SECTION C

BID DOCUMENTS

BIDDER'S SUBMITTAL

PROPOSAL, SPECIFICATIONS, BOND AND AFFIDAVIT FOR THE CONSTRUCTION OF MISCELLANEOUS SEWER MAIN IMPROVEMENTS AND REPAIRS, I-61/I-149
B2014-59

Company: BURTECH PIPELINE INCORPORATED

This Bid requires a Bidder to separately list its Total Bid pricing for the 2 options listed below. The Bidder must list its Total Bid price in numbers for each option. If a Bidder fails to list its Total Bid price for any one option, the Bidder would be considered non-responsive for that option only.

The City will determine the lowest responsible bidder for each of the options. For the purpose of awarding the contract, the City will select one of the options only and subsequently recommend award to the Bidder who is determined the lowest responsible bidder for the City's selected option.

In the event a Bidder does not correctly list its Total Bid pricing on this page, the City will determine the correct Total Bid pricing from the individual bid schedules included herein.

Options (list Total Bid in numbers)

1. Total Bid (Base Bid Schedule A): $ 540,486.50

2. Total Bid (Base Bid Schedule A + Additive Bid Schedule B): $ 782,545.65

BIDDER'S SUBMITTAL

PROPOSAL, SPECIFICATIONS, BOND AND AFFIDAVIT FOR THE CONSTRUCTION OF MISCELLANEOUS SEWER MAIN IMPROVEMENTS AND REPAIRS, I-61/I-149 B2014-59

Honorable Mayor and Members
of the Torrance City Council
Torrance, California

Members of the Council:

In accordance with the Notice Inviting Bids pertaining to the receiving of sealed proposals by the City Clerk of the City of Torrance for the above titled improvement, the undersigned hereby proposes to furnish all Work to be performed in accordance with the Plans, Specifications, Standard Drawings, and the Contract Documents, for the unit price or lump sum set forth in the following schedule.

MISCELLANEOUS SEWER MAIN IMPROVEMENTS AND REPAIRS, I-61/I-149

BASE BID SCHEDULE A

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
1	1	LS	MOBILIZATION	9-3.4	10,000.—	10,000.—
2	1	LS	TRAFFIC CONTROL	7-10	5,000.—	5,000.—
3	1	LS	BEST MANAGEMENT PRACTICES	7-8.6.2	2,500.—	2,500.—
4	930	LF	INSTALL LINER IN 8 INCH VCP SEWER ON PASEO DE GRANADA FROM MANHOLE 92-6-21 TO MANHOLE 101-2-01, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg#23 & 26)	30.50	28,365.—
5	26	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON PASEO DE GRANADA BETWEEN MANHOLE 92-6-21 TO MANHOLE 101-2-01	500-1.1.7(a) (Appendix V, Dwg# 23 & 26)	25.00	650.—
6	1001	LF	INSTALL LINER IN 8 INCH VCP SEWER ON CALLE MIRAMAR FROM MANHOLE 93-4-08 TO MANHOLE 92-6-08, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 50, 53 & 56)	30.50	30,530.50
7	16	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON CALLE MIRAMAR BETWEEN MANHOLE 93-4-08 TO MANHOLE 92-6-08	500-1.1.7(a) (Appendix V, Dwg# 50, 53 & 56)	25.00	400.00
8	356	LF	INSTALL LINER IN 8 INCH VCP SEWER ON VIA ALAMEDA FROM MANHOLE 101-1-13 TO MANHOLE 101-1-05, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 16)	30.50	10,858.00

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
9	9	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON VIA ALAMEDA BETWEEN MANHOLE 101-1-13 TO MANHOLE 101-1-05	500-1.1.7(a) (Appendix V, Dwg# 16)	25.00	225.00
10	3050	LF	INSTALL LINER IN 8 INCH VCP SEWER ON VIA PASQUAL FROM MANHOLE 101-3-04 TO MANHOLE 91-6-10, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 1, 4, 6, 9 & 13)	30.50	93,025.00
11	72	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON VIA PASQUAL BETWEEN MANHOLE 101-3-04 TO MANHOLE 91-6-10	500-1.1.7(a) (Appendix V, Dwg# 1, 4, 6, 9 & 13)	25.00	1,800.00
12	1792	LF	INSTALL LINER IN 8 INCH VCP SEWER ON VIA MONTE D'ORO FROM MANHOLE 92-5-31 TO MANHOLE 92-1-15, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 9, 31, 34, 38, 41 & 42)	30.50	54,656.00
13	35	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON VIA MONTE D'ORO BETWEEN MANHOLE 92-5-31 TO MANHOLE 92-1-15	500-1.1.7(a) (Appendix V, Dwg# 9, 31, 34, 38, 41 & 42)	25.00	875.00
14	1403	LF	INSTALL LINER IN 8 INCH VCP SEWER ON CALLE DE MADRID FROM MANHOLE 102-1-08 TO MANHOLE 92-6-18, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 64, 68 & 71)	30.50	42,791.50
15	45	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON CALLE DE MADRID BETWEEN MANHOLE 102-1-08 TO MANHOLE 92-6-18	500-1.1.7(a) (Appendix V, Dwg# 64, 68 & 71)	25.00	1,125.00
16	200	LF	INSTALL LINER IN 8 INCH VCP SEWER ON VIA LOS MIRADORES FROM MANHOLE 92-4-08 TO MANHOLE 91-6-11, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 48)	30.50	6,100.00
17	7	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON VIA LOS MIRADORES BETWEEN MANHOLE 92-4-08 TO MANHOLE 91-6-11	500-1.1.7(a) (Appendix V, Dwg# 48)	25.00	175.00
18	354	LF	INSTALL LINER IN 8 INCH VCP SEWER ON CALLE DE ARBOLES FROM MANHOLE 101-1-17 AND MANHOLE 101-2-11, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 19)	30.50	10,797.00
19	13	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON CALLE DE ARBOLES BETWEEN MANHOLE 101-1-17 AND MANHOLE 101-2-11	500-1.1.7(a) (Appendix V, Dwg# 19)	25.00	325.00

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
20	291	LF	INSTALL LINER IN 8 INCH VCP SEWER ON CALLE DE ANDALUCIA FROM MANHOLE 102-1-11 AND MANHOLE 101-3-07, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 29)	30.50	8,875.50
21	8	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON CALLE DE ANDALUCIA BETWEEN MANHOLE 102-1-11 AND MANHOLE 101-3-07	500-1.1.7(a) (Appendix V, Dwg# 29)	25.00	200.00
22	263	LF	INSTALL LINER IN 8 INCH VCP SEWER ON PASEO DE LAS DELICIAS FROM MANHOLE 83-2-03 TO MANHOLE 83-2-02, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 62)	30.50	8,021.50
23	5	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON PASEO DE LAS DELICIAS BETWEEN MANHOLE 83-2-03 TO MANHOLE 83-2-02	500-1.1.7(a) (Appendix V, Dwg# 62)	25.00	125.00
24	200	LF	INSTALL LINER IN 8 INCH VCP SEWER ON VISTA DEL SOL FROM MANHOLE 91-5-02 TO MANHOLE 91-5-01, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix V, Dwg# 58)	30.50	6,100.00
25	7	EA	RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD ON VISTA DEL SOL BETWEEN MANHOLE 91-5-02 AND MANHOLE 91-5-01	500-1.1.7(a) (Appendix V, Dwg# 58)	25.00	175.00
26	1	EA	POINT REPAIR ON 8" VCP SEWER ON VIA PASQUAL, APPROXIMATELY 12 FEET DEEP. REMOVE AND REPLACE 12 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 91-6-10. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 1 & 2)	7,107.00	7,107.00
27	1	LS	POINT REPAIR ON 8" VCP SEWER ON VIA PASQUAL, APPROXIMATELY 7 FEET DEEP. REMOVE AND REPLACE 8 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 92-5-30. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 9 & 10)	4,646.00	4,646.00
28	1	LS	POINT REPAIR ON 8" VCP SEWER AND DROP CONNECTION ON VIA PASQUAL, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 8 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 92-5-31. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 9 & 10)	4,646.00	4,646.00
29	1	LS	POINT REPAIR ON 8" VCP SEWER ON VIA LOS MIRADORES, APPROXIMATELY 6 FEET DEEP. REMOVE AND REPLACE 6 FEET MAXIMUM LENGTH OF PIPE. POINT	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 44 &	3,505.20	3,505.20

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
			REPAIR LOCATION IS APPROXIMATELY 38' FROM MANHOLE 92-5-06. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	45)	~~3,450.00~~	~~3,~~
30	1	LS	POINT REPAIR ON 8" VCP SEWER ON VIA LOS MIRADORES, APPROXIMATELY 7 FEET DEEP. REMOVE AND REPLACE 4 FEET MAXIMUM LENGTH OF PIPE. POINT REPAIR LOCATION IS APPROXIMATELY 72' FROM MANHOLE 92-5-06. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 44 & 45)	3,450.-	3,450.-
31	1	LS	POINT REPAIR ON 8" VCP SEWER ON VISTA DEL SOL, APPROXIMATELY 7 FEET DEEP. REMOVE AND REPLACE 8 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 91-5-01. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg# 58 & 59)	4,572.40	4,572.40
32	1	LS	POINT REPAIR ON 8" VCP SEWER 242ND ST, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 10 FEET MAXIMUM LENGTH OF PIPE. LOCATION IS APPROXIMATELY 100' FROM MANHOLE 104-1-09. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#75 & 76)	4,887.50	4,887.50
33	1	LS	POINT REPAIR ON 8" VCP SEWER ON 242ND ST, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 10 FEET MAXIMUM LENGTH OF PIPE. LOCATION IS APPROXIMATELY 228' FROM MANHOLE 104-1-09. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#75 & 76)	5,750.-	5,750.-
34	1	LS	POINT REPAIR ON 8" VCP SEWER ON 242ND ST, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 6 FEET MAXIMUM LENGTH OF PIPE. LOCATION IS APPROXIMATELY 10' FROM MANHOLE 104-1-10. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#75 & 76)	3,505.20	3,505.20
35	1	EA	12" DIAMETER TULIP TREE REMOVAL AND ROOTS	300-1.3, 300-1.4 (Appendix V, Dwg#75)	3,125.00	3,125.00
36	1	EA	PLANT 15 GAL CRAPE MYRTLE NEW TREE	308-4 (Appendix V, Dwg#75)	1,875.-	1,875.-
37	2000	SF	PROVISIONAL REMOVE AND CONSTRUCT PCC DRIVEWAY APPROACH	303-5.9, (Appendix V, Dwg#77)	15.-	30,000.-
38	1	EA	PROVISIONAL TREE REMOVAL UP TO 12" DIAMETER AND ROOTS	300-1.3, 300-1.4 (Appendix V, Dwg#77)	3,125.-	3,125.-

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
39	1	EA	PROVISIONAL PLANT 15 GAL CRAPE MYRTLE NEW TREE	308-4 (Appendix V, Dwg#77)	1,875.—	1,875.—
40	128	LF	PROVISIONAL PIPELINE REPAIR ON 8" VCP SEWER ON 242ND ST, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 128 FEET MAXIMUM LENGTH OF PIPE. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#77)	270.25	34,592.00
41	1	LS	POINT REPAIR ON 8" VCP SEWER ON OCEAN, APPROXIMATELY 8 FEET DEEP. REMOVE AND REPLACE 6 FEET MAXIMUM LENGTH OF PIPE. LOCATION IS APPROXIMATELY 8' FROM MANHOLE 104-1-10. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#75 & 76)	3,505.20	3,505.20
42	30	LF	PROVISIONAL ITEM FOR POINT REPAIR/REPLACEMENT ON 8" VCP SEWER, INCLUDING, IF NECESSARY, LATERAL SERVICE CONNECTION, APPROXIMATELY 8 FEET DEEP, INCLUDING POST-REPAIR CCTV VIDEO INSPECTION RECORDED TO EXTERNAL HARD DRIVE PRIOR TO PLACING PERMANENT RESURFACING	500-1.1.9, 500-1.2-7	345.00	10,350.00
43	30	LF	PROVISIONAL ITEM FOR ADDITIONAL LENGTH OF PIPE TO BE REPAIRED AT POINT REPAIR LOCATIONS UP TO APPROXIMATELY 8 FEET DEPTH	500-1.1.9, 500-1.2-7	345.00	10,350.00
44	10	EA	PROVISIONAL ITEM FOR ADDITIONAL MANHOLE CHANNEL/SHELF TO BE REPAIRED WITH RAPID SETTING CONCRETE	500-2.10.2 (Appendix V)	1,725.—	17,250.—
45	1	LS	POINT REPAIR ON 8" VCP SEWER ON VIA PASQUAL, APPROXIMATELY 7 FEET DEEP. REMOVE AND REPLACE WYE CONNECTION AND LATERAL APPROXIMATELY 42 FEET FROM MANHOLE 092-5-30. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#8, 9,&10)	4,025.—	4,025.—
46	1	LS	POINT REPAIR ON 8" VCP SEWER ON VIA ALAMEDA, APPROXIMATELY 6 FEET DEEP. REMOVE AND REPLACE WYE CONNECTIONS AND LATERALS APPROXIMATELY 112 FEET FROM MANHOLE 101-1-13. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix V, Dwg#15 &16)	4,025.—	4,025.—
47	45	EA	WITH RAPID-SETTING CONCRETE: FILL/REPAIR VOIDS IN UNDERLYING MANHOLE CHANNEL/SHELF, AND REPAIR CHANNEL AND SHELF	500-2.10.2(Appendix V)	600.—	27,000.—
48	2	EA	PRUNE TREE ROOTS ALONG THE SIDEWALK ONLY AT 103 AND 109 VIA ALAMEDA	300-1.3(Appendix V, Dwg#16)	1,062.50	2,125.00

Item No.	Est. Qty	Units	Bid Item Description	Spec. Section	Unit Price	Total Bid
49	400	SF	REOMVE EXISTING AND CONSTRUCT 3 1/2" PCC SIDEWALK OVER 4" CMB	303-5.13(Appendix V, Dwg#16)	28.75	11,500.00
50	10	EA	SURVEY MONUMENTS (PROVISIONAL)	2-9.1	1,000.00	10,000.00

TOTAL BASE BID SCHEDULE A PRICE $ 540,486.50
(Figures)*

TOTAL BASE BID SCHEDULE A PRICE: _____
(Words)*

Five Hundred Forty Thousand Four Hundred Eighty Six Dollars and Fifty Cents

***BID MAY BE REJECTED IF TOTAL IS NOT SHOWN IN FIGURES AND WORDS.**

Additive Bid Schedule B may be included in the contract awarded for this project. The City may choose to award the contract for Base Bid Schedule A, or from the combination of Base Bid Schedule A and Additive Bid Schedule B. If Additive Bid Schedule B is to be included in the contract, the lowest responsible bidder will be determined on the total amount shown for Base Bid Schedule "A" plus the total amount for Additive Bid Schedule "B". The City reserves the right to award the contract for only Base Bid Schedule A to the lowest responsible bidder based on the amount shown only in Base Bid Schedule A.

MISCELLANEOUS SEWER MAIN IMPROVEMENTS AND REPAIRS, I-61/I-149
ADDITIVE BID SCHEDULE B

Item #	Est. Qty	Unit	Bid Item Description	SPEC. SECTION	Unit Price	Total Bid
1	1	LS	MOBILIZATION		10,000.—	10,000.—
2	1	LS	TRAFFIC CONTROL		3,500.—	3,500.—
3	1	LS	BEST MANAGEMENT PRACTICES	7-8.6.2	2500.—	2,500.—
4	330	LF	BORDER AVE ALLEY INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 73-4-11 TO MANHOLE 73-4-03, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#1)	33.75	11,137.50
5	11	EA	BORDER AVE ALLEY RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 73-4-11 AND MANHOLE 73-4-03	500-1.1.7(a) (Appendix VI, Dwg#1)	25.00	275.—
6	255	LF	CRAVENS AVE ALLEY INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 66-1-19 TO MANHOLE 66-1-16, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#12)	33.75	8,606.25
7	12	EA	CRAVENS AVE ALLEY RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 66-1-19 AND MANHOLE 66-1-16	500-1.1.7(a) (Appendix VI, Dwg#12)	25.00	300.00
8	241	LF	ZAKON RD INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 85-1-06 TO MANHOLE 85-1-03, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#11)	33.75	8,133.75
9	6	EA	ZAKON RD RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 85-1-06 TO MANHOLE 85-1-03	500-1.1.7(a) (Appendix VI, Dwg#11)	25.00	150.00
10	296	LF	CALLE MAYOR INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 85-2-05 TO MANHOLE 76-5-25, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#3)	33.75	9,990.00

Item #	Est. Qty	Unit	Bid Item Description	SPEC. SECTION	Unit Price	Total Bid
11	11	EA	CALLE MAYOR RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 85-2-05 AND MANHOLE 76-5-25	500-1.1.7(a) (Appendix VI, Dwg#3)	25.00	275.—
12	132	LF	CALLE MAYOR INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 85-2-04 TO MANHOLE 85-2-05, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#6)	33.75	4,455.—
13	1	EA	CALLE MAYOR RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 85-2-04 AND MANHOLE 85-2-05	500-1.1.7(a) (Appendix VI, Dwg#6)	25.—	25.—
14	240	LF	CALLE MAYOR INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 85-1-08 TO MANHOLE 85-2-04, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#6)	33.75	8,100.—
15	1	EA	CALLE MAYOR RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 85-1-08 AND MANHOLE 85-2-04	500-1.1.7(a) (Appendix VI, Dwg#6)	25.—	25.—
16	322	LF	CALLE MIRAMAR INSTALL LINER IN 8 INCH VCP SEWER FROM MANHOLE 82-6-09 TO MANHOLE 82-6-05, INCLUDING POST-INSTALLATION VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.4.9 (Appendix VI, Dwg#8)	33.75	10,867.50
17	5	EA	CALLE MIRAMAR RECONNECT EXISTING SEWER SERVICE LATERAL TO LINED SEWER PIPE BY TRENCHLESS METHOD BETWEEN MANHOLE 82-6-09 AND MANHOLE 82-6-05	500-1.1.7(a) (Appendix VI, Dwg#8)	25.—	125.—
18	1	LS	GRAMERCY PL POINT REPAIR ON 8" VCP SEWER, APPROXIMATELY 25 FEET DEEP. REMOVE AND REPLACE 8 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 29-4-06. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix VI, Dwg#9 & 10)	13,500.—	13,500.—
19	1	LS	BORDER AVE ALLEY POINT REPAIR ON 8" VCP SEWER, APPROXIMATELY 5 FEET DEEP. REMOVE AND REPLACE 6 FEET MAXIMUM LENGTH OF PIPE. POINT REPAIR LOCATION APPROXIMATELY 50' FROM MANHOLE 73-4-03. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix VI, Dwg#1)	3,505.20	3,505.20
20	87	LF	CALLE MAYOR SURVEY AS NEEDED, REMOVE AND REPLACE 8" VCP SEWER,	500-1.1.9, 500-1.2-7	258.75	22,511.25

Item #	Est. Qty	Unit	Bid Item Description	SPEC. SECTION	Unit Price	Total Bid
			APPROXIMATELY 2 FEET DEEP. REMOVE AND REPLACE 87 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 85-1-09 AND 85-1-12. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	(Appendix VI, Dwg#2)		
21	1	LS	CALLE MIRAMAR ALLEY POINT REPAIR ON 8" VCP SEWER APPROXIMATELY 114' FROM MANHOLE, APPROXIMATELY 6 FEET DEEP. REMOVE AND REPLACE 6 FEET MAXIMUM LENGTH OF PIPE. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix VI, Dwg#8)	3,505.20	3,505.20
22	1	EA	VIA LE SELVA POINT REPAIR ON 8" VCP SEWER, APPROXIMATELY 7 FEET DEEP. REMOVE AND REPLACE 10 FEET MAXIMUM LENGTH OF PIPE. RECONNECT NEW PIPE TO EXISTING MANHOLE 92-1-31. POST-REPAIR CCTV VIDEO-INSPECTION RECORDED TO AN EXTERNAL HARD DRIVE	500-1.1.9, 500-1.2-7 (Appendix VI, Dwg#13)	4,887.50	4,887.50
23	5	EA	WITH RAPID-SETTING CONCRETE: FILL/REPAIR VOID(S) IN AND/OR UNDERLYING MANHOLE CHANNEL/SHELF, AND REPAIR CHANNEL AND SHELF	500-2.10.2(Appendix VI)	1,725.00	8,625.00
24	20	LF	PROVISIONAL ITEM FOR ADDITIONAL LENGTH OF PIPE TO BE REPAIRED AT POINT REPAIR LOCATIONS	500-1.1.9, 500-1.2-7 (Appendix VI)	488.75	9,775.00
25	5	EA	PROVISIONAL ITEM FOR ADDITIONAL MANHOLE CHANNEL/SHELF TO BE REPAIRED WITH RAPID SETTING CONCRETE	500-2.10.2 (Appendix VI)	1,725.00	8,625.00
26	80	SF	REMOVE AND CONSTRUCT 4' PCC RIBBON GUTTER	303-5.9, (Appendix VI)	207.00	16,560.00
27	3000	SF	REMOVE AND CONSTRUCT PCC DRIVEWAY APPROACH	303-5.9, (Appendix VI)	20.70	62,100.00
28	10	EA	SURVEY MONUMENTS (PROVISIONAL)	2-9.1	1,000.00	10,000.00

TOTAL BID PRICE ALTERNATE SCHEDULE B $ 242,059.15
(Figures)*

TOTAL BID PRICE ALTERNATE SCHEDULE B: Two Hundred Forty Two Thousand
(Words)*

Fifty-Nine Dollars and Fifteen Cents

***BID MAY BE REJECTED IF TOTAL IS NOT SHOWN IN FIGURES AND WORDS.**

B2014-59

BIDDER'S SUBMITTAL (Continued) B2014-59

The undersigned furthermore agrees to enter into and execute a contract, with necessary bonds, at the unit prices set forth herein and in case of default in executing such contract, with necessary bonds, the check or bond accompanying this bid and the money payable thereon shall be forfeited thereby to and remain the property of the City of Torrance.

The above unit prices include all work appurtenant to the various items as outlined in the Specifications and all work or expense required for the satisfactory completion of said items. In case of discrepancies between unit prices and totals, the unit prices shall govern.

The undersigned declares that it has carefully examined the Plans, Specifications, and Contract Documents, and has investigated the site of the work and is familiar with the conditions thereon.

Contractor: BURTECH PIPELINE INCORPORATED

Date: DEC. 17, 2014 By: _____

Contractor's State License No. 718202 Class A

Address: 102 2ND STREET, ENCINITAS, CA 92024

Phone: 760-634-2822

Fax: 760-634-2415

ACKNOWLEDGMENT OF ADDENDA RECEIVED – B2014-59

The Bidder shall acknowledge the receipt of addenda by placing an "X" by each addendum received.

