

(B) Type M

Type M backer rod is a closed-cell polyolefin foam backer rod which has a closed-cell skin over an open cell core. Use this backer rod in roadway and bridge joints with both silicone sealant types. Use Type M backer rod that complies with Table 1028-2.

Property	Requirement	Test Method
Min. Density	2.0 lb/cf	ASTM D 1622
Min. Tensile Strength	25 psi	ASTM D 1623
Max. Water Absorption	0.5% by volume	ASTM C 509

(C) Type N

Provide bond breaking tape made from extruded polyethylene that has a pressure sensitive adhesive on one side. Bond breaking tape may be used with both types of silicone but is suitable for bridge joints only. Bond breaking tapes shall be at least 0.005 inch in thickness.

SECTION 1032 CULVERT PIPE

1032-1 CORRUGATED METAL CULVERT PIPE

Use corrugated metal culvert pipe from sources on the Department's approved list and that participate in the Department's Brand Registration program for metal culvert pipe available from the website or the Materials and Tests Unit's Central Laboratory. The Department will remove a manufacturer of metal culvert pipe from this program if the monitoring efforts indicated that non-specification material is being provided or test procedures are not being followed.

The following types of steel and aluminum alloy pipe and all associated accessories may be accepted under this program.

(A) Coated corrugated metal culvert pipe and pipe arches,

(B) Coated corrugated metal end sections, coupling band and other accessories,

(C) Corrugated aluminum alloy structural plate pipe and pipe arches,

(D) Corrugated aluminum alloy end sections, coupling band and other accessories, and

Field joints for each type of corrugated steel pipe or corrugated aluminum pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installation. Coupling bands may be of the following types: bands with annular corrugations; bands with helical corrugations; bands with projections (dimples); channel bands for upturned flanges, with or without annular corrugations; flat bands; and smooth sleeve-type couplers. Coupling bands shall be installed in accordance with details in plans and/or in accordance with manufacturer's recommendations.

Corrugated metal pipe and coupling bands shall conform to ASTM B745 for Corrugated Aluminum Pipe, ASTM A796 for Corrugated Steel Pipe, ASTM A760 for Aluminized Coated Corrugated Steel Pipe, and ASTM A762 for Polymer Pre-coated Corrugated Steel Pipe.

1032-2 CORRUGATED ALUMINUM ALLOY CULVERT PIPE**(A) Corrugated Aluminum Alloy Culvert Pipe**

Corrugated aluminum alloy culvert pipe shall meet AASHTO M 196, except that Type IA pipe will not be permitted.

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1 When elongated pipe is called for by the contract, use pipe that is shop formed to provide
2 for a 5% vertical elongation.

3 (1) Coupling Bands

- 4 (a) Use corrugated coupling bands except as otherwise provided below.
- 5 (b) A hugger type corrugated band having one annular corrugation at each outside
6 edge of the band will be acceptable.
- 7 (c) Coupling bands with projections (dimples) may be used where it is necessary to
8 join new pipe to existing pipe having helical corrugations at the joint locations.
9 The bands shall be formed with projections in annular rows with one projection
10 for each corrugation of helical pipe. Use an approved sealer with this type of
11 coupling band. Coupling bands with projections (dimples) may be used for
12 circumferential pipe, heliacal pipe, or a combination of both.
- 13 (d) Fasten coupling bands on the ends with at least two 1/2 inch bolts.
- 14 (e) Annular corrugated bands shall have a minimum width of 10 1/2 inches where
15 2 2/3 inches x 1/2 inch corrugations are used.

16 (B) Corrugated Aluminum Alloy Pipe Tees and Elbows

17 Corrugated aluminum alloy pipe tees and elbows shall meet all applicable requirements
18 of AASHTO M 196.

19 (C) Acceptance

20 Acceptance of corrugated aluminum alloy culvert pipe and its accessories will be based
21 on, but not limited to, visual inspections, classification requirements and check samples
22 taken from material delivered to the project and conformance to the annual Brand
23 Registration.

24 Culvert pipe materials not meeting the above requirements will be rejected, unless written
25 approval is obtained from the State Materials Engineer.

