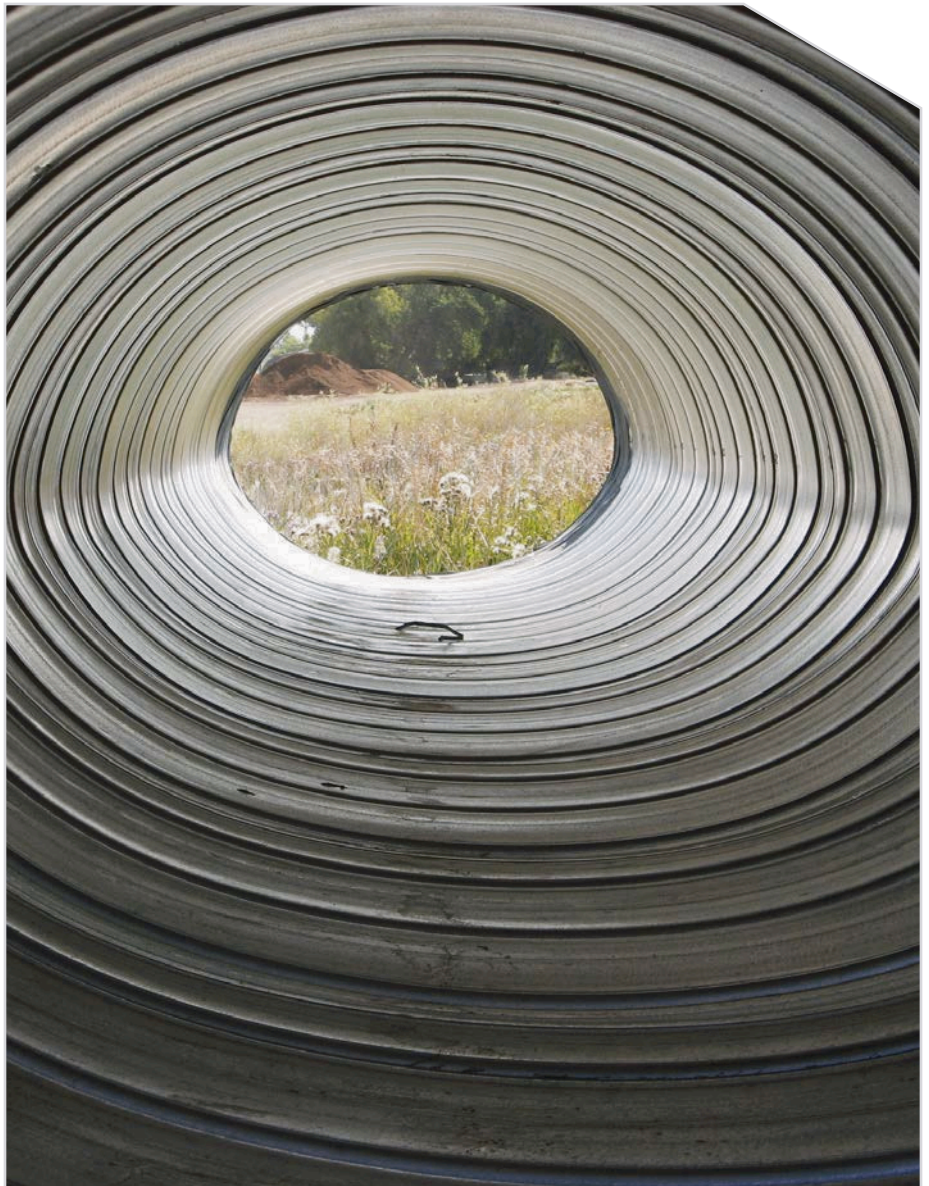


DRAINAGE SOLUTIONS AND WATER TREATMENT / ULTRA FLO STEEL PIPE

ULTRA FLO STEEL PIPE TECHNICAL GUIDE

LARGE-DIAMETER STORM
SEWER PIPE DELIVERS
SUPERIOR HYDRAULIC
PERFORMANCE

Fast Installation
Durable
Nestable Pieces
Value
Efficient Hydraulics



Ultra Flo spiral rib pipe is a flexible metal pipe which has been proven to be a reliable product in thousands of installations. Ultra Flo pipe is manufactured from factory-coated steel coils, utilizing a spiral forming process with interlocking seams. Stiffness is provided by external box-shaped ribs, 19mm x 19mm, at 190mm centres with the rib being a continuous spiral. This configuration produces a hydraulically smooth inside wall, with a Mannings "n" of about 0.013, comparable to concrete pipe. Ultra Flo pipe is available in diameters from 450mm to 2600mm and in steel thickness 1.6mm to 2.8mm.

