



To: SUPERSEDED ^{BY} <i>EB 99-066</i> <i>EFFECTIVE 11/4/99</i>		New York State Department of Transportation ENGINEERING INSTRUCTION	EI 98-038
Title: STANDARD SPECIFICATION REVISION FOR 603 CULVERT AND STORM DRAIN AND 707-02 CORRUGATED STEEL PIPE			
Distribution: <input checked="" type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Main Office (30) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Contractors (39) <input checked="" type="checkbox"/> Regions/Agencies (32) <input type="checkbox"/> _____ ()	Approved:  P. J. Mack, Deputy Chief Engineer, Technical Services Division <div style="text-align: right;"><i>10/22/98</i> Date</div>		

This Engineering Instruction supersedes **EI 93-033 and 96-004**. In addition, this EI partially supersedes **EI 95-051 and EI 96-16** as follows:

1. EI 95-51. Under transmitted specifications, items 2, 3, and 5 are superseded.
2. EI 96-16. Pages 24 through 27 are superseded.

EFFECTIVE DATE:

The effective date for the specifications, disapproved pay items, and approved pay items will be the letting July 22, 1999.

PURPOSE: This instruction transmits shelf notes to revise §603 and §707-02 of the 1995 Standard Specifications.

BACKGROUND:

1. **Add:** Aluminum Coated Type 2 (AASHTO M 274M) to the Standard Specification §707-02 and §603.

The current specification gives the contractor three options for a metallic coating: zinc(galvanizing), aluminum or aluminum-zinc alloy. The revised §707-02 Specification eliminates aluminum-zinc alloy as an allowable metallic coating due to poor performance as a corrosion inhibitor and because manufactures no longer use this coating. The current Specification makes no distinction as to whether the aluminum coating is Type 1 or Type 2. Type 2 has been proven to be effective as a corrosion inhibitor for pipe. Therefore the revised §707-02 Specification clearly designates Type 2 as the only aluminum coating allowed. Zinc (galvanized) coating continues to be allowed with no revisions.

2. **Delete:** §603-2.02, Thickness Reduction for Aluminum Coated Pipe.

Section §603-2.02, Thickness Reduction for Aluminum Coated Pipe, is deleted from the Standard Specification. Aluminum coated pipe did not have its own pay item, rather the Contractor was given a one standard gauge reduction for selecting an aluminum coating. This is no longer allowed. A pay item has been created for Aluminum-Coated (Type 2). For design, the anticipated service life for Aluminum Coated (Type 2) pipe should be considered to be the same as corrugated steel pipe with a paved invert. For example, use Table 8-8 (the column titled "Galvanized w/Paved Invert or Fully Paved §707-02") of

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Chapter 8 of the Highway Design Manual to determine what gauge corrugated steel pipe aluminum coated (Type 2) to specify. Aluminum-Coated is no longer a Contractor option.

3. **Delete:** Standard Specification § 602, Polymer Coated Steel Pipe, and incorporate Polymer Coated Steel Pipe into the §603 Specification.

Polymer Coated Pipe was previously found under its own section, §602, in the Standard Specification. It has been moved to the Culvert and Storm Drain section, §603, with the other culvert materials for consistency.

4. **Add:** Polyethylene Pipe to the Standard Specification.

Polyethylene Pipe will be added to the next printing of the Standard Specification book. Until that time it will be available as a shelf note. Special Specification 18603.9801 will be used until the effective date of the shelf note. The Materials Bureau Approved List will continue to be used to list all acceptable manufacturers.

5. **Delete:** Vitrified Clay Pipe - Storm Drains, §706-08 and Vitrified Clay Pipe Underdrain, §706-09, from the Standard Specification due to lack of use. Remove reference to Vitrified Clay from §603-3.06D. (Vitrified Clay and Cast Iron Pipes). Remove the pay Item 603.04xx. In §605 - Underdrains remove all reference to Vitrified Clay Pipe Underdrain and the pay Item No. 605.01 M

Vitrified Clay Pipe is no longer specified by the AASHTO. It was dropped from the 1997 AASHTO specifications because of lack of use. There has been minimal use of this product in NYS therefore it is being deleted. Alternative materials are readily available.