Addendum No. 1 ____

Addendum No. 2 ____

Addendum No. 3 ____

Addendum No. 4 ____

Addendum No. 5 ____

Addendum No. 6 ____

Addendum No. 7 ____

Addendum No. 8 ____

If an addendum or addenda have been issued by the City and not noted above as being received by the Bidder, the Bid Proposal may be rejected.

Bidder's Signature

DEC. 17, 2014
Date

CONTRACTOR'S AFFIDAVIT

STATE OF CALIFORNIA }
}
COUNTY OF SAN DIEGO } **B2014-59**

DOMINIC J. BURTECH, being first duly sworn, deposes and says:

1. That he is the
PRESIDENT & CEO
Title

of BURTECH PIPELINE INCORPORATED
(Name of Partnership, Corporation, or Sole Proprietorship)

hereinafter called "Contractor," who has submitted to the City of Torrance a proposal for the Construction of **MISCELLANEOUS SEWER MAIN IMPROVEMENTS AND REPAIRS, I-61/I-149.**

2. That said proposal is genuine; that the same is not sham; that all statement of facts therein are true;

3. That such proposal was not made in the interest or behalf of any person, partnership, company, association, organization or corporation not named or disclosed;

4. That the Contractor did not, directly or indirectly, induce, solicit or agree with anyone else to submit a false or sham bid, to refrain from bidding, or to withdraw the bid, to raise or fix the bid price of the Contractor or anyone else, or to raise or fix any overhead, profit or cost element of the Contractor's price or the price of anyone else; and did not attempt to induce action prejudicial to the interest of the City of Torrance, or of any other bidder, or anyone else interested in the proposed contract;

5. That the Contractor has not in any manner sought by collusion to secure for itself an advantage over any other bidder or to induce action prejudicial to the interests of the City of Torrance, or of any other bidder or of anyone else interested in the proposed contract;

6. That the Contractor has not accepted any bid from any subcontractor or materialman through any bid depository, the bylaws, rules or regulations of which prohibit or prevent the Contractor from considering any bid from any subcontractor or materialman, which is not processed through said bid depository, or which prevent any subcontractor or materialman from bidding to any contractor who does not use the facilities of or accept bids from or through such bid depository;

7. That the Contractor did not, directly or indirectly, submit the Contractor's bid price or any breakdown thereof, or the contents thereof, or divulge information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, or to any individual or group of Individuals, except to the City of Torrance, or to any person or persons who have a partnership or other financial interest with said Contractor in its business.

Dated this 17th day of December, 2014.

BURTECH PIPELINE INCORPORATED
(Contractor)
PRESIDENT & CEO
(Title)

Subscribed and Sworn to before me this 17 day of December, 2014.

Notary Public in and for said County and State.
(Seal)

CLS1 ARTHUR P. ARQUILLA Commission No. 2051358 NOTARY PUBLIC - CALIFORNIA SAN DIEGO COUNTY Commission Expires January 7, 2018 CLS1

LIST OF SUBCONTRACTORS: B2014-59

The Bidder is required to fill in the following blanks in accordance with the provisions of the California Public Contract Code Sections 4100-4114, CHAPTER 4. SUBLETTING AND SUBCONTRACTING. The contractor, sub recipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of Title 49 CFR (Code of Federal Regulations) part 26 in the award and administration of US DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate. Each subcontract signed by the bidder must include this assurance. Failure of the bidder to fulfill the requirements of the Special Provisions for submittals required to be furnished after bid opening, including but not limited to escrowed bid documents, where applicable, may subject the bidder to a determination of the bidder's responsibility in the event it is the apparent low bidder on a future public works contracts.

Name Under Which Subcontractor is Licensed: NU-LINE TECHNOLOGIES, LLC

Subcontractor's Address: 102 2ND STREET STE-B, ENCINITAS, CA 92024

Specific Description of Sub-Contract: CIPP LINING

License Number: 997520 CA License Classification/Type: A General Eng'g

Name Under Which Subcontractor is Licensed: TUNNELWORK SERVICES

Subcontractor's Address: 13502-H Whitteir Blvd. Ste 165, Whittier, CA 90605

Specific Description of Sub-Contract: CLEANING & PRE-CCTV

License Number: 963734 CA License Classification/Type: A

Name Under Which Subcontractor is Licensed: _____

Subcontractor's Address: _____

Specific Description of Sub-Contract: _____

License Number: _____ CA License Classification/Type: _____

Subcontractors listed must be properly licensed under the laws of the State of California for the type of work which they are to perform. Do not list alternate subcontractors for the same work.

The Bidding Contractor must include each subcontractor's contract license number (AB 44). An inadvertent error in listing the subcontractor's license number shall not be grounds for filing a bid protest, or grounds for considering the bid nonresponsive, if the corrected contractor's license number is submitted to the public entity by the prime contractor within 24 hours after the bid opening – provided that the corrected license number corresponds to the submitted name and location of the subcontractor.

REFERENCES (Page 1 of 2)
B2014-59

List work similar in magnitude and degree of difficulty completed by the Contractor within the past three (3) years.

1. Name (Firm/Agency): City of San Diego
   Address: 1200 Third Ave, Ste. 200, San Diego, CA 92101
   Contact Person: Reagan Owen, R.E. Telephone No.: 619-533-5205
   Title of Project: Pipeline Rehabilitation Phase K1
   Project Location: Linda Vista & Serra Mesa Community, San Diego, CA 92123
   Date of Completion: 10/11/2013 Contract Amount: $ 2,225,000.00

2. Name (Firm/Agency): City of San Diego
   Address: 1200 Third Ave, Ste. 200, San Diego, CA 92101
   Contact Person: Steve Frick, R.E. Telephone No.: 619-533-3409
   Title of Project: Sewer Main Rehabilitation Phase J-1D
   Project Location: Otay Mesa and Del Cerro Area, San Diego, CA 92154
   Date of Completion: 3/22/2013 Contract Amount: $ 3,515,000.00

3. Name (Firm/Agency): City of San Diego
   Address: 1200 Third Ave, Ste. 200, San Diego, CA 92101
   Contact Person: Maryam Liaghat, R.E. Telephone No.: 619-533-5192
   Title of Project: Pipeline Rehabilitation N-1
   Project Location: Allied Gardens and Mid-City Community, SD, CA 92120
   Date of Completion: 3/14/2014 Contract Amount: $ 5,907,193.00

4. Name (Firm/Agency): City of San Diego
   Address: 1200 Third Ave, Ste. 200, San Diego, CA 92101
   Contact Person: Reagan Owen, R.E. Telephone No.: 619-533-5205
   Title of Project: Pipeline Rehabilitation Phase M-1
   Project Location: Encanto Community Neighborhood
   Date of Completion: 6/17/2014 Contract Amount: $ 2,810,251.51

REFERENCES (PAGE 2 OF 2)
B2014-59

If Contractor has not performed work for the City of Torrance within the last five (5) years, list all work done within said five years (attach additional sheets if necessary). Note if work was done as subcontractor [include only subcontract amount]:

Work Description & Contract Amount	Agency	Date Completed
SEE ATTACHED SHEETS		

Contractor's License No.: 718202 Class: A

a. Date first obtained: October 31, 1995 Expiration: January 31, 2016

b. Has License ever been suspended or revoked? NO

If yes, describe when and why: _____

c. Any current claims against License or Bond? NONE

If yes, describe claims: _____

Principals in Company (List all – attach additional sheets if necessary):

NAME	TITLE (If Applicable)	LICENSE NO.
Dominic J. Burtech	President & CEO	718202
Julie J. Burtech	Exec. VP & Secretary	

Burtech Pipeline Project References – CIPP

Project / Description	Owner / Contact	Contract Amount	Date
2010 Pipeline Rehabilitation Phase K1 CIPP lining of 36,465 LF of 8-inch diameter sanitary sewer. Point Repairs, Cleanout Installations, Manhole Rehabilitation, 781 Top Hats (SLC's) and 781 Lateral Launch Video	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Reagan Owen, R.E. 619-533-5205	2,225,000.00	10/11/2013
2010 Sewer Main Rehabilitation Phase J-1D CIPP lining of 61,050 LF of 8-inch diameter sanitary sewer. Point Repairs, Cleanout Installations, Manhole Rehabilitation, 990 Top Hats (SLC's) and 990 Lateral Launch Video	City of San Diego 11010 2nd Avenue., Ste. 800 San Diego, CA 92101 Steve Frick, R.E. 619-533-3409	3,515,000.00	3/22/2013
2011 Pipeline Rehabilitation Phase N-1 CIPP lining of 44,510 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 1,032 Top Hats (SLC's) and 1,032 Lateral Launch Video, 1,032 4-inch CIPP Lateral Installation & Cleanouts	City of San Diego 600 B Street., Ste. 800 San Diego, CA 92101 Maryam Liaghat, R.E. 619-533-4641	5,907,193.00	3/14/2014
2012 Sewer & Water Group 761 CIPP lining of 2,020 LF of 8-inch and 10-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 43 Top Hats (SLC's) and 43 Lateral Launch Video, 3,000 LF of 4-inch CIPP Lateral Installation.	City of San Diego 1010 2nd Avenue., Ste. 1400 San Diego, CA 92101 Chris Gascon, R.E. 619-533-7418	2,712,835.81	12/19/2013
2012 Pipeline Rehabilitation Phase M-1 CIPP lining of 27,043 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 407 Top Hats (SLC's) and 407 Lateral Launch Video, 407 4-inch CIPP Lateral Installation.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Reagan Owen, R.E. 619-533-5205	2,810,251.51	6/17/2014
2012 Pipeline Rehabilitation Phase S-1 CIPP lining of 36,707 LF of 6-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 930 Top Hats (SLC's) and 930 Lateral Launch Video, 929 4-inch CIPP Lateral Installation.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Luis Schaar, R.E. 619-533-4641	4,343,851.40	7/21/2014
2010 Sewer & Water Group 734 CIPP lining of 503 LF of 8-inch and 3,994 LF sanitary sewer replacement. Point Repairs, Manhole Rehabilitation, Top Hats (SLC's), 4-inch CIPP Lateral Installation.	City of San Diego 600 B Street, Ste. 800 San Diego, CA 92101 Akram Bassoon, R.E. 619-533-6902	588,355.90	11/10/2011

Burtech Pipeline Project References – CIPP

2013 Sewer & Water Group 758 CIPP lining of 2,612 LF of 8-inch and 10,135 LF sanitary sewer replacement. Point Repairs, Manhole Rehabilitation, 30 (SLC's), CIPP Lateral Installation, Bypass Pumping.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Luis Schaar, R.E. 619-533-4641	4,434,852.02	On Going
2012 Sewer & Water Group 799 CIPP lining of 4,467 LF of 6" & 8" CIPP, Sanitary Sewer Main Replacement. Point Repairs, Manhole Rehabilitation, Service Lateral Connections, Bypass Pumping.	City of San Diego 600 B Street, Ste. 800 San Diego, CA 92101 Jericho Gallardo, R.E. 619-533-7523	5,257,792.05	On Going
2013 Sewer & Water Group 720 CIPP lining of 621 LF of 6-inch, Sanitary Sewer Main Replacement. Point Repairs, Manhole Rehabilitation, Service Lateral Connections, Bypass Pumping.	City of San Diego 525 B Street, MS 908A San Diego, CA 92101 Bijan Shakiba, R.E. 619-533-5191	2,378,259.67	On Going
2014 Wing Ave Flood Control Clean/CCTV & CIPP lining of 159 LF of 18-inch & 24-inch Storm Drain, Flow Diversion.	Flatiron 1770 La Costa Meadows Drive San Marcos, Ca 92708 Ruben Claudio 760-916-9100	33,030.00	5/28/2014
2014 Pipeline Rehabilitation Phase W-1 CIPP lining of 21,754 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 425 Top Hats (SLC's) and 425 Lateral Launch Video, 425 4-inch CIPP Lateral Installation.	City of San Diego 525 B Street, Ste. 750 San Diego, CA 92101 Maryam Liaghat, P.E. 619-533-5192	2,465,095.10	On Going
2014 Sewer Rehabilitation Project No. 9 CIPP lining of 9,166 LF of 8" & 10" diameter sanitary sewer. Clean & CCTV, Bypass Pumping	Los Angeles Dept. of Public Works 900 South Fremont Ave Alhambra, CA 90014 Attn: Jose Pou 626-458-2191	232,000.00	Start 9/2/2014
2014 Pipeline Rehabilitation Phase X-1 CIPP lining of 4,092 LF of 6", 8", 10" & 15" diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 44 Service Lateral Connections and 44 Lateral Launch Video, 44 CIPP Lateral Installation.	City of San Diego 9485 Aero Drive San Diego, CA 92101 Jericho Gallardo, R.E. 619-533-7523	513,000.00	Projected Start 9/15/2014

Burtech Pipeline Project References – CIPP

2014 Sewer Pipeline and Storm Drain Repairs CIPP lining of 3,367 LF of 6", 8" & 18" diameter sanitary sewer & Storm Drain. Point Repairs, Manhole Rehabilitation,	City of Solana Beach 9485 Aero Drive Solana Beach , CA 92075 Taryn Kjolsing 858-720-2470	455,414.50	Projected Start 9/22/2014

Burtech Pipeline Project References – CIPP

VIOLATIONS OF FEDERAL, STATE OR LOCAL LAWS
B2014-59

1. Has your firm or its officers been assessed any penalties by an agency for noncompliance or violations of Federal, State or Local labor laws and/or business or licensing regulations within the past five (5) years relating to your construction projects?

   Yes/No: NO Federal/State: _____

   If "yes," identify and describe, (including agency and status): _____

   _____

   _____

   _____

   Have the penalties been paid? Yes/No: _____

2. Does your firm or its officers have any ongoing investigations by any public agency regarding violations of the State Labor Code, California Business and Professions Code or State Licensing Laws?

   Yes/No: NO Code/Laws: _____ Section/Article: _____

   If "yes," identify and describe, (including agency and status): _____

   _____

   _____

   _____

DISQUALIFICATION OR DEBARMENT

Has your firm, any officer of your firm, or any employee who has a proprietary interest in your firm ever been disqualified, removed, or otherwise prevented from bidding on, performing work on, or completing a federal, state or local project because of a violation of law or a safety regulation? Yes/No: NO. If yes, provide the following information (if more than once, use separate sheets):

Date: _____ Entity: _____

Location: _____

Reason: _____

_____

_____

_____

_____

Provide Status and any Supplemental Statement: _____

_____

_____

_____

_____

Has your firm been reinstated by this entity? Yes/No: _____

EXPERIENCE STATEMENT
B2014-59

To be responsive, the bidder must list below the required project information as listed in the Qualification of Bidders statement, no less than five (5) years of experience in the magnitude and character of the work bid in Public Works projects.

1. Project Title Pipeline Rehabilitation Phase K1
   Contract Amount $ 2,225,000.00
   Type of Work Rehabilitation of existing Sewer Mains
   Client City of San Diego
   Agency Project Manager Reagan Owen, R.E. Phone 619-533-5205
   Date Completed 10/11/2013 % subcontracted 46%

2. Project Title Sewer Main Rehabilitation Phase J-1D
   Contract Amount $ 3,515,000.00
   Type of Work Rehabilitation of existing Sewer Mains
   Client City of San Diego
   Agency Project Manager Steve Frick, R.E. Phone 619-533-3409
   Date Completed 3/22/2013 % subcontracted 46%

3. Project Title Pipeline Rehabilitation Phase N-1
   Contract Amount $ 5,907,193.00
   Type of Work Rehabilitation of existing Sewer Mains
   Client City of San Diego
   Agency Project Manager Maryam Liaghat Phone 619-533-5192
   Date Completed 3/14/2014 % subcontracted 47%

4. Project Title Pipeline Rehabilitation Phase M-1
   Contract Amount $ 2,810,251.51
   Type of Work Rehabilitation of existing Sewer Mains
   Client City of San Diego
   Agency Project Manager Reagan Owen, R.E.Phone 619-533-5205
   Date Completed 6/17/2014 % subcontracted 40%

5. Project Title Pipeline Rehabilitation Phase S-1

Contract Amount $ 4,343,851.40

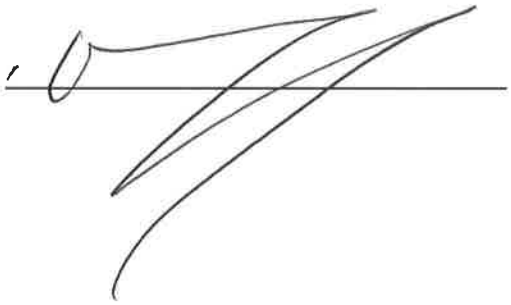
Type of Work Rehabilitation of existing Sewer Mains

Client City of San Diego

Agency Project Manager Luis Schaar, R.E. Phone 619-533-4641

Date Completed 7/21/2014 % subcontracted 41%

NOTE: If requested by the City, the bidder shall furnish a certified financial statement, references, and other information sufficiently comprehensive to permit an appraisal of his current financial condition.

Bidder's Signature 

APPLIED FELTS

450 College Drive
Martinsville, VA 24112
(276) 656-1904, Fax (276) 656-1909, E-Mail office@appliedfelts.com

TECHNICAL INFORMATION

Product: Inversion Liner for Hot Water/Steam Cure Installation (PROCESS QUALITY CONTROL)

1. Raw Materials

Each supplier is assessed against Quality Assurance criteria. If the supplier meets the criteria set out, then they may be included in our "Approved Supplier List". Periodic reviews take place of all of our approved suppliers to ensure that they continue to meet our criteria.

Inspection and test of raw materials, when received also enables us to assess the supplier as well as each batch of delivered raw material. Details are shown in Table 1.1.

Table 1.1

Raw Material	Characteristic Tested
Polyester fiber (Several specifications)	Staple length Crimp level Denier Shade Supplier Certification
Polyurethane granules (Several specifications)	Granularity Blocking Yellowness Supplier Certification
Tetrahydrofuran	Supplier Certification
Polyurethane film, sealing tape	Gauge Density Strength of weld - Heat Strength of weld - Chemical Opacity

2. Production of Felt (Nonwoven)

The sole raw material used in the production of felt is polyester staple fiber. The most suitable fiber specification for the customer's particular end-use is selected (on the basis of resin type, impregnation equipment, installation conditions and cure regime).

The process utilizes state of the art equipment and technology to ensure that the nonwoven Product is fully suited to the customer's requirements.

Continual operator inspection at each stage of the process and product, combined with the use of standard machine parameters and computerized machine monitoring ensures that the process is repeatable and consistent.

Each product is tailored to the specific customer's requirements, and a production specification is produced by the Technical Department. The felt produced is tested against the requirements of this document to concur suitable.

Process controls are described in Table 2.1.

Table 2.1

Process	Control	Characteristic
Opening fiber	Operator inspection, set parameters	Even density and thickness
Carding	Operator inspection, set parameters, computer feedback	Even fiber distribution
Tacker needling	Operator inspection, set parameters, computer feedback orientation of fibers	Permits controlled
Reorientation of fibers	Operator inspection, set parameters, computer feedback	Controls relative elongation modulii in length and cross directions
Needling	Operator inspection, set parameters, computer feedback	Density, strength, ability to weld

3. Polyurethane Coating of Felt

The sole consumable is granular polyurethane. The polyurethane specification is selected to ensure that the coating has the correct properties to meet the requirements of the customer.

Process controls are described in Table 3.1.

Table 3.1

Process	Control	Characteristic
Extrusion of polymer into Flat die	Fully automatic temperature, pressure control	Homogeneity of extrudate
Formation of molten polymer film	Operator control of machine temperatures, pressures, speeds	Coating uniformity
Transfer of molten film onto felt	Operator control of machine temperatures, pressures, speeds. Continual monitoring of coating thickness.	Coating mass per unit area Weight distribution over entire roll area.

4. Testing of Plain and Coated Felts

Each roll of plain felt and felt for coating is sampled and destructively tested against the requirements of the Production Specification as shown in Table 4.1. Each coated roll undergoes testing as Table 4.2.

Table 4.1

Characteristic	Test
Density and density distribution at various applied pressures	Compression measurement at increasing pressure
Load at break in machine and cross directions	Tensile testing- Maximum Resistive Force
Secant Modulus in machine and cross directions (resistance to stretch).	Tensile testing- Maximum Resistive Force vs Extension %

Table 4.2

Characteristic	Test
Density and density distribution at various applied pressures.	Compression measurement at Increasing pressure.
Load at break in machine and cross directions.	Tensile testing - Maximum Resistive Force
Secant Modulus in machine and cross directions (resistance to stretch)	Tensile testing - Maximum Resistive Force vs Extension %
Coating weight and distribution	Samples weighed to determine distribution of coating in cross direction of roll.
Coating adhesion and ability to weld.	Peel strength of welded tape (Standard specification)
Coating surface finish	Visual inspection

5. Production of Liners

Liner requirements are collected by way of the Customer Order and customer liaison, and are confirmed to the customer on our Order Acknowledgment form.

Once all requirements are known, a liner is designed which will fulfill all the requirements.

The design is detailed to the Production department as a Manufacturing Specification. This is then entered onto the Production Schedule.

The liner may be produced by one of a number of production techniques, depending on the requirements.

6. Testing the finished liner

The control and test of the liner properties are detailed in Table 6.1.

From each liner produced, a sample is cut from one end for QC inspection and test. This sample is destructively tested to ensure that all of the liner properties are within the Manufacturing Specification.

Table 6.1

Property	Control	Test
Circumference of liner	Monitored at each production stage against Manufacturing Specification	Destructive test of sample. All layers are measured.
Density, Gauge of liner under various applied pressures	Selection of felt layers in order that finished density and gauge are within Manufacturing Specification	Compression test of sample of all layers
Length of liner	Monitored at each production stage against Manufacturing Specification	Inspection regime includes measurement of a sample of liners against Manufacturing Specifications.
Coating Integrity	Continually monitored by state-of-the-art gauge.	Inspected after coating Monitored throughout liner manufacture
Metal Free	Needling process is continually monitored for alignment to prevent needle damage	Each roll passes through Metal Detection equipment
Felt Weld Strength	All welding equipment operates to set parameters. Overlapped thermal welded.	Each weld is sampled And destructively tested Results are compared to the Manufacturing Specification

Table 6.1 con't

Sealing Tape Weld Strengths	All welding equipment operates to set parameters, chemically bonded seal.	Each weld is sampled, specially conditioned, and destructively tested under conditions simulating the "worst case" for that liner

Technical Information

Product: Polyurethane Coated Liner for Hot Cure Eversion

Specification

Felt:

The fiber is PET Polyester staple fiber.

The denier of the fiber for a standard hot cure eversion liner for vacuum impregnation with a polyester resin is usually selected as nominally 6 denier (+10%) (dependant on specific liner and installation details).

The felt is manufactured to a thickness specification of ± 3 % when measured at a compressive pressure of 0.5 bar (7.4 psi) (16 ft. water head). Standard thickness of 1.5 mm, 3mm, 4.5mm, 6mm exist.

