED STEEL PIPE

3226.1 SCOPE

Provide prefabricated corrugated steel (CS) pipe to construct culverts and underdrains. The unmodified term “pipe” refers to any or all types of pipe.

The Department will designate the size of the circular pipe by the nominal inside diameter. The Department will designate the size of the pipe-arches by the span width measured from the inside crest of the corrugations.

3226.2 REQUIREMENTS

Provide pipe meeting the requirements of AASHTO M 36M for the type required by the contract and in accordance with the following:

A (Blank)

B Dimensions

Ensure that pipe dimensions meet the requirements of AASHTO M 36M except as modified by the following:

- (1) Provide each size of pipe with a nominal sheet thickness as shown on the plans and meeting the requirements for specified thickness in Table 4 of AASHTO M 218.
- (2) Provide pipes with a corrugation size of $1\frac{1}{2}$ in \times $\frac{1}{4}$ in [38 mm \times 6.5 mm], $2\frac{7}{8}$ in \times $\frac{1}{2}$ in [68 mm \times 13 mm], 3 in \times 1 in [75 mm \times 25 mm], or 5 in \times 1 in [125 mm \times 25 mm] as shown on the plans and meeting the requirements in Table 1 of AASHTO M 36M for the provided pipe sizes.
- (3) Provide spiral ribbed pipes with a corrugation size of $\frac{3}{4}$ in \times $\frac{3}{4}$ in \times $7\frac{1}{2}$ in [19 mm \times 19 mm \times 190 mm] and meeting the requirements of AASHTO M 36M, “Table 3” for the provided pipe sizes. Provide the pipes with section properties meeting the requirements of AASHTO LRFD Bridge Design Specifications Appendix A12.

C (Blank)

D Appurtenant Parts and Sections

Provide metallic coated steel aprons fabricated in accordance with this section and 3351, “Sheet Steel Products.”

Provide elbow, tee, and wye sections as shown on the plans and fabricated from standard pipe sections, using mitered and welded joints, forming the required

intersection angles for each installation. Provide special adapters as necessary to make connections between different sizes and types of pipe.

Provide an outlet screen at each free end of underdrain systems. The Contractor may provide metal end caps to close the dead ends of pipe instead of installing concrete or vitrified clay plugs.

E Identification Marks

Mark each pipe section with identification meeting the requirements of AASHTO M 196.

Provide pipe with a sheet thickness, as designated in the markings on sheets and coils, meeting the requirements in Table 4 of AASHTO M 218.

3226.3 SAMPLING AND TESTING

The Engineer will not accept units of pipe if the zinc (galvanized) coating has been burned by shop welding or otherwise damaged in shop fabrication, unless the Contractor re-galvanizes the pipe units using the hot-dip process or the metalizing process specified in AASHTO M 36M. Do not make shop repairs with zinc paint. Use the metalizing process to make zinc coating repairs on butt-welded seams of helical corrugated pipe, if the adjacent zinc coating is burned to a width greater than three times the metal thickness.

After the Contractor delivers the pipe to the project, the Engineer will inspect each unit for compliance with the details of construction, workmanship, and finish requirements. In addition to all other defects as listed in AASHTO M 36M constituting cause for rejection, the Engineer may reject, at the project, any units damaged during shipment or fabrication.

The Contractor may use zinc paint to repair pipe coating damage caused by job site field welding or fabrication in lieu of re-galvanizing. Use organic zinc primer paint specified on the Approved/Qualified Products List under Bridge Structural Steel Coating Systems as Three Coat Systems (Organic). Clean the damaged area by sandblasting or as otherwise approved by the Engineer. Apply the zinc paint in accordance with instructions from the paint manufacturer.

3229 POLYMERIC COATED CORRUGATED STEEL PIPE

3229.1 SCOPE

Provide polymeric-coated corrugated steel (PC-CS) pipe for use as culverts and underdrains.

3229.2 REQUIREMENTS

Use precoated galvanized steel sheets meeting the requirements of AASHTO M 246 to fabricate pipe meeting the requirements of AASHTO M 245 and in accordance with 3226, "Corrugated Steel Pipe."