26 1032-3 CORRUGATED STEEL CULVERT PIPE

27 (A) Corrugated Steel Culvert Pipe and Pipe Arch

28 Corrugated steel culvert pipe and pipe arch shall meet AASHTO M 36 with the following
29 exceptions:

30 (1) Coupling Bands

- 31 (a) Use corrugated coupling bands except as otherwise provided below.
- 32 (b) A hugger type corrugated band having one annular corrugation at each outside
33 edge of the band will be acceptable.
- 34 (c) Coupling bands with projections (dimples) may be used where it is necessary to
35 join new pipe to existing pipe having helical corrugations at the joint locations.
36 The bands shall be formed with projections in annular rows with one projection
37 for each corrugation of helical pipe. Use an approved sealer with this type of
38 coupling band. Coupling bands with projections may be used for circumferential
39 pipe, heliacal pipe, or a combination of both.
- 40 (d) Fasten coupling bands on the ends with at least two 1/2 inch bolts.
- 41 (e) Annular corrugated bands shall have a minimum width of 10 1/2 inches where
42 2 2/3 inches x 1/2 inch corrugations are used.

1 (2) Corrugations

2 Where 1/4 inch deep corrugations are permitted by AASHTO M 36, the maximum
3 pitch of the corrugations shall be 1 7/8 inches.

4 Where 3 inches x 1 inch corrugations are required, the Contractor will be permitted
5 to use 5 inches x 1 inch corrugations.

6 Pipe with helical corrugations shall have rerolled ends with at least 2 annual
7 corrugations at each end.

8 (3) Elongated Pipe

9 When elongated pipe is called for by the contract, use pipe that is shop formed to
10 provide for a 5% vertical elongation.

11 (4) Lifting Straps

12 The pipe may be furnished either with or without lifting straps for handling. Attach
13 the lifting straps by bolting or by welding. Bolt holes for attaching the straps shall be
14 a smooth hole that is either punched or drilled. No burning of holes will be
15 permitted. Design the lifting straps so the holes can be plugged to prevent
16 infiltration of backfill material.

17 Design the placement of lifting straps to ensure the pipe is equally supported along
18 its axis.

19 (5) Coating Repair

20 Repair shall be in accordance with Section 1076-7.

21 (6) Type IA Pipe

22 Type IA pipe will not be permitted.

23 (7) Aluminized Pipe

24 Aluminized pipe shall meet all requirements herein except that the pipe and coupling
25 bands shall be fabricated from aluminum coated steel sheet meeting
26 AASHTO M 274.

27 (8) Marking Requirements

28 Pipe sections and special attachments for pipe 60 inches or larger diameter pipe shall
29 be alphanumerically match-marked at the plant site before shipping. There may be
30 additional markings as required by the Department's Brand Certification Program.

31 **(B) Prefabricated Corrugated Steel Pipe End Sections**

32 Corrugated steel end sections shall be in accordance with the details shown in the plans
33 and Subarticle 1032-3(A). Repair end sections on which the spelter coating has been
34 bruised or broken either in the shop or in shipping in accordance with AASHTO M 36.

35 **(C) Corrugated Steel Pipe Tees and Elbows**

36 Corrugated steel tees and elbows shall be in accordance with Subarticle 1032-3(A).

37 **(D) Corrugated Steel Eccentric Reducers**

38 Corrugated steel eccentric reducers shall be in accordance with Subarticle 1032-3(A) and
39 the additional requirements shown below.

40 Construct the eccentric reducer so the invert or flow line from the large pipe through the
41 reducer and into the small pipe is a continuous straight line.

42 Make the reducer from the same thickness corrugated metals as the large diameter pipe.
43 The reducing section may be riveted or welded.

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1 (E) Acceptance

2 Acceptance of corrugated steel culvert pipe and its accessories will be based on, but not
3 limited to, visual inspections, classification requirements and check samples taken from
4 material delivered to the project and conformance to the annual Brand Registration.

5 Culvert pipe materials not meeting the above requirements will be rejected, unless written
6 approval is obtained from the State Materials Engineer.