Coating:

The coating is a thermoplastic polyester polyurethane. The nominal weight may be 400 - 500, 500 - 600 or 600 - 700 grams per square meter. It is usual for the 400 - 500 gsm spec to be used. This affords an average coating thickness of 0.33mm for 400 gsm, 0.41mm for 500 gsm.

All coating weights are applied in a minimum of two passes to ensure that pin holes are avoided.

Liner:

The liner is assembled from layers of plain felt and an outer layer of coated felt. Each inner plain layer is overlapped approximately 50mm (2") at each joint and welded by hot fusion techniques to give the requisite weld strength to support the installation pressure (with a safety factor included). The safety factor is in excess of 2.

The outer coated layer has a high strength felt strip fusion welded across the inside of the joint and a sealing tape of polyurethane welded over the coating to give a seal and a barrier of comparable thickness to the coating.

The finished liner thickness is measured at the installation head and is toleranced at -0 + 5% on nominal ordered thickness.

CERTIFICATION

This certifies that Applied Felts manufactured tubes meet the material requirements of ASTM F1216-93. In support of ASTM D5035, specifically as it relates to tensile strengths, our liner tensile properties average 1100 psi. The minimum tensile strength is 750 psi as per ASTM D5813-95 item 6.1 *Fabric Tube Strength* (see Page 10). All our materials are tested to ensure suitability to the application. Each liner is typically tested in 28 different ways and traceable test data is available for any particular liner.

Recommendations for minimum, maximum and ideal pressures are provided for each and every liner that Applied Felts manufactures. This ensures that the installer understands the requirements for holding the tube against the existing conduit and the maximum allowable pressure so as not to damage the tube. A head pressure chart is attached as examples for various tube sizes.

Applied Felts has provided polymer coated felt tubes for use in Cured In Place Pipe (CIPP) lining for more than twelve years, and supplied materials for the CIPP industry for more than twenty years. Over 22 million feet of our liner has been successfully installed world wide, of which 10 million feet has been installed in the United States. Over 97,476 feet of our liner with diameter 36" and above have been installed in the U.S.

Applied Felts also certifies that all liners manufactured will meet the minimum requested finished thickness (or greater) as ordered by its customers.

Applied Felts is a registered ISO 9002 company.

FABRIC TUBE STRENGTH

BATCH	1809			8/15/07
Roll #	Warp Break	Warp Modulus	Weft Break	Weft Modulus
1809/01	2250	10.42	2980	8.01
1809/02	2250	10.56	3110	7.19
1809/03	2210	9.83	2730	6.43
1809/04	2200	9.23	2940	5.96
1809/05	2210	10.53	3040	6.42
1809/06	2260	10.47	2910	6.20
1809/07	2330	10.61	2830	6.77
1809/08	2480	11.28	2870	7.41
1809/09	2240	10.64	2860	6.96
1809/10	2480	12.21	2920	7.68
1809/11	2230	11.02	2930	7.96
1809/12	2220	10.73	2940	7.83
1809/13	2370	12.32	2890	7.14
1809/14	2370	11.38	2860	6.94
1809/15	2320	11.80	2920	6.50
1809/16	2340	11.31	2900	7.45
1809/17	2380	12.24	2820	7.56
1809/18	2390	12.20	2820	7.28
1809/19	2190	9.82	2800	7.48
1809/20	2250	10.67	2700	6.27
1809/21	2000	9.47	2860	7.17
1809/22	2360	12.32	2750	6.91
1809/23	2260	11.72	2910	7.99
1809/24	2270	11.23	2970	7.66
1809/25	2320	10.39	2940	7.30
1809/26	2180	11.27	2800	6.83
1809/27	2320	10.72	2680	7.18
1809/28	2290	11.82	2930	6.54
1809/29	2280	10.92	3060	7.58
1809/30	2180	9.26	2840	6.94
1809/31	2220	9.59	2870	7.21
1809/32	2290	10.61	2860	7.69
1809/33	2250	10.27	2810	7.02
Average	2278	10.87		7.14
	1101 psi			

RECOMMENDED HANDLING AND STORAGE FOR LINERS

1 Avoid extremes of temperature.

Freezing may cause the coating structure to degrade locally, especially areas where the coating is in tension or compression, at bends and edges and immediately adjacent to seam welds.

Recommended storage temperature 5 to 35 degrees C.

Shelf life at this temperature: in excess of 1 year.

2 Avoid extremes of humidity.

Very high relative humidity (especially at high temperature such as tropical countries) will accelerate the hydrolysis of the polyurethane coating, consequently reducing the shelf life.

Recommended storage humidity 25% rh to 65% rh.

Shelf life at 65%, 35 degrees C: 1 year.

3 Avoid prolonged wet storage.

As with high humidity, the coating more susceptible to degradation at higher temperatures, and even further susceptible if pH of liquid in contact is below 7.

Wet storage is not recommended.

4 Avoid direct sunlight of incident UV radiation.

Prolonged exposure to ultra violet light will accelerate the degradation of the polyurethane.

It is recommended that liners remain in the original packaging until they are required for use. Failing this, the liner should be covered to prevent exposure.

5 Mechanical damage should be avoided.

In order to ensure that the liner is not damaged, the following recommendations should be followed:

a) Ensure that liner is not placed directly onto grit or gravel floor. Sweep and cover floor first.
b) Ensure personnel are instructed not to walk on liner.
c) Handle liner with care.
d) Ensure nip rollers clean, and liner is not in contact with any sharp edges or snags anywhere during impregnation and installation.
e) Large liners will require special handling considerations (especially when wet-out), as their weight will preclude manual handling. Cranes or conveyors may be required. If a liner is to be lifted with a crane sling, it is important that the sling should be sufficiently wide to prevent it from "biting" into the liner. It should be set up in such a way that the sling does not grip the liner (ie. both loops of the sling onto the crane hook).

Storage and Handling con't.

6 Styrene and Chemical Attack

Avoid prolonged contact with solvents and chemicals.

On impregnation with styrene-based resin, the solvent/monomer may start to swell the coating, giving an orange peel appearance. In time, this effect will increase to severe wrinkling (stretch by 60%).

If the contact time is sufficient, the coating will feel tacky. At this stage, the product should not be used.

Recommended shelf life after impregnation will vary dependant on the proportion of styrene in the resin, the nature and proportion of thixotropes, inhibitors, accelerators and catalysts, and the storage temperature.

As a general rule, the impregnated liner should be stored below 10 degrees C. The typical shelf life at this temperature, with a polyester resin system, is maximum 7 days. With some resin systems, this shelf life is reduced to less than 24 hours. If using an unfamiliar system, it is recommended a section of coated felt is soaked in resin and assessed periodically to determine shelf life. With experience, this may be judged visually by the degree of wrinkling.

Certificate of Registration

COPY

QUALITY MANAGEMENT SYSTEM - ISO 9001:2008

This is to certify that:

Applied Felts Inc.
450 College Drive
Martinsville
Virginia
24112
USA

Holds Certificate No: **FM 55735**
and operates a Quality Management System which complies with the requirements of ISO 9001:2008 for the following scope:

Manufacture of textile products used in pipeline rehabilitation.

For and on behalf of BSI:

Gary Fenton, Global Assurance Director

Originally Registered: **08/15/2000** Latest Issue: **05/14/2012** Expiry Date: **05/31/2015**

A WORLD OF FIBRES

APPLIED FELTS

Applied Felts, Inc. 450 College Drive, Martinsville, Virginia 24112
Telephone (276) 656-1904 Fax: (276) 656-1909
office@appliedfelts.com

May 19, 2014

To Whom It May Concern:

This letter certifies that Applied Felts manufactured tubes meet the material requirements of ASTM F1216-09 (paragraph 5.1) and ASTM F 1743-08(section 6) as well as meet the minimum strength requirements of ASTM-D5813-04 (paragraph 6.1). All our materials and finished products are tested to ensure suitability to the application. Each liner is typically tested in 28 different ways and traceable test data is available for any particular liner.

Applied Felts has provided polymer coated felt tubes for use in Cured In Place Pipe (CIPP) lining for more than fifteen years, and supplied materials for the CIPP industry for more than twenty years. Over 80 million feet of our liner has been successfully installed worldwide, of which 65 million feet has been installed in the United States. Our liners are assembled in Martinsville, VA, using only raw materials made in the USA.

Applied Felts is a registered ISO 9001:2008 company.
Burtech Pipeline is a certified installer of Applied Felts lining products.

Sincerely,

W. Mark Sanders
General Manager

A WORLD OF FIBRES

APPLIED FELTS

Applied Felts, Inc. 450 College Drive, Martinsville, Virginia 24112
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office@appliedfelts.com

Material Health and Safety Data Sheet

EFFECTIVE DATE: APRIL 26, 2012

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY

PRODUCT NAME: POLYURETHANE COATED LINER

SUPPLIER: Applied Felts, Inc
450 College Drive
Martinsville, VA 24112

TELEPHONE: (276) 656-1904

FAX: (276) 656-1909

2. COMPOSITION/INFORMATION ON INGREDIENTS

COATING: Thermoplastic Polyurethane Polymer
SUBSTRATE: Polyethylene Terephthalate Felt

3. HAZARDS IDENTIFICATION

HAZARDS DESIGNATION: Not Classified as a Hazardous Material.
POTENTIAL HEALTH HAZARDS: During decomposition or combustion, the product can cause irritation to eyes, skin, or respiratory tract. As a delayed effect, sensitization to isocyanates may occur.

4. FIRST AID MEASURES

INHALATION: No effects anticipated
INGESTION: No effects anticipated
SKIN: No effects anticipated
EYES: No effects anticipated

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5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA:	Water, Foam, Dry Chemical
HAZARDOUS DECOMPOSITION PRODUCTS:	Carbon Dioxide (CO^2), Carbon Monoxide (CO), Hydrogen Cyanide (HCN), Oxides of Nitrogen, Hydrocarbons and Diisocyanate
SPECIAL PROTECTIVE EQUIPMENT:	Positive pressure self-contained breathing apparatus

6. ACCIDENTAL RELEASE MEASURES

SPILL CLEAN-UP METHODS:	N/A

7. HANDLING AND STORAGE

USAGE PRECAUTIONS:	N/A
STORAGE PRECAUTIONS:	N/A

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

PROTECTIVE EQUIPMENT	
VENTILATION:	N/A
RESPIRATORS:	N/A
PROTECTIVE GLOVES:	N/A
EYE PROTECTION:	N/A
GENERAL PROTECTIVE AND HYGIENIC MEASURES:	Standard industry safety and hygiene principles should be exercised

9. PHYSICAL AND CHEMICAL PROPERTIES

FORM:	Polyurethane coated liner
COLOR:	White
ODOR:	Faint
MELT POINT – FELT	260° C
MELT POINT – COATING	> 177° C
DENSITY – FELT	150 – 200 Kg/m^3
DENSITY – COATING	1100 – 1300 Kg/m^3
FLAMMABILITY	N/A

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10. STABILITY AND REACTIVITY

STABILITY:	Normally Stable
CONDITIONS/MATERIALS TO BE AVOIDED:	Excessive heat, Organic solvents
HAZARDOUS DECOMPOSITION PRODUCTS:	Carbon Dioxide (CO^2), Carbon Monoxide (CO), Hydrogen Cyanide (HCN), Oxides of Nitrogen, Hydrocarbons and Diisocyanate, are all anticipated at levels above trace
FIRE CREATES:	

11. TOXICOLOGICAL INFORMATION

HEALTH WARNINGS:	No health risk at ambient temperatures. Elevated temperatures may cause this product to emit irritating vapors

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL HAZARDS:	Not biologically degradable. Bioaccumulation improbable Generally not hazardous to water

13. DISPOSAL CONDSIDERATIONS

DISPOSAL METHODS:	Dispose of waste by incineration or in landfill in accordance with local regulations

14. TRANSPORT INFORMATION

NOT CLASSIFIED AS A DANGEROUS CARGO

15. REGULATORY INFORMATION

DESIGNATION ACCORDING TO EUROPEAN COMMISSION GUIDELINES:	No known regulations related to this product. Observe the local safety regulations for handling chemicals.

A WORLD OF FIBRES

APPLIED FELTS

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16. OTHER INFORMATION

This data is based on our present knowledge. However, they shall not be constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	1	Slight
	REACTIVITY	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	1	Slight
	PHYSICAL:	0	Minimal

SUPERSEDES MSDS DATED: JUNE 4, 2008

National Liner

Cured-In-Place Pipe (CIPP) Wall Thickness Design and Hydraulic Capacity Calculations

Project: Miscellaneous Sewer Main Improvements and Repairs
Location: Torrance, Ca
Owner: City of Torrance
Line Segment(s): 8-inch

Design Assumptions:

Condition of host pipe		FD	PD = partially deteriorated, FD = fully deteriorated
Inside diameter of host pipe (in)	D =	8	
Ovality of host pipe (%)	q =	2.0	Default value is 2%; range = 0%-10%
Slope of host pipe (ft/ft)	S =	0.190	
Host pipe Manning's roughness (dimensionless)	n_i =	0.015	varies from 0.013-0.030 (dependent on existing pipe material, geometry, diameter and condition)
CIPP Manning's roughness (dimensionless)	n_f =	0.010	varies from 0.009-0.013
Constrained soil modulus of native soil in the pipe zone (psi)	M_{sn} =	750	See table below for recommended values

From Table 5.6 of *AWWA Manual of Water Practices M45, Second Edition*

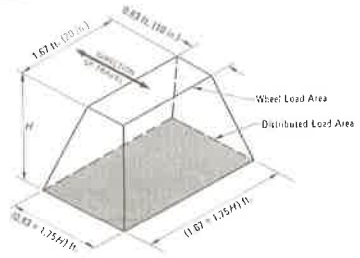
Granular Native Soils		Cohesive Native Soils: Unconfined compressive strength (q_u)		Description	M_{sn}	
Blows/ft (per ASTM D1586)	Description	tons/sf	kPa		psi	MPa
> 0 - 1	very, very loose	> 0 - 0.125	0 - 13	very, very soft	50	0.3
1 - 2	very loose	0.125 - 0.25	13 - 25	very soft	200	1.4
2 - 4		0.25 - 0.50	25 - 50	soft	700	4.8
4 - 8	loose	0.50 - 1.0	50 - 100	medium	1,500	10.3
8 - 15	slightly compact	1.0 - 2.0	100 - 200	stiff	3,000	20.7
15 - 30	compact	2.0 - 4.0	200 - 400	very stiff	5,000	34.5
30 - 50	dense	4.0 - 6.0	400 - 600	hard	10,000	69.0
> 50	very dense	> 6.0	> 600	very hard	20,000	138.0

Flexural modulus of Elasticity of CIPP, initial (psi)	E =	250,000	Minimum value is 250,000 psi per ASTM F1216
Long-term retention of mechanical properties (%)		50%	Determined from flexural creep modulus testing extrapolated to proposed design life (such as 50 years), b
Flexural modulus of elasticity of CIPP, long-term (psi)	E_L =	125,000	Determined from flexural creep modulus testing extrapolated to proposed design life (such as 50 years)
Design safety factor	N =	2	Default value is 2.0
Unit weight of soil (pcf)	δ_s =	120	Applies to fully deteriorated designs only
Unit weight of water (pcf)	δ_w =	62.4	
Depth of cover (ft)	H =	7.5	Measured from ground surface to top of pipe
Height of groundwater (ft)	H_w =	2.0	Measured from top of pipe; **Note: If water table is below top of pipe, input a negative number!**
Internal vacuum pressure (psi)	P_v =	0.0	Default value is 0
Internal pressure (psi)	P =	0.0	Pressure pipe applications only! If no pressure, input 0
Diameter of hole or opening in original pipe wall (in)	d =	0.000	Pressure pipe applications only! If no pressure, input 0
Poisson's ratio of CIPP	v =	0.30	Average value for CIPP per ASTM F1216
Flexural strength of CIPP, initial (psi)	σ_I =	4,500	Minimum value is 4,500 psi per ASTM F1216
Flexural strength of CIPP, time-weighted (psi)	σ_L =	4,500	At buckling the time-weighted flexural strength is equal to the lower 95% confidence value of the short-ter
Tensile strength of CIPP, initial (psi)	σ_T =	3,000	Pressure pipe applications only!
Tensile strength of CIPP, long-term (psi)	σ_{TL} =	1,500	Determined from long-term tensile strength testing.
Enhancement factor (dimensionless)	K =	7.0	Minimum value recommended per ASTM F1216
Surface live loading condition		H20	H20, E80 or airport

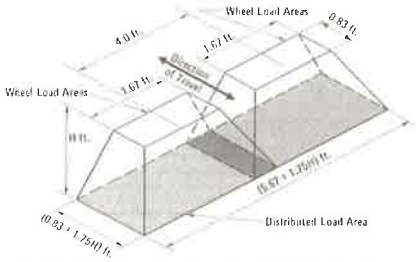
H20 Calculations (Highway Loads)

Impact factor for traffic load (dimensionless)	I_f =	1.0	From *AASHTO Standard Specifications for Highway Bridges, 12th Edition*
Distributed load area over pipe at depth H (ft^2)	A_{LL} =	337.5	See table and figures below
Total applied surface wheel load (lb)	P_{LW} =	48,000	Based on critical loading configuration (see table below)
H20 live load transferred to pipe at depth H (psi)	w_{LH} =	1.0	$w_L = (P \cdot I_f)/(144 \cdot A_{LL})$

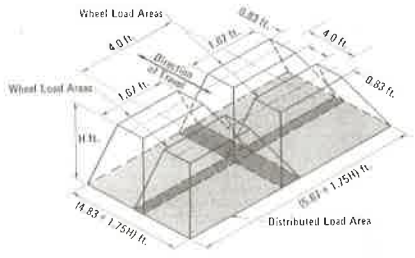
Critical Loading Configurations for H20 loads (per AASHTO)			
Condition	H, ft	P, lbs	A_{LL}, ft^2
1	H < 1.33	16,000	(0.83 + 1.75H)(1.67 + 1.75H)
2	1.33 ≤ H < 4.10	32,000	(0.83 + 1.75H)(5.67 + 1.75H)
3	4.10 ≤ H	48,000	(4.83 + 1.75H)(5.67 + 1.75H)



Condition 1. Distributed Load Area - Single Dual Wheel



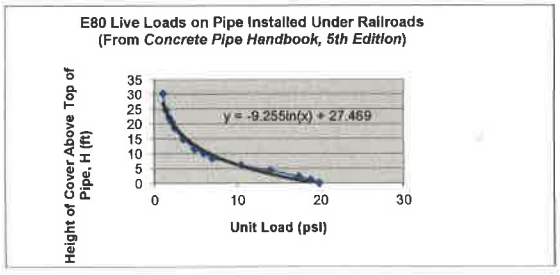
Condition 2. Distributed Load Area - Two H20 Trucks Passing



Condition 3. Distributed Load Area - Alternate Loads in Passing Mode

E80 Calculations (Railway Loads)

E80 live load transferred to pipe at depth H (psi) w_{LR} = 0.00 from graph below



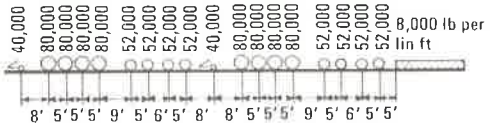
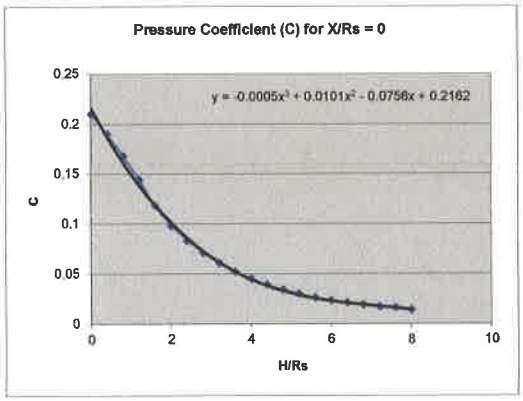


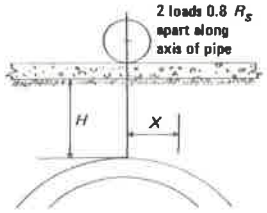
Figure 4.30. Spacing of Wheel Loads Per Axle for a Cooper E 80 Design Loading.