Provide steel sheets with a polymer coating on both sides that is 0.01 in [250 µm].

3229.3 SAMPLING AND TESTING — (BLANK)

3231 GALVANIZED STEEL STRUCTURAL PLATE FOR PIPE, PIPE-ARCHES, AND ARCHES

3231.1 SCOPE

Provide galvanized corrugated steel (CS) structural plate and fasteners for use in constructing pipe, pipe-arches, underpasses, and special shapes for field assembly.

3231.2 REQUIREMENTS

Provide structural plates and fasteners meeting the requirements of AASHTO M 167 and the following:

A Fabrication

Provide the plate thickness specified in Table 6 of AASHTO M 167, unless otherwise specified on the plans. Provide steel plate with the section modulus shown on the plans. A different thickness and section modulus is acceptable if the strength is at least equal to the strength of the thickness and section modulus shown on the plans.

Provide plates of a size and shape that yield a finished structure of the dimensions shown on the plans. Stagger either the longitudinal or the transverse seams.

Punch bolt holes before galvanizing the sheets.

B Workmanship and Finish

The Engineer will reject individual plates or shipments of plates with the following defects:

- (1) Plates without careful and finished workmanship;
- (2) Incorrect plate shape;
- (3) Unevenly lined or spaced bolt holes;
- (4) Plates with ragged edges;
- (5) Plates with illegible or improper markings;
- (6) Bruised, scaled, broken, or improperly repaired zinc (galvanized) coating; or
- (7) Metal plates with dents or bends.

3231.3 SAMPLING AND TESTING 3226.3

**3233 ALUMINUM ALLOY STRUCTURAL PLATE FOR PIPE,
PIPE-ARCHES, AND ARCHES**

3233.1 SCOPE

Provide corrugated aluminum alloy (CA) structural plate, accessories, and fasteners for the construction of pipe, pipe-arches, arches, and special shapes, for field assembly.

3233.2 REQUIREMENTS

Provide structural plates, accessories, and fasteners meeting the requirements of AASHTO M 219 and the following:

A Fabrication

Provide the plate thickness, pipe shape, sheet fabrication details, and assembly bolting as shown on the plans.

B Workmanship and Finish

The Engineer will reject individual plates or shipments of plates with the following defects:

- (1) Plates without careful and finished workmanship,
- (2) Incorrect plate shape,
- (3) Unevenly lined or spaced bolt holes,
- (4) Plates with ragged edges,
- (5) Plates with illegible or improper markings, or

- (6) Metal plates with dents or bends.

3233.3 SAMPLING AND TESTING — (BLANK)

3236 REINFORCED CONCRETE PIPE

3236.1 SCOPE

Provide reinforced concrete pipe of circular, arch, elliptical, or special shape and design, with appropriate appurtenances to construct culverts, sewers, or underpasses.

3236.2 REQUIREMENTS

Provide reinforced concrete pipe meeting the following design requirements and as modified in this section:

Pipe type	AASHTO reference
Circular	AASHTO M 170
Pipe-Arch	AASHTO M 206
Elliptical	AASHTO M 207

Provide concrete aprons manufactured as shown on the plans. Attach aprons compatible with pipe.

Provide concrete cattle pass units manufactured as shown on the plans and meeting the requirements of AASHTO M 170 for Class III pipe of equivalent wall thickness.

The Department will not require external load bearing tests on cattle passes and aprons.

A Materials

A.1 Aggregate Quality 3126 and 3137

A.2 Form Release Agents 3902

A.3 Portland Cement 3101

The Department will allow admixtures in accordance 2461, "Structural Concrete," except do not use calcium chloride.

The Department will allow the following cement substitutions:

- (1) 30 percent Class F or Class C fly ash by weight,
- (2) 35 percent ground granulated blast furnace slag by weight,
- (3) 35 percent substitution with a combination of ground granulated blast furnace slag, and
- (4) Class F or Class C fly ash by weight.

