

**SECTION 02210  
CORRUGATED METAL PIPE (CMP)**

**PART I: GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Corrugated metal pipe (CMP).
- B. Corrugated metal pipe with smooth interior (CMPSI).

**1.2 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. No separate payment will be made for corrugated metal pipe in open cut under this Section. Include payment in the unit price for Section 02600 – Storm Sewers.
  - 2. No separate payment will be made for corrugated metal pipe in non-open cut under this Section. Include payment in the unit price for applicable tunneling section.
  - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
  - 1. If Contract is Stipulated Price Contract, payment for work in this Section shall be included in Total Stipulated Price.

**1.3 REFERENCES**

- A. AASHTO – American Association of State Highway and Transportation Officials.
  - 1. AASHTO M36 – Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
  - 2. AASHTO M 90 – Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
  - 3. AASHTO M196 – Corrugated Aluminum Pipe for Sewers and Drains.
  - 4. AASHTO M197 – Aluminum Alloy Sheet for Corrugated Aluminum Pipe.
  - 5. AASHTO M218 – Steel Sheet, Zinc Coated (Galvanized) for Corrugated Steel Pipe.
  - 6. AASHTO M232 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 7. AASHTO M245 – Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains.
  - 8. AASHTO M246 – Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe.
  - 9. AASHTO M274 – Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.
- B. ASTM – American Society for Testing and Materials.

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1. ASTM B633 – Standard Specification for Electro deposited Coatings of Zinc on Iron and Steel.
2. ASTM A760 – Standard Specifications for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
- C. CFTS – City of Friendswood Technical Specifications.

#### 1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit shop drawings with following information:
  1. Design dimensions and details for pipe and fittings indicating alignment, grade and laying dimensions.
  2. Fabrication details, details of fittings and flanges, details of specials and proposed welding procedures.
  3. Show station numbers for pipe and fittings corresponding to the Drawings.

#### 1.5 QUALITY ASSURANCE

- A. Provide manufacturer's affidavits that pipe was manufactured in compliance with standards referenced in this Section.

## PART II: PRODUCTS

### 2.1 PIPE AND FITTINGS

- A. Corrugated metal pipe may be galvanized steel, aluminized steel, aluminum or precoated galvanized steel as indicated on the Drawings and conforming to TABLE 4.1 – AASHTO STANDARDS in this Section.
  1. Reference to gauge of metal is to U.S. Standard Gauge for uncoated sheets. Tables in AASHTO M218 and AASHTO M274 list thicknesses for coated sheets in inches. Tables in AASHTO M197 list thicknesses in inches for clad aluminum sheets.
- B. Coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to requirements of AASHTO M36 for steel pipe and AASHTO M196 for aluminum pipe.
  1. Coupling bands shall be not more than three (3) nominal sheet thicknesses lighter than thickness of pipe to be connected and in no case lighter than fifty-two thousandths inch (0.052 In) for steel or forty-eight thousandths inch (0.048 In) for aluminum.
  2. Coupling bands shall be made of same base metal and coating (metallic or otherwise) as pipe.
  3. Minimum width of corrugated locking bands shall be as shown below for corrugations which correspond to end circumferential corrugations on pipes being joined:
    - a. Ten and one-half inches (10-1/2 In) wide for two and two-thirds inch by one-half inch (2-2/3 In x 1/2 In) corrugations.
    - b. Twelve inches (12 In) wide for three inch by one inch (3