Airport Loads

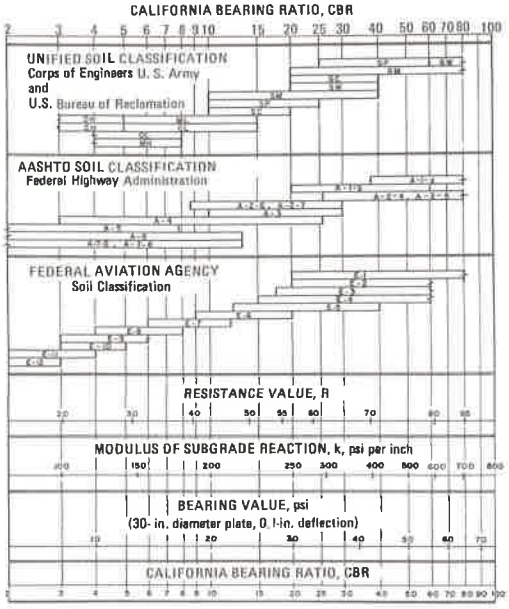
Modulus of elasticity of concrete (psi)	E_c =	4,000,000	default value is 4,000,000
Poisson's ratio of concrete (dimensionless)	μ =	0.3	default value is 0.15
Modulus of subgrade reaction (lb/in^3)	k =	250	see adjacent figure
Thickness of concrete pavement (in)	h =	12	
Depth of cover, top of pipe to bottom of slab (ft)	H =	6.5	
Horizontal distance from pipe centerline (ft)	X =	0	assumed = 0 (worst case)
Radius of stiffness of the rigid pavement (ft)	R_s =	3.32	$R_s = \sqrt[4]{\frac{Eh^3}{12(1-\mu^2)k}}$
Wheel load (lbs)	P_{LA} =	90,000	

Worst-case loading scenario is for 2 loads spaced 0.8R_s apart and is calculated below.
For alternate loading conditions, see *Concrete Pipe Handbook, 5th Edition*





H/R_s =	1.955	
C =	0.103	



Airport live load transferred to pipe at depth H (psi) w_{LA} = 0.00 $w_{LA} = CP/R_s^2$

Wall Thickness Design

Partially Deteriorated Gravity Pipe Condition

Ovality reduction factor (dimensionless) C = 0.84 $C = \left(\frac{1-q/100}{[1+q/100]^2}\right)^3$

External hydrostatic pressure from groundwater (psi) P_w = 1.16 $P_w = \gamma_w(H_w + D/12)/144$

Minimum thickness required, hydrostatic buckling t_1 = 0.09 in = 2.27 mm $t_1 = \frac{D}{\left(\left[\frac{2\cdot K\cdot E_L\cdot C}{(1-\nu^2)\cdot N\cdot(P_w+P_v)}\right]^{1/3}\right)+1}$ ASTM F1216, Equation X1.1

Minimum thickness required, ovality check t_2 = 0.03 in = 0.80 mm, SDR_2 = 253 $1.5\cdot\frac{q}{100}\cdot\left(1+\frac{q}{100}\right)\cdot SDR^2 - 0.5\cdot\left(1+\frac{q}{100}\right)\cdot SDR - \frac{\sigma_L}{P\cdot N} = 0$ ASTM F1216, Equation X1.2

If P_w = 0, default SDR = 100

Quadratic factors for Eq. X1.2 used to solve for SDR_2 and t_2: a = 0.0306, b = -0.510, c = -1947.12

Fully Deteriorated Gravity Pipe Condition

Total live load transferred to pipe at depth H (psi) =	W_e =	0.99	From live load calculations
Water buoyancy factor (dimensionless)	R_w =	0.91	$R_w = 1 - 0.33(H_w/H)$ (min. value = 0.67) **Note: If H_w<0, use H_w = 0 in this calculation**
Total external pressure on pipe (psi)	q_t =	7.84	$q_t = 0.433H_w + aS_sHR_w/144 + W_e$ **Note: If H_w<0, use H_w = 0 in this calculation**
Coefficient of elastic support (in-lb)	B' =	0.289	$B' = 1/(1+4e^{-0.065H})$ 1 ← **See Note X1.3 of ASTM F1216**

Minimum thickness required, Luscher's buckling equation t_3 = 0.13 in = 3.35 mm $t = \left[\frac{(Nq_t)^2\cdot D^3\cdot 12}{32\cdot R_w\cdot B'\cdot M_{ss}\cdot E_L\cdot C}\right]^{1/3}$ ASTM F1216, Equation X1.3

Minimum thickness required, pipe stiffness t_4 = 0.13 in = 3.35 mm $t = (D^3*0.093\cdot 12/E)^{1/3}$ ASTM F1216, Equation X1.4

Partially Deteriorated Pressure Pipe Condition

Minimum thickness required to withstand internal pressure in spanning across any holes in the original pipe wall t_{pr} = 0.00 in; $t_{pr} = D/([(D/d)^2\cdot(5.33\cdot\sigma_L/PN)]^{1/2}+1)$ ASTM F1216, Equation X1.6

d/D = 0.00

$1.83(t_{pr}/D)^{1/2}$ = 0.00

If d/D > $1.83\cdot(t_{pr}/D)^{1/2}$, ASTM F1216, Equation X1.5, then liner is in ring tension or hoop stress and fully deteriorated pressure pipe condition applies (ASTM F1216, Equation X1.7)

Minimum thickness required by design check t_{pr1} = 0.00 in = 0.00 mm

Fully Deteriorated Pressure Pipe Condition

Minimum thickness required to withstand all external loads and the full internal pressure t_{pr2} = 0.00 in = 0.00 mm $t_{pr2} = D/((2\cdot\sigma_{TL}/PN) + 2)$ ASTM F1216, Equation X1.7

CIPP Wall Thickness Design Summary

Host pipe condition		Fully Deteriorated	
CIPP end use application		Gravity Flow	
CIPP outside diameter (host pipe inside diameter)	D =	8	in
Minimum CIPP thickness calculated	t_{calc} =	0.13 in = 3.35 mm	Greatest value calculated from ASTM F1216 Equations X1.1, X1.2, X1.3 and X1.4 (gravity flow) or greatest of X1.1, X1.2, X1.3, X1.4 and X1.7 (pressure pipe)
Minimum CIPP thickness recommended	t_{min} =	0.13 in = 3.35 mm	Based on a maximum SDR = 100
Nominal CIPP thickness to be supplied	t_{CIPP} =	4.5 mm	Rounded up to the nearest 1.5 mm to reflect standard CIPP thicknesses supplied
	SDR_{CIPP} =	45	SDR = D/t Maximum recommended SDR for CIPP is 100 per ASTM F1216

Hydraulic Calculations

CIPP inside diameter (in)	D_f =	7.6
Flow area of host pipe (ft^2)	A_f =	0.35
Flow area of CIPP (ft^2)	A_f =	0.32
Capacity of host pipe (cfs)	Q_f =	4.57
Capacity of CIPP (cfs)	Q_f =	6.07
% increase/decrease in Flow Capacity	ΔQ =	33%

$Q = 1.486 \cdot A \cdot R_H \cdot S^{1/2}$ (Manning's Equation)
where R_H = hydraulic radius = D/4 for pipe flowing full

BURTECH PIPELINE CIPP INSTALLATION PROCEDURES (AIR)

The following are guidelines for installing CIPP (Cured-in-Place Pipe). Actual field conditions can vary and thus may require adjustments or deviations from these procedures as needed.

PREPARATORY WORK

F. Clean each length of pipe to be lined and dispose of any resulting material in accordance with the cleaning and disposal procedures.

G. Control active leaks to the extent required to install the liner.

H. Provide bypass pumping of sewage flows only when necessary in conditions of flow.

I. Perform a pre-lining television inspection to document that the sewer is clean of all dirt and debris and any protruding laterals have been cut prior to lining. Burtech Pipeline shall confirm that the conditions are suitable for lining.

STORAGE AND HANDLING

C. Resin products will be stored in a refrigerated truck at the recommended storage temperature listed for each product. The resin impregnated liner shall be stored in the same manner as the resin products.

D. Precautions for safe handling of all material shall be performed by adhering to the handling guidelines stated in the manufacturer's MSDS.

RESIN IMPREGNATION

D. The liner tube shall be vacuum-impregnated with resin under controlled conditions to thoroughly saturate the tube prior to being sent for installation. The volume of resin used shall be sufficient to fill all voids in the tube material at nominal thickness and diameter, and to allow for any migration of resin into the cracks and joints of the pipe being rehabilitated.

E. In this case, factory or off site resin impregnation, the liner shall be transported and kept in a refrigerated truck until the time of installation. The refrigerated truck shall be equipped with a sealed temperature recording device that continuously monitors the temperature of the liner at all times after leaving the wet-out site. Transportation and storage of the resin impregnated liner shall be done so that the liner is not damaged, exposed to direct sunlight or creates a safety hazard.

F. For more details on the resin impregnation process refer to the section titled Spiniello CIPP Wet-Out Procedures.

INVERSION

I. No CIPP installations shall be undertaken in weather conditions that could jeopardize the installation of the CIPP, or be detrimental to the long term performance of the CIPP.

J. The first step before setting equipment up for inversion is to establish site specific safety measures and the correct traffic control. Once traffic control has been set-up the inversion tower is then erected over the manhole or point of inversion. The height of the inversion tower is adjusted to meet the required inversion head depending on the depth of the pipe to be rehabilitated. In this case, the installation is scheduled to be an air inversion, so the same depth measurement is converted into PSI. (Please note: if the inversion vessel is planned for use, the impregnated liner is already loaded into the vessel before the unit arrives on site).

K. With the portable shooter in place, the liner is then pulled into position and the open end of the down tube is turned inside out and attached to the vertical portable shooter. The liner was resin Impregnated at the factory; therefore, it will be pulled out of a refrigerated trailer. The inversion down-tube which is suspended from the portable shooter is then preformed by inverting the liner through itself. For air inversion the portable shooter is then attached to the truck using steam hose. A lubricant is then added to the inside and outside to reduce friction for a smooth inversion. The lubricant is in the form of a non-toxic oil-based product such as vegetable oil. We may also use Dawn dish-washing liquid

for the inversion process. The liner then enters through the manhole or other inversion point until it reaches the invert, at which point the inversion end is angled so that its direction of progression is straight into the direction of the host pipe to be lined. This is achieved by angling the liner in the direction of the host pipe. The angle of the liner is based on the invert in the manhole. After installed in the mouth of the invert, the procedure is to apply air in order to invert the liner. After the half way point, a can is then put on for the rest of the full inversion.

L. As the liner enters the host pipe an electrical thermocouple is placed in the invert between the tube and the pipe wall. This thermocouple placement is repeated at intermediate manholes to monitor temperatures during the curing and cool-down process.

M. Air is introduced into the down tube maintaining the required inversion pressure and air pressure is constantly regulated during the inversion process. When using air, only regulating the air supply allows the operator to slow down or speed up the inversion process. The air pressure is maintained to ensure a tight fit of the liner along the host pipe wall. The inversion process continues until the liner is completely installed to the termination point.

N. Using the air method and since the liner has reached its destination point, the pressure can be reduced and an air hose connection is then attached to the liner allowing pressure to be regulated through a device (B station) that can allow the operator to regulate both the air pressure and record the heat as the curing process takes place

O. Once the liner is in its satisfactory position and is up to size the curing process can then begin.

CURING (Resin Manufacturer's cure recommendations govern over general procedures noted below)

D. Curing shall begin immediately following inversion. Curing shall be accomplished by adding heat to the air source with the use of steam. The CONTRACTOR shall provide adequate equipment and monitoring devices in order to maintain the specified curing temperature until the CIPP has attained its ultimate exotherm.

E. For steam installation, air in the liner is heated by the introduction of steam at approximately 125 - 240 degrees F to initiate the exothermic reaction of the resin/catalyst mixture. The temperature of the liner and the resulting temperature "spike" during the exothermic reaction is monitored and recorded at the thermocouples. This information along with the size and length of the installation, equipment performance and surrounding site conditions, dictate the length of time used to hold a curing temperature in the liner.

F. The actual time required to cure a liner is left to the Contractor's discretion because of the numerous factors involved. Some of the factors that can affect the curing process are the catalyst used, the liner thickness, the material of the host pipe, the heating capacities (Boiler used), the ambient temperature and water content of the surrounding soil. Please refer to the cure schedule for more information (Appendix C).

G. After the liner has cured, it is then allowed to cool down before cutting the ends. For steam installation, the steam introduction is first stopped and compressed air continues to be circulated through the air/water until the temperature measures approximately 115 degrees F at the outgoing end (B station) or is close to sending temperature at A station. Once again the actual time required for cool down is left to the Contractor's discretion because of the numerous factors involved.

POST CURING

G. Cool down and draining of the pipe shall be undertaken in such a manner to avoid creating a vacuum in the pipe.

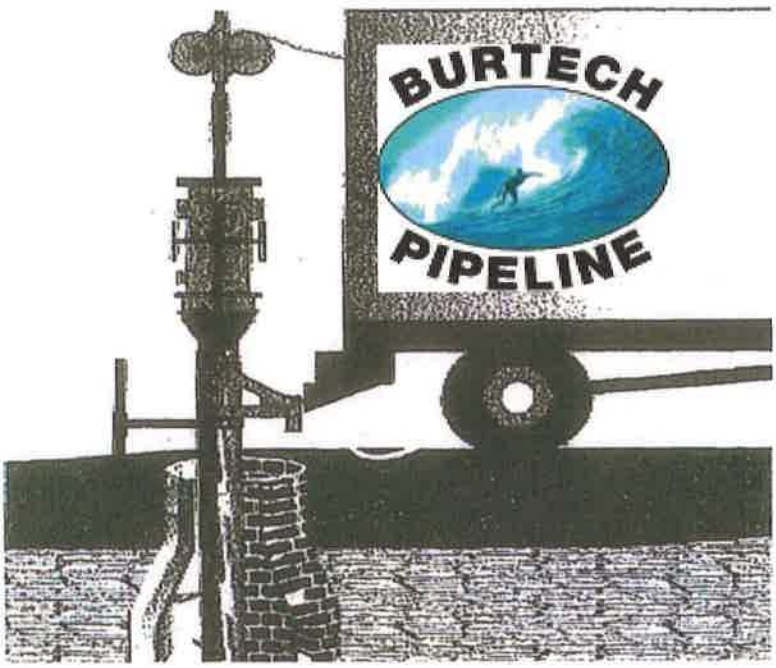
H. For each segment of liner installed, samples will be prepared and will be submitted for testing purposes per the project specifications, in accordance with ASTM F1216 and ASTM 0790. Restrained samples are preferred as noted.

I. All cutting and sealing of the liner at manhole connections shall provide watertight pipe and manhole trough seals.

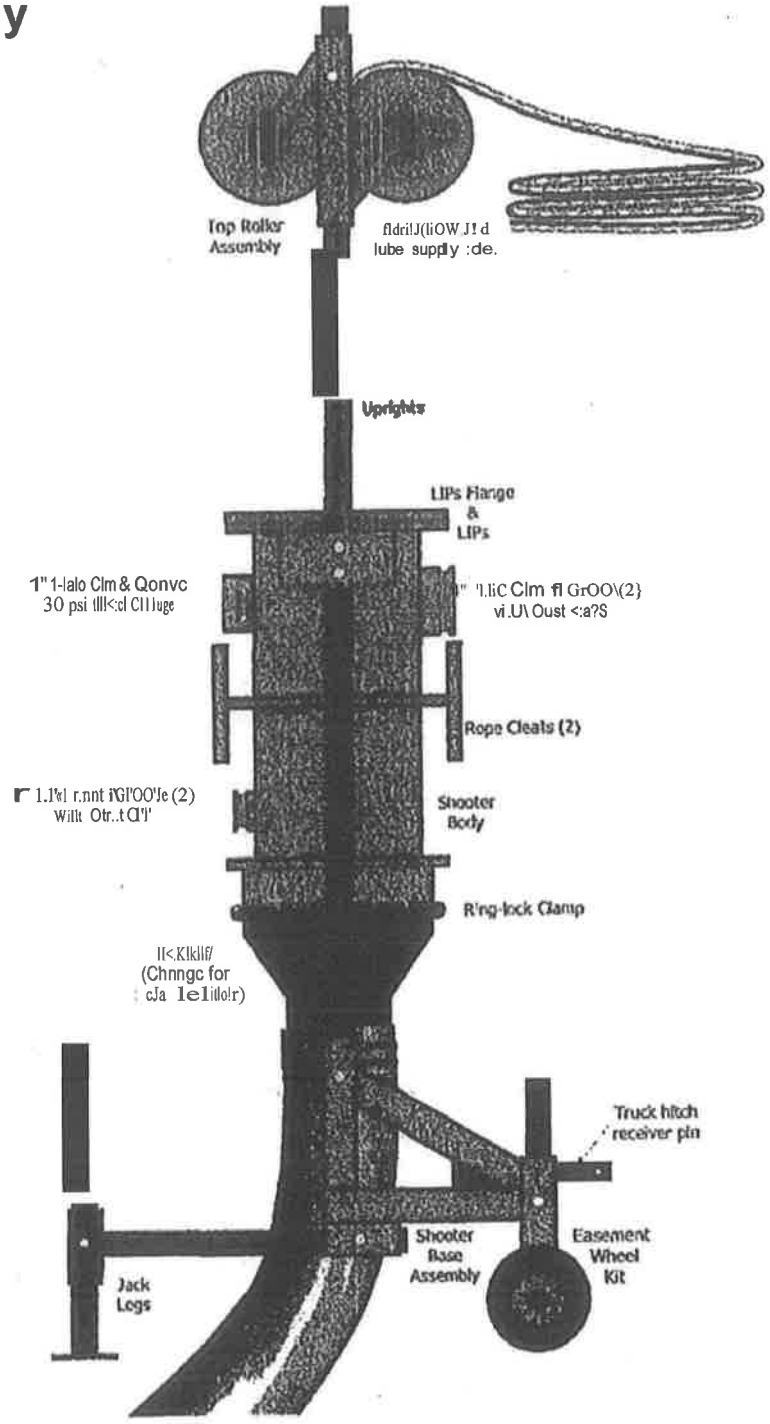
J. Any gap between installed liner and host pipe sh<:dl be fill d_using Aquatapoxy A6.

K. Following installation of the liner, the liner shall be cleaned and the debris removed. The CONTRACTOR shall then conduct a post-lining television inspection of the completed work. The post-lining television inspection shall verify the quality of the lining work, including the opening and sealing of manholes and service connections. The CONTRACTOR shall correct non-conforming lining work as noted from the post-lining inspections or otherwise noted by the ENGINEER. The CONTRACTOR shall re-televise or have still digital photographs taken to verify and document the quality of the corrective work.

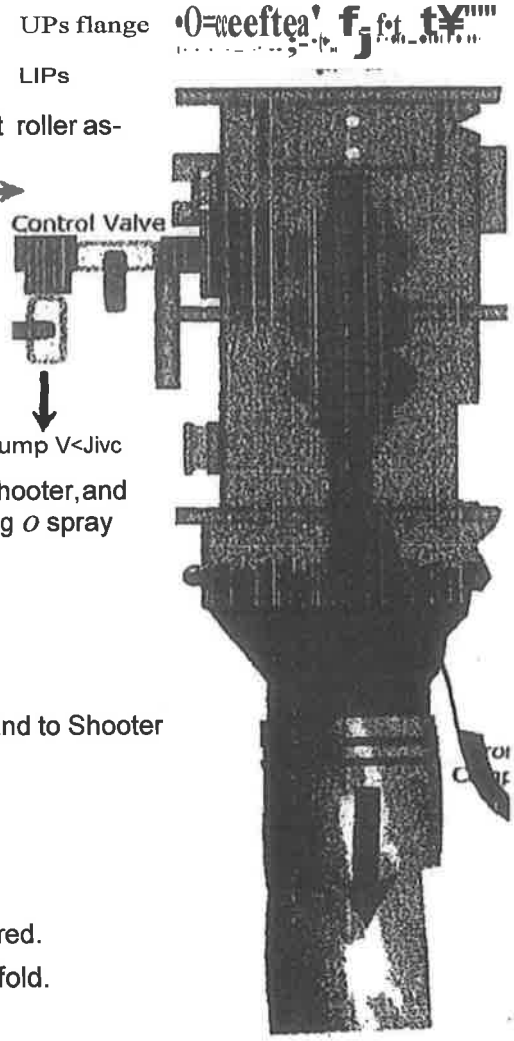
L. The CONTRACTOR shall prepare and submit internal inspection records according to the CONTRACT DOCUMENTS.


BURTECH
PIPELINE

Assembly


Top Roller Assembly
fldri!J(liOW J! d lube supply :de.
Uprights
LIPs Hange & LIPs
1" 1-lalo Clm & Qonvc 30 psi llll<:cl Cll luge
'l.liC Clm fl GrOO\(2} vi.U\ Oust <:a?S
Rope Cleats (2)
1.J'tl r.nnt iGl'OO'Je (2) Witt Otr..t Cl'l'
Shooter Body
R'ng-lock Clamp
II<.Klklif/ (Chnngc for cJa lelilo!r)
Truck hitch receiver pin
Shooter Base Assembly
Easement Wheel Kit
Jack Legs

Procedures



:> Assemble Shooter: mount legs and wheeJs as required, Insert uprights Into base ancl mount body to upri Jhts, mount roller assembly.

:> Select LIPs, adjust, and mount Into Shooter.

:> *Select* hookup uozzle and ring-lock clamp into place.

:> Thread Liner tube over flange roller e ncl between the two rollers, through the UPs and bancl onto the hookup nozzle.

:> Put at least 2 quarts of lubricant inside shooter, and • spray onto liner as It enters the LIPs using *o* spray pump.

:> t-1ount regulator manifold to upright.

:> t-lount regulator to l-inch outlet.

:> Cap the alternate outlet.

:> Connect l-Inch hose to regulator outlet and to Shooter body.

:> Open dump valve.

o Close tolltrol valve.

:> Adjust regulator to full out- · no flow.

:> Connect other hoses to regulator as desired.

:> Conrwct air supply hose to base of manifold.

:> Securely tie nil connections.

Turn on air compressor.

:> Open control valve.

:> Close dump valve.

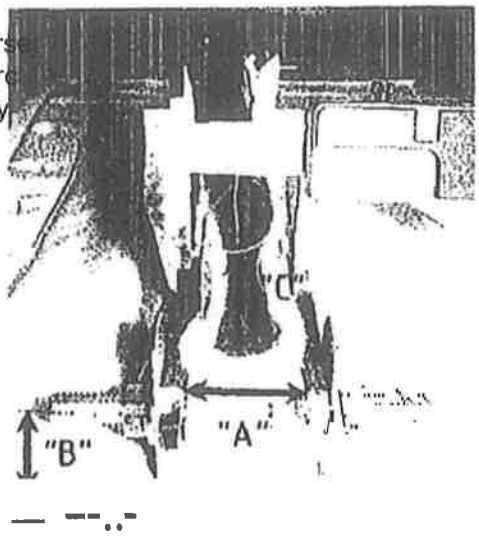
=> Slowly adjust regulntnr to Increase air flow to the Shooter.

=> f'.1onltor pressure gage on front of Shooter. Adjust pressure upward to begin inversion.

:> For street work It Is advised to remount Shooter to the reefer or other unit for Increased productivity. Use the undercarriage for easements-or mount Shooter to a tractor.

LIPs Adjustments

Set "A" to approximately your pinch roller gap setling plus 20-mrn.



:> Tlohten gap If Ups tend to nutter or re- verse during inversion. Loosen if sides or UPs are too light against flats of the Liner. factory

Setting Is 35 nun :t: 2 nun.

:> Uli<fender washers to lift studs tight "0" away from nange part of UPs.

:>• Waliher!i must be trimmed to fit into the Shooter for 12-Inch LIPs.

"C" can be trimmed shorter with a pair of sclssot·s. Shorter equals less drag—longer equals better !';eal. Try to dish them so that the flats ("D'? are shorter and the ends nre longer to get a better seal at the folcls of the laid flat liner.

:> "E" length will effect seal when inverting 10-Inch wllh a 10/12 combo UPs or 4- inch and 6·1nch with a 8/6/4 combo UPs. Shorter allows the LIPs to seal better at the ends.

:I Use a Silicone spray lubricant on the slip surfaces.

:I Lubricate! Lubricate! Lubricate! Usc a Spray nozzle to constantly lubricate the tube as it feeds Into the LIPs.

The 51tOOTER"' Is made In IhUSA

fl-" Mtc!tl Illi t..)'Itl. 'IS

Martinsville, VA 24112
276-656-1904
800-547-1235
281-874-0333 Fa"

Applied Felts Inc.

June 5,2014

Mr. Frank Durazo
Burtech Pipeline Inc.
102 Second Street,
Encinitas CA, 92024

Re: Applied Felts Recommended Curing Schedules
For Hot Water and Hot Air Curing ofCIPP

Dear Mr. Durazo,

Per your request, the standard curing schedules for all Applied Felts Liner CIPP are given below. These procedures are being sent to you as an extension of the more detailed processing information contained in the Applied Felts Liner Installation and Training Manual. Site specific project parameters may warrant deviating from these standard recommen- dations. If you feel your project has unique parameters requiring such deviations, please feel free to contact us and we shall revise the recommended curing schedule for the method of curing you are proposing to use to be consistent with those paranteters.