A.4 Flyash for Use in Portland Cement Concrete..... 3115

A.5 Ground Granulated Blast Furnace Slag Cement..... 3102

A.6 Structural Concrete 2461

A.7 Metal Reinforcement 2472

A.8 Preformed Gasket Seals for Concrete Pipe 3726

B Pipe Design

Provide pipe designed as shown on the plans or meeting the AASHTO requirements referenced in Table 3236-1, if approved as an alternate by the Engineer for the different classes of pipe meeting the following design requirements:

- (1) Pipe shape (circular, arch, elliptical),
- (2) Diameter,
- (3) Wall thickness,
- (4) Compressive strength of concrete, and
- (5) Area and type of circumferential reinforcement.

Provide pipe with reinforcement placed in accordance with applicable AASHTO Specifications referenced in Table 3236-1, except as otherwise shown on the plans or as approved by the Engineer. Do not use circular pipe with elliptical reinforcement. Lap wire mesh at least one full mesh or twenty wire diameters, whichever is greater. Do not weld laps of reinforcement for pipe unless the Engineer approves the welder, in conjunction with the Materials Engineer.

If the plans show pipes with rubber gasket seals, ensure the joint surfaces adjacent to the gasket are smooth and free of imperfections to allow the rubber gasket seal to meet the specified performance requirement.

C Manufacture

Provide products manufactured in a precast concrete manufacturing plant pre-approved by the Materials Engineer and listed on the Approved/Qualified Products List. Provide certified products as required by the contract from a manufacturer with production set-up on a pre-approved basis. The Engineer will limit acceptance of products to each precast concrete manufacturer and to each of the plants as pre-approved by the Materials Engineer. The Engineer, in conjunction with the

Materials Engineer, will limit pre-approval to the identified sizes of circular pipe, arch pipe, elliptical pipe, and appurtenances.

Notify the Materials Engineer, before the manufacturer begins producing pipe requiring shear steel or Special Designs not listed on the Approved/Qualified Products List. Pin all shear steel.

Provide concrete units cured by the steam or water curing methods, unless using methods otherwise approved by the Materials Engineer. If steam curing, use curing chambers with an atmospheric temperature no greater than 160 °F [71 °C]. Protect concrete units from freezing or drying after casting and until the completion of curing.

D Permissible Variations

Provide pipe meeting the tolerance requirements of applicable AASHTO specifications referenced in Table 3236-1.

3236.3 SAMPLING AND TESTING

The Materials Engineer will inspect the plant, approve each precast concrete manufacturer and its individual plants to provide precast concrete products under the pre-approval program. The Materials Engineer will not authorize precast concrete production if the manufacturer fails to abide by the terms, conditions, and requirements contained in this program.

If the Materials Engineer finds manufacturer non-compliance with the pre-approval program or evidence of non-conformance of certified products, the Materials Engineer, in conjunction with the Engineer, may perform the following:

- (1) Reject the individual product,
- (2) Reject the questioned shipment,
- (3) Reject the identified day's production, or
- (4) Revoke pre-approval privileges.

A Plant QC

Ensure the manufacturer establishes and implements a QC program, including the following elements for each pre-approved plant:

A.1 Internal QC Program

Ensure the manufacturer includes the following in the internal QC program:

- (1) Sampling and testing of component materials or documentation of acceptability if materials were previously inspected and tested, or received from a certified source,
- (2) Inspection of product manufacturing including the following:

- (2.1) Reinforcing steel fabrication and placement,
 - (2.2) Concrete mix design and proportioning,
 - (2.3) Concrete placement and consolidation, and
 - (2.4) Concrete curing.
- (3) Testing of finished products including the following:
- (3.1) Strength of concrete cylinders,
 - (3.2) Three-edge-bearing test (round pipe), and
 - (3.3) Absorption and steel verification from pipe cores. For each class, size, and type of manufacture, on the first run of the year and as directed by the Materials Engineer, provide core specimens at least 4 in [100 mm] in diameter for the absorption test and steel verification.
- (4) Final visual inspection and stamping, and
- (5) Maintenance of plant facilities and equipment.