EFFECTED PAY ITEMS:

Disapproved Pay Items

Polymer Coated Corrugated Steel Pipe - The Standard Contract Metric Pay Items assigned to Polymer Coated Corrugated Steel Pipe on pages 24 through 27 of EI 96-16 are disapproved. The disapproved pay items are identified in Tables 1 through 8.

Smooth Interior Corrugated Polyethylene Culvert and Storm Drains - The item numbers identified in Table 23 are disapproved.

Vitrified Clay Pipe Storm Drains - The item numbers identified in Table 25 are disapproved.

Vitrified Clay Pipe Underdrain - The item numbers identified in Table 26 are disapproved.

Approved Pay Items

Polymer Coated Corrugated Steel Pipe - Tables 9 through 16 identify the approved pay items for Polymer Coated Corrugated Steel Pipe.

Corrugated Steel Pipe Aluminum Coated (Type 2) - Tables 17 through 22 identify the approved pay items for Corrugated Steel Pipe Aluminum Coated (Type 2).

Smooth Interior Corrugated Polyethylene Culvert and Storm Drain Pipe - Table 24 identifies the approved pay items for Smooth Interior Corrugated Polyethylene Culvert and Storm Drain Pipe.

COST IMPACTS: These changes will be cost neutral.

The revisions to the Standard Specifications book dated January 2, 1995 will be incorporated into the next addenda and/or the next update to the Standard Specifications.

ACTIONS BY MAIN OFFICE DESIGN QUALITY ASSURANCE BUREAU:

The next update of the Standard Specifications will incorporate the attached shelf notes. Until that time and beginning with the effective date of this instruction, the Design Quality Assurance Bureau will insert these specifications to contract proposals with specification section 603 pay items.

CONTACT PERSON: Direct any questions regarding this Engineering Instruction to Guy Hildreth of the Materials Bureau, Field Engineering I Section at (518) 457-5956.

Table 24 - Smooth Interior Corrugated Polyethylene Culvert and Storm Drain Pipe

Pay Item	Unit	Quantity	Rate	Total
603.10	LF	1000	1.00	1000.00
603.11	LF	1000	1.00	1000.00
603.12	LF	1000	1.00	1000.00
603.13	LF	1000	1.00	1000.00
603.14	LF	1000	1.00	1000.00
603.15	LF	1000	1.00	1000.00
603.16	LF	1000	1.00	1000.00
603.17	LF	1000	1.00	1000.00
603.18	LF	1000	1.00	1000.00
603.19	LF	1000	1.00	1000.00
603.20	LF	1000	1.00	1000.00
603.21	LF	1000	1.00	1000.00
603.22	LF	1000	1.00	1000.00
603.23	LF	1000	1.00	1000.00
603.24	LF	1000	1.00	1000.00
603.25	LF	1000	1.00	1000.00
603.26	LF	1000	1.00	1000.00
603.27	LF	1000	1.00	1000.00
603.28	LF	1000	1.00	1000.00
603.29	LF	1000	1.00	1000.00
603.30	LF	1000	1.00	1000.00

Table 1 Disapproved 602.05xx M pay items.

Item No. 602.05xx M Corrugated Steel Pipe-Polymer Coated (68 x 13)			
Diameter (mm)	Gauge		
	16	14	12
300	.051016	.051014	
375	.051116	.051114	
450	.051216	.051214	.051212
525	.051316	.051314	.051312
600	.051416	.051414	.051412
750	.051616	.051614	.051612
900	.051816	.051814	.051812
1 050	.051916	.051914	.051912
1 200	.052016	.052014	.052012
1 350		.052114	.052112
1 500			.052212

Table 2 Disapproved 602.06xx M pay items.

Item No. 602.06xx M Corrugated Steel Pipe-Polymer Coated Paved Invert (68x13)				
Diameter (mm)	Gauge			
	18	16	14	12
300	.061018	.061016	.061014	
375	.061118	.061116	.061114	
450	.061218	.061216	.061214	.061212
525	.061318	.061316	.061314	.061312
600	.061416	.061416	.061414	.061412
750		.061616	.061614	.061612
900		.061816	.061814	.061812
1 050		.061916	.061914	.061912
1 200		.062016	.062014	.062012
1 350			.062114	.062112
1 500				.062212

Table 3 Disapproved 602.08xx M pay items.

