320 kPa HDPE Culvert

SCOPE

This specification covers the requirements of 100mm to 900mm nominal diameter corrugate high-density polyethylene pipe with a smooth interior wall and annular exterior corrugations for gravity-flow drainage applications.

MATERIALS

Pipe shall be manufactured from high-density polyethylene resin which shall meet or exceed the Cell Class requirements of ASTM D3350.

PIPE DIMENSIONS

The nominal size of the pipe is based on the nominal inside diameter of the pipe. The tolerance on the specified inside diameter shall be +3 / -1.5%. Outside diameters should be specified for manhole/catch basins to accommodate the pipe. Perforated pipe and filter cloth is available on special order and may vary by region.

Nominal Inside Diameters (mm)	100	150	200	250	300	375	450	525	600	750	900
Outside Diameters (mm)	120	177	234	292	361	444	540	627	726	895	1,087

STOCKED LENGTHS

Standard pipe lengths shall be 6m or as requested by the Engineer. Lengths shall not be less than 99% stated length.

JOINTS

Pipes shall be joined with external double bell 'snap' couplers (100mm - 200mm) or external 'split' couplers (250mm - 900mm) for soil-tight applications meeting CSA Group standard B182.8 Type 3 / BNQ 3624-120. Pipes shall be joined with Ultra Stab 75 gasketed bell and spigot couplers (150mm - 900mm) lab tested to 75kPa in accordance with ASTM standard D3212 meeting CSA Group standard B182.8 Type 1 / BNQ 3624-120 for water-tight applications under normal gravity flow operating pressures. Styrene-Butadiene Rubber (SBR) gaskets shall be incorporated into the system with lubricant supplied by the manufacturer.

PIPE STIFFNESS

The pipe shall have a minimum pipe stiffness of 320kPa (100mm - 900mm) meeting CSA Group standard 182.8 or 210kPa (250mm - 900mm) at 5% deflection. Tests shall be conducted in accordance with ASTM D2412.

HYDRAULICS

The pipe shall have a Manning's 'n' value of 0.012 at a flow velocity of 0.75 m/s.

RETEST AND REJECTION

If any failure to conform to these specifications occurs, the pipe or fittings may be retested to establish conformity in accordance with the agreement between the purchase and the seller.

APPLICABLE STANDARDS

CSA B182.8, BNQ 3624-120, OPSS 1840, OPSS 410, OPSD 806.02, BC MoT SS-317

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Features and Benefits of HDPE Culvert

LIGHTWEIGHT
Its light weight allows for safe handling and quick installation with minimal equipment

HYDRAULIC PERFORMANCE
The smooth interior ensures optimum flow capacity for storm sewer applications

COST EFFECTIVE
Less equipment and manpower required for installation

CHEMICAL/ABRASION RESISTANT
Highly resistant to chemical attack and abrasive environments

UV RESISTANT
A minimum of 2% carbon black additive protects against UV light deterioration

DURABLE
Highly durable; withstands impact in all weather conditions

Research shows that when it comes to abrasion and chemical resistance HDPE outperforms other commercially available pipe materials:

FIGURE 1: ABRASION LOSS OF VARIOUS PIPE MATERIALS*

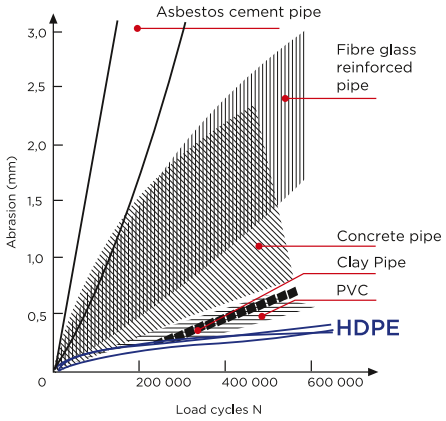
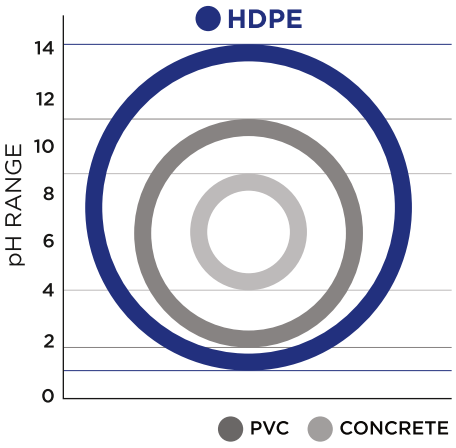


FIGURE 2: pH RANGE OF COMMERCIALLY AVAILABLE PIPE MATERIALS



HDPE material provides excellent resistance to both acidic and alkaline environments pH 1.25 to 14.

