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## **CORRUGATED METAL CULVERT PIPE**

### **GENERAL**

Corrugated steel culvert pipe, aprons, end sections, coupling bands, special fittings, and associated hardware shall meet the requirements of AASHTO M36 for TYPE I pipe, and AASHTO M218 unless otherwise specified. The minimum sheet thickness will be shown on the plans.

Approved sources for steel sheet zinc coated (galvanized) are listed in [Appendix A](#). Approved sources of corrugated metal pipe culvert is listed in [Appendix B](#), coupling devices, [Appendix C](#). Approved sources of coated corrugated pipes are listed in [Appendix D](#). Aprons and end sections are listed in [Appendix E](#).

**NOTE:** When the type is not designated on the plans, either the standard or positive type may be used.

### **ACCEPTANCE**

Acceptance shall be based on the following requirements:

- A. Material from an approved fabricator
- B. Use of approved brands of metal
- C. Fabricator certificate of compliance
- D. Compliance of test results on monitor samples of metal and hardware
- E. Satisfactory fabrication plant inspection
- F. Proper storage and storage techniques
- G. Proper and complete pipe identification (each pipe, end section, apron, and coupling device shall have the fabricating plant name engraved and / or has a permanent tag attached)

Note: Engraving shall be placed at the end of the pipe or end section and on the top of the corrugation.

### **FABRICATOR APPROVAL**

Fabricator approval will be based on information supplied by the fabricator and an inspection of fabricated pipe. The fabricator shall submit the request for approval in writing to the Central Materials Office in Ames, Iowa, and include the following information:

- 1. Brands of metal to be used
- 2. Diameters and corrugation size of pipe to be furnished
- 3. Fabrication methods used
- 4. Coupling devices furnished
- 5. Description of quality control procedures used
- 6. A copy of a typical invoice or bill of lading containing the certification statement of compliance as outlined in this IM

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7. Quality Control Plan/Program
  8. Qualified QC Personnel
  9. Plant approval (equipment, machinery, etc.)

### **ACCEPTED BRANDS OF METAL**

No metal will be accepted until after the sheet manufacturer certified analysis and manufacturer guarantee have been reviewed by the Central Materials Office and accepted. A list of accepted brands of metal is contained in [Appendix A](#). The metallic coated cut sheets or coils furnished shall meet the requirements of, and be marked in accordance with ASTM A-929 Specifications that cover steel sheets used in the manufacture of corrugated metal pipe culvert.

### **FABRICATOR CERTIFICATE OF COMPLIANCE**

The pipe fabricator shall furnish an identification list, invoice or bill of lading for each shipment to an Iowa project or shipment to an intermediate distributor intended for use in Iowa. It shall list the project number, quantities and description of fabricated materials, corrugation size, and thickness of metal used for each pipe size shipped, and contain a certification statement of compliance with Iowa DOT Specifications and AASHTO requirements. When different metal thicknesses are used in bituminous-coated pipe of the same size for any one project, each pipe shall be tagged or marked in a manner that will identify the metal thickness used. The certificate of compliance shall be stated as follows:

#### **FABRICATOR CERTIFICATE OF COMPLIANCE**

The material covered by this certificate of compliance was manufactured in conformity with Iowa Department of Transportation specifications [section 4141](#) and AASHTO M 36 and M 218. Based on mill certificates and quality control testing, it is certified that representative samples of the listed materials have been tested in accordance with these specifications and that the results meet the requirements. (Material description and shipping destination are as shown.)

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

An authorized representative of the company shall sign the certificate of compliance.

One copy of the document described above shall accompany each shipment and this copy shall be retained in the project engineer file or in the distributor records. Additional copies shall be forwarded at the time of shipment to the Central Materials Office in Ames, Iowa, the District Office responsible for monitor inspections, and the District Office responsible for project administration. Copies of this original document shall be furnished as described above along with the invoice or bill of lading when shipments are made to a project from a distributor.

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The fabricator or the intermediate distributor shall also provide summary quantity documentation to the District Materials Engineer at the completion of shipments to a project. A designated representative shall sign the summary documentation. It shall include type and size, the total quantity of each and the project number.

### **MONITOR SAMPLING & TESTING**

Continued acceptance of brands of metal on the basis of the sheet manufacturer certified analysis and guarantee will be based on satisfactory test results obtained on monitor samples.

Monitor samples of metal may be secured from cut sheets or coils at the fabricator plant or from fabricated pipe at a distributor yard or project site. Samples shall be taken randomly at a minimum frequency of two samples annually as available. The fabricator or distributor shall notify the District Office responsible for monitor inspection of each shipment received.

Monitor samples of metal taken from cut sheets or coils shall be at least 4 inches (100 mm) in length by the "as coated" width. Samples taken from fabricated pipe shall consist of about 6 inches (150 mm) cut from the end of the pipe. The fabricator or distributor shall secure certified mill test results and coating weights when requested by the monitoring engineer.

