

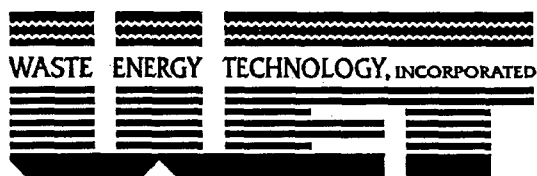
RECORD DOCUMENTATION

LANDFILL GAS MANAGEMENT SYSTEM

TRAIL RIDGE LANDFILL
Baldwin, Florida

PREPARED FOR:
TRAIL RIDGE LANDFILL
Baldwin, Florida

WET PROJECT No: 98496
January 1999



ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS

FORT WALTON BEACH, FLORIDA



11 Tupelo Avenue, S.E. • Fort Walton Beach, Florida 32548-5414
Tel (850) 243-0033 • Fax (850) 243-0077

RECORD DOCUMENTATION
LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

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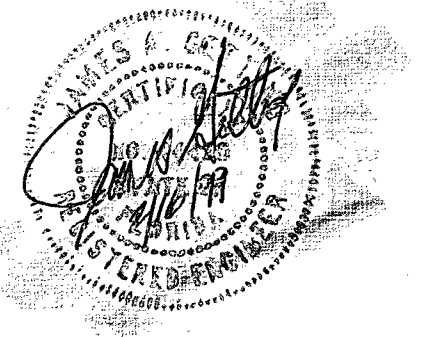
Prepared for:

Trail Ridge Landfill, Inc.
5110 US Hwy. 301
Baldwin, Florida 32234
(904) 289-9100

Prepared by:

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE
Fort Walton Beach, Florida 32548
(850) 243-0033

WET Project No: 98496



LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

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LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

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PROJECT OVERVIEW

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PROJECT SUMMARY

On August 21, 1998, Trail Ridge Landfill, Inc. contracted with R. B. Baker Construction. They, in turn, subcontracted with Waste Energy Technology, Inc. (WET) to complete the Landfill Gas Management System at the Trail Ridge Landfill located in Baldwin, Florida.

On September 7, 1998, WET mobilized on site to begin construction. The gas extraction wells were completed on September 16, 1998. On September 23, 1998, WET began construction of the header and lateral system. The system start-up was conducted on December 18, 1998, and WET demobilized.

This Landfill Gas Management System project consisted of the following:

- Installation of 1,281 linear feet of 36" diameter Boring with 6" PVC Schedule 80 Casing
- Installation of 243 linear feet of 36" diameter Boring with 8" PVC Schedule 80 Casing
- Installation of 14,425 linear feet of 6" through 26" HDPE SDR 17 Gas Collection Header and Laterals
- Abandoned 47 linear feet of Well Boring
- Installation of 23 Temporary Gas Extraction Wellheads
- Installation of 5 Gas Extraction Wellheads
- Installation of 232 linear feet of 2" HDPE SDR 11 Electrical Conduit
- Installation of 378 linear feet of 4" x 2" HDPE SDR 11 Dual Containment Forcemain
- Installation of eight (8) 6" Underground Isolation Control Valves
- Installation of two (2) 10" Underground Isolation Control Valves
- Installation of two (2) 20" Underground Isolation Control Valves
- Installation of one (1) 24" Underground Isolation Control Valves
- Installation of one (1) 12" HDPE SDR 11 Condensate Knockout
- Installation of one (1) 24" HDPE SDR 11 Condensate Knockout

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PROJECT SUMMARY (Cont.)

- Installation of eight (8) tie-ins to existing Leachate Collection System
- Installation of one (1) tie-in to existing Forcemain
- Installation of six (6) Steel Pipe Casing Road Crossings
- Installation of one (1) 3000 gallon Below Ground Storage Tank
- Installation of two (2) Flyght Submersible Pumps
- Installation of one (1) LFG Blower/Flare Station

The system start-up was completed on December 20, 1998. The final acceptance by the Owner is currently outstanding.

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PROJECT CONTACT LIST

PROJECT SPONSOR:

Trail Ridge Landfill, Inc.
5110 US Hwy. 301
Baldwin, Florida 32234
(904) 289-9100

GENERAL MANAGER:

Greg Mathes
Trail Ridge Landfill, Inc.
5110 US Hwy. 301
Baldwin, Florida 32234
(904) 289-9100

DESIGN ENGINEER:

John Crilly
Rust Environment and Infrastructure
15 Brendan Way
Greenville, South Carolina 29615
(864) 234-3000

ENGINEER OF RECORD:

Juanitta Clem
England-Thims & Miller, Inc.
3131 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 642-8990

PROJECT QA/QC:

Ken Bunnell
LAW Engineering
3901 Carmichael Avenue
Jacksonville, Florida 32207
(904) 396-5173

GENERAL CONTRACTOR:

John Avino
R. B. Baker Construction
9235 Busch Drive
Jacksonville, Florida 32218
(904) 757-6100

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PROJECT CONTACT LIST (Cont.)