Hot Water Curing--

	4.5-10 mm	10.5-18 mm	19-24 mm	24.5-33 mm
Heat-up Time	15-45 min	30-60 min	> 90min	>210 min
Curing Time	180min	180 min	180 min	180min
Curing Temperature	185°F	185°F	185°F	185°F
Post-Curing Time	N/A	**60 min***	60 min*	60 min*
Cool-down Rate	60°F / hr	**30°F / hr**	20°F lhr	20°F lhr

Hot Air Curing --

	4.5-10 mrri	10.5-18 mm	19-24 mm	24.5-33 mm
Heat-up Time	10-20 min	20-35 min	>90 min	> 210 min
Curing Time	30 min	60 min	90min	90min
Curing Air Temp	195°F	195°F	185°F	185°F
Post-Curing Time	60 min	90 min	90 min	90 min
Post-Curing Air Temp	260°F, max	260°F, max	260°F, max	260°F, max
Interface Temp (PC)	140°F	125°F	125°F	125°F
Cool-down Rate	60°F /hr	30°F / hr	20°F / hr	**20°F / hr**

* If required per the stated parameters found in the National Liner Installation and Training Manual

Sincerely,

Kampbell

EdKampbell
Technical Consultant

National Liner

Designation: F1216-09

An American National Standard

Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube[1, 2]

This standard is issued under the fixed designation F1216; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice describes the procedures for the reconstruction of pipelines and conduits (4 to 108-in. diameter) by the installation of a resin-impregnated, flexible tube which is inverted into the existing conduit by use of a hydrostatic head or air pressure. The resin is cured by circulating hot water or introducing controlled steam within the tube. When cured, the finished pipe will be continuous and tight-fitting. This reconstruction process can be used in a variety of gravity and pressure applications such as sanitary sewers, storm sewers, process piping, electrical conduits, and ventilation systems.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see 7.4.2.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D638 Test Method for Tensile Properties of Plastics

D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D903 Test Method for Peel or Stripping Strength of Adhesive Bonds

D1600 Terminology for Abbreviated Terms Relating to Plastics

D3567 Practice for Determining Dimensions of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

D3839 Guide for Underground Installation of "Fiberglass" (Glass-FiberReinforced Thermosetting-Resin) Pipe

D5813 Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

E797 Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method

F412 Terminology Relating to Plastic Piping Systems

2.2 *AWWA Standard:*

Manual on Cleaning and Lining Water Mains, M 28 [4]

2.3 *NASSCO Standard:*

Recommended Specifications for Sewer Collection System Rehabilitation [5]

3. Terminology

3.1 Definitions are in accordance with Tenninology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *Definitions of Temzs Specific to This Standard:*

3.2.1 *cured-in-place pipe (CIPP)-a* hollow cylinder containing a nonwoven or a woven material, or a combination of nonwoven and woven material surrounded by a cured thermosetting resin. Plastic coatings may be included. This pipe is formed within an existing pipe. Therefore, it takes the shape of and fits tightly to the existing pipe.

3.2.2 *inversion-the* process of turning the resin-impregnated tube inside out by the use of water pressure or air pressure.

3.2.3 *lift-a* portion of the CIPP that has cured in a position such that it has pulled away from the existing pipe wall.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.67 on Trenchless Plastic Pipeline Technology.

Current edition approved March 1, 2009. Published March 2009. Originally approved in 1989. Last previous edition approved 2008 as F1216-08. DOI: 10.15201F1216-09.

The following report has been published on one of the processes: Driver, F. T and Olson. M. R., "- *Demonstration of Sewer Relining by the InsitufomJ Process, Northbrook, Illinois,"* EPA-600/2-83-064, Environmental Protection Agency. 1983. Interested parties can obtain copies from the Environmental Protection Agency or from a local technical library.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.o, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASrM Stwu/ards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from American Water Works Association (AWWA), 6666 W. Quincy Ave., Denver, CO 80235. http://www.awwa.org.

[5] Available from the National Association of Sewer Service Companies, 101 Wymore Rd., Suite 501, Altamonte, FL 32714.

*A Summary or Changes section appears at tbe end or tbis standard.

4. Significance and Use

4.1 This practice is for use by designers and specifiers, regulatory agencies, owners, and inspection organizations who are involved in the rehabilitation of conduits through the use of a resin-impregnated tube inverted through the existing conduit. As for any practice, modifications may be required for specific job conditions.

5. Materials

5.1 *Tithe-The* tube should consist of one or more layers of flexible needled felt or an equivalent nonwoven or woven material, or a combination of nonwoven and woven materials, capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system used. The material should be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube should be plastic coated with a material that is compatible with the resin system used. The tube should be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowance should be made for circumferential stretching during inversion.

5.2 *Resin-A* general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process should be used. The resin must be able to cure in the presence of water and the initiation temperature for cure should be less than 180°F (82.2°C). The CIPP system can be expected to have as a minimum the initial structural properties given in Table **1**. These physical strength properties should be determined in accordance with Section 8.

6. Design Considerations

6.1 *General Guidelines-The* design thickness of the CIPP is largely a function of the condition of the existing pipe. Design equations and details are given in Appendix XI.

7. Installation

7.I *Cleaning and Inspection:*

7.1.1 Prior to entering access areas such as manholes, and performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen must be undertaken in accordance with local, state, or federal safety regulations.

7.1.2 *Cleaning of Pipeline-All* internal debris should be removed from the original pipeline. Gravity pipes should be cleaned with hydraulically powered equipment, high-velocity jet cleaners, or mechanically powered equipment (see NASSCO Recommended Specifications for Sewer Collection System Rehabilitation). Pressure pipelines should be cleaned with cable-attached devices or fluid-propelled devices as shown in AWWA Manual on Cleaning and Lining Water Mains, M 28.

TABLE 1 CIPP Initial StructuralPropertiesA

Property	Test Method	Minimum Value	
		psi	(MPa)
Flexural strength	D790	4500	(31)
Flexural modulus	D790	250000	(1 724)
Tensile strength (for pressure pipes only)	0638	3000	(21)

"The values in Table 1 are for field inspection. The purchaser should consult the manufacturer for the long-term structural properties.

7.1.3 *Inspection of Pipelines-Inspection* of pipelines should be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television or man entry. The interior of the pipeline should be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube, such as protruding service taps, collapsed or crushed pipe, and reductions in the cross-sectional area of more than 40 %. These conditions should be noted so that they can be corrected.

7.1.4 *Line Obstntctions-The* original pipeline should be clear of obstructions such as solids, dropped joints, protruding service connections, crushed or collapsed pipe, and reductions in the cross-sectional area of more than 40 % that will prevent the insertion of the resin-impregnated tube. **If** inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then a point repair excavation should be made to uncover and remove or repair the obstruction.

7.2 *Resin Impregnation-The* tube should be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used should be sufficient to fill all voids in the tube material at nominal thickness and diameter. The volume should be adjusted by adding 5 to 10 % excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe.

7.3 *Bypassing-If* bypassing of the flow is required around the sections of pipe designated for reconstruction, the bypass should be made by plugging the line at a point upstream of the pipe to be reconstructed and pumping the flow to a downstream point or adjacent system. The pump and bypass lines should be of adequate capacity and size to handle the flow. Services within this reach will be temporarily out of service.

7.3.1 Public advisory services will be required to notify all parties whose service laterals will be out of commission and to advise against water usage until the mainline is back in service.

7.4 *Inversion:*

7.4.1 *Using Hydrostatic Head-The* wet-out tube should be inserted through an existing manhole or other approved access by means of an inversion process and the application of a hydrostatic head sufficient to fully extend it to the next designated manhole or termination point. The tube should be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the tube should be turned inside out and attached to the standpipe so that a leakproof seal is created. The inversion head should be adjusted to be of sufficient height to cause the impregnated tube to invert from point of inversion to point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care should be taken during the inversion so as not to over-stress the felt fiber.

7.4.1.1 An alternative method of installation is a top inversion. In this case, the tube is attached to a top ring and is inverted to form a standpipe from the tube itself or another method accepted by the engineer.

NOTE 1-The tube manufacturer should provide information on the maximum allowable tensile stress for the tube.

7.4.2 *Using Air Pressure-The* wet-out tube should be inserted through an existing manhole or other approved access by means of an inversion process and the application of air pressure sufficient to fully extend it to the next designated manhole or termination point. The tube should be connected by an attachment at the upper end of the guide chute so that a leakproof seal is created and with the impermeable plastic membranes side out. As the tube enters the guide chute, the tube should be turned inside out. The inversion air pressure should be adjusted to be of sufficient pressure to cause the impregnated tube to invert from point of inversion to point of termination and hold the tube tight to the pipe wall, producing dimples at side connections. Care should be taken during the inversion so as not to overstress the woven and nonwoven materials.

NOTE 2-Warning:Suitable precautions should be taken to eliminate hazards to personnel in the proximity of the construction when pressurized air is being use.

7.4.3 *Required Pressures-Before* the inversion begins, the tube manufacturer shall provide the minimum pressure required to hold the tube tight against the existing conduit, and the maximum allowable pressure so as not to damage the tube. Once the inversion has started, the pressure shall be maintained between the minimum and maximum pressures until the inversion has been completed.

7.5 *Lubricant-The* use of a lubricant during inversion is recommended to reduce friction during inversion. This lubricant should be poured into the inversion water in the downtube or applied directly to the tube. The lubricant used should be a nontoxic, oil-based product that has no detrimental effects on the tube or boiler and pump system, will not support the growth of bacteria, and will not adversely affect the fluid to be transported.

7.6 *Curing:*

7.6.1 *Using Circulating Heated Water-*After inversion is completed, a suitable heat source and water recirculation equipment are required to circulate heated water throughout the pipe. The equipment should be capable of delivering hot water throughout the section to uniformly raise the water temperature above the temperature required to effect a cure of the resin. Water temperature in the line during the cure period should be as recommended by the resin manufacturer.

7.6.1.1 The heat source should be fitted with suitable monitors to gage the temperature of the incoming and outgoing water supply. Another such gage should be placed between the impregnated tube and the pipe invert at the termination to determine the temperatures during cll!"e.

7.6.1.2 Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature should be raised to the post-cure temperature recommended by the resin manufacturer. The post-cure temperature should be held for a period as recommended by the resin manufacturer, during which time the recirculation of the water and cycling of the boiler to maintain the temperature continues. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

7.6.2 *Using Steam-After* inversion is completed, suitable steam-generating equipment is required to distribute steam throughout the pipe. The equipment should be capable of delivering steam throughout the section to uniformly raise the temperature within the pipe above the temperature required to effect a cure of the resin. The temperature in the line during the cure period should be as recommended by the resin manufacturer.

7.6.2.1 The steam-generating equipment should be fitted with a suitable monitor to gage the temperature of the outgoing steam. The temperature of the resin being cured should be monitored by placing gages between the impregnated tube and the existing pipe at both ends to determine the temperature during cure.

7.6.2.2 Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm or cure in the resin. After initial cure is reached, the temperature should be raised to post-cure temperatures recommended by the resin manufacturer. The post-cure temperature should be held for a period as recommended by the resin manufacturer, during which time the distribution and control of steam to maintain the temperature continues. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of soil).

7.6.3 *Required Pressures-As* required by the purchase agreement, the estimated maximum and minimum pressure required to hold the flexible tube tight against the existing conduit during the curing process should be provided by the seller and shall be increased to include consideration of the external ground water, if present. Once the cure has started and dimpling for laterals is completed, the required pressures should be maintained until the cure has been completed. For water or steam, the pressure should be maintained within the estimated maximum and minimum pressure during the curing process. If the steam pressure or hydrostatic head drops below the recommended minimum during the cure, the CIPP should be inspected for lifts or delarninations and evaluated for its ability to fully meet the applicable requirements of 7.8 and Section 8.

7.7 *Cool-Down:*

7.7.1 *Using Cool Water After Heated Water Cure-The* new pipe should be cooled to a temperature below 100°F (38°C) before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care

should be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.

7.7.2 *Using Cool Water After Steam Cure*-The new pipe should be cooled to a temperature below 113°F (45°C) before relieving the internal pressure within the section. Cool-down may be accomplished by the introduction of cool water into the section to replace the mixture of air and steam being drained from a small hole made in the downstream end. Care should be taken in the release of the air pressure so that a vacuum will not be developed that could damage the newly installed pipe.

7.8 *Workmanship-The* finished pipe should be continuous over the entire length of an inversion run and be free of dry spots, lifts, and delaminations. If these conditions are present, remove and replace the CIPP in these areas.

7.8.1 If the CIPP does not fit tightly against the original pipe at its termination point(s), the space between the pipes should be sealed by filling with a resin mixture compatible with the CIPP.

7.9 *Service Connections-After* the new pipe has been cured in place, the existing active service connections should be reconnected. This should generally be done without excavation, and in the case of non-man entry pipes, from the interior of the pipeline by means of a television camera and a remote-control cutting device.

8. Inspection Practices

8.1 For each inversion length designated by the owner in the Contract documents or purchase order, the preparation of a CIPP sample is required, using one of the following two methods, depending on the size of the host pipe.

8.1.1 For pipe sizes of 18 in. or less, the sample should be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

8.1.2 In medium and large-diameter applications and areas with limited access, the sample should be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the downtube when circulating heated water is used and in the silencer when steam is used. This method can also be used for sizes 18 in. or less, in situations where preparing samples in accordance with 8.1.1 can not be obtained due to physical constrains, if approved by the owner.

8.1.3 The samples for each of these cases should be large enough to provide a minimum of three specimens and a recommended five specimens for flexural testing and also for tensile testing, if applicable. The following test procedures should be followed after the sample is cured and removed.

8.1.3.1 *Short-Teml Flexural (Bending) Propellies-The* initial tangent flexural modulus of elasticity and flexural stress should be measured for gravity and pressure pipe applications in accordance with Test Methods D790 and should meet the requirements of Table L

8.1.3.2 *Tensile Propellies-Tbe* tensile strength should be measured for pressure pipe applications in accordance with Test Method D638 and must meet the requirements of Table L

8.2 *Gravity Pipe Leakage Testing-If* required by the owner in the contract documents or purchase order, gravity pipes should be tested using an exfiltration test method where the CIPP is plugged at both ends and filled with water. This test should take place after the CIPP has cooled down to ambient temperature. This test is limited to pipe lengths with no service laterals and diameters of 36 in. or less. The allowable water exfiltration for any length of pipe between termination points should not exceed 50 U.S. gallons per inch of internal pipe diameter per mile per day, providing that all air has been bled from the line. During exfiltration testing, the maximum internal pipe pressure at the lowest end should not exceed 10 ft (3.0 m) of water or 4.3 psi (29.7 kPA) and the water level inside of the inversion standpipe should be 2 ft (0.6 m) higher than the top of the pipe or 2 ft higher than the groundwater level, whichever is greater. The leakage quantity should be gaged by the water level in a temporary standpipe placed in the upstream plug.The test should be conducted for a minimum of one hour.

NoTE 3-It is impractical to test pipes above 36-in. diameter for leakage due to the technology available in the pipe rehabilitation industry. Post inspection of larger pipes will detect major leaks or blockages.

8.3 *Pressure Pipe Testing-If* required by the owner in the contract documents or purchase order, pressure pipes should be subjected to a hydrostatic pressure test. A recommended pressure and leakage test would be at twice the known working pressure or at the working pressure plus 50 psi, whichever is less. Hold this pressure for a period of two to three hours to allow for stabilization of the CIPP. After this period, the pressure test will begin for a minimum of one hour. The allowable leakage during the pressure test should be 20 U.S. gallons per inch of internal pipe diameter per mile per day, providing that all air has been evacuated from the line prior to testing and the CIPP has cooled down to ambient temperature.

NOTE 4-The allowable leakage for gravity and pressure pipe testing is a function of water loss at the end seals and trapped air in the pipe.

8.4 *Delamination Test-If* required by the owner in the contract documents or purchase order, a delamination test should be performed on each inversion length specified. The CIPP samples should be prepared in accordance with 8.1.2, except that a portion of the tube material in the sample should be dry and isolated from the resin in order to separate tube layers for testing. (Consult the tube manufacturer for further information.) Delamination testing shall be in accordance with Test Method D903, with the following exceptions:

8.4.1 The rate of travel of the power-actuated grip shall be 1 in. (25 mm)/min.

8.4.2 Five test specimens shall be tested for each inversion specified.

8.4.3 The thickness of the test specimen shall be minimized, but should be sufficient to adequately test delamination of nonhomogeneous CIPP layers.

8.5 The peel or stripping strength between any nonhomogeneous layers of the CIPP laminate should be a minimum of 10 lb/in. (178.60 g/mm) of width for typical CIPP applications.

NoTE 5-The purchaser may designate the dissimilar layers between which the delamination test will be conducted.

NoTE 6-For additional details on conducting the delamination test, contact the CIPP contractor.

8.6 *CIPP Wall Thickness-The* method of obtaining CIPP wall thickness measurements should be determined in a manner consistent with 8.1.2 of Specification D5813. Thickness measurements should be made in accordance with Practice D3567 for samples prepared in accordance with 8.1. Make a minimum of eight measurements at evenly spaced intervals around the circumference of the pipe to ensure that minimum and maximum thicknesses have been determined. Deduct from the measured values the thickness of any plastic coatings or CIPP layers not included in the structural design of the CIPP. The average thickness should be calculated using all measured values and shall meet or exceed minimum design thickness as agreed upon between purchaser and seller. The minimum wall thickness at any point shall not be less than 87.5% of the specified design thickness as agreed upon between purchase and seller.

8.6.1 *Ultrasonic Testing of Wall Thickness-An* alternative method to 8.6 for measuring the wall thickness may be performed within the installed CIPP at either end of the pipe by the ultrasonic pulse echo method as described in Practice E797. A minimum of eight (8) evenly spaced measurements should be made around the internal circumference of the installed CIPP within the host pipe at a distance of 12 to 18 in. from the end of the pipe. For pipe diameters of fifteen (15) in. or greater, a minimum of sixteen (16) evenly spaced measurements shall be recorded. The ultrasonic method to be used is the flaw detector with A-scan display and direct thickness readout as defined in 6.1.2 of E797. A calibration block shall be manufactured from the identical materials used in the installed CIPP to calibrate sound velocity through the liner. Calibration of the transducer shall be performed daily in accordance with the equipment manufacturer's recommendations. The average thickness should be calculated using all measured values and shall meet or exceed minimum design thickness as agreed upon between purchaser and seller. The minimum wall thickness at any point shall not be less than 87.5 % of the specified design thickness as agreed upon between purchaser and seller.

8.7 *Inspection and Acceptance-The* installation may be inspected visually if appropriate, or by closed-circuit television if visual inspection cannot be accomplished. Variations from true line and grade may be inherent because of the conditions of the original piping. No infiltration of groundwater should be observed. All service entrances should be accounted for and be unobstructed.

APPENDIXES

(Nonmandatory Information) XI.

DESIGN CONSIDERATIONS

X1.1 *Tenninology:*

X1.1.1 *partially deteriorated pipe-the* original pipe can support the soil and surcharge loads throughout the design life of the rehabilitated pipe. The soil adjacent to the existing pipe must provide adequate side support. The pipe may have longitudinal cracks and up to 10.0% distortion of the diameter. If the distortion of the diameter is greater than 10.0%, alternative design methods are required (see Note 1).

X1.1.2 *fully deteriorated pipe-the* original pipe is not structurally sound and cannot support soil and live loads or is expected to reach this condition over the design life of the rehabilitated pipe. This condition is evident when sections of the original pipe are missing, the pipe has lost its original shape, or the pipe has corroded due to the effects of the fluid, atmosphere, soil, or applied loads.

X1.2 *Gravity Pipe:*

X1.2.1 *Partially Deteriorated Gravity Pipe Condition-The* CIPP is designed to support the hydraulic loads due to groundwater, since the soil and surcharge loads can be supported by the original pipe. The groundwater level should be determined by the purchaser and the thickness of the CIPP should be sufficient to withstand this hydrostatic pressure without coiJapsing. The following equation may be used to determine the thickness required:

$$P = \frac{2}{(1-\mu^2)} \cdot K \cdot (DR-1)^3 \cdot \frac{C}{N} \qquad \text{(XI.I)}$$

where:

p = groundwater load, psi (MPa), measured from the invert of the pipe

K = enhancement factor of the soil and existing pipe adjacent to the new pipe (a minimum value of 7.0 is recommended where there is full support of the existing pipe),

EL = long-term (time corrected) modulus of elasticity for CIPP, psi (MPa) (see Note XL I),

μ = Poisson's ratio (0.3 average),

DR = dimension ratio of CIPP,

C = ovality reduction factor =

$$\left(\left[1-\frac{\Delta}{100}\right]/\left[1+\frac{\Delta}{100}\right]^2\right)^3$$

Δ = percentage ovality of original pipe =

$$100 \times \frac{(\text{Mew1 Inside Diameter} - \text{Minimum Inside Diameter})}{\text{Mew1 Inside Diwneter}}$$

or

$$100 \times \frac{(\text{Maximum Inside Dimneter} - \text{Mean Inside Diameter})}{\text{Mean Inside Diameter}}$$

and

N = factor of safety.

NOTE X1.1-The choice of value (from manufacturer's literature) of EL will depend on the estimated duration of the application of the load, P, in relation to the design life of the structure. For example, if the total duration of the load, P, is estimated to be 50 years, either continuously applied, or the sum of interminent periods of loading, the appropriately conservative choice of value for EL will be that given for 50 years of continuous loading at the maximum ground or fluid temperature expected to be reached over the life of the structure.

NoTE X1.2-If there is no groundwater above the pipe invert, the CIPP should typically have a maximum *SDR* of 100, dependent upon design conditions.

X1.2.1.1 If the original pipe is oval, the CIPP design from Eq X1.1 shall have a minimum thickness as calculated by the following formula:

$$1.5 \geq \left(\frac{1}{1+B'}\right)\left(\frac{1}{DR}\right)^2 - 0.5\left(\frac{1}{1+B'}\right)\left(\frac{1}{DR}\right) \quad \text{(X1.2)}$$

where:

Ch = long-term (time corrected) flexural strength for CIPP, psi (MPa) (see Note X1.5).

X1.2.1.2 See Table X1.1 for typical design calculations.