Item No. 602.08xx M Corrugated Steel Pipe-Arch, Polymer Coated (68x13)				
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge		
		16	14	12
375	430 X 330	.081116	.081114	
450	530 X 380	.081216	.081214	
525	610 X 460	.081316	.081314	.081312
600	710 X 510	.081416	.081414	.081412
750	885 X 610	.081616	.081614	.081612
900	1 060 X 740	.081816	.081814	.081812
1 050	1 240 X 840		.081914	.081912
1 200	1 440 X 970			.082012
1 350	1 620 X 1 100			.082112

Table 4 Disapproved 602.09xx M pay items.

Item No. 602.09xx M Corrugated Steel Pipe-Arch, Polymer Coated Paved Invert (68x13)				
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge		
		16	14	12
375	430 X 330	.091116	.091114	
450	530 X 380	.091216	.091214	
525	610 X 460	.091316	.091314	.091312
600	710 X 510	.091416	.091414	.091412
750	885 X 610	.091616	.091614	.091612
900	1 060 X 740	.091816	.091814	.091812
1 050	1 240 X 840		.091914	.091912
1 200	1 440 X 970			.092012
1 350	1 620 X 1 100			.092112

Table 5 Disapproved 602.11xx M pay items.

Item No. 602.11xx M Corrugated Steel Pipe-Polymer Coated (75x25) or (125x25)			
Diameter (mm)	Gauge		
	16	14	12
1 350	.112116	.112114	.112112
1 500	.112216	.112214	.112212
1 650	.112316	.112314	.112312
1 800	.112416	.112414	.112412
1 950	.112516	.112514	.112512
2 100	.112616	.112614	.112612
2 250	.112716	.112714	.112712
2 400		.112814	.112812
2 550		.112914	.112912
2 700			.113012
2 850			.113112
3 000			.113212

Table 6 Disapproved 602.12xx M pay items.

Item No. 602.12xx M Corrugated Steel Pipe-Polymer Coated Paved Invert (75x25) or (125x25)			
Diameter (mm)	Gauge		
	16	14	12
1 350	.122116	.122114	.122112
1 500	.122216	.122214	.122212
1 650	.122316	.122314	.122312
1 800	.122416	.122414	.122412
1 950	.122516	.122514	.122512
2 100	.122616	.122614	.122612
2 250	.122716	.122714	.122712
2 400		.122814	.122812
2 550		.122914	.122912
2 700			.123012
2 850			.123112
3 000			.123212

Table 7 Disapproved 602.14xx M pay items.

Item No. 602.14xx M Corrugated Steel Pipe-Arch, Polymer Coated (75x25) or (125x25)		
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge
		12
1 350	1 520 X 1 170	.142112
1 500	1 670 X 1 300	.142212
1 650	1 850 X 1 400	.142312
1 800	2 050 X 1 500	.142412
1 950	2 200 X 1 620	.142512
2 100	2 400 X 1 720	.142612
2 250	2 600 X 1 820	.142712
2 400	2 840 X 1 920	.142812
2 550	2 970 X 2 020	.142912

Table 8 Disapproved 602.15xx M pay items.

Item No. 602.15xx M Corrugated Steel Pipe-Arch, Polymer Coated Paved Invert (75x25) or (125x25)		
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge
		12
1 350	1 520 X 1 170	.152112
1 500	1 670 X 1 300	.152212
1 650	1 850 X 1 400	.152312
1 800	2 050 X 1 500	.152412
1 950	2 200 X 1 620	.152512
2 100	2 400 X 1 720	.152612
2 250	2 600 X 1 820	.152712
2 400	2 840 X 1 920	.152812
2 550	2 970 X 2 020	.152912

Table 9 Approved 603.80xx M pay items.

Item No. 603.80xx M Corrugated Steel Pipe-Polymer Coated (68 x 13)			
Diameter (mm)	Gauge		
	16	14	12
300	.801016	.801014	
375	.801116	.801114	
450	.801216	.801214	.801212
525	.801316	.801314	.801312
600	.801416	.801414	.801412
750	.801616	.801614	.801612
900	.801816	.801814	.801812
1 050	.801916	.801914	.801912
1 200	.802016	.802014	.802012
1 350		.802114	.802112
1 500			.802212

Table 10 Approved 603.81xx M pay items.