- In x 1 In) corrugations.
4. Helical pipe without circumferential end corrugations shall be permitted only when it is necessary to join new pipe to existing pipe which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at ends shall be field jointed with either helically corrugated bands or with bands with projections (dimples). Minimum width of helical corrugated bands shall conform to following:
    - a. Twelve inches (12 In) wide for one-half inch (1/2 In) deep helical end corrugations.
    - b. Fourteen inches (14 In) wide for one inch (1 In) deep helical end corrugations.
  5. Bands with projections shall have circumferential rows of projections with one (1) projection for each corrugation. Width of bands with projections shall be not less than following:
    - a. Twelve inches (12 In) wide for pipe diameters up to and including seventy-two inches (72 In). Bands shall have two (2) circumferential rows of projections.
    - b. Sixteen and one-quarter inches (16-1/4 In) wide for pipe diameters of seventy-eight inches (78 In) and greater. Bands shall have four (4) circumferential rows of projections.
  6. Bolts for coupling bands shall be one-half inch (1/2 In) diameter. Bands twelve inches (12 In) wide or less shall have minimum of two (2) bolts per end at each connection and bands greater than twelve inches (12 In) wide shall have minimum of three (3) bolts at each connection.
  7. Galvanized bolts may be hot dip galvanized in accordance with requirements of AASHTO M232, mechanically galvanized to provide same requirements as AASHTO M232 or electro galvanized per ASTM B633, Type RS.
- C. Coat bituminous coated pipe or pipe arch inside and out with bituminous coating which shall meet these performance requirements and requirements of AASHTO M190.
1. Uniformly coat pipe inside and out to minimum thickness of five hundredths inch (0.05 In), measured on crests of corrugations.
  2. Adhere bituminous coating to metal so that it shall not chip, crack or peel during handling and placement; and to protect pipe from corrosion and deterioration.
  3. Where paved invert is shown on the Drawings, pipe or pipe arch, in addition to fully-coated treatment described above, shall receive additional bituminous material, same as specified above, applied to bottom quarter of circumference to form smooth pavement. Maintain minimum thickness of one-eighth inch (1/8 In) above crests of corrugations.

- D. Furnish fittings and specials required for bends, end sections, branches, access manholes and connections to other fittings. Design fittings and specials in accordance with the Drawings and ASTM A760. Fittings and specials are subject to same internal and external loads as straight pipe.

## 2.2 PIPE FABRICATION

### A. Steel Pipe:

- 1. Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M36, Type I, Type IA or Type II, as indicated on the Drawings.
- 2. Fabrication with circumferential corrugations, lap joint construction with riveted or spotwelded seams, helical corrugations with continuous helical lock seam or ultra-high frequency resistance butt-welded seams is acceptable.

### B. Aluminum Pipe:

- 1. Conform to requirements of AASHTO M196, Type I, Type IA, circular pipe or Type II, pipe arch as indicated on the Drawings.
- 2. Fabrication with circumferential corrugations, lap joint construction with riveted or spotwelded seams or helical corrugations with continuous helical lock seam.
- 3. Portions of aluminum pipe that is to be in contact with concrete or metal other than aluminum shall be insulated from these materials with coating of bituminous material meeting requirements of AASHTO M190. Extend coating minimum distance of one foot (1 Ft) beyond area of contact.

### C. Precoated Galvanized Steel Pipe:

- 1. Pipe shall be full circle or arch pipe conforming to AASHTO M245, Type I, Type IA or Type II as indicated on the Drawings.
- 2. Fabrication with circumferential corrugations, lap joint construction with riveted seams or helical lock seams is acceptable.
- 3. Inside and outside coating shall be minimum of ten (10) mils.

## PART III: EXECUTION

### 3.1 PREPARATION

- A. Repair damaged spelter coating by thoroughly wire brushing damaged area and removing all loose, cracked or weld-burned spelter coating. Paint cleaned area with zinc dust-zinc oxide paint conforming to Federal Specifications TT-P-641g.
- B. Repair damaged aluminized or polymer coating in accordance with manufacturer's recommendations.

### 3.2 EARTHWORK

- A. Excavate in accordance with requirements of Section 02125 – Excavation and Backfill for Utilities, except where tunneling or jacking methods are shown on the Drawings. When pipes are laid in trench,

trench when completed and shaped to receive pipe, shall be of sufficient width to provide free working space for satisfactory bedding and jointing and thorough tamping of backfill and bedding material under and around pipe.