X1.2.2 *Fully Deteriorated Gravity Pipe Condition-The* CIPP is designed to support hydraulic, soil, and live loads. The groundwater level, soil type and depth, and live load should be determined by the purchaser, and the following equation should be used to calculate the CIPP thickness required to withstand these loads without collapsing:

$$q_t = \frac{1}{N}[32R_w B' E'_s \cdot C(E_L/nY)]^{1/2} \quad \text{(X1.3)}$$

TABLE X1.1 Maximum Groundwater Loads for Partially Deteriorated Gravity Pipe Condition

Diameter, in. (Inside Diameter of Original Pipe)	Nominal CIPP Thickness, mm	CIPP Thickness, t, in.	Maximum Allowable Groundwater Load"' (above invert)	
			It	m
a	6	0236	40.0	12.2
10	6	0.236	20.1	6.1
12	6	0.236	11.5	3.5
15	9	0.354	20.1	6.1
18	9	0.354	11.5	3.5
18	12	0.472	27.8	8.5
24	12	0.472	11.5	3.5
24	15	0.591	22.8	6.9
30	15	0.591	11.5	3.5
30	18	0.709	20.1	6.1

"'Assumes K = 7.0, E = 125 000 psi (862 MPa) (50-year strength), ν = 0.30, C = 0.64 (5 % ovality), and N = 2.0

where:

q_t = total external pressure on pipe, psi (MPa),
= **0.433Hw+ \V 144 + Ws, (English Units)**
0.00981Hw+ wHRwfl000 + W., (Metric Units)

Rw = water buoyancy factor (0.67 min) = I – 0.33 H. pf).

w = soil density, lb.lf(KN/m),

Ws live load, psi (Mpa),

Hw height of water above top of pipe, ft (m)

H = height of soil above top of pipe, ft (m),

B' = coefficient of elastic support = l/(1 + 4e-0.06SH) inch-pound units, (1/(1 + 4e-0.213H) SI units

I = moment of inertia of CIPP, in.4/in. (rnm4/mm) = *r3t12,*

t = thickness of CIPP, in. (mm),

C ovality reduction factor (see X1.2.1),

N = factor of safety,

E'_s = modulus of soil reaction, psi (MPa) (see Note X1.4),

EL = long-term modulus of elasticity for CIPP, psi (MPa), and

D = mean inside diameter of original pipe, in. (mm)

X1.2.2.1 The CIPP design from Eq X1.3 should have a minimum thickness as calculated by the following formula:

$$D_3 = IZ(DR)_3 2{:}0.093 \frac{EI}{E} \textit{ (inch-pound units),} \quad \text{(X1.4)}$$

or

$$IZ(DR)_7 2{:}\ 0.00064 \frac{E}{\textit{(Siunits)}}$$

where:

E = initial modulus of elasticity, psi (MPa)

NoTE XI.3-For pipelines at depth not subject to construction disturbance, or if the pipeline was originally installed using tunneling method, the soil load may be calculated using a tunnel load analysis. Fmite element analysis is an alternative design method for noncircular pipes.

NOTE XI.4-For definition of modulus of soil reaction, see Practice D3839.

X1.2.2.2 The minimum CIPP design thickness for a fully deteriorated condition should also meet the requirements of Eq X1.1 and X1.2.

X1.3 *Pressure Pipe:*

X1.3.1 *Partially Deteriorated Pressure Condition-A* CIPP installed in an existing underground pipe is designed to support external hydrostatic loads due to groundwater as well as withstand the internal pressure in spanning across any holes in the original pipe wall. The results of Eq X1.1 are compared to those from Eq X1.6 or Eq X1.7, as directed by Eq X1.5, and the largest of the thicknesses is selected. In an above-ground design condition, the CIPP is designed to withstand the internal pressure only by using Eq XI.5-X1.7 as applicable.

X1.3.1.1 If the ratio of the hole in the original pipe wall to the pipe diameter does not exceed the quantity shown in Eq X1.5, then the CIPP is assumed to be a circular flat plate fixed

at the edge and subjected to transverse pressure only. In this case, Eq X1.6 is used for design. For holes larger than the diD value in Eq X1.5, the liner cannot be considered in flat plate loading, but rather in ring tension or hoop stress, and Eq X1.7 is used.

$$t = 1.83 \left(\frac{d}{D}\right) 1/2 \qquad \text{(X1.5)}$$

where:

d = diameter of hole or opening in original pipe wall, in. (mm),
D = mean inside diameter of original pipe, in. (mm), and
= thickness of CIPP, in. (mm).

$$p = \frac{5.33}{(DR-1)^2}\left(\frac{D}{d}\right)^2 \frac{\sigma_{CYL}}{N} \qquad \text{(X1.6)}$$

where:

DR = dimension ratio of CIPP,
D = mean inside diameter of original pipe, in. (mm),
d = diameter of hole or opening in original pipe wall, in. (rom),
σ_{TL} = long-term (time corrected) flexural strength for CIPP, psi (MPa) (see Note X1.5), and
N = factor of safety.

NOTE X1.5-The choice of value (from manufacturer's literature) of σ_{TL} will depend on the estimated duration of the application of the load, P, in relation to the design life of the structure. For example, if the total duration of the load, P, is estimated to be 50 years, either continuously applied, or the sum of intennittent periods of loading, the appropriately conservative choice of value of σ_{TL} will be that given for 50 years of continuous loading at the maximum ground or Ouid temperature expected to be reached over the life of the structure.

X1.3.2 *Fully Deteriorated Pressure Pipe Condition-A* CIPP to be installed in an underground condition is designed to withstand all external loads and the full internal pressure. The design thicknesses are calculated from Eq X1.I, Eq X1.3, Eq X1.4, and Eq X1.7, and the largest thickness is selected. If the pipe is above ground, the CIPP is designed to withstand internal pressure only by using Eq X1.7.

$$P = \frac{2\sigma_{TL}}{(DR-2)N} \qquad \text{(X1.7)}$$

where:

P = internal pressure, psi (MPa),
σ_{TL} = long-term (time corrected) tensile strength for CIPP, psi (MPa) (see Note 12),
DR = dimension ratio of CIPP, and
N = factor of safety.

NoTE X1.6-The choice of value (from manufactur·s literature) of σ_{TL} will depend on the estimated duration of the application of the load, P, in relation to the design life of the structure. For example, if the total duration of the load, P, is estimated to be 50 years, either continuously applied, or the sum of intennittent periods of loading, the appropriately conservative choice of value of σ_{TL} will be that given for 50 years of continuous loading at the maximum ground or Ouid temperature expected to be reached over the life of the structure.

X1.4 *-Negative Pressure-Where* the pipe is subject to a vacuum, the CIPP should be designed as a gravity pipe with the external hydrostatic pressure increased by an amount equal to the negative pressure.

NoTE X1.7-Table X1.1 presents maximum groundwater loads for partially deteriorated pipes for selected typical nominal pipe sizes. CIPP is custom made to fit the original pipe and can be fabricated to a variety of sizes from 4 to 96-in. diameter which would be impractical to list here.

X2. CHEMICAL-RESISTANCE TESTS

X2.1 *Scope:*

X2.1.1 This appendix covers the test procedures for chemical-resistance properties of CIPP. Minimum standards are presented for standard domestic sewer applications.

X2.2 *Procedure for Chemical-Resistance Testing:*

X2.2.1 Chemical resistance tests should be completed in accordance with Practices D543. Exposure should be for a minimum of one month at 73.4°F (23°C). During this period, the CIPP test specimens should lose no more than 20 % of their initial flexural strength and flexural modulus when tested in accordance with Section 8 of this practice.

X2.2.2 Table X2.1 presents a list of chemical solutions that serve as a recommended minimum requirement for the chemical-resistant properties of CIPP in standard domestic sanitary sewer applications.

X2.2.3 For applications other than standard domestic sewage, it is recommended that chemical-resistance tests be conducted with actual samples of the fluid flowing in the pipe. These tests can also be accomplished by depositing CIPP test specimens in the active pipe.

TABLE X2.1 Minimum Chemical Resistance Requirements for Domestic Sanitary Sewer Applications

Chemical Solution	Concentration, o/o
Tap water (pH 6-9)	100
Nitric acid	5
Phosphoric acid	10
Sulfuric acid	10
Gasoline	100
Vegetable oil	100
Detergent	0.1
Soap	0.1

SUMMARY OF CHANGES

Committee **F17** has identified the location of selected changes to this standard since the last issue (Fl216-08) that may impact the use of this standard. (Approved March I, 2009.)

(1) 8.1, 8.1.1 and 8.1.2 were revised.

Committee Fl7 has identified the location of selected changes to this standard since the last issue (Fl217-07b) that may impact the use of this standard.

(1) Added Practices D3567, E797, and Specification D5813 to Section 2, Reference Documents.
(2) Added 8.6 and 8.6.1 to include an alternative method of wall thickness measurement by Ultrasonic Methods.
(3) Renumbered Inspection and Acceptance from 8.6 to 8.7.

STEAM CURING PROCEDURE
6-INCH THRU 24-INCH DIAMETERS
10.22.08

SAFETY CONCERNS

1. This procedure involves using low-pressure air. Proper safety precautions should be adopted and practiced by the installation personnel. National Liner® recommends using end fittings and other devices that the Installer has confidence will provide reasonable safety against separating during curing of the liner. Components that could become projectiles should be tethered to control the reach of their flight.

2. This procedure involves using steam to heat the ah· to temperatures up to 260°F. Proper safety precautions should be adopted and practiced by the installation personnel to avoid bum injuries. Steam is hotter than heated water and can bum personnel more quickly. Potential areas of steam escaping the system during curing should be respected and adequately restricted.

THE PROCEDURE

1. Inve1t the resin-impregnated tube into the pipeline using air pressure at approximately the same recommended heads for installing the impregnated tube with water (i.e., depending on length of the inversion 8" at 10 to 15psi). On longer installation lengths it might be necessary to add a small amount of water to facilitate the inversion process.

2. Once in place and properly inflated, continue discharging air at the downstream end while maintaining the recommended expansion pressure (Installation note: If the pipeline is below the water table, 1psi must be added to the recommended expansion pressure for each 2.3 feet of external hydrostatic head on the host pipe (measured from the flowline of the host pipe)). Start the steam generator and, when ready, begin to discharge steam until an air temperature of 190°F (88°C) is obtained entering the liner. Maintain this temperature until an exotherm is observed at the downstream end (or the liner is hardened at all observable points); typically this will be achieved in 10-45 minutes depending upon the diameter and length of reach being renewed.

3. While continuing to maintain the recommended expansion pressure, increase the flow of steam allowing the temperature to rise to its maximum value. This will typically necessitate the operator throttling back the air supply to achieve this maximum temperature. Do not, however, allow the air temperature measured at the inlet to the liner to exceed 260°F (127°C). This will begin the liner's post-curing phase. Observe the temperatures at the various interfaces and begin timing.

4. PLEASE NOTE. THE APPLIED FELTS PU COATING HAS A MAXIMUM TEMPERATURE CAPABILITY OF 400°F (204°C); DO NOT ALLOW THE STEAM TO REACH THIS TEMPERATURE OR MELTING OF THE PU COATING CAN OCCUR.

5. Continue post-curing at the above conditions until the temperatures measured at all points along the host pipe-liner pipe interface have read at or above 140°F (60°C) for at least 60 minutes for liners 4.5mm to 9.0mm in thickness and 126°F (52°C) for at least 90 minutes for liners 9.5mm to 13.5mm in thickness.

6. Once the post-curing portion of the process is complete, discontinue the addition of steam, continue to maintain the curing pressure, and allow maximum ventilation to occur using the air flow only. Continue this cool down process until the temperature gauge at the secondary monitoring station rep01ts a value below 100°F (38°C). Water may be introduced into the liner during this process to facilitate the cooling process. You may also deploy a chiller on the air. In any event, the cool down rate of the liner (NOT THE AIR) should be no greater than that specified in the National Liner Manual for the thicknesses being processed which are repeated below:

4.5- 9.0mm	20.0°F /15 minutes
9.5-13.5mm	10.0°F /15 minutes

PLEASE NOTE-COOLING THE LINER TOO QUICKLY OR UNEVENLY WILL RESULT IN THERMAL SHOCK TO THE I\TEW LINER AND COULD RESULT IN A CIRCUMFERENTIAL SEPARATION (A CRACK) OF THE NEW LINER AT ONE OR MORE POINTS ALONG ITS LENGTH. IN THE EVENT THAT THE RATE OF COOLING IS OBSERVED TO BE FASTER THAN SHOWN ABOVE, STEAM MUST BE ADDED TO THE COOLING AIR IN AN AMOUNT THAT BRINGS THE RATE OF COOLING INTO COMPLIANCE WITH THE ABOVE STATED RATES.

7. Once cool down is complete, the ends of liner can be opened. Inspect finished line for defects; con-ect any identified deficiencies. Re-instate the laterals.

Burtech Pipeline Project References – CIPP

Project / Description	Owner / Contact	Contract Amount	Date
2010 Pipeline Rehabilitation Phase K1 CIPP lining of 36,465 LF of 8-inch diameter sanitary sewer. Point Repairs, Cleanout Installations, Manhole Rehabilitation, 781 Top Hats (SLC's) and 781 Lateral Launch Video	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Reagan Owen , R.E. 619-533-5205	2,225,000.00	10/11/2013
2010 Sewer Main Rehabilitation Phase J-1D CIPP lining of 61,050 LF of 8-inch diameter sanitary sewer. Point Repairs, Cleanout Installations, Manhole Rehabilitation, 990 Top Hats (SLC's) and 990 Lateral Launch Video	City of San Diego 11010 2nd Avenue., Ste. 800 San Diego, CA 92101 Steve Frick , R.E. 619-533-3409	3,515,000.00	3/22/2013
2011 Pipeline Rehabilitation Phase N-1 CIPP lining of 44,510 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 1,032 Top Hats (SLC's) and 1,032 Lateral Launch Video, 1,032 4-inch CIPP Lateral Installation & Cleanouts	City of San Diego 600 B Street., Ste. 800 San Diego, CA 92101 Maryam Liaghat , R.E. 619-533-4641	5,907,193.00	3/14/2014
2012 Sewer & Water Group 761 CIPP lining of 2,020 LF of 8-inch and 10-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 43 Top Hats (SLC's) and 43 Lateral Launch Video, 3,000 LF of 4-inch CIPP Lateral Installation.	City of San Diego 1010 2nd Avenue., Ste. 1400 San Diego, CA 92101 Chris Gascon, R.E. 619-533-7418	2,712,835.81	12/19/2013
2012 Pipeline Rehabilitation Phase M-1 CIPP lining of 27,043 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 407 Top Hats (SLC's) and 407 Lateral Launch Video, 407 4-inch CIPP Lateral Installation.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Reagan Owen , R.E. 619-533-5205	2,810,251.51	6/17/2014
2012 Pipeline Rehabilitation Phase S-1 CIPP lining of 36,707 LF of 6-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 930 Top Hats (SLC's) and 930 Lateral Launch Video, 929 4-inch CIPP Lateral Installation.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Luis Schaar , R.E. 619-533-4641	4,343,851.40	7/21/2014
2010 Sewer & Water Group 734 CIPP lining of 503 LF of 8-inch and 3,994 LF sanitary sewer replacement. Point Repairs, Manhole Rehabilitation, Top Hats (SLC's), 4-inch CIPP Lateral Installation.	City of San Diego 600 B Street, Ste. 800 San Diego, CA 92101 Akram Bassyouni , R.E. 619-533-6902	588,355.90	11/10/2011

Burtech Pipeline Project References – CIPP

2013 Sewer & Water Group 758 CIPP lining of 2,612 LF of 8-inch and 10,135 LF sanitary sewer replacement. Point Repairs, Manhole Rehabilitation, 30 (SLC's), CIPP Lateral Installation, Bypass Pumping.	City of San Diego 1200 Third Avenue., Ste. 200 San Diego, CA 92101 Luis Schaar , R.E. 619-533-4641	4,434,852.02	On Going
2012 Sewer & Water Group 799 CIPP lining of 4,467 LF of 6" & 8" CIPP, Sanitary Sewer Main Replacement. Point Repairs, Manhole Rehabilitation, Service Lateral Connections, Bypass Pumping.	City of San Diego 600 B Street, Ste. 800 San Diego, CA 92101 Jericho Gallardo , R.E. 619-533-7523	5,257,792.05	On Going
2013 Sewer & Water Group 720 CIPP lining of 621 LF of 6-inch, Sanitary Sewer Main Replacement. Point Repairs, Manhole Rehabilitation, Service Lateral Connections, Bypass Pumping.	City of San Diego 525 B Street, MS 908A San Diego, CA 92101 Bijan Shakiba , R.E. 619-533-5191	2,378,259.67	On Going
2014 Wing Ave Flood Control Clean/CCTV & CIPP lining of 159 LF of 18-inch & 24-inch Storm Drain, Flow Diversion.	Flatiron 1770 La Costa Meadows Drive San Marcos, Ca 92708 Ruben Claudio 760-916-9100	33,030.00	5/28/2014
2014 Pipeline Rehabilitation Phase W-1 CIPP lining of 21,754 LF of 8-inch diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 425 Top Hats (SLC's) and 425 Lateral Launch Video, 425 4-inch CIPP Lateral Installation.	City of San Diego 525 B Street, Ste. 750 San Diego, CA 92101 Maryam Liaghat , P.E. 619-533-5192	2,465,095.10	On Going
2014 Sewer Rehabilitation Project No. 9 CIPP lining of 9,166 LF of 8" & 10" diameter sanitary sewer. Clean & CCTV, Bypass Pumping	Los Angeles Dept. of Public Works 900 South Fremont Ave Alhambra, CA 90014 Attn: Jose Pou 626-458-2191	232,000.00	Start 9/2/2014 Finish 10/31/2014
2014 Pipeline Rehabilitation Phase X-1 CIPP lining of 4,092 LF of 6", 8", 10" & 15" diameter sanitary sewer. Point Repairs, Manhole Rehabilitation, 44 Service Lateral Connections and 44 Lateral Launch Video, 44 CIPP Lateral Installation.	City of San Diego 9485 Aero Drive San Diego, CA 92101 Jericho Gallardo , R.E. 619-533-7523	513,000.00	Projected Start 9/15/2014

Burtech Pipeline Project References – CIPP

2014 Sewer Pipeline and Storm Drain Repairs CIPP lining of 3,367 LF of 6", 8" & 18" diameter sanitary sewer & Storm Drain. Point Repairs, Manhole Rehabilitation,	City of Solana Beach 9485 Aero Drive Solana Beach , CA 92075 Taryn Kjolsing 858-720-2470	455,414.50	Start 9/22/2014 Finish 11/26/2014
2014 Sewer & Water Group 833 CIPP lining of 3,876 LF of 6", 8" and 10" Sanitary Sewer Main Replacement. Point Repairs, Manhole Rehabilitation, Service Lateral Connections, Bypass Pumping.	City of San Diego 525 B Street, MS 908A San Diego, CA 92101 Bijan Shakiba , R.E. 619-533-5191	513,000.00	Start 12/1/2014

Burtech Pipeline Project References – CIPP

Burtech Pipeline Project References – CIPP

Burtech Pipeline Project References – CIPP

Martin Carmona

Superintendent
West Coast Region

Education

- B.S. Education – General Matias Ramos College, Zacatecas, Mexico – 1984
- Federal #4 High School, Victoria, Mexico

Training

- Confined Space Training
- CCTV, Lateral Cutting and Chemical Grouting

Professional Experience

With Over twenty years experience in the construction and pipeline rehabilitation industry, Mr. Carmona has progressed from a Technician, Supervisor and Superintendent in the Rib Loc, Cured-In-Place, and Fold & Form pipelining methods. Additionally he has successfully trained all CCTV and Cutter operators for Burtech Pipeline.

Burtech Pipeline
Foreman
Oversee Cutting and CCTV Crew
Operation and maintenance of Cues equipment
Development and training of new employees.
Continuing education and research for development of efficiencies for lateral cutting.
Investigation, development and training of new technologies.

Repipe-California
Lead Superintendent
Oversee all CCTV, Cutting and Lateral Grouting crews
Operation and maintenance of Cues equipment
Development and training of new employees.
Continuing education and research for development of efficiencies for lateral cutting.
Investigation, development and training of new technologies.
Developer of the Lateral Measurement Device.
Management of projects and employees.

Preussag Pipe Rehabilitation, Inc.
CCTV, Cutting and Pipe Installation Superintendent
Operation and maintenance of Cues equipment.
Coordination of the Training for new technicians.
Research and development for efficiency of lateral cutting.
Developer of the Lateral Measurement Device.
Management of projects and employees.

Preussag Pipe Rehabilitation Inc.
Cutter Supervisor
Training and supervision of all PPR Cutters.
Communication with Cues for necessary equipment modification.
Modification of cutting and camera equipment to improve effiency,
Coordination of daily construction activities with PPR superintendents.
Operation of CCTV and Cutting equipment.
Oversaw PPR field crews.
Communication with owner field representatives and inspectors.
Management of PPR field activities, project schedules and crew production.
Identification of project change conditions.
Management of project labor costs.
Maintenance of Site Safety Programs.
Training of PPR cutters and laborers.
Assistance in planning and project set-up.

Management and maintenance of PPR CCTV/Cutter trucks and equipment.

CAT Contracting
CCCTV, Cured-in-place Forman
Performed operation of RST Equipment.
Operation and maintenance of Cues Kangaroo, Beaver Robotics.
Cured-In-Place Pipe Foreman.
Boiler Operator.

Insituform Technologies,
CCTV Cutting and Training Superviors
Coordination of the training of new cutting technicians.
Scheduling of technicians to meet production demands.
Coordination with Superintendents' daily activities.

Insituform Southwest
Operation of RST CCTV Equipment
Operation maintenance and repair of technical underground and Beaver Robotic lateral reinstatement equipment.
CCTV Crew Leader.
Cured-In-Place Crew Forman, Fold and Form Pipe Installer.

Insituform Technologies
CCTV Technician
Operation of underground surveyor's equipment.
Maintenance of cameras and transporters.
Installation of Cured-In-Place pipe liner.

Frank Durazo

Operations Manager
West Coast Region

Education

- Rio Hondo Community College
- Arroyo High School, El Monte, CA

Training

- Small Crane Truck Certificate
- Commercial Class A Drivers License,
- Forklift certification.

Certifications

- 1995 Employee of the Year – Insituform Southwest.

Professional Experience

Mr. Durazo has over fifteen years experience in the trenchless technology industry with experience in Cured-In-Place and Rib Loc pipelining processes including CIPP Wetout. Using his expertise he has progressed from a supervisor to Warehouse Foreman and was promoted to the position of Project Manager.

Burtech Pipeline
Operations Manager

- Leads scheduling, managing and organization of Burtech Pipeline field activities.
- Provides technical and project approach guidance to Burtech Pipeline field personnel.
- Communicates with owner's field representatives, site engineers, inspectors and subcontractor supervisors on project-related matters.
- Assist GM and Estimator with Project Estimates for bids
- Analyze and solve all field-related problems (Equipment, Installation, Personnel, Etc.).
- Develop and implement sewer bypass systems. Train field employees with proper use.
- Identifies, initiates and controls project revisions and field changes.
- Reviews project costs and assists in developing project budgets.

Repipe-California, Inc., Ontario, CA
Operations Manager

- Leads scheduling, managing and organization of Repipe-CA field activities.
- Provides technical and project approach guidance to Repipe-CA field personnel.
- Communicates with owner's field representatives, site engineers, inspectors and subcontractor supervisors on project-related matters.
- Assist GM and Estimator with Project Estimates for bids
- Analyze and solve all field-related problems (Equipment, Installation, Personnel, Etc.).
- Develop and implement sewer bypass systems. Train field employees with proper use.
- Identifies, initiates and controls project revisions and field changes.
- Reviews project costs and assists in developing project budgets.

Repipe-California, Inc. Ontario, CA
Project Manager/Project Scheduler

- Responsible for scheduling and ordering of all lining materials, wet-out and delivery.
- Manage multiple CIPP and Rib Loc projects simultaneously from $100k to $2.5M.
- Review of job costs to ensure profitable projects.