Failing test results on a monitor sample will be considered sufficient cause to discontinue approval of pipe fabricated from the heat or lot represented and to require additional sampling and testing for the purpose of evaluating the continuance of metal brand acceptance.

The bituminous coating and materials for connections and special fittings will be subject to monitor sampling and testing.

### **MATERIALS**

**Steel sheets:** All fabricated pipe shall be formed from zinc-coated sheet conforming to AASHTO M218 or aluminum-coated type 2 sheet conforming to AASHTO M274M. **NOTE:** All pipe furnished to a project shall have the same type of sheeting and metallic coating, unless otherwise specified.

**Steel sheet for coupling bands:** The sheets used in fabricating coupling bands shall have the same coating and shall conform to the same specifications as the pipe requirements.

**Rivets:** Rivets shall be of the same materials as the base metal specified for the corrugated sheets.

**Bolts & Nuts:** Bolts shall meet the requirements of ASTM F568M, Class 8.8. Nuts shall meet the requirements of ASTM A563M, Grade DH (ASTM A563M, Class 12).

**Bolts & Nuts for Coupling Bands or Joining Systems:** Bolts shall meet the requirements of ASTM F568M, Class 4.6. Nuts shall meet the requirements of ASTM A563, Grade D, A, B, or C (ASTM A563M, Class 5.9.85).

**Gaskets:** If gaskets are used in joining systems, they shall be a band of expanded rubber meeting the requirements of ASTM D1056 for the “RE” closed cell grades, or O-rings meeting the requirements of ASTM C443.

**Physical Requirements (Flat Sheet Prior to Fabrication):** Tensile strength minimum is 45 ksi (310 MPa). Yield Strength minimum is 33 ksi (230 MPa). Elongation in 2-inch minimum is 20%.

### **Metal Pipe Aprons and Beveled End Sections**

Materials for the pipe aprons and beveled end sections shall meet the chemical and physical requirements of AASHTO M218.

The Galvanized sheet metal of the aprons and end sections shall be comparable to the pipe sections in type, grade sheet thickness, corrugations, dimensions, and coatings.

**Note:** Galvanized sheet metal cannot be mixed with aluminized sheet metal.

Aprons and end sections shall meet the requirements of Iowa DOT current standard road plans RF5 and RF44.

Bolts and nuts (hardware) shall meet the requirements of this IM (page 3).

Approved sources for apron and end sections are listed in [Appendix B](#) of this IM.

### **FABRICATION INSPECTION**

Continued acceptance of certified fabrication compliance shall be based on compliance with the workmanship and other specified requirements as determined by monitoring inspection of the fabricated pipe. These inspections may be conducted at the fabricator plant, the distributor storage area, or the project site. All systems for handling the galvanized/aluminized pipes shall have padded contact areas. Coated pipes shall be stored above the ground on wooden or padded supports with timbers placed between pipes when stacking is necessary.

### **CORRUGATIONS**

Corrugations shall be either annular or helical. Corrugations shall be smooth, continuous curves and tangents. Dimensions of corrugations shall be follows:

<u>Nominal Size (mm)</u>	<u>Maximum Pitch (mm)</u>	<u>Minimum Depth (mm)</u>
38 x 6.5	48	6.0
68 x 13	73	12.0
75 x 25	83	24.0
125 x 25	135	24.0

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**NOTE:** Pitch is measure from crest to crest of corrugations at 90° to the direction of corrugation.

**Sawed Joints:** Cut ends of all pipes and aprons shall be free of notches, gouges or burrs and shall have a workman-like finish.

**NOTE:** All structural plates, cut ends, including fittings and cut ends, shall be zinc-coated after cutting.

Unsatisfactory workmanship or failure to meet other specified pipe requirements will be considered sufficient cause for rejection of the faulty pipe. Evidence that the fabrication problem has been corrected will be required for the purpose of evaluating the continuance of certified fabrication compliance.

**NOTE:** If bituminous coating is specified, then the material shall meet AASHTO M-190 Specifications. If polymer coating is specified, material shall meet AASHTO M-245/245M.

### **WORKMANSHIP**

The completed pipe shall show careful, finished and acceptable workmanship. Pipe that has been damaged, either during fabrication or in shipping, may be rejected unless repairs are made that are satisfactory to the engineer.

Among others, the following defects shall be considered as basis for rejection:

- Variations from straight center line
- Dents or bends in the metal
- Ragged/rough, sheared edges
- Elliptical shape in pipe intended to be round
- Metallic coating which has been bruised, scuffed, broken or otherwise damaged
- Illegible markings on the steel sheets
- Uneven laps in riveted or spot-welded pipe
- Loosely formed lock seams
- Defective welds

Noncompliant pipes shall be segregated, marked and shall not be used on any projects.

### **PRODUCT MARKING**

- Brand's Name
- Manufacturer's Name
- Sheet thickness, gage, and grade
- AASHTO Designation
- Heat number and coating lot number