GAS MANAGEMENT SYSTEM CONTRACTOR:

Terry D. Norris - Project Manager
Kevin Rooffener - Project Supervisor
Tommy Weder - Drilling Supervisor
Matt Rodgers - Collection Header Surveyor
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE
Fort Walton Beach, Florida 32548
(850) 243-0033

RECORD DOCUMENTATION ENGINEER:

James A. Getting, P.E.
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE
Fort Walton Beach, Florida 32548
(850) 243-0033

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

VENDOR LIST

VENDOR:

AGGREGATE:

Conrad Yelvington
800 Big Tree Rd.
Daytona Beach, Florida 32115
(904) 767-5500

CONDENSATE PUMPS:

Jim House and Associates, Inc.
PO Box 320129
Birmingham, Alabama 35232
(205) 592-6302

CONDENSATE TANK:

Lannon Tank Corporation
PO Box 516
Lannon, Wisconsin 53046
(414) 251-7890

FLARE PACKAGE:

LFG Specialties, Inc.
750 Friendship Drive
New Concord, Ohio 43762
(800) 331-7683

FLOW MEASUREMENT SYSTEM:

LFG Specialties, Inc.
750 Friendship Drive
New Concord, Ohio 43762
(800) 331-7683

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

SUB-CONTRACTOR LIST

SUBCONTRACTORS:

ELECTRICAL:

C & C Powerline
12035 Palm Lake Drive
Jacksonville, Florida 32218
(904) 751-6020

FENCING:

Big John Fence Company, Inc.
5066 Lucille Drive
Jacksonville, Florida 32254
(904) 781-1188

LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PROJECT RECORD DRAWINGS

<u>DWG NO.</u>	<u>TITLE</u>
COVER	TITLE AND INDEX
1	WELL AND HEADER LAYOUT
2-3	HEADER ROUTE SURVEY DATA
4-5	WELL AND WELLHEAD DETAILS
6-7	HEADER DETAILS
8-9	CONDENSATE MANAGEMENT DETAILS
10	FLARE STATION DETAILS



RECORD CONSTRUCTION DATA

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

WELL SCHEDULE

BOTTOM OF							
WELL	GRID		GROUND	WELL	WELL	SOLID	SLOTTED
ID	COORDINATES		ELEV.	ELEV.	DEPTH	PIPE	PIPE
	(north)	(east)	(ft)	(ft)	(ft)	(ft)	(ft)
GAS EXTRACTION WELLS							
T-1	9508	12051	218.1	142.1	76	38	38
T-2	9524	11774	216.7	145.7	71	36	35
T-2A	ABANDONED				47	N/A	N/A
T-3	9468	11557	212.6	149.6	63	32	31
T-4	9526	11317	201.2	151.2	50	25	25
T-5	9396	11210	183.2	149.2	34	20	14
T-6	9569	11143	186.1	153.1	33	17	16
T-7	9449	11050	186.7	150.7	36	18	18
T-8	9720	11038	191.6	148.6	43	22	21
T-9	9496	10913	188.1	153.1	35	20	15
T-10	9565	10803	191.4	155.4	36	20	16
T-11	9719	10698	207.1	156.1	51	25	24
T-12	9439	10688	218.3	159.3	59	30	29
T-13	9452	10485	213.2	158.2	55	28	27
T-14	9236	10460	211.5	160.5	51	26	25
T-15	9240	10679	214.1	158.1	56	29	27
T-16	9297	10889	216.1	155.1	61	21	20
T-17	9297	11122	206.8	154.8	52	26	26
T-18	9292	11403	204.2	152.2	52	26	26
T-19	9293	11659	214.4	148.4	66	33	33
T-20	9292	11934	218.4	145.4	73	37	36
T-21	9288	12208	213.0	142.0	71	36	35
T-22	9580	10392	214.0	161.0	53	26.5	26.5
T-23	9585	10592	217.7	160.7	57	28.5	28.5
TOTALS					1281	620	592

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

WELL SCHEDULE