Item No. 603.81xx M Corrugated Steel Pipe-Polymer Coated Paved Invert (68x13)				
Diameter (mm)	Gauge			
	18	16	14	12
300	.811018	.811016	.811014	
375	.811118	.811116	.811114	
450	.811218	.811216	.811214	.811212
525	.811318	.811316	.811314	.811312
600	.811418	.811416	.811414	.811412
750		.811616	.811614	.811612
900		.811816	.811814	.811812
1 050		.811916	.811914	.811912
1 200		.812016	.812014	.812012
1 350			.812114	.812112
1 500				.812212

Table 11 Approved 603.82xx M pay items.

Item No. 603.82xx M Corrugated Steel Pipe-Arch, Polymer Coated (68x13)				
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge		
		16	14	12
375	430 X 330	.821116	.821114	
450	530 X 380	.821216	.821214	
525	610 X 460	.821316	.821314	.821312
600	710 X 510	.821416	.821414	.821412
750	885 X 610	.821616	.821614	.821612
900	1 060 X 740	.821816	.821814	.821812
1 050	1 240 X 840		.821914	.821912
1 200	1 440 X 970			.822012
1 350	1 620 X 1 100			.822112

Table 12 Approved 603.83xx M pay items.

Item No. 603.83xx M Corrugated Steel Pipe-Arch, Polymer Coated Paved Invert (68x13)				
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge		
		16	14	12
375	430 X 330	.831116	.831114	
450	530 X 380	.831216	.831214	
525	610 X 460	.831316	.831314	.831312
600	710 X 510	.831416	.831414	.831412
750	885 X 610	.831616	.831614	.831612
900	1 060 X 740	.831816	.831814	.831812
1 050	1 240 X 840		.831914	.831912
1 200	1 440 X 970			.832012
1 350	1 620 X 1 100			.832112

Table 13 Approved 603.84xx M pay items.

Item No. 603.84xx M Corrugated Steel Pipe-Polymer Coated (75x25) or (125x25)			
Diameter (mm)	Gauge		
	16	14	12
1 350	.842116	.842114	.842112
1 500	.842216	.842214	.842212
1 650	.842316	.842314	.842312
1 800	.842416	.842414	.842412
1 950	.842516	.842514	.842512
2 100	.842616	.842614	.842612
2 250	.842716	.842714	.842712
2 400		.842814	.842812
2 550		.842914	.842912
2 700			.843012
2 850			.843112
3 000			.843212

Table 14 Approved 603.85xx M pay items.

Item No. 603.85xx M Corrugated Steel Pipe-Polymer Coated Paved Invert (75x25) or (125x25)			
Diameter (mm)	Gauge		
	16	14	12
1 350	.852116	.852114	.852112
1 500	.852216	.852214	.852212
1 650	.852316	.852314	.852312
1 800	.852416	.852414	.852412
1 950	.852516	.852514	.852512
2 100	.852616	.852614	.852612
2 250	.852716	.852714	.852712
2 400		.852814	.852812
2 550		.852914	.852912
2 700			.853012
2 850			.853112
3 000			.853212

Table 15 Approved 603.86xx M pay items.

Item No. 603.86xx M Corrugated Steel Pipe-Arch, Polymer Coated (75x25) or (125x25)		
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge
		12
1 350	1 520 X 1 170	.862112
1 500	1 670 X 1 300	.862212
1 650	1 850 X 1 400	.862312
1 800	2 050 X 1 500	.862412
1 950	2 200 X 1 620	.862512
2 100	2 400 X 1 720	.862612
2 250	2 600 X 1 820	.862712
2 400	2 840 X 1 920	.862812
2 550	2 970 X 2 020	.862912

Table 16 Approved 603.87xx M pay items.