7 The reducing section shall reduce in diameter no more than 3 inches in 24 inches of
8 length. Rivet or weld a 24 inches long constant diameter stub to each end of the reducing
9 section to form the complete reducer.

10 Have the completed reducer show careful, finished workmanship in all particulars.
11 Repair reducers on which the spelter coating has been bruised or broken either in the
12 shop or in shipping in accordance with AASHTO M 36. Reducers that show defective
13 workmanship will be rejected. The following defects are evidence of poor workmanship,
14 and the presence of any of them in any individual reducer will constitute sufficient cause
15 for rejection:

- 16 (1) Not meeting required dimensions,
- 17 (2) Not of the specified shape,
- 18 (3) Uneven laps,
- 19 (4) Ragged or diagonal sheared edges,
- 20 (5) Loose, unevenly lined or spaced rivets,
- 21 (6) Poorly formed rivet heads,
- 22 (7) Lack of rigidity,
- 23 (8) Dents or bends in the metal itself,
- 24 (9) Uneven welds, or
- 25 (10) Gaps in welds.

26 **1032-4 COATED, PAVED AND LINED CORRUGATED STEEL CULVERT PIPE**

27 (A) Coatings for Steel Culvert Pipe or Pipe Arch

28 The below coating requirements apply for steel culvert pipe, pipe arch, end sections, tees,
29 elbows and eccentric reducers.

- 30 (1) Steel Culvert pipe shall have an aluminized coating, meeting the requirement of
31 AASHTO M 274.
- 32 (2) When shown in the plans or as approved by the Engineer, a polymeric coating
33 meeting AASHTO M 246 for Type B coating may be substituted for aluminized
34 coating.

35 (B) Acceptance

36 Acceptance of coated steel culvert pipe and its accessories will be based on, but not
37 limited to, visual inspections, classification requirements and check samples taken from
38 material delivered to the project and conformance to the annual Brand Registration.

39 **1032-5 WELDED STEEL PIPE FOR DRAINAGE**

40 Welded steel pipe shall meet ASTM A139 for the grade of pipe called for in the plans.

41 Acceptance of welded steel culvert pipe and its accessories will be based on, but not limited
42 to, visual inspections, classification requirements and check samples taken from material
43 delivered to the project and conformance to the Department's welded steel pipe program.

44 Culvert pipe materials not meeting the above requirements will be rejected, unless written
45 approval is obtained from the State Materials Engineer.

1 **1032-6 CONCRETE CULVERT PIPE**

2 **(A) General**

3 Use concrete pipe from sources participating in the Department's Concrete Pipe QC/QA
4 Program. A list of participating sources is available from the Materials and Tests Unit's
5 Central Laboratory. The Department will remove a manufacturer of concrete pipe from
6 this program if the monitoring efforts indicated that non-specification material is being
7 provided or testing procedures are not being followed.

8 **(B) Reinforced Concrete Culvert Pipe**

9 Reinforced concrete culvert pipe shall meet AASHTO M 170 for the class of pipe called
10 for in the plans except as follows:

- 11 (1) The permissible wall thickness outside of the joint configuration shall not be more
12 than that shown in the design by more than 5% or 3/16 inch, whichever is greater.
- 13 (2) The maximum weighted average loss for both fine and coarse aggregates shall be
14 15% when subjected to 5 cycles of the soundness test.
- 15 (3) The maximum percentage of wear for coarse aggregates is 55%.

16 The design wall thickness shall be either the wall thickness shown in AASHTO M 170
17 for the applicable class and wall or the wall thickness shown in a modified design that has
18 been approved by the Engineer. A wall thickness greater than permitted by the above
19 tolerance will be cause for rejection of the pipe. The circumferential steel in single cage
20 pipe shall not be more than 3 inches from either end of the pipe section excluding the
21 tongue and groove. On double cage pipe, extend one cage into the tongue or groove.
22 Place the other cage so a circumferential wire shall be not less than 2 inches from the
23 other end of the barrel of the pipe.

