

Section 02642

CORRUGATED METAL PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for corrugated metal pipe in open cut under this Section. Include payment in unit price for Section 02631 - Storm Sewers.
 - 2. No payment will be made for corrugated metal pipe in non-open cut under this Section. Include payment in unit price for applicable tunneling section.
 - 3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. AASHTO M 36 - Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
- B. AASHTO M 190 - Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
- C. AASHTO M 196 - Corrugated Aluminum Pipe for Sewers and Drains.
- D. AASHTO M 197 - Aluminum Alloy Sheet for Corrugated Aluminum Pipe.
- E. AASHTO M 218 - Steel Sheet, Zinc Coated (Galvanized) for Corrugated Steel Pipe.
- F. AASHTO M 232 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- G. AASHTO M 245 - Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains.

- H. AASHTO M 246 - Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe.
- I. AASHTO M 274 - Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.
- J. ASTM B 633 - Standard Specification for Electro deposited Coatings of Zinc on Iron and Steel.
- K. ASTM A 760 - Standard Specifications for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

1.04 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 Drawings.

1.05 QUALITY ASSURANCE

- A. Provide manufacturer's affidavits that pipe was manufactured in compliance with standards referenced in this Section, and that coatings and linings were not applied or allowed to cure in freezing temperatures.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

- A. Corrugated metal pipe may be galvanized steel, aluminized steel, aluminum or precoated galvanized steel as indicated on Drawings and conforming to following:

Galvanized Steel	AASHTO M 218
Aluminized Steel	AASHTO M 274
Aluminum	AASHTO M 197
Precoated Galvanized Steel	AASHTO M 246

1. Reference to gauge of metal is to U.S. Standard Gauge for uncoated sheets. Tables in AASHTO M 218 and AASHTO M 274 list thicknesses for coated sheets in inches. Tables in AASHTO M 197 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 M 36 for steel pipe and AASHTO M 196 for aluminum pipe.
1. Coupling bands shall be not more than 3 nominal sheet thicknesses lighter than thickness of pipe to be connected and in no case lighter than 0.052 inch for steel or 0.048 inch 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. 102 inches wide for 2-2/3 inch by 2 inch corrugations.
 - b. 12 inches wide for 3 inch by 1 inch corrugations.
 4. Helical pipe without circumferential end corrugations will 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. 12 inches wide for 2 inch deep helical end corrugations.
 - b. 14 inches wide for 1 inch deep helical end corrugations.
 5. Bands with projections shall have circumferential rows of projections with one projection for each corrugation. Width of bands with projections shall be not less than following:
 - a. 12 inches wide for pipe diameters up to and including 72 inches. Bands shall have two circumferential rows of projections.
 - b. 163 inches wide for pipe diameters of 78 inches and greater. Bands shall have four circumferential rows of projections.
 6. Bolts for coupling bands shall be 2-inch diameter. Bands 12 inches wide or less will have minimum of 2 bolts per end at each connection, and bands greater than 12 inches wide shall have minimum of 3 bolts at each connection.

7. Galvanized bolts may be hot dip galvanized in accordance with requirements of AASHTO M 232, mechanically galvanized to provide same requirements as AASHTO M 232, or electrogalvanized per ASTM B 633, 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 M 190.

1. Uniformly coat pipe inside and out to minimum thickness of 0.05 inch, measured on crests of corrugations.
2. Adhere bituminous coating to metal so that it will not chip, crack, or peel during handling and placement; and to protect pipe from corrosion and deterioration.
3. Where paved invert is shown on 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 c inch 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 Drawings and ASTM A 760. Fittings and specials are subject to same internal and external loads as straight pipe.

2.02 PIPE FABRICATION

A. Steel Pipe:

1. Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I, Type IA, or Type II, as indicated on Drawings.
2. Fabrication with circumferential corrugations, lap joint construction with riveted or spot-welded 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 M 196, Type I, Type IA, circular pipe, or Type II, pipe arch as indicated on Drawings.
2. Fabrication with circumferential corrugations, lap joint construction with riveted or spot-welded seams, or helical corrugations with continuous helical lock seam.
3. Portions of aluminum pipe that will 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 M 190. Extend coating minimum distance of one foot beyond area of contact.

C. Precoated Galvanized Steel Pipe:

1. Pipe shall be full circle or arch pipe conforming to AASHTO M 245, Type I, Type IA or Type II as indicated on 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 10 mils.

PART 3 EXECUTION

3.01 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.

3.02 EARTHWORK

- A. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities, except where tunneling or jacking methods are shown on 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 Drawings. When requested by City Engineer, 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 12 inches thick.
- D. Remove and replace where soil encountered at established grade is quicksand, muck or similar unstable materials in accordance with requirements of Section 02317 - 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 6 inches 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 specifications. Above three-fourths point of structure, place uniformly on each side of pipe in layers not to exceed 12 inches.
- F. Only hand operated tamping equipment will be allowed within vertical planes 2 feet beyond horizontal projection of outside surface of structure for backfilling, until minimum cover of 12 inches is obtained. Remove and replace damaged pipe.
- G. Do not permit heavy earth moving equipment to haul over structure until minimum of 4 feet 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 will be made of inside periphery of structure for local or unequal deformation caused by improper construction methods. Evidence of deformation will be reason for corrective measures as may be directed by City Engineer.

3.03 PIPING INSTALLATION

- 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 centerlines of individual barrels parallel. Unless otherwise indicated on Drawings, maintain following clear distances between outer surfaces of adjacent pipes:

<u>Diameter of Pipe</u>	<u>Clear Distance Between Pipes Full Circle and Pipe Arch</u>	<u>Pipe Arch Design No.</u>
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"	8
60"-84"	3'-2"	9
90"-120"	3'-5"	10 & Over

- E. Where extensions are attached to existing structures, install proper connection between structure and existing as indicated on Drawings, coat connection with bituminous material when required.
- F. When existing headwalls and aprons are indicated for reuse on 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.

3.04 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 full circumferential corrugation of pipe ends being coupled.

END OF SECTION