A.2 On-Site Quality Control Technicians

Ensure the manufacturer employs and has on-site during production QC technicians trained and certified meeting the requirements of Mn/DOT Level I, "Concrete Field Tester" or ACI Grade I, "Quality Control Technician" to perform the following:

- (1) Ensure the conformance of all pre-approved products to the requirements,
- (2) Maintain knowledge of the following:
 - (2.1) Plans and specification requirements,
 - (2.2) Product manufacturing operations, and
 - (2.3) Significance of the specification requirements in producing quality products.
- (3) Correct, stop, or both, operations causing non-conforming attributes,
- (4) Reject products not meeting the contract requirements,
- (5) Ensure the manufacturer meets requirements related to producing pre-approved products, and
- (6) Contact the Department's inspector before making repairs greater than 10 percent of the respective surface, inside or outside.

A.3 Equipment 2461

A.4 System of Record Keeping

Ensure the manufacturer maintains the following records:

- (1) Component material sources and passing quality test results, authorized certification, or other evidence of inspection and satisfactory testing,

- (2) Test results covering product manufacture and the finished product as listed in the records section of the ACPA manual,
- (3) Records of manufactured products in accordance with the following:
 - (3.1) Date,
 - (3.2) Size, and
 - (3.3) Class.
- (4) Running inventory of pre-approved products in stock, and
- (5) Equipment calibration reports.

B Quality Assurance

The Materials Engineer will visit each plant to perform tasks in accordance with this specification and including the following:

- (1) Random sampling and testing of the materials used in the manufacture of pre-approved products,
- (2) Random sampling and testing of the pre-approved pipe produced,
- (3) Observing the manufacturing process,
- (4) Reviewing the manufacturer's quality control tests, inspection, records, and stockpiling practices, and
- (5) Reviewing the pre-approved product inventory.

The Engineer will perform a final inspection upon delivery.

C Testing Rates

C.1 Concrete

Ensure the manufacturer tests the air content of concrete in each mix once a day for each positive slump mix.

Ensure the manufacturer tests the concrete strength of each mix meeting the requirements of "Cylinder and Core Guidelines for Precast Pipe and Box Culvert" kept on file by the Materials Engineer.

C.2 Load Bearing Test

Ensure the manufacturer conducts Three-Edge Bearing tests meeting the requirements of AASHTO M 170, on each size and class of pipe, and in accordance with the following schedule:

Table 3236-2		
Load Bearing Test Rates		
Size Range, in [mm]	Class Range	Test Rates
12 – 18 [300 – 450]	≤ 5	1 per 5,000 ft [1,500 m]

21 – 48 [525 – 1,200]	≤ 5	1 per 3,000 ft [900 m]
54 – 72 [1,350 – 1,800]	≤ 4	1 per 2,000 ft [600 m]
54 – 72 [1,350 – 1,800]	5	1 per 1,000 ft [300 m]
78 – 96 [1,950 – 2,400]	All classes	1 per 1,000 ft [300 m]
NOTE: Begin a new schedule of testing after changing the mix design, after shutting down the system for major repairs and renovations, when beginning a new production run, and when beginning a new season.		

Notify the Materials Engineer 2 full business days before testing. The Materials Engineer may select pipes for testing and may direct the manufacturer to perform additional testing at no additional cost to the Department.

Provide pipe meeting the specified D-load as demonstrated by testing before shipping. Maintain documentation of all load tests performed.

D Pipe Marking

Provide pipe marked by the manufacturer in accordance with the following:

- (1) Meeting the marking requirements of AASHTO M 170,
- (2) Stamped with the word, "Certified,"
- (3) Stamped with the manufacturing plant identification,
- (4) For units at least 24 in [600 mm] in diameter, stamped on the inside, and
- (5) For units smaller than 24 in [600 m] in diameter, stamped on the outside.

Before stockpiling, mark products manufactured for projects with special requirements not meeting the standards of the pre-approved program with an identifying project number or the buyer's name.