- B. Bed pipe in accordance with the Drawings. When requested by the Project Manager, furnish simple template for each size and shape of pipe for use in checking shaping of bedding. Template shall consist of thin plate or board cut to match lower half of cross section.
- C. Where rock in either ledge or boulder form exists below pipe, remove rock below grade and replace with suitable materials so slightly yielding compacted earth cushion is provided below pipe minimum of twelve inches (12 In) thick.
- D. Remove and replace where soil encountered at established grade is quicksand, muck or similar unstable materials in accordance with requirements of Section 02125 – Excavation and Backfill for Utilities. Do not allow cement stabilized materials for backfill to come into contact with uncoated aluminum or aluminized pipe surface.
- E. After metal pipe structure has been completely assembled on proper line and grade and headwalls constructed when required by drawing details, place selected material from excavation or borrow along both sides of completed structures equally, in uniform layers not exceeding six inches (6 In) in depth (loose measurement), wetted when required and thoroughly compacted between adjacent structures and between structure and sides of trench or for distance each side of structure equal to diameter of pipe. Compact backfill material to same density requirements as specified for adjoining sections of embankment in accordance with the specifications. Above three-fourths (3/4) point of structure, place uniformly on each side of pipe in layers not to exceed twelve inches (12 In).
- F. Only hand operated tamping equipment shall be allowed within vertical planes two feet (2 Ft) beyond horizontal projection of outside surface of structure for backfilling, until minimum cover of twelve inches (12 In) is obtained. Remove and replace damaged pipe.
- G. Do not permit heavy earth moving equipment to haul over structure until minimum of four feet (4 Ft) of permanent or temporary compacted fill has been placed.
- H. During backfilling, obtain uniform backfill material and uniform compacted density throughout length of structure to avoid unequal pressure. Provide proper backfill under structure.
- I. Prior to adding each new layer of loose backfill material, inspection shall be made of inside periphery of structure for local or unequal deformation caused by improper construction methods. Evidence of deformation shall be reason for corrective measures as may be directed by the Project Manager.

### 3.3 PIPING INSTALLATION

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- A. Place pipes on prepared foundation starting at outlet end. Join sections firmly together, with side laps or circumferential joints pointing upstream and with longitudinal laps on sides.
- B. Coat metal in joints not protected by galvanizing or aluminizing with approved asphaltum paint.
- C. Provide proper equipment for hoisting and lowering sections of pipe into trench without damaging pipe or disturbing prepared foundation and sides of trench. Take up and re-lay pipe which is not in alignment or which shows undue settlement after laying or is damaged.
- D. Lay multiple installations of corrugated metal pipe and pipe arches with center lines of individual barrels parallel. Unless otherwise indicated on the Drawings, maintain following clear distances between outer surfaces of adjacent pipes as specified in TABLE 4.2 – PIPE CLEARANCE DISTANCES in this Section.
- E. Where extensions are attached to existing structures, install proper connection between structure and existing as indicated on the Drawings, coat connection with bituminous material when required.
- F. When existing headwalls and aprons are indicated for reuse on the Drawings, sever portion to be reused from existing culvert and relocate to prepared position. Restore damaged headwalls, aprons or pipes attached to headwall to their original condition.

#### 3.4 JOINTING

- A. Use field joints to maintain pipe alignment during construction and prevent infiltration of side material.
- B. Lap coupling bands equally on pipes being connected to form tightly-closed joint.
- C. Use corrugated locking bands to field join pipes furnished with circumferential corrugations including pipe with helical corrugations having reformed circumferential corrugations on ends. Fit locking bands into minimum of one (1) full circumferential corrugation of pipe ends being coupled.

**PART IV: TABLES**

**4.1 AASHTO STANDARDS**

<b>Corrugated Metal Pipe Type</b>	<b>AASHTO Standard</b>
Galvanized Steel	AASHTO M218
Aluminized Steel	AASHTO M274
Aluminum	AASHTO M197
Precoated Galvanized Steel	AASHTO M246

**4.2 PIPE CLEARANCE DISTANCES**

<b>Diameter of Pipe</b>	<b>Clear Distance Between Pipes Full Circle and Pipe Arch</b>	<b>Pipe Arch Design No.</b>
18"	1' – 2"	2
24"	1' – 5"	3
30"	1' – 8"	4
36"	1' – 11"	5
42"	2' – 2"	6
48"	2' – 5"	7
54"	2' – 10"	5
60" – 84"	3' – 2"	9
90" – 120"	3' – 5"	10 & Over

**END OF SECTION**