Proven Strength

Armtec Ultra Flo spiral rib pipe has the same strength advantages as corrugated metal pipe, a product that has been trusted for over one hundred years. Ultra Flo performs as a flexible compression ring under load, redistributing pressure radially into the surrounding high density soil. The unit pressure at the pipe invert can be as little as one third of the unit pressure under a rigid pipe experiencing identical loading conditions. This feature results in savings for the extensive base improvement that is generally required for rigid types of pipe.

Durability

Ultra Flo pipe is available in three factory applied coatings:

- Galvanized Z610 for non-aggressive environments (the majority of installations)
- Aluminized Type 2 for more aggressive environments or where height abrasion loads are expected.
- Polymer-Laminated (on a Z610 galvanized base coat) recommended for the most aggressive environments



ALUMINIZED STEEL (GREY PAINTED ENDS)

TYPICAL APPLICATIONS

- Municipal storm sewers, especially in large diameter in long runs
- Highway median drainage
- Industrial storm sewers
- Storm water detention structures
- Large diameter culvert
- Slip-lines
- Stormwater
- Detention tanks



ULTRA FLO STEEL PIPE

STORM SEWER DESIGN AND ACCESSORIES

Economical Storm Sewer Designs

Armtec Ultra Flo is competitive with other types of storm sewer pipe. The total cost savings are significant when consideration is given to the installation advantages offered by Ultra Flo.

Due to its light unit weight and longer lengths, Ultra Flo pipe can be installed with lower handling and laying costs than concrete pipe. The equipment used for trenching can also be used for lifting and placing pipe lengths. With fewer pipe joints installation can proceed quickly.

Ultra Flo is manufactured in lengths up to 12m and couplers are easy to install. Mechanical couplers are installed quickly and without specialized equipment.

For equal inside diameters Ultra Flo has an external pipe diameter smaller than that of concrete pipe, thus allowing for a reduction in trench width and depth, leading to reduced excavation and backfill quantities. These important cost saving advantages in installation should be considered by the owner or designer when comparing Ultra Flo with other types of pipe.

NOTE

* For the handling weight for aluminized steel type 2 or galvanized steel ultra flo, see the chart at the top of the next page.



A HUGGER BAND COUPLER IS TIGHTENED AROUND PIPE ENDS TO PRODUCE A VERY STRONG JOINT



ULTRA FLO FITTINGS

Couplers

Ultra Flo pipe is manufactured with reformed corrugated ends designed to accommodate both corrugated couplers and Armtec's Hugger band coupler with O ring gasket. Various types of couplers are available. Band type couplers are used to connect pipes. Gaskets, if specified, are supplied with these couplers to meet most infiltration and exfiltration requirements for storm sewers.

Fittings

Armtec manufactures a complete line of fittings for storm sewers:

- Manholes c/w ladders and safety grates
- Elbows
- Catch basins
- Tins
- Y's
- Stubs
- Tapered Sections

NOTE:

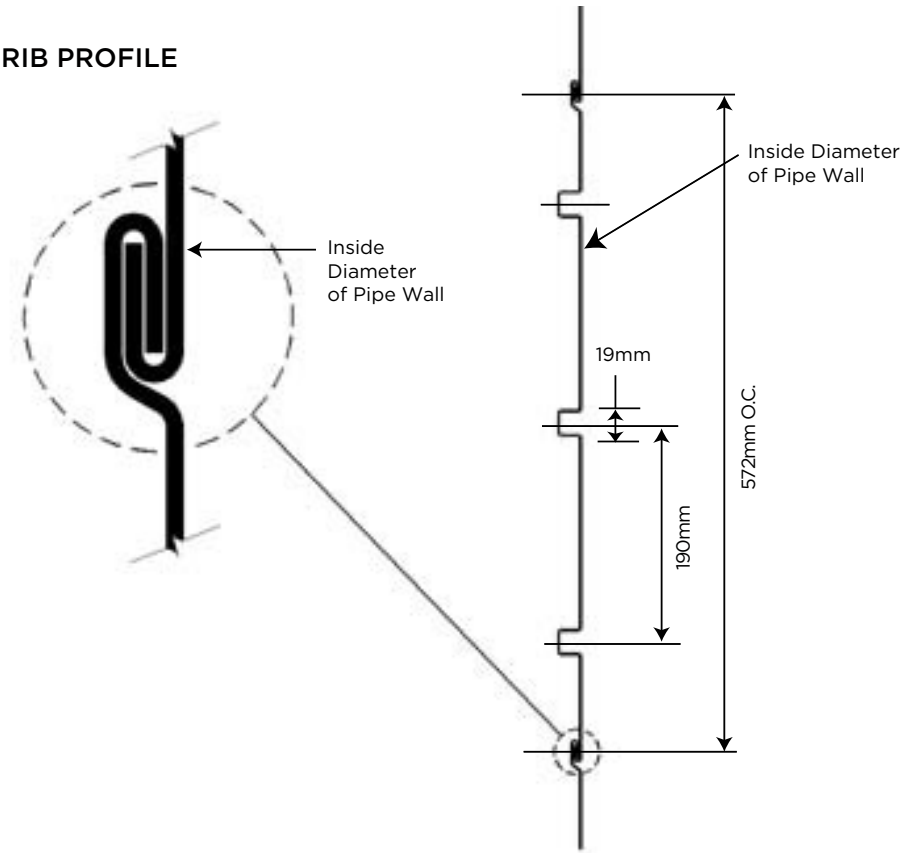
- Our fittings are relatively low cost and economical to install because of their lighter weight compared to other competitive pipe fittings.

Handling Weight for Aluminized Steel Type 2
or Galvanized Steel Ultra Flo

Ultra Flo has been thoroughly tested and analyzed structurally to confirm the sectional properties. The height of cover table for the selection of a wall thickness for a particular diameter is shown in the following table.

Diameter	Mass (Kg/m) Thickness (mm)		
	1.6	2.0	2.8
Kg/mm			
450	21.9	26.8	-
525	25.6	31.3	42.6
600	29.2	35.8	48.6
750	36.5	44.7	60.8
900	43.8	53.6	72.9
1050	51.1	62.6	85.1
1200	58.4	71.5	97.3
1350	-	80.5	109.4
1500	-	89.4	121.6
1650	-	98.3	133.7
1800	-	107.3	145.9
2100	-	125.2	170.2
2400	-	-	194.5
2600	-	-	210.7

RIB PROFILE



INSTALLATION GUIDELINES

1. Bedding

Bedding preparation is critical to both pipe performance and service life. A good bedding will help to maintain the proper pipe elevation, eliminate undesirable stresses in the pipe, and ensure good hydraulic performance. The bedding should be free of rock formations, protruding stones, frozen lumps, roots, or other foreign matter that may cause unequal settlement.

It is recommended that the bedding be stable, well-graded granular material. Placing the pipe on the bedding surface is generally accomplished by two methods to ensure satisfactory compaction beneath the haunches. One method is shaping the bedding surface to conform to the lower section of the pipe. The other method is to carefully tamp a granular or select material beneath the haunches to achieve a well-compacted condition.

A qualified civil engineer should be engaged to design a proper foundation, adequate bedding and backfill.

2. Backfill

Satisfactory backfill material, proper placement and compaction are key factors in obtaining maximum strength and stability. Typical Ultra Flo installation requirements are the same as for any other corrugated steel pipe installed in a trench. Bedding and backfill materials follow the requirements of the CSP installation specification outlined in ASTM A798; and must be free from stones, frozen lumps and other debris. When installations are for size and gauge combinations noted with an asterisk (*) in the Height of Cover tables, use clean, easily compacted granular backfill materials in accordance with ASTM A796, paragraph 17.2.3.

NOTE:

* Backfilling is an important ingredient in the structural design. Material placement and compaction must be done in accordance with the guidelines.

* Ultra Flo is a superior CSP storm sewer product that is normally installed in a trench condition. In those unusual circumstances where installation in an embankment is required, pipe sizes and gauges may be restricted. Your Armtec Sales Engineer can provide you with further guidance.