The Engineer may accept pre-approved shipments if the Contractor provides pipe marked with the following by the manufacturer:

- (1) The phrase, "CERTIFIED PLANT COMPANY," in 4 in \times 4 in [100 mm \times 100 mm] letters,
- (2) Company identification, and
- (3) Individual production plant.

Provide the Engineer with a certified bill of materials or invoice, signed by a designated, responsible company representative with each shipment that identifies the following information:

- (1) Project number;
- (2) Contractor;
- (3) Type of material;
- (4) Number of pieces of each size, class, and length; and
- (5) The following statement:

“The materials itemized in this shipment are certified to be in compliance with the applicable Minnesota Department of Transportation Specifications and the Project Plans.”

Authorized Signature and Date

Ensure the manufacturer does not ship pre-approved products until after the completion of QC tests and inspections, and as approved by the Materials Engineer.

E Stockpiling

Ensure the manufacturer stockpiles products meeting the above requirements to allow the Materials Engineer to inspect the products for QA, and that the manufacturer stockpiles special, non-pre-approved product in areas separate from pre-approved stock.

3238 PRECAST CONCRETE BOX CULVERTS

3238.1 SCOPE

Provide precast concrete single and multi-cell box culverts, headwalls, and aprons.

3238.2 REQUIREMENTS

A Fabrication Drawings, Falsework and Forms

If full construction details are not included in the plans, provide shop drawings meeting the following requirements to the Engineer for review by the Office of Bridges and Structures before fabricating the units:

- (1) Complete and comprehensive,
- (2) Include the number of mats,
- (3) Show mat makeup and configuration, and
- (4) List stirrup sizes and spacing for each type of segment as shown on the plans.

Provide precast concrete box culverts with individual sections at least 4 ft long [1.2 m] capable of being tied to the adjacent section with concrete pipe ties as specified by Mn/DOT Standard Plate 3145 and as shown on the plans.

B Materials

B.1 Concrete..... 2461

Provide concrete with mix designations as shown on the plans for the specific items of work.

B.2 Reinforcement Bars 3301

B.3 Steel Fabric..... 3303

C Forms

Provide forms capable of withstanding pressure from concrete, vibration, and impact without distorting. Set and maintain forms in a mortar tight condition, free of warp, and on a rigid foundation. Provide joints in the sectional forms without offset. Set forms to create dimensions of the precast unit as shown on the plans. Repair or replace forms not meeting the dimensions shown on the plans before casting additional sections.

Clean forms before use. Treat the face of the forms in contact with the concrete with form coating material in accordance with 3902, "Form Coating Material," before setting the forms.

D Reinforcement Steel

Place reinforcement steel as shown on the plans. Support reinforcement steel with chairs. Splice, secure, and tie reinforcement steel in accordance with 2472, "Metal Reinforcement." Provide concrete cover of at least 1½ in [40 mm] or as shown on the plans. Provide stainless steel, plastic, plastic tipped, hot dipped galvanized, or mechanically galvanized reinforcement supports in contact with the precasting forms. Extend coatings on the supports at least 1 in [25 mm] from the form surface. Do not tack weld reinforcement.

E Placement of Concrete

Do not place concrete for precast units until the Materials Engineer inspects and approves the forms and steel placement.

Place the concrete in each precast unit without interruption. Vibrate the concrete internally, externally, or both, to produce uniformly dense concrete and to avoid displacement of enclosures or steel units. Internally vibrate in accordance with 2401.3.D., "Compaction of Concrete," except provide internal vibrators with a vibrating head no greater than 1¼ in [32 mm] in diameter and capable of operating at a frequency of at least 100 Hz [6,000 impulses per min].

F Concrete Curing

Use steam or water curing methods to cure the precast concrete units unless the Materials Engineer approves the use of sealing membrane or other methods. If steam curing, steam cure in accordance with 2405.3, "Prestressed Concrete Beams, Construction Requirements." If steam curing, place the manufacturer-provided temperature recording device as directed by the Materials Engineer. Provide the Materials Engineer with the temperature records for review.