24 **(C) Precast Concrete Pipe End Sections**

25 Precast concrete pipe end sections shall meet AASHTO M 170 and Section 1077 except
26 those requirements pertaining to design.

27 Design concrete pipe end sections in accordance with the plans or with plans prepared by
28 the manufacturer which have been approved by the Engineer. Reinforce all concrete pipe
29 end sections. Use air entrained concrete in pipe end sections with a strength of 3,500 psi
30 when tested in accordance with AASHTO T 22.

31 **(D) Concrete Pipe Tees and Elbows**

32 Concrete pipe tees and elbows shall meet AASHTO M 170 for the class of pipe tee or
33 elbow called for in the plans.

34 **(E) Marking**

- 35 (1) Clearly etchmark the following information on the outside of each section of pipe,
36 pipe end section, tee and elbow:
- 37 (a) Pipe class and type of wall if reinforced,
38 (b) The date of manufacture, and
39 (c) Name or trademark of the manufacturer.
- 40 (2) Clearly stamp, stencil, sticker or paint the following information on each section of
41 pipe, pipe end section, tee and elbow:
- 42 (a) The State assigned plant number,
43 (b) The inside diameter of the pipe product, and

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1 (c) The year of manufacture. This marking shall be in the following format: State
2 plant number - diameter - year (CP99-24-06).

3 When concrete pipe, pipe end sections, tees and elbows have been inspected and accepted
4 they will be stamped with the Department seal of approval. Do not use pipe sections,
5 pipe end sections, tees, or elbows which do not have this seal of approval. Failure of as
6 much as 20% of any lot of pipe due to cracks, fractures, variation in alignment
7 or other manufacturing defects will be cause for the rejection of the entire lot.
8 The lots shall be as designated by the manufacturer before inspection.
9 Individual lengths of pipe within the lot which were not specifically rejected but which
10 are considered acceptable by the manufacturer may be removed from the rejected lot and
11 resubmitted for inspection as a separate lot.

12 (F) Joint Materials

13 Cement shall meet Article 1024-1. Sand shall meet Article 1014-1 for fine aggregate or
14 Article 1040-7 for mortar sand. Hydrated lime shall meet Article 1040-6.

15 Flexible plastic joint material shall meet AASHTO M 198 for Type B flexible plastic
16 gaskets, except as follows:

17 (1) The flash point, Cleveland Open Cup (C.O.C.) shall be at least 325°F.

18 (2) The fire point, C.O.C. shall be at least 350°F.

19 1032-7 CORRUGATED POLYETHYLENE (HDPE) CULVERT PIPE

20 (A) General

21 Use corrugated polyethylene pipe from sources participating in the Department's HDPE
22 Pipe QC/QA Program. A list of participating sources is available from the Materials and
23 Tests Unit. The Department will remove a manufacturer of polyethylene pipe from this
24 program if the monitoring efforts indicated that non-specification material is being
25 provided or test procedures are not being followed.

26 Use corrugated polyethylene culvert pipe that meets AASHTO M 294 for Type S or
27 Type D and has been evaluated by NTPEP.

28 (B) End Treatments, Pipe Tees and Elbows

29 End treatments, pipe tees and elbows shall meet AASHTO M 294, Section 7.8.

30 (C) Marking

31 Clearly mark each section of pipe, end section, tee and elbow and other accessories
32 according to the Department's HDPE Pipe QC/QA Program:

33 (1) AASHTO Designation

34 (2) The date of manufacture

35 (3) Name or trademark of the manufacturer

36 When polyethylene pipe, end sections, tees and elbows have been inspected and accepted
37 they will be stamped with the Department seal of approval. Do not use pipe sections,
38 flared end sections, tees or elbows which do not have this seal of approval.

39 1032-8 PVC PROFILE WALL DRAIN PIPE

40 PVC pipe shall conform to AASHTO M 304. When rubber gaskets are to be installed in the
41 pipe joint, the gasket shall be the sole element relied on to maintain a tight joint. Watertight
42 joints shall be watertight in accordance with AASHTO M 304, unless a higher pressure rating
43 is specified in the plans.