*Reference "Problems of Abrasion in Pipes" by O. Kirschmer

DESIGN SERVICE LIFE

The failure mode most common to HDPE pipe is either excessive wall thrust or large strains. Establishing the Design Service Life (DSL) is dependent upon limiting the stress and strain levels in the pipe wall. Thermoplastic materials, when subjected to stress or strain, exhibit time dependent relaxations referred to as creep or stress relaxation. Creep is a measure of the increase in strain with time under a constant stress while stress relaxation is the decrease in stress under a constant strain.

In 2007 AASHTO Bridge Design Specifications adopted LRFD (Load and Resistance Factor Design) procedures for the design of thermoplastic pipes. Resistance factors vary with the various thermoplastic pipe materials available. The load and resistance factors used in the LRFD design procedure address the design criteria of limiting stress and strain levels in buried thermoplastic pipe to meet DSL demands.

Studies by the Florida Department of Transportation established a DSL of 100 years for HDPE based on laboratory evaluations. Similar studies and declarations have been made based on the publically available literature including the Ontario Ministry of Transportation's Gravity Pipe Design Guidelines which states a 75 year DSL for HDPE.

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HDPE Culvert Specifications

STOCKED LENGTHS	6 metres
CUSTOM LENGTHS	Available on special order
STOCKED STIFFNESS	320 kPa (100mm – 900mm) – CSA 182.8 210 kPa (250mm – 900mm)
JOINING SYSTEMS	WATER-TIGHT (CSA 182.8 Type 1, BNQ 3624-120) • Ultra Stab 75 (100mm – 900mm) SOIL-TIGHT (CSA 182.8 Type 3, BNQ 3624-120) • External double bell 'snap' coupler (100mm – 200mm) • External 'split' coupler (250mm – 900mm)
FITTINGS AVAILABLE	Refer to Fig. 4, pg. 12
APPLICABLE STANDARDS	CSA B182.8, BNQ 3624-120

NOMINAL INSIDE DIAMETERS (mm)	100	150	200	250	300	375	450	525	600	750	900
OUTSIDE DIAMETERS (mm)	120	177	234	292	361	444	540	627	726	895	1,087
PROFILE TYPE ANNULAR (A)	A	A	A	A	A	A	A	A	A	A	A

NOTE: MANNING'S 'N' VALUE = 0.012

If you wish to specify HDPE for your storm sewer application the following is suggested:
HDPE in accordance to CSA Group specification B182.8, with Type 1 water-tight joints (75 kPa).

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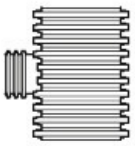
Easy To Use Fittings

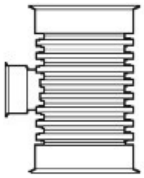
FIGURE 4: Fitting Configurations

TEES

Plain End

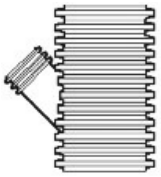


Belled



45° Y

Plain End



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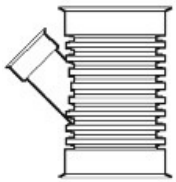
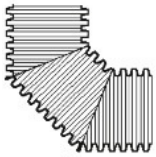


90° ELBOW

Plain End



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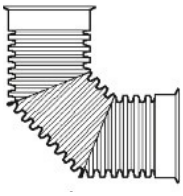
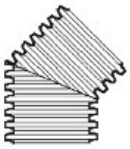


45° ELBOW

Plain End



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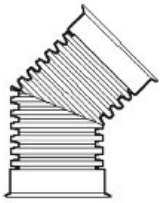
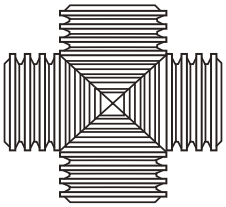
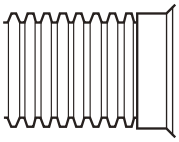