Cure until the concrete reaches a compressive strength of at least 2,500 psi [17 MPa] based on break results from control cylinders cured with the product. The Contractor may cure control cylinders separately from the precast units if curing conditions for the cylinders are the same as for the precast units, and the control cylinders and the precast units use temperature recording devices.

G Concrete Finishing and Repair

Provide formed surfaces of the precast units with a uniform dense surface finish in accordance with 2401.3.F.2.a, "Ordinary Surface Finish." After removing the forms, examine the concrete surfaces for areas of unsound concrete and defective surfaces caused by faulty forms or form assembly, improper concrete placement, improper form removal, and other causes.

Remove and replace concrete with porosity, honeycomb, delamination, hollow sound, or segregated materials as approved by the Materials Engineer.

The Materials Engineer will not allow the following repairs in the finished product:

- (1) Individual repairs greater than 4 sq. ft [0.4 sq. m] on an inside or outside surface, and
- (2) Repairs to the tongue or groove down to the steel and greater than 4 ft [1.2 m] long.

With the approval of the Materials Engineer and in compliance with the plant quality control program, the Contractor may repair minor surface cavities or irregularities before the unit completes curing.

H Certified Plant Requirement

Provide precast concrete box culverts, end sections, and appurtenances constructed in a precast concrete fabrication plant certified by the American Concrete Pipe Association, the National Precast Concrete Association, or another organization approved by the Materials Engineer. If requested, provide quality control and plant certification records to the Materials Engineer.

3238.3 SAMPLING AND TESTING

The Materials Engineer is the Engineer with authority regarding this Specification.

The Materials Engineer will inspect the units at the plant and will stamp approved units with the official mark of the Department. Store individual units in an upright position to facilitate inspection unless otherwise approved by the Materials Engineer.

Do not ship units without the official mark of the Department. Notify the Materials Engineer at least 24 h before intent to ship. Complete finishing and repair work on units before submitting notice of intent to ship. The Engineer will make a final inspection of the units after delivery.

Unless otherwise directed by the Materials Engineer, mark the inside of each box section with the following information:

- (1) Project number,
- (2) Overfill height, and
- (3) Segment number as shown on the plans.

3241 PLASTIC TRUSS PIPE

3241.1 SCOPE

Provide plastic truss (PT) pipe, couplings, and fittings for sewer piping.

3241.2 REQUIREMENTS

Provide plastic truss pipe, couplings, and fittings meeting the requirements of ASTM D 2680. Unless otherwise specified on the plans or special provisions, the Contractor may choose the joint type.

Obtain a Certificate of Compliance from the manufacturer for each pipe shipment and submit to the Engineer.

3241.3 SAMPLING AND TESTING — (BLANK)

3245 THERMOPLASTIC PIPE

3245.1 SCOPE

Provide thermoplastic (TP) pipe and fittings for use as pipe sewers or subsurface drains.

3245.2 REQUIREMENTS

Provide thermoplastic pipe and fittings meeting the requirements of one of the following:

- (1) AASHTO M 278, Class PS 46, Polyvinyl Chloride (PVC) Pipe,

- (2) ASTM D 2751, Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe, SDR 35,
- (3) ASTM D 3034, Type PSM PVC Sewer Pipe, SDR 35,
- (4) ASTM F 758, Smooth-Wall PVC, Type PS 46, or
- (5) ASTM F 949, PVC Corrugated Sewer Pipe.

If perforated pipe is specified, provide pipe with perforations in accordance with the applicable specification or otherwise specified in the plans or special provisions.

If the perforation dimensions are not specified in the applicable specifications, plans, or special provisions, provide pipe with perforations meeting one of the following:

- (1) Perforations from 0.2 in to 0.4 in [5 mm to 10 mm] in diameter, spaced 3 in [75 mm] center-to-center. Provide two rows of holes for 4 in [100 mm] pipe and four rows for 6 in to 10 in [150 mm to 250 mm] pipe, or
- (2) Any of the configurations indicated for other pipe types allowed in this section.