- Prepare submittals, schedules, cost estimates, and interact with clients and contractors
- Assist GM and Estimator with Project Estimates for bids

Repipe-California, Inc, Santa Ana, CA
Warehouse Foreman/Project Scheduler

- Responsible for scheduling and ordering of all lining materials, wet-out and delivery.
- Maintain and repair of all Repipe-CA construction equipment and vehicles, management of all inventory and job-related materials, ordering of equipment materials and supplies, assistance to field as required on-site with Rib Loc, or CIPP installations, and establishment and maintenance of warehouse operations.
- Identify and negotiate with new suppliers
- Performs as the acting Safety Director and assures that OSHA safety compliance is adhered to in the field, corporate office and within the warehouse environment.

Preussag Pipe Rehabilitation
Warehouse Foreman

- Responsible for the maintenance and repair of all PPR construction equipment and vehicles, management of all inventory and job-related materials, ordering of equipment materials and supplies, assistance to field as required on-site with RibLoc, or CIPP installations, and establishment and maintenance of warehouse operations.
- Responsible for resourcing equipment and material vendors.
- Mechanical assistance to jobsite and field personnel.
- Oversee Driver Vehicle Inspection Reports and Driver Daily Logs for DOT Bit Inspections and coordinates quarterly maintenance for corporate fleet in preparation of DOT bit inspections.
- Performs as the acting Safety Director and assures that OSHA safety compliance is adhered to in the field, corporate office and within the warehouse environment.

National Liner-West, Gardena, CA
Installation Supervisor

- Supervision of the impregnation and installation for Cured-In-Place trenchless lining system for the Western Region of the United States.
- Installation Supervisor for 10 crewmembers for the U-Liner Fold and Form Lining System.
- Additional responsibilities included daily reporting to inspectors from various cities and counties, purchasing and ordering of equipment and materials and scheduling of equipment and personnel for projects.

Cooke Pipeline Rehabilitation
Installation Supervisor

- Supervision for the impregnation and installation procedures for Cured-In-Place trenchless pipeliners and the Ultra-Liner Fold and Form System pipelining system.

- Acted as Purchasing Agent for equipment and materials for the jobsites and was responsible for bypass planning and traffic control setup.

Insituform, Southwest
Installation Supervisor

- Responsible for the impregnation procedure for the trenchless Cured-In-Place Lining System.
- Responsible for job scheduling; personnel and equipment, purchasing and ordering of materials and field sample testing and reporting.

Senior Welder

- Responsible for welding and fabrication of equipment for the snack food industry.
- Additional responsibilities included blueprint design, research and development for prototypes.

State Of California
CONTRACTORS STATE LICENSE BOARD
ACTIVE LICENSE

Consumer Affairs

License Number **718202** Entity CORP

Business Name BURTECH PIPELINE INCORPORATED

Classification(s) A

Expiration Date 01/31/2016 www.cslb.ca.gov

Confined Space Entry Program

A. PURPOSE

To provide personnel with the requirements for entering and working within a Confined Space.

Confined Space entry and work procedures must be in compliance with current OSHA and other regulatory standards as they apply to the scope of work. In cases where work is performed in an Operating Complex, the Facility Confined Space Procedure as well as these procedures shall be followed and a Confined Space Entry Permit issued.

B. SCOPE

All personnel who are required to enter or work within a Confined Space.

C. POLICY

All confined or enclosed spaces shall be considered as permitted at all times and this procedure will be implemented.

D. DEFINITIONS

1. A confined or enclosed space is any space with limited means of entry or exit, and/or which accumulate toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces that are more than four feet in depth, such as pits, tubs, vessel vaults, and sumps.

E. REQUIREMENTS

1. Persons required to enter a confined space must be instructed by the supervisor as to the nature of the hazards involved, necessary safety precautions to be taken, and the emergency and protective equipment required prior to entry into the confined space.

2. Before entering a "confined space", for any purpose, all possible exposures must be evaluated to ensure that there is no danger from:

    a. Flammable vapors

    b. Toxic substances

    c. Oxygen deficient atmospheres

d. Engulfment

3. The following shall be reviewed during the preplanning.

   a. Previous contents of the confined space

   b. Oxygen content in air

   c. Mean of getting in and out of confined spaces

   d. Number of men and duration of job

   e. Accidental leaks into "confined space"

4. Before directing employees to enter a "confined space", responsible supervision will determine that the necessary ventilation, protective clothing, respiratory equipment, monitoring devices, emergency standby equipment, and fire prevention precautions are specified and provided.

5. Confined spaces will not be entered without permission from the responsible supervisor.

F. PERMITS

A Confined Space entry permit system shall be used to authorize the entry into, and working within, a confined space.

Copies of the completed Confined Space Entry Permit will be filed weekly with the Corporate Safety Director.

The following permit will be required prior to an entry into a confined space:

-CONFINED SPACE ENTRY PERMIT-

G. ATMOSPHERIC TESTING

1. All Supervisors will issued 4-gas detection units capable of monitoring H2S, CO, O2 and Flammable Vapors. These units will be kept with the Supervisor at all times.

2. Supervisors will calibrate their units weekly. The unit will not be used unless it calibrates according to the manufacture's specifications.

3. All Supervisors will be trained in the operation of the detection units, unit calibration and proper sampling techniques.
   - **NOTE:** When Testing for atmospheric hazards, testing will be done first for oxygen, combustible gases, vapors and then for toxic gases and vapors.

4. No entry will be allowed unless the atmosphere conforms to the following safe levels:

>	Oxygen	(19.5% - 23.5%)
>	H2S	(Below 10 ppm)
>	CO	(Below 35 ppm)
>	Flammable Vapors	(Below 10% LEL/LFL)

5. Continuous monitoring will be conducted while any employee is in the confined space.

6. Once the entry work is complete, and the manhole is exited, testing will be performed before any re-entry is permitted

H. PURGE AND CLEANING OF THE CONFINED SPACE

1. In the event that space needs to be purged and cleaned of materials and residue a high Pressure water jet will clean the subject space purging all debris and residue with a vacon.

I. MECHANICAL VENTILATION

1. Mechanical ventilation is required prior to (at least one minute) and continuously during all confined space entries, regardless of air sampling results.

2. Mechanical ventilation units must be located so as to reduce the possibility of sucking in hazardous vapors / fumes from the surrounding area.

3. In high vehicular traffic areas it may be necessary to raise the blower above ground level, or other harmful exhaust fumes.

4. If the forced ventilation unit fails or runs out of gas, all employees shall vacate the confined space until the unit is refueled or another unit is in place and operating. **DO NOT REFUEL THE UNIT WHILE EMPLOYEES ARE IN THE MANHOLE.**

5. The most efficient way to ventilate a confined space is to introduce fresh air near the bottom of the space and discharge it from the top.

6. Where mechanical ventilation cannot be used because of Client regulations, supplied air shall be used.

J. CONTROLLED ACESS

1. Supervisor- The entry Supervisor is responsible for:
   a) Knowing the hazards which may be encountered during entry, including the mode, signs and symptoms of exposure.
   b) Verifying that a permit is complete and that all tests are complete, systems are safe, and procedure and equipment are in place before allowing entry.
   c) Terminates the entry when work is complete, cancels the permit, and returns it to safety.
   d) Verifies that rescue services are available and the means to summon them are operational.
   e) Remove unauthorized personnel who enter or attempt to enter the space.
   f) Ensures that procedures for entry and work operations are conducted in accordance with the entry procedure an permit requirements.

2. Entrant- Each entrant must know the following:
   a) The hazards which may be encountered including the mode, signs, symptoms and consequence of exposure.
   b) Proper use of all equipment used in the permit space.
   c) Communicate with the attendant as necessary to enable the attendant to monitor conditions and
   d) Alert the attendant whenever:
      1) They recognize warning signs or symptoms of exposure to a hazard.
      2) They recognize a prohibited condition.
   e) Exit from the space quickly, whenever:
      1) An order to evacuate is given by the attendant or entry supervisor.
      2) They recognize signs or symptoms of exposure to a dangerous situation.
      3) They recognize a prohibited condition.
      4) An evacuation alarm is activated.

3. Attendant - Each attendant is responsible for:
   a) Knowing the hazards faced during entry, including the mode, signs, symptoms and consequences of exposure.
   b) Aware of possible behavioral effects of hazard exposure in authorized entrants.

c) Continuously maintain an accurate count of authorized entrants, and to identify those listed as authorized on the permit.

d) Remain outside the permit space until relieved by another attendant.

e) Communicate with authorized entrants as necessary to monitor entrant status and to alert entrant of the need to evacuate.

f) Monitor activities inside and outside the space to determine if it safe for entrants to remain inside and to order an immediate evacuation under any of the following conditions:
   1) Detection of a prohibited condition,
   2) Detects behavioral effects of hazard exposure in an authorized entrant,
   3) If the attendant detects a situation outside the space which could endanger the entrants,
   4) If the attendant can not effectively and safely perform the duties of the attendant.

g) Summon rescue and other emergency services as soon as the attendant determines the entrants need assistance in escaping from permit space hazards.

h) Take the following actions when unauthorized persons approach or enter a permit space when entry is underway.
   1) Warn person to stay from the permit space.
   2) Advise the persons they must exit immediately if they have entered the permit space.
   3) Inform the authorized entrants and entry supervisor that unauthorized person have entered the permit space.

i) Perform non-entry rescues as specified on the emergency action plan, such as winching entrants out with entry tripod.

j) Perform no other duties which may interfere with the attendants primary duty of monitoring and protecting the authorized entrants.

K. ISOLATION

1. If plugging is required, plugs should be set by properly trained personnel.

2. Always inspect the plug for damage prior to field use. Never inflate the plug unrestrained.

3. Never use a plug if it is in disrepair.

4, When inflating a plug, always use a pressure gauge. Plugs should not be over-inflated and must be inspected before use.

5. If at all possible, plugs should be set from above ground.

6. To set the plug from inside the manhole, always have the entrant place the plug in the line and then air up the plug until snug. The entrant will then exit the manhole prior to completing inflation.

7. If a worker must enter a manhole to set plugs, he/she must wear all required safety equipment and PPE, and there must be a standby person posted at the top of the manhole.

8. Tape the valve handle and screw in air plug at the open end of the air line valve to protect against accidental release.

9. Secure the plug air line rope to an adequate structure.

10. In some cases, where flow behind the plug may exist and a person will be working in the pipe, bracing and/or tying off the plug is required to prevent injury should the plug fail. Double plugging must also be used in such situations.

11. Have an employee assigned to check the upstream manhole level and plug pressure every fifteen (15) minutes.

12. If heavy flow is present, by-passing must be used at the upstream manhole, and monitored to avoid engulfment.

L. COMMUNICATION

Communication must be maintained with all personnel in enclosed or confined spaces, using one or more of the following methods:

1. Telephone – via hard wire

2. Two-way radio

M. MANHOLE ENTRY

1. All manholes shall be considered permitted.

2. Entry into a manhole will only be made if it necessary in order to effectively perform the task.

3. Only personnel who have been properly trained in confined space entry procedure, respiratory protection, use of PPE and safety equipment and hazard recognition will be allowed to enter confined spaces.

4. No employee will enter or remain in any confined space unless a standby person is posted at the entrance to the confined space.

5. A full body harness, with the D-Ring(s) located in the middle of the back or on the shoulders, and with the lifeline attached shall be required for all confined space entry.

6. An approved tripod and man-winch, with separate lifeline, must be in place and used to accomplish any manhole entry, regardless of depth.

7. Employees shall be lowered and raised with the tripod/man-winch equipment in any manhole that exceeds five (5) feet in depth.

8. Only approved, non-conductive ladders shall be used.

9. Employees will avoid using cast in place steps in manholes.

10. Plugging will be used to block up line flow.

N. UPLINE ENTRY

When an employee enters a pipe the following must be in place:

1. A specific entry plan that identifies the following must be in place:

   a. The entry plan will take into consideration any additional client safety and permit requirements if applicable.

   b. Each entry plan must be used as a guide for pre-job safety meeting.

2. There must be two (2) standbys:

   a. One in the manhole at the entrance to the pipe.

   b. One above ground at the entrance to the pipe.

3. The entrant must have on the following safety equipment

   a. A full face airline respirator.

   b. Water resistant coveralls and slicker.

   c. Rubber gloves and boots.

d. Anklet straps with an approved retrieval harness and lifeline.

4. The down hole standby must wear the following safety equipment.

   a. Water resistant coveralls and slicker.

   b. Rubber gloves and boots.

   c. Full body harness with appropriate D-Rings.

   d. Five (5) minute escape pack.

   e. Appropriate head, eye and face protective equipment.

   Note: Anklet straps and retrieval harness available as backup.

5. An approve tripod and man-winch, with separate lifeline, must be in place and used by the down hole standby.

6. If the employee must go beyond the standby's range of sight, there must be a TV camera pulled up line with the employee for constant visual contact.

7. Hand signals must be established and agreed on prior to entry.

8. Double plugs and bracing will be used anytime employees enter a pipe where flow is present or possible.

9. If upstream flow is present or imminent, set up a bypass to control overloading of head pressure.

O. EMERGENCY RESCUE PLAN

An entrant's evacuation from a Confined Space, or self rescue, shall take place when any of the following conditions occur:

1. An attendant observes a potential problem that can affect the entrants, such as failure of a ventilation blower.

2. Activation of an alarm that signal a hazardous change in atmospheric conditions;

3. Entrants believe they are in danger because they experience signs and symptoms of a hazard in the space.

4. In the event that an entrant becomes unconscious, attendants **shall not** attempt to enter the space to perform rescue.

5. Rescue services that can be performed safely from outside of the Confined Space (e.g. hoisting a harnessed entrant) shall be undertaken. Other entrants in the space shall immediately exit the space and only provide such assistance as will not endanger them and not require man entry of the confined space.

6. The attendant shall immediately contact the local fire department by calling 9-1-1. In no case shall the attendant be required to relay emergency information through a third party unless the third party location is fully staffed during the entire entry.

7. Emergency rescue services will be provided for all Confined Space emergencies by the local fire and rescue. Local fire and rescue services will provide their own equipment and training in accordance with federal and state regulations.

8. Burtech Pipeline will notify the local Fire Station of the ongoing entry of spaces on the project.

P. CONFINED SPACE ENTRY; SUPERVISORS, ATTENDANT, and ENTRANTS

During the duration of the Project the following employees will be designated as follows:

• Michael Espinosa	Supervisor/Attendant/Entrant
• Efren Hernandez	Supervisor/Attendant/Entrant
• Martin Carmona	Supervisor/Attendant/Entrant
• Ceasar Magana	Attendant/Entrant
• Jose Tamayo	Attendant/Entrant
• Diego Cerpa	Attendant/Entrant

The above employees are all trained in Confined Space Entry Procedures. When a confined space is entered on the project the permit will be posted at the confined space being entered and maintained and monitored for the duration of the entry.

AOC®
World Leader in Resin Technology

Vipel® L704-NET-11 Series Polyester Resin

Product Information

Vipel® Isophthalic Based Resin for Underground Sewer Pipe Liners

TYPICAL LIQUID RESIN PROPERTIES*(1) Vipel® L704-NET-11 see back page

	Nominal
Viscosity @ 77°F/25°C, RVF Brookfield Spindle #4 @ 20 RPM, cps.	5,600
Thix Index 2/20	4.3
Color	Opaque
Specific Gravity @ 77°F/25°C	1.11
Non-Volatiles, %	62
Gel Time @ 140°F with (1.0% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and 0.5% Trigonox® KSM), minutes	11
Pot Life @ 77°F/25°C (1% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and + 0.5% Trigonox® KSM), hours	40

Trigonox is a trademark of Akzo Nobel Chemicals

TYPICAL CAST MECHANICAL PROPERTIES* (2) see back page

		Test Method
Tensile Strength, psi/MPa	13,500/93.1	ASTM D 638
Tensile Modulus, psi/GPa	600,000/4.1	ASTM D 638
Tensile Elongation, %	3.0	ASTM D 638
Flexural Strength, psi/MPa	23,300/161	ASTM D 790
Flexural Modulus, psi/GPa	630,000/4.3	ASTM D 790
Heat Distortion Temperature, °F/°C @ 264 psi	212/100	ASTM D 648
Barcol Hardness	40	ASTM D 2583

*Typical properties are not to be construed as specifications.

DESCRIPTION

The Vipel® L704-NET-11 is a high molecular weight isophthalic/unsaturated polyester resin. Vipel® L704-NET-11 Series provides the corrosion resistance, durability and toughness that is required for cured in place pipe applications. Refer to the AOC Corrosion Resistant Resin Guide for corrosion resistance information listed under Vipel® F701.

FEATURES

- Excellent catalyzed pot life
- Superior mechanical properties
- High molecular weight
- High viscosity version

BENEFITS

Adaptability

AOC's Vipel® L704-NET-11 molecular architecture provides an excellent balance of corrosion and physical properties.

Vipel® L704-NET-11 Polyester Resin

PERFORMANCE GUIDELINES

A. Keep full strength catalyst levels between 1.0% - 3.0% of the total resin weight.

B. Maintaining shop temperatures between 65°F/ 18°C and 90°F/32°C and humidity between 40% and 90% will help the fabricator make a high quality part. Consistent shop conditions contribute to consistent gel times.

STORAGE STABILITY

Resins are stable for three months from date of production when stored in the original containers away from sunlight at no more than 77°F/25°C. After extended storage, some drift may occur in gel time.

During the hot summer months, no more than two months stability at 86°F/30°C should be anticipated.

SAFETY

See appropriate Material Safety Data Sheet for guidelines.

ISO 9001:2000 CERTIFIED

The Quality Management Systems at every AOC manufacturing facility have been certified as meeting ISO 9001:2000 standards. This certification recognizes that each AOC facility has an internationally accepted model in place for managing and assuring quality. We follow the practices set forth in this model to add value to the resins we make for our customers.

FOOTNOTES

(1)

The pot life times shown are typical but may be affected by catalyst, promoter and inhibitor concentrations in resin, and environmental temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and fillers can retard or accelerate gelation. It is recommended that the fabricator check the gelling characteristics of a small quantity of resin under actual operating conditions prior to use.

(2)

Based on tests on Vipel™ L704-NET-11 pipe at 77°F/25° and 50% relative humidity. Ccastings were prepared using 1.0% Perkadox 16 and 0.5 Trigonox C.

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Pub. No. F-AOC-Vipel® L704-NET-11

Effective Date: May 2008

AOC
World Leader in Resin Technology

ASTM F1216 TEST RESULTS ON L704 SERIES
ONE MONTH RESULTS AT 77°F

	L704 (Isophthalic)	REQUIREMENTS %	PASS OR FAIL
CONTROL SAMPLE			
FLEXURAL STRENGTH, psi	9,544		
STANDARD DEVIATION	252		
FLEXURAL MODULUS, psi	564,989		
STANDARD DEVIATION	15,329		
TAP WATER			
FLEXURAL STRENGH, psi	10,915		
STANDARD DEVIATION	432		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	563,496		
STANDARD DEVIATION	10,993		
% FLEXUARAL MODULUS RETENTION	100	>80	**PASS**
5% NITRIC ACID			
FLEXURAL STRENGH, psi	10,672		
STANDARD DEVIATION	894		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	528,173		
STANDARD DEVIATION	13,842		
% FLEXUARAL MODULUS RETENTION	100	>80	**PASS**
10% PHOSPHORIC ACID			
FLEXURAL STRENGH, psi	10,301		
STANDARD DEVIATION	1,439		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	552,544		
STANDARD DEVIATION	9,333		
% FLEXUARAL MODULUS RETENTION	98	>80	**PASS**
10% SULFURIC ACID			
FLEXURAL STRENGH, psi	12,438		
STANDARD DEVIATION	620		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	545,889		
STANDARD DEVIATION	6,319		
% FLEXUARAL MODULUS RETENTION	97	>80	**PASS**
AMOCO GASOLINE			
FLEXURAL STRENGH, psi	9,209		
STANDARD DEVIATION	1278		
% FLEXURAL STRENGTH, psi RETENTION	97	>80	**PASS**
FLEXURAL MODULUS, psi	567,531		
STANDARD DEVIATION	4,611		
% FLEXURAL MODULUS RETENTION	100	>80	**PASS**

VEGETABLE OIL			
FLEXURAL STRENGH, psi	11,809		
STANDARD DEVIATION	2,484		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	549,755		
STANDARD DEVIATION	27,235		
% FLEXUARAL MODULUS RETENTION	97	>80	**PASS**
0.1% DETERGENT			
FLEXURAL STRENGH, psi	8,073		
STANDARD DEVIATION	1,732		
% FLEXURAL STRENGTH, psi RETENTION	85	>80	**PASS**
FLEXURAL MODULUS, psi	511,284		
STANDARD DEVIATION	15,837		
% FLEXUARAL MODULUS RETENTION	91	>80	**PASS**
0.1% SOAP			
FLEXURAL STRENGH, psi	11,756		
STANDARD DEVIATION	325		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	**PASS**
FLEXURAL MODULUS, psi	549,192		
STANDARD DEVIATION	11,869		
% FLEXURAL MODULUS RETENTION	97	>80	**PASS**

August 1, 1999

AOC®

World Leader in Resin Technology

Material Safety Data Sheet

MSDS #: 2295V6

WHMIS (Canada)	NFPA (USA)	HMIS (USA)	Protective clothing
 B-2 D-2A D-2B			

Section 1. Chemical product and company identification

Trade name	**L704-NET-11**
Product type	Polyester Resin Solution
Chemical family	Aromatic.
Material uses	Used in the manufacture of thermoset plastic parts.

Manufacturer

AOC, LLC
950 Highway 57 East
Collierville, TN U.S.A. 38017
Website: www.aoc-resins.com
Phone Number: (901) 854-2800
8am-5pm (Central Time) Mon-Fri

In case of emergency

CHEMTREC (US): 24 hours/7 days (800) 424-9300
CANUTEC (Canada): 24 hours/7 days (613) 996-6666

Section 2. Hazards identification

OSHA status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Routes of entry	Eye contact, Skin contact, Inhalation, Ingestion
Potential acute health effects	**Eyes:** Severe eye irritant which may result in redness, burning, tearing and blurred vision. **Skin:** Skin irritant which may result in burning sensation. Repeated or prolonged skin contact may cause dermatitis. **Ingestion:** Ingestion may result in mouth, throat and gastrointestinal irritation, nausea, vomiting and diarrhea. **Inhalation:** Inhalation of spray mist or liquid vapors may cause upper respiratory irritation and possible central nervous system effects including headaches, nausea, vomiting, dizziness, drowsiness, loss of coordination, impaired judgement and general weakness.
Potential chronic health effects	**CARCINOGENIC EFFECTS:** Styrene: Classified A4 (not classifiable for human or animal) by ACGIH. Classified 2B (possible for human) by IARC. An increased incidence of lung tumors was observed in mice from a recent inhalation study. The relevance of this finding is uncertain since data from other long-term animal studies and from epidemiology studies of workers exposed to styrene do not provide a basis to conclude that styrene is carcinogenic to humans. Lung effects have been observed in mouse studies following repeated exposure. Silica, Amorphous: Classified 3 (not classifiable for human) by IARC. **MUTAGENIC or TERATOGENIC EFFECTS:** No known effect according to our database.