Item No. 603.87xx M Corrugated Steel Pipe-Arch, Polymer Coated Paved Invert (75x25) or (125x25)		
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge
		12
1 350	1 520 X 1 170	.872112
1 500	1 670 X 1 300	.872212
1 650	1 850 X 1 400	.872312
1 800	2 050 X 1 500	.872412
1 950	2 200 X 1 620	.872512
2 100	2 400 X 1 720	.872612
2 250	2 600 X 1 820	.872712
2 400	2 840 X 1 920	.872812
2 550	2 970 X 2 020	.872912

Table 17 Approved 603.88xx M pay items.

Item No. 603.88xx M Corrugated Steel Pipe Aluminum Coated (Type 2) (68x13)					
Diameter (mm)	Gauge				
	18	16	14	12	10
300	.881018	.881016	.881014		
375	.881118	.881116	.881114		
450	.881218	.881216	.881214	.881212	
525	.881318	.881316	.881314	.881312	
600	.881418	.881416	.881414	.881412	.881410
750		.881616	.881614	.881612	.881610
900		.881816	.881814	.881812	.881810
1 050		.881916	.881914	.881912	.881910
1 200		.882016	.882014	.882012	.882010
1 350			.882114	.882112	.882110
1 500				.882212	.882210
1 650					.882310
1 800					.882410

Table 18 Approved 603.89xx M pay items.

Item No. 603.89xx M Corrugated Steel Pipe Arch Aluminum Coated (Type 2) (68 x 13)					
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge			
		16	14	12	10
375	430 X 330	.891116	.891114		
450	530 X 380	.891216	.891214	.891212	
525	610 X 460	.891316	.891314	.891312	
600	710 X 510	.891416	.891414	.891412	.891410
750	885 X 610	.891616	.891614	.891612	.891610
900	1 060 X 740	.891816	.891814	.891812	.891810
1 050	1 240 X 840		.891914	.891912	.891910
1 200	1 440 X 970			.892012	.892010
1 350	1 620 X 1 100			.892112	.892110
1 500	1 800 X 1 200				.892210
1 650	1 950 X 1 320				
1 800	2 100 X 1 450				

Table 19 Approved 603.90xx M pay items.

Item No. 603.90xx M Corrugated Steel Pipe Aluminum Coated (Type 2) (75 x 25) or (125 x 25)				
Diameter (mm)	Gauge			
	16	14	12	10
1 350	.902116	.902114	.902112	.902110
1 500	.902216	.902214	.902212	.902210
1 650	.902316	.902314	.902312	.902310
1 800	.902416	.902414	.902412	.902410
1 950	.902516	.902514	.902512	.902510
2 100	.902616	.902614	.902612	.902610
2 250	.902716	.902714	.902712	.902710
2 400		.902814	.902812	.902810
2 550		.902914	.902912	.902910
2 700			.903012	.903010
2 850			.903112	.903110
3 000			.903212	.903210

Table 20 Approved 603.91xx M pay items.

Item No. 603.91xx M Corrugated Steel Pipe Arch Aluminum Coated (Type 2) (75 x 25) or (125 x 25)			
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge	
		12	10
1 350	1 520 X 1 170	.912112	.912110
1 500	1 670 X 1 300	.912212	.912210
1 650	1 850 X 1 400	.912312	.912310
1 800	2 050 X 1 500	.912412	.912410
1 950	2 200 X 1 620	.912512	.912510
2 100	2 400 X 1 720	.912612	.912610
2 250	2 600 X 1 820	.912712	.912710
2 400	2 840 X 1 920	.912812	.912810
2 550	2 970 X 2 020	.912912	.912910
2 700	3 240 X 2 120		.913010
2 850	3 470 X 2 220		.913110
3 000	3 600 X 2 320		.913210

Table 21 Approved 603.92xx M pay items.

Item No. 603.92xx M Corrugated Steel Pipe Aluminum Coated (Type 2) Type IR		
Diameter (mm)	Gauge	
	14	12
525	.921314	.921312
600	.921414	.921412
750	.921614	.921612
900	.921814	.921812
1 050	.921914	.921912
1 200	.922014	.922012
1 350	.922114	.922112
1 500	.922214	.922212
1 650	.922314	.922312
1 800	.922414	.922412
1 950	.922514	.922512
2 100		.922612
2 250		.922712
2 400		.922812
2 550		.922912

Table 22 Approved 603.93xx M pay items.