Unless otherwise specified in the applicable specifications, plans, or special provisions, the Contractor may choose the joint type.

Do not use damaged pipe.

3245.3 SAMPLING AND TESTING

Submit to the Engineer a manufacturer's Certificate of Compliance with each pipe shipment.

3247 CORRUGATED POLYETHYLENE PIPE

3247.1 SCOPE

Provide corrugated polyethylene (CP) dual-wall pipe for use as culverts or pipe sewers.

3247.2 REQUIREMENTS

Provide corrugated polyethylene (CP) dual-wall pipe with couplings and fittings meeting the requirements of AASHTO M 294 Type "S" pipe, and Section 12 of the AASHTO LRFD Bridge Design Specifications.

Provide CP pipe and fittings manufactured from high-density polyethylene (HDPE) virgin compounds. The Contractor may provide clean, reworked HDPE materials from the manufacturer's own production, if the pipe fittings produced meet the requirements of this section.

Store and handle CP pipe as recommended by the manufacturer. Do not expose CP pipe to direct sunlight for a total time greater than six months after fabrication. Do not use damaged pipe.

3247.3 SAMPLING AND TESTING

Corrugated High Density Polyethylene Pipe (HDPE) manufacturing facilities are required to participate and be in compliance with AASHTO's National Transportation Product Evaluation Program (NTPEP) for producers of AASHTO M294 HDPE pipe. If a plant has a compliant NTPEP audit for AASHTO M294 pipe at the time the pipe is manufactured, then the plant has met requirements.

Compliant plants are listed on the NTPEP website and can also be accessed through the Approved Products List.

Submit to the Engineer a manufacturer's Certificate of Compliance with each pipe shipment.

3248 POLYVINYL CHLORIDE PIPE

3248.1 SCOPE

Provide polyvinyl chloride (PVC) pipe for use as culverts or pipe sewers.

3248.2 REQUIREMENTS

Provide PVC pipe with couplings and fittings meeting the requirements of the following:

- (1) ASTM F 794,
- (2) ASTM F 949, and
- (3) Section 12 of the AASHTO LRFD Bridge Design Specifications.

Provide PVC pipe and fittings manufactured from virgin PVC compounds. The Contractor may use clean, reworked PVC materials from the manufacturer's own production if the pipe fittings meet the requirements of this section.

Store and handle corrugated PVC pipe as recommended by the manufacturer. Do not use damaged pipe.

3248.3 SAMPLING AND TESTING

Submit to the Engineer a manufacturer's Certificate of Compliance with each pipe shipment.

3249 CULVERT LINER MATERIALS

3249.1 SCOPE

Provide pipe liner for use in lining culverts.

3249.2 REQUIREMENTS

Provide pipe liner meeting one of the following requirements:

- (1) Polyethylene (PE) pipe meeting the requirements of ASTM F 714 (SDR 32.5);
- (2) Closed-profile PE pipe with an ASTM D 3350 cell classification of 345464C;
or
- (3) PVC pipe meeting the requirements of ASTM F 949.

Do not use damaged pipe liner.

3249.3 SAMPLING AND TESTING

Submit to the Engineer a manufacturer's Certificate of Compliance with each pipe shipment.

3252 CAST IRON SOIL PIPE

3252.1 SCOPE

Provide cast iron soil pipe and fittings for use in gravity flow plumbing, drain, waste and vent sanitary and storm water applications.

3252.2 REQUIREMENTS

Provide cast iron soil pipe and fittings meeting the requirements of ASTM A 74 for the class shown on the plans or special provisions.

3252.3 SAMPLING AND TESTING — (BLANK)

3278 CORRUGATED POLYETHYLENE DRAINAGE TUBING

3278.1 SCOPE

Provide corrugated polyethylene (PE) tubing and fittings.

3278.2 REQUIREMENTS

Provide corrugated polyethylene (PE) tubing and fittings meeting the requirements of AASHTO M 252.

3278.3 SAMPLING AND TESTING

Submit to the Engineer a manufacturer's Certificate of Compliance with each tubing shipment.