Section 3. Composition/information on ingredients

Name	CAS #	% by weight
1) Styrene	100-42-5	40.7
2) Silica, Amorphous	7631-86-9	1 - 5

Section 4. First aid measures

Eye contact	Flush with a continuous flow of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Use of buffered baby shampoo will aid in removal. Seek medical attention.
Skin contact	Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. If irritation persists, seek medical attention.
Inhalation	Move the victim to a safe area as soon as possible. Allow the victim to rest in a well-ventilated area. If breathing is difficult, give oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.
Ingestion	Do not induce vomiting. Seek immediate medical attention.

Section 5. Fire-fighting measures

The product is:	Flammable liquid, Class IC.
Auto-ignition temperature	914°F(490°C) Styrene
Flash point	87.6°F (31°C) Styrene
Flammable limits	**Lower:** 0.9% **Upper:** 6.8% (Styrene)
Products of combustion	May produce carbon monoxide, carbon dioxide, and irritating or toxic vapors, gases or particulate.
Fire hazard	Flammable in the presence of open flames, sparks, or heat.
Explosion hazard	Can react with oxidizing materials. Explosive in the form of vapor when exposed to heat or flame. Material may polymerize when container is exposed to heat (fire) and polymerization will increase pressure in a closed container which may cause the container to rupture violently.
Fire-fighting media and instructions	SMALL FIRE: Use carbon dioxide, foam, dry chemical or water fog to extinguish. LARGE FIRE: Evacuate surrounding areas. Use carbon dioxide, foam, dry chemical or water fog to extinguish. Wear self-contained breathing apparatus (SCBA) and full fire-fighting protective clothing. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion. Prevent run off to sewers or other water ways.

Section 6. Accidental release measures

Small spill	Absorb with an inert material and place in an appropriate waste disposal container.
Large spill	Stop leak if without risk. Eliminate all ignition sources. Contain with an inert material, recover as much as possible and place the remainder in an appropriate waste disposal container. Warn unauthorized personnel to move away. Prevent entry into sewers or confined areas.

Section 7. Handling and storage

Handling	WARNING! Use only in well-ventilated areas. Store away from direct sunlight. Avoid inhalation and contact with eyes, skin, and clothing. Wear appropriate personal protective equipment for your task. Ground and bond all containers when transferring the material. Empty containers may retain product and product vapor. Do not expose to heat, flame, sparks or other ignition sources such as cutting, welding, drilling, grinding or static electricity. Do not pressurize. Provide adequate safety showers and eyewashes in the area of use. Note: If product contains metal compounds (Section III), avoid dust from dried product or grinding of articles made from this material.
Storage	Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Containers should be grounded.

Section 8. Exposure controls/personal protection

Exposure limits	Styrene	**ACGIH TLV (United States, 2/2010). Absorbed through skin.** TWA: 20 ppm 8 hour(s). TWA: 85 mg/m³ 8 hour(s). STEL: 40 ppm 15 minute(s). STEL: 170 mg/m³ 15 minute(s). **OSHA PEL Z2 (United States, 11/2006).** TWA: 100 ppm 8 hour(s). CEIL: 200 ppm AMP: 600 ppm 5 minute(s). **NIOSH REL (United States, 6/2009).** TWA: 50 ppm 10 hour(s). TWA: 215 mg/m³ 10 hour(s). STEL: 100 ppm 15 minute(s). STEL: 425 mg/m³ 15 minute(s).
	Silica, Amorphous	**NIOSH REL (United States, 6/2009).** TWA: 6 mg/m³ 10 hour(s).
	While the federal workplace exposure limit for styrene is 100 ppm, OSHA accepted the styrene industry's proposal to voluntarily meet a PEL of 50 ppm on an 8 hours TWA.	
Engineering controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Provide adequate safety showers and eyewashes in the area of use.	
Personal protection	Personal protective equipment may vary depending on the job being performed. **Eye/face:** Wear eye protection such as safety glasses with side shields, splash goggles or face shield with safety glasses. **Skin:** Avoid skin contact. Impervious gloves should be worn. Other items may include long sleeves, lab coats, or impervious jackets. **Respiratory:** Determine if airborne concentrations are below the recommended exposure limits in accordance your company's PPE program and regulatory requirements. If they are not, select a NIOSH-approved respirator that provides adequate protection from the concentration levels encountered. Air-purifying respirators are generally adequate for organic vapors. Use positive pressure, supplied-air respirators if there is potential for an uncontrolled release, if exposure levels are unknown, or under circumstances where air-purifying respirators may not provide adequate protection. Reference OSHA 29 CFR 1910.134.	
Personal protection in case of a large spill	Chemical resistant gloves, full protective suit, and boots. Respiratory protection in accordance with OSHA regulation 29 CFR 1910.134. A self-contained breathing apparatus should be used to avoid inhalation of the product vapors.	

Section 9. Physical and chemical properties

Physical state	Liquid.
Color	Clear to Amber.
Odor	Aromatic.
Molecular weight (g/mol)	1000 to 15000
Boiling point	293°F(145°C) Styrene
Melting point	Not available.
pH (1% soln/water)	Not applicable.
Vapor pressure	4.5 mm Hg@ 68°F (20°C) Styrene
Vapor density	3.59 Styrene (Air = 1)
Specific gravity	1.1 (Water = 1)
Water/oil dist. coeff.	Not available.
Evaporation rate	Not available.

Section 9. Physical and chemical properties

Odor threshold	0.14 ppm Styrene
Solubility in water	Slight.
Dispersibility properties	Not dispersed in water.

Section 10. Stability and reactivity

Stability	This product is normally stable, but can become unstable at elevated temperatures and undergo polymerization, which could produce heat and fumes resulting in over-pressurization and rupture in a closed container.
Instability temperature	>170°F (77°C)
Conditions of instability	Heat.
Incompatibility with various substances	Polymerizes in the presence of organic peroxides, oxidizing materials, or heat.
Corrosivity	Our database contains no additional remark on the corrosivity of this product

Section 11. Toxicological information

Toxicity to animals	Name	Result	Species	Dose	Exposure
	Styrene	LD50 Oral LC50 Inhalation Vapor	Rat Rat	2650 mg/kg 5634.2 ppm	- 4 hours

Special remarks on toxicity to animals	Lung effects have been observed in mouse studies following repeated exposure.
Special remarks on chronic effects on humans	No additional remark.
Special remarks on other toxic effects on humans	No additional remark.

Section 12. Ecological information

Ecotoxicity	Toxic to aquatic organisms. Should not be released to sewage system or other bodies of water at concentrations above limits established in regulations or permits.

Section 13. Disposal considerations

Waste disposal	Recycle to process, if possible. Consult your local or regional authorities. Ignitable characteristic.

Section 14. Transport information

DOT	UN1866; Resin Solution; 3; III.	**Labels** 
TDG	UN1866; Resin Solution; 3; III.	
IATA/IMDG	UN1866; Resin Solution; 3; III	
Additional information	US regulations require the reporting of spills when the amount exceeds the Reportable Quantity (RQ) for specific components of this material. See CERCLA in Section 15, Regulatory Information, for the Reportable Quantities.	

Section 14. Transport information

Section 15. Regulatory information

Other regulations

This section does not reference all applicable regulatory compliance lists.

TSCA: All ingredients are listed or compliant with TSCA.

DSL: All ingredients are listed or compliant with the NSNR.

Proposition 65 Warning: This product contains a chemical(s) known to the State of California to cause cancer, birth defects and/or reproductive harm.

SARA 302 component(s): None.

SARA 313 component(s): Styrene.

CERCLA(RQ): Styrene - 1000 lbs. (453.6 kg)

Section 16. Other information

Prepared by AOC, LLC - Corporate Regulatory Affairs. CA; FL; ON

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HAUSER®

August 10, 2000
Test Report No. M00248B/40141

CLIENT: AOC
950 Hwy 57 East
Collierville, TN 38017
Attn: Bruce Curry

Re: PO 5061

MATERIAL: One set of fifty rectangular coupons made with 6mm felt impregnated with Vipel™L704 resin were submitted and identified by the client.

TESTING: Chemical Resistance testing per ASTM D5813-95, paragraphs 6.4.1 and 8.2.1 was conducted. Coupons were exposed in accordance with ASTM D543-95 in the solutions shown in the table below at room temperature for a one-year immersion period. Flexural properties testing as described below will be conducted at the conclusion of the immersion period.

Chemical Solution	Concentration, %
Nitric acid	1
Sulfuric acid	5
ASTM Fuel C	100
Vegetable oil	100
Detergent	0.1
Soap	0.1

One set of Control coupons was tested for initial flexural properties as reported in Hauser Laboratories Test Report No. M00248A on August 31, 1999. A second set of Control coupons was exposed for one year at 50% Relative Humidity, and 23°C. These coupons were tested on August 9, 2000 along with the exposed coupons. All testing was conducted in accordance with ASTM D790-98, Procedure A using a span-to-depth ratio of 16:1.

RESULTS: The results are summarized in Table 1 and presented in detail in Table 2. All values exceeded the ASTM D5813 requirements of at least 80% retention of flexural modulus after one-year immersion in all solutions.

TESTING SUPERVISED BY:

Julie Krause-Singh
Department Manager

TESTING CONDUCTED BY:

Dale J. Beasley
Technician III

TABLE 1
SUMMARY OF CHEMICAL RESISTANCE TEST RESULTS

Solution	Average Retention of Flexural Strength*	Average Retention of Flexural Modulus*
	%	%
Nitric Acid	89	96
Sulfuric Acid	103	95
ASTM Fuel C	145	97
Mineral Oil	112	98
Detergent	118	95
Soap	90	94
ASTM D5813 Requirement		80 minimum

*These calculations were based on the data from the Control sample tested 8/9/00.

TABLE 2
CHEMICAL RESISTANCE TEST RESULTS

Specimen No.	Flexural Strength	Flexural Modulus
	psi	psi
Vipel™L704		
Control 8/31/99		
1	4570	736000
2	5300	709000
3	5410	686000
4	4680	682000
5	7600	665000
6	8670	726000
7	8560	681000
Average	6400	698000
Std. Dev.	1820	26300
Control 8/9/00		
1	8530	528000
2	5180	548000
3	7750	548000
4	4520	590000
5	5340	586000
6	4530	556000
Average	5980	559000
Std. Dev.	1730	24200
1% Nitric Acid		
1	5580	528000
2	5650	531000
3	5800	543000
4	4400	527000
5	5080	521000
6	5300	555000
Average	5300	534000
Std. Dev.	510	12700

TABLE 2 CONTINUED
CHEMICAL RESISTANCE TEST RESULTS

Specimen No.	Flexural Strength	Flexural Modulus
	psi	psi
5% Sulfuric Acid		
1	5820	530000
2	5220	519000
3	5430	520000
4	5750	545000
5	7550	538000
6	6980	537000
Average	6130	531000
Std. Dev.	930	10300
ASTM Fuel C		
1	10300	521000
2	7640	535000
3	4990	536000
4	8490	574000
5	9080	542000
6	11600	560000
Average	8670	545000
Std. Dev.	2280	19200
Mineral Oil		
1	6680	523000
2	5930	509000
3	7790	582000
4	8610	571000
5	5030	566000
6	6290	548000
Average	6720	550000
Std. Dev.	1290	29000

TABLE 2 CONTINUED
CHEMICAL RESISTANCE TEST RESULTS

Specimen No.	Flexural Strength	Flexural Modulus
	psi	psi
Detergent		
1	7320	529000
2	7690	564000
3	4890	514000
4	7480	536000
5	7000	549000
6	7920	507000
Average	7050	533000
Std. Dev.	1100	21600
Soap		
1	5170	508000
2	5410	517000
3	4600	535000
4	5630	526000
5	4330	520000
6	6980	537000
Average	5350	524000
Std. Dev.	940	11100

HAUSER®

May 24, 2000
Test Report No. E90868/40067

CLIENT: AOC
950 Highway 57 East
Collierville, TN 38017
Attn: Dave Treadwell

MATERIAL: Six each rectangular specimens from two plastic materials identified as felt composites L471 and L704 were submitted by the client. The specimens were each approximately 6 inches x ½ inch x 0.3 inches.

TESTING: Flexural creep testing per ASTM D2990-95 using a three-point static-load configuration with a span to depth ratio of approximately 16:1 and a stress level of 400 psi at 23°C and 50% Relative Humidity.

RESULTS: The results for 10000 hours are presented as both graphical and tabular data of flexural modulus versus time for each group of five specimens tested. Tabular results for sample L471 are presented in Table 1 and tabular results for sample L704 are presented in Table 2

TESTING SUPERVISED BY:

Julie Krause-Singh
Department Manager

TESTING CONDUCTED BY:

John C. McCoy
Technician II

TABLE 2
FLEXURAL CREEP DATA
SAMPLE L704

TEMPERATURE: 23° C/ 50% RH
STRESS: 400 psi

Elapsed Time	FLEXURAL MODULUS, psi					
Hours	1	2	3	4	5	Average
0.00						
0.02	810900	879100	649100	664400	739500	748600
0.10	810900	879100	649100	655900	729500	744900
0.20	798400	879100	641200	631600	710300	732100
0.50	774600	865200	633400	631600	710300	723000
1.00	774600	851700	618500	601900	666400	702600
2.00	741400	838600	604300	588000	666400	687800
3.43	720800	825900	597500	574800	658300	675500
22.08	632900	707900	547700	522000	580400	598200
68.58	625300	681300	505500	491900	550800	571000
114.2	570300	656700	469400	465100	509200	534200
257.4	503900	524100	381000	409300	461400	455900
456.0	439800	514200	378200	362800	412100	421400
792.8	393200	454200	339200	332200	374900	378700
1414.3	368100	436000	326600	321800	350500	360600
1651.6	360400	425800	320600	315800	339500	352400
1802.0	341400	400800	303900	292300	325200	332700
2011.3	339200	400800	303900	292300	323200	331900
2109.6	337000	400800	302200	290700	321300	330400
2154.9	337000	397900	302200	290700	321300	329800
2322.8	332700	397900	302200	289000	317500	327900
2660.8	332700	397900	300400	289000	315700	327100
2808.1	330600	395000	300400	287400	313800	325400
3002.1	330600	395000	300400	287400	313800	325400
3193.5	328500	386600	292100	285800	312000	321000
3312.6	314500	378500	288900	278000	305000	313000
3547.9	310800	373300	282700	272100	301600	308100
3618.8	309800	372100	282700	272100	301600	307700
3834.1	308900	370800	282700	272100	299900	306900
4003.4	307100	370800	282700	272100	299900	306500
4171.3	305300	370800	282700	270700	298200	305500
4513.7	300000	365800	281200	267900	295000	302000

TABLE 2 CONTINUED
FLEXURAL CREEP DATA
SAMPLE L704

Elapsed Time	FLEXURAL MODULUS, psi					
Hours	1	2	3	4	5	Average
4676.1	298300	365800	279700	266500	295000	301000
5012.2	298300	363400	278200	265100	295000	300000
5186.1	298300	363400	278200	265100	295000	300000
5392.3	296600	361000	278200	262400	293400	298300
5689.7	296600	361000	276700	262400	293400	298000
5901.7	294900	361000	275300	262400	293400	297400
6021.8	294900	361000	273800	262400	291800	296800
6167.8	291600	361000	273800	259700	290200	295300
6331.0	291600	361000	275300	259700	290200	295500
6719.3	291600	358600	273800	259700	290200	294800
7338.3	283600	349400	268200	254500	281100	287400
7507.1	283600	349400	271000	253300	281100	287700
7866.4	285200	349400	266900	254500	282600	287700
8251.8	285200	347200	266900	253300	281100	286700
8376.1	282100	347200	266900	253300	281100	286100
8512.6	282100	347200	266200	253300	281100	286000
9016.1	279800	345000	266900	252000	278200	284400
9261.1	279000	342800	265500	250800	278200	283300
9324.3	278300	342800	265500	250800	276800	282800
9571.7	278300	342800	265500	249600	276800	282600
9911.3	274600	338600	264200	248400	275400	280200
10025.4	274600	338600	264200	248400	275400	280200

FLEXURAL CREEP DATA SAMPLE L704
AT 400 PSI STRESS

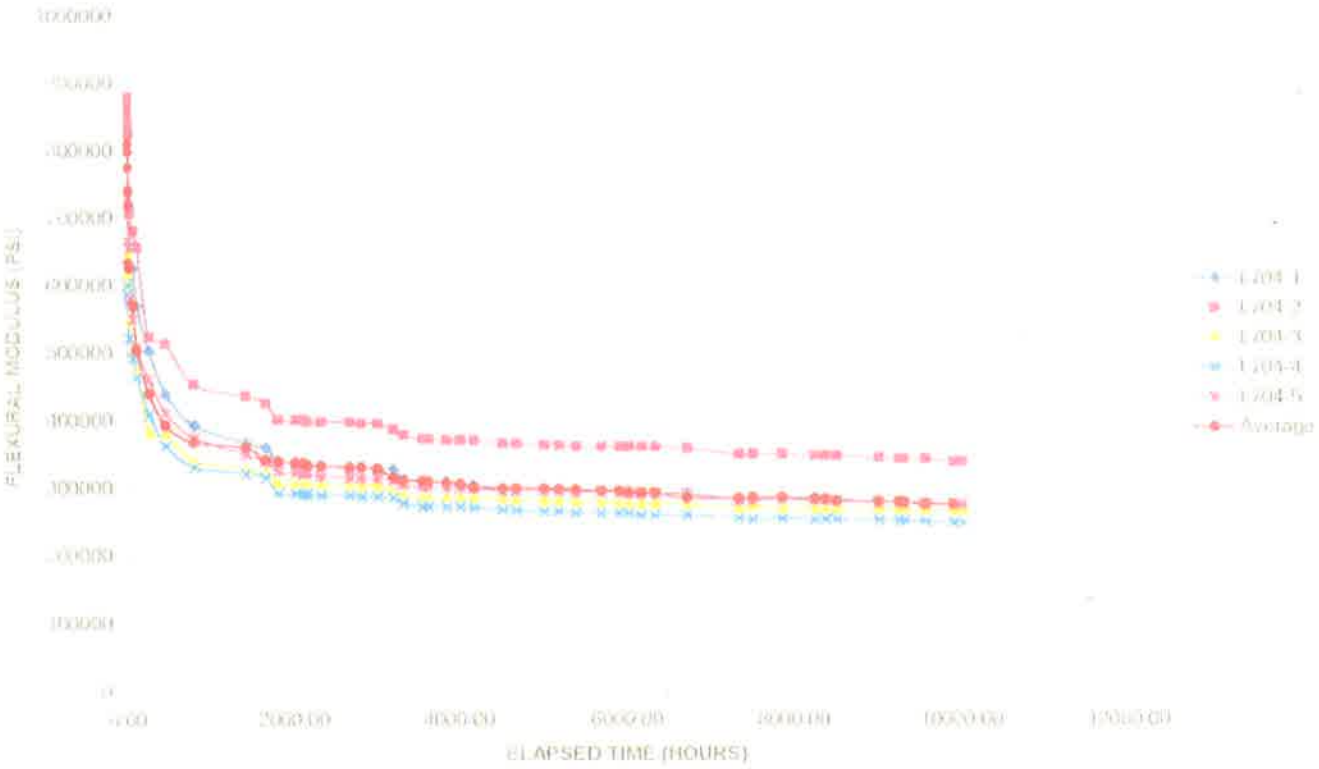

TABLE 1
FLEXURAL CREEP DATA
SAMPLE L471

TEMPERATURE: 23° C/ 50% RH
STRESS: 400 psi

Elapsed Time	FLEXURAL MODULUS, psi					
Hours	1	2	3	4	5	Average
0.00						
0.02	643500	648300	562900	635700	696200	631600
0.10	643500	648300	562900	616100	672900	617300
0.20	629900	626200	547800	603600	658300	603300
0.50	623400	626200	547800	597600	658300	601300
1.00	604500	605600	528900	574600	630900	578200
2.00	598400	605600	528900	569100	630900	576300
3.67	586700	592500	524400	558500	605700	562900
22.4	529600	529900	487000	524200	571400	527500
68.8	498700	501000	468400	466900	513300	482800
114.4	460300	471000	441400	429900	488400	453300
257.6	393700	393600	383500	360000	406500	383300
456.3	367100	369800	354700	332000	371600	352700
793.1	328800	330000	319600	297300	329200	315300
1414.6	308500	309600	302300	274100	299800	292100
1651.9	297700	302800	295000	265600	291200	283900
1802.3	294800	278300	272700	252200	280400	268400
2011.5	275800	275500	269100	245900	272800	262600
2109.8	275800	275500	269100	245900	271600	262200
2155.2	274500	271500	266800	242900	266800	258800
2323.0	273300	270100	266773	242900	266800	258800
2661.0	270800	267500	263300	239000	262200	254900
2808.4	268400	266200	263300	236200	259900	253200
3002.4	266000	261200	258900	234400	255500	249600
3193.7	260200	258700	2535500	227200	250300	243700
3312.9	257900	256300	251466	224700	248200	241400
3548.2	256800	255100	250400	224700	247200	240800
3619.0	255700	255100	250400	224700	246200	240400
3834.4	255700	255100	250400	223800	245200	239800
4003.7	252500	252800	247400	221300	243200	237300
4171.6	252500	252800	247400	220500	243200	237100
4513.9	251400	249300	245400	219700	243233	236124

TABLE 1 CONTINUED
FLEXURAL CREEP DATA
SAMPLE L471

Elapsed Time	FLEXURAL MODULUS, psi					
Hours	1	2	3	4	5	Average
4676.4	248300	247100	243500	218100	241300	234300
5012.4	248300	246000	241600	216500	239400	232500
5186.3	247300	244900	240600	215700	238400	231600
5392.6	247300	244400	240600	215700	238400	231600
5689.9	247300	243800	240600	215700	237500	231300
5901.9	243300	242800	240600	215000	237500	231000
6022.0	242300	242800	240600	215000	236600	230700
6168.1	241300	241700	239700	213400	233800	229000
6331.3	246300	241700	239700	213400	233800	229000
6719.6	246300	241700	239700	213400	233800	229000
7338.6	241300	238600	236000	209700	232100	225900
7507.4	240300	238600	236000	209700	232100	225900
7866.7	240300	238600	236000	209700	232100	225900
8252.1	239400	238600	236000	209700	232100	225900
8376.3	239400	238600	235991	209700	232100	225909
8512.8	238400	238600	236000	209000	231200	225400
9016.3	237500	238600	236000	208200	230300	224800
9261.4	236500	237500	236000	208200	230300	224800
9324.6	236500	237500	236000	208200	230300	224800
9572.0	236500	237500	235100	207500	230300	224800
9911.6	235600	236500	234600	206100	227700	222800
10025.7	235600	236500	234600	206100	227700	222800

FLEXURAL CREEP DATA SAMPLE L471
AT 400 PSI STRESS