Item No. 603.93xx M Corrugated Steel Pipe Aluminum Coated (Type 2) Type IIR			
Equivalent Diameter (mm)	Span X Rise (mm)	Gauge	
		14	12
525	580 X 490	.931314	.931312
600	680 X 540	.931414	.931412
750	830 X 670	.931614	.931612
900	1 010 X 790	.931814	.931812
1 050	1 160 X 920		.931912
1 200	1 340 X 1 050		.932012
1 350	1 520 X 1 170		.932112
1 500	1 670 X 1 300		.932212

Table 23 Disapproved 18603.9801xx M pay items.

Item No. 18603.9801xx M Smooth Interior Corrugated Polyethylene Culvert and Storm Drain	
Diameter (mm)	Item No.
305	.980112
380	.980115
455	.980118
610	.980124
760	.980130
915	.980136

Table 24 Approved 603.98xx M pay items.

Item No. 603.98xx M Smooth Interior Corrugated Polyethylene Culvert and Storm Drain	
Diameter (mm)	Item No.
300	.9812
375	.9815
450	.9818
600	.9824
750	.9830
900	.9836

Table 25 Disapproved 603.04xx M pay items.

Item No.603.04xx Vitrified Clay Pipe Storm Drains	
Diameter (mm)	Item No.
100	.0401
150	.0402
200	.0403
250	.0404
300	.0405
375	.0406
450	.0407
525	.0408
600	.0409
200	.0410
250	.0411

Table 26 Disapproved 605.01xx M pay items.

Item No.605.01xx Vitrified Clay Pipe Underdrain	
Diameter (mm)	Item No.
75	.0101
100	.0102
150	.0103
200	.0104
250	.0105
300	.0106
375	.0107
450	.0108
525	.0109
600	.0110
675	.0111
750	.0112
825	.0113
900	.0114
975	.0115
1050	.01126

CULVERTS AND STORM DRAINS

Make the following changes to the Standard Specifications of January 2, 1995

Delete "SECTION 601 (VACANT) thru 603" and *replace* it with the following:

Section 600

INCIDENTAL CONSTRUCTION

SECTION 601 (VACANT)

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SECTION 603 - CULVERTS AND STORM DRAINS

603-1 DESCRIPTION. This work shall consist of the construction or reconstruction of culverts and storm drains in accordance with these specifications, the contract plans, and the appropriate standard sheets.

603-2 MATERIALS

603-2.01 General. Materials requirements are specified in the following subsections:

Geotextile	207	Corrugated Structural Steel Plate for	
Portland Cement Concrete	501	Pipe, Pipe-Arches and Underpasses	707-09
Portland Cement	701-01	Galvanized Steel End Sections	707-10
Masonry Cement	701-02	Aluminum End Sections	707-11
Concrete Repair Material	701-04	Corrugated Aluminum Pipe	707-13
Mortar Sand	703-03	Corrugated Aluminum Structural	
Non-Reinforced Concrete Pipe	706-01	Plate for Pipe and Pipe-Arches	707-14
Reinforced Concrete Pipe	706-02	Anchor Bolts for Corrugated Culverts	707-20
Reinforced Concrete Elliptical Pipe	706-03	Zinc Chromate Primer	708-04
Reinforced Concrete End Sections	706-07	Wire Fabric for Concrete	
Smooth Interior Corrugated		Reinforcement	709-02
Polyethylene Pipe	706-12	Plastic Coated Fiber Blankets	
Corrugated Steel Pipe	707-02	(For Curing)	711-03
Ductile Iron Pipe (Non-Pressure)	707-03	Membrane Curing Compound	711-05
		Water	712-01

603-3 CONSTRUCTION DETAILS

603-3.01 Excavation. Apply the requirements specified in §206, Trench, Culvert and Structure Excavation, except as modified by the Contract Documents or as directed by the Engineer.

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603-3.02 Laying Pipe

A. General. Lay all pipe in close conformity to line and grade having a full, firm and even bearing at each joint and along the entire length of pipe. Lay all pipe beginning at the downstream end and progress upstream. Use the same material in each run of pipe unless otherwise directed by the Engineer.