AN ULTRA FLO TEE-TYPE MANHOLE RISER COMBINED WITH A SERVICE TEE IS SHOWN COMBINING A STANDARD HEL-COR STUB WITH AN ULTRA FLO STORM SEWER PIPE



LONG LENGTHS AND POSITIVE JOINTS ASSURE GOOD ALIGNMENT AND LEAK RESISTANT PERFORMANCE

INSTALLATION GUIDELINES CONTINUED

Multiple runs of large-diameter Ultra Flo

Ample spacing should be used between runs to allow proper sidefill placement and compaction. Pipe spacing will change depending upon pipe diameter, backfill material and compaction methods. General guidelines for spacing between runs of pipe are:

Diameters:

- Up to 600mm – 300mm
- 600mm to 1,800mm - 1/2 pipe diameter
- 1,800mm and over – 900mm

Relining

Restoration of failed or deteriorating rigid pipe can be accomplished by relining with Ultra Flo. Ultra Flo's profile allows the end area of the reline to be maximized. The hydraulic capacity may be improved over the existing deteriorated storm sewer.

Ultra Flo's light weight makes the lining process easier. Ultra Flo can be provided in various lengths to meet individual site conditions.

For additional information, contact your nearest Armtec sales office.

Simple shape monitoring

Measuring the rise and span at several points in the run is recommended in all types of installation. It provides a check on proper backfill placement and compaction materials. Use soil placement and compaction methods which will ensure that the vertical pipe dimension (rise) does not increase in excess of 5% of the nominal diameter.

Use methods which will ensure that the horizontal pipe dimension (span) does not increase in excess of 3% of the nominal diameter. These guidelines will help ensure that the final deflections are within normal limits.



PIPE-ARCH SHAPES CAN BE SUPPLIED WHERE THERE IS LOW HEADROOM



ULTRA FLO PIPE CAN BE INSTALLED IN TIGHT CONSTRUCTION ZONES

HEIGHT OF COVER TABLE - ULTRA FLO ROUND PIPE

Diameter	Area	Minimum Height of Fill	Metal Thickness (mm) Maximum Height of Fill (m)		
			1.6	2.0	2.8
mm	m ²	mm			
450	0.16	300	22.7	22.7	
525	0.22	300	19.4	28.8	50.6
600	0.28	300	17.0	25.2	44.3
750	0.44	300	13.6	20.2	35.4
900	0.64	300	11.3	16.8	29.5
1050	0.87	300	9.7	14.4	25.3
1200	1.13	300	8.5*	12.6	22.1
1350	1.43	340	7.5*	11.2	19.7
1500	1.77	380	6.8*	10.1*	17.7
1650	2.14	410		9.1*	16.1
1800	2.54	450		8.4*	14.7
2100	3.46	530			12.6*
2400	4.52	600			11.0*
2600	5.31	650			9.0*

HEIGHT OF COVER TABLE - ULTRA FLO PIPE ARCHES

Span	Rise	Equivalent Diameter	Area	Minimum Height of Fill	Maximum Height of Fill (m) to Limit Corner Bearing Pressure to a Maximum of 200 kPa Metal Thickness (mm)		
					1.6	2.0	2.8
mm	mm	mm	m ²	mm			
500	410	450	0.15	300	4.0	4.0	
580	490	525	0.21	300	5.2	5.2	5.2
680	540	600	0.27	300	5.2	5.2	5.2
830	660	750	0.43	300	5.2	5.2	5.2
1010	790	900	0.62	300	4.4	4.4	4.4
1160	920	1050	0.85	300	5.1	5.1	5.1
1340	1050	1200	1.12	300		4.4	4.4
1520	1200	1350	1.44	340		5.3*	5.3
1670	1300	1500	1.79	380		5.1*	5.1
1850	1400	1650	2.15	410		4.7*	4.7

NOTES:

1. Allowable minimum cover is measured from the top of pipe to the bottom of a flexible pavement or top of a rigid pavement. Minimum cover in unpaved areas must be maintained. Backfill is assumed to be compacted to a minimum of 95% Standard Proctor Dry Density
2. All heights of cover are based on installation in a trench. If embankment conditions exist, there may be restrictions on gauges for large diameters. Your Armtec Sales Engineer can provide you with further guidance.
3. Tables are for CL-625 loading only. For heavy construction loads, higher minimum covers may be required. Your Armtec Sales Engineer can provide you with further guidance.

* These sizes and gauges are installed in accordance with ASTM A796, paragraph 17.2.3 and ASTM A798.

Drawings and product details are for information and/or illustrative purposes only and may vary. Please contact your Armtec representative for the most current product information.



Armtec is a leading Canadian infrastructure and construction materials company combining creative engineered solutions, relevant advice, dedicated people, proven products and a national presence with a local focus on exceptional customer service.

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