CROSSES



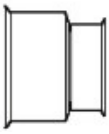
MANHOLE ADAPTER



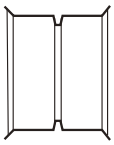
REDUCERS

Eccentric

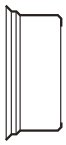
Concentric



REPAIR COUPLINGS



END CAPS



Height-of-Cover Table

Nominal Inside Diameter	Minimum Cover CL-6251 or HS-252	Minimum Cover E-803	Maximum Cover 320 kPa Pipe Stiffness4	Maximum Cover 210 kPa Pipe Stiffness4
(mm)	(m)	(m)	(m)	(m)
100	0.3	0.6	16.5	16.5
150	0.3	0.6	15.5	15.5
200	0.3	0.6	15.5	15.5
250	0.3	0.6	15.8	13.7
300	0.3	0.6	10.7	9.1
375	0.3	0.6	11.6	10.4
450	0.3	0.6	10.4	8.5
525	0.3	0.6	11.0	9.4
600	0.3	0.6	9.1	7.6
750	0.3	0.6	10.1	8.2
900	0.3	0.6	8.8	7.6

NOTES:
1. CSA S6 CL-625 TRUCK LOADING
2. AASHTO HS-25 TRUCK LOADING
3. COOPER E-80 RAILWAY LOADING
4. BASED ON DESIGN METHOD SPECIFIED IN "AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SEVENTH EDITION, 2014, SECTION 12.12 - THERMOPLASTIC PIPES"

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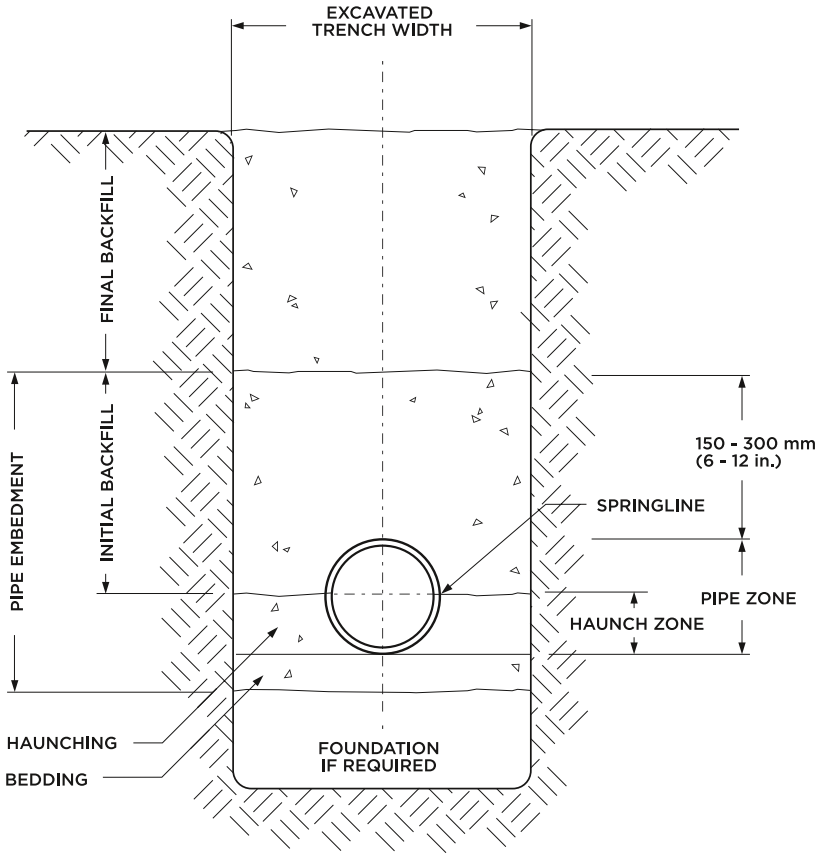
Installation Guidelines

As with any sewer pipe material the key to a successful installation of HDPE Culvert is the achievement of stable and permanent support through the selection and compaction of proper embedment materials.

Complete guidelines and procedures can be found in CSA standard B182.11 “Recommended Practice for Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings” or BNQ 1809-300.



1. FOUNDATION PREPARATION

The pipe must rest on a smooth, stable foundation, free of rocks and clumps.

2. BEDDING

Bedding should consist of compacted well-graded granular material, levelled to the proper grade.

3. HAUNCHING

Haunching should be the same material as bedding, placed and compacted in successive lifts of 150mm, up to the springline of the pipe and compacted to 95% Standard Proctor Density.

4. INITIAL BACKFILL

Backfill should be the same material as for haunching, extending from the springline to 300mm above the pipe crown. For pipe diameters less than 300mm, this dimension may be reduced to one pipe diameter, but not less than 150mm. Compaction should be to 95% Standard Proctor Density.

5. FINAL BACKFILL

Select native materials may be used for final backfill, depending on the application. Large rocks or clumps should not be placed within 600mm of the pipe.

BACKFILLING

PREPARING THE SOIL FOR HDPE PIPE INSTALLATION

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