B. Handling and Assembly of Pipe. Follow the Manufacturer's instructions or approved Materials Details except as modified on the Contract Plans or as directed by the Engineer.

C. Bell and Spigot Type Pipe. Lay all pipe with the bells upstream. Where the spigot end of an existing pipe does not fit the bell end of a new pipe, construct a concrete collar as shown on the Standard Sheets. Fill the bottom half of the space on the inside of the pipe between the existing spigot and the new bell with an approved concrete repair material (701-04). Alternate designs may be submitted to the Director, Materials Bureau, for approval.

Where the spigot end fits into the bell end and the clearance is so great as to render the elastomeric gasket or preformed sealer ineffective, join the pipe by caulking a gasket of jute or oakum into the joint space and then fill with mortar of equal parts of Portland Cement and Mortar Sand or a preformed or poured caulking compound of a type approved by the Engineer.

D. Round Corrugated Metal Pipe and Pipe-Arches. Place steel or aluminum pipe with longitudinal seams located at the sides. Place circumferential seams with laps in the downstream direction so flow of water is directed over instead of under each succeeding downstream section.

E. Corrugated Structural Plate Pipe and Pipe-Arches. Assemble the plates for corrugated steel or aluminum structural plate pipe and pipe-arches to form the circular pipe or pipe-arch cross section as defined by the pipe manufacturer.

For metal pipe arches, install the bolts nearest the visible edge of the lapped joint in the valley at the top of the corner plate of the corrugations. Cover the joint with the top of the corner plate on the outside of the structure with a geotextile conforming to Geotextile Underdrain from the Department's Materials Bureau Approved List. Extend the covering a minimum of 300 mm beyond each side of the joint for its entire length. A minimum of 300 mm is required for any longitudinal lap.

F. Polyethylene Pipe. Handle, store and assemble all pipe in accordance with the Approved Materials Details except as modified in the Contract Documents or by the Engineer. Joint misalignment resulting in offsets greater than 6 mm or joint separations greater than 13 mm between adjoining sections of pipe will not be allowed. Field cuts are permitted only at the terminal ends and with a minimum pipe length of one (1) meter.

G. Corrugated Metal End Sections. Assemble all pipe end sections in accordance with the Contract Documents or as approved by the Engineer.

H. Thickness Measuring Equipment. Prior to laying any pipe, provide the Engineer with equipment to measure gauge and steel coating thickness. Gauge shall be measured with a micrometer caliper. Measure steel coating thickness with a Type 2 Fixed Probe Magnetic Gauge meeting the requirements of Steel Structures Painting Council Specification SSPC-PA2. When the Engineer verifies the required gauge and coating thickness the pipe may be laid. Micrometer calipers and Type 2 probes shall remain the property of the Contractor.

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603-3.03 Bedding and Backfilling Pipe. Apply the standards of 203-3.15, Fill and Backfill at Structures, Culverts, Pipes, Conduits, and Direct Burial Cables and the appropriate NYSDOT Standard Sheets. Select Granular Fill used to backfill around aluminum or aluminum coated pipes will be free of portland cement unless the pipe sections are thoroughly coated with Zinc Chromate Primer, §708-04 or an equivalent alternative as approved by the Materials Bureau. 100% of the Select Granular Fill used around Type IR and IIR corrugated aluminum pipe must pass a 50 mm sieve.

603-3.04 Damaged Pipe and Repair

A. General. Repair, realign or replace pipe that is damaged or disturbed through any cause occurring prior to acceptance of the contract. Pipe which is defective from any cause, including damage caused by handling and determined by the Engineer as unrepairable, will be unacceptable for installation and shall be replaced as directed by the Engineer at no cost to the State.

B. Concrete Pipe. Repair concrete pipe in the field in accordance with the requirements set forth in 706-02, Reinforced Concrete Pipe. The repairs will be acceptable if they are sound, properly finished and cured, as determined by the Engineer, and the repaired pipe conforms to the requirements of the Contract Documents.

C. Damaged Bituminous Coating and Paving. Damage to bituminous coating may be repaired in the field by a cold asphalt repair material. The repair material must appear on the Department's Approved List. Damage to bituminous paving may be repaired by an application of the original hot material for areas 0.2 m² or less in each pipe section. Damage to bituminous paving in areas greater than 0.2 m² in a pipe section will be cause for rejection of that section.

D. Polyethylene Pipe. Polyethylene pipe with damaged ends may be incorporated into the work at terminal locations provided the damaged portion is totally removed by the field cut. Repair or replacement of pipe that is disturbed, damaged or misaligned must provide the same product as a new pipe installation, as determined by the Engineer. After backfilling operations are complete, inspect the pipe for deflection. No more than 5% deflection of the internal diameter will be allowed. If this is exceeded, the pipe will be rejected and removed at the Contractors expense.

603-3.05 Field Strutting of Corrugated and Structural Plate Pipe. Field strutting of corrugated metal pipe and structural plate pipe may be done at the Contractor's option and expense to provide added protection from construction equipment and other loads during installation, backfilling and filling above the pipe. The method and scheduling of installation and removal of strutting, must be approved by the Engineer. Field strutting shall constitute installation of structurally sound timber sills, compression caps and struts.

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603-3.06 Joints

A. Corrugated Metal Pipe. Use corrugated band field connections for corrugated metal pipe and pipe arch connections. Lap the band on equal portions of each culvert section to be connected. All connections shall be an approved type, fabricated and installed so that a secure and firm pipe connection may be readily made in the field. Thoroughly coat all aluminum or aluminum coated field connections in contact with concrete with Zinc Chromate Primer §708-04 or an equivalent alternative as approved by the Materials Bureau and permit to dry prior to concrete placement.

B. Structural Plate Pipe. Assemble plates for structural plate pipe and pipe arches with joints staggered such that not more than three (3) plates come together at any one point. Tighten all nuts for field or shop assembled plates to at least 200 but not more than 400 N·m of torque, before filling and backfilling are commenced. Supply the Engineer-in-Charge with an approved torque wrench.

C. Concrete Pipe. For round concrete pipe, use flexible water-tight elastomeric gaskets. For elliptical pipe and cattle pass use a preformed plastic sealer listed on the Department's Approved List. Install all sealants at the time the pipe is being laid to line and grade.

To detect leakage in the finished installation, internal pressure tests will be required in concrete pipe only when specified in the Contract Documents. If a leakage test is required, use an exfiltration test between consecutive manholes. Perform the test by filling the pipe with water to a height 600 mm above the top of the pipe at the upstream manhole and allowing the pipe to remain saturated for a period of 72 hours prior to checking for leakage. No more than 23 L/m of pipe diameter per meter of pipe length in a 24 hour period will be allowed.

Where a culvert or a storm drain system is open at either one or both ends, with or without end sections, use a minimum laying length of 2300 mm. Round pipe less than 600 mm in diameter, elliptical pipe, and larger diameter round pipe beginning with 1675 mm diameter where the weight of the pipe section requires a shorter length may have a minimum length of 1800 mm.

Shorter sections will be permitted where they are required to obtain an exact length of culvert. Use of one or a combination of shorter sections requires approval by the Engineer. For closed storm drain systems, drains having structures such as drop inlets on each end, the length of sections is unspecified.

Connect the first three full sections at the open end(s) of a culvert or storm drain system together to restrain movement of the sections. A full section is defined as a section with a minimum laying length of 2300 or 1800 mm as defined in the preceding paragraph. An end section is considered as the first section. If a short section is used at the end or within the first three full sections of a culvert, connect it together with the first three full sections.

Use a device at the springline on each side of the pipe to restrain the sections from movement. Use a device at least 3600 mm in length when using 2300 mm minimum length pipe sections and at least 3000 mm in length when used with 1800 mm minimum length sections. Securely anchor the devices to the pipe, with minimum slack in the device and the joints. Locate anchoring points a minimum of 450 mm from the end of the pipe sections and the flared end sections. Anchor each end of the device with a 25 mm diameter bolt with a nut and washer, or its equivalent, through the section wall. Apply ANSI B 18.2.1, ANSI B 18.2.2 and ANSI B 27.2, Grade A or B respectively for all nuts, bolts, and washers.

For all round pipe 1300 mm in diameter and smaller, and/or equivalent diameter elliptical pipe use a steel strap for the restraining device conforming to ASTM A36 with a minimum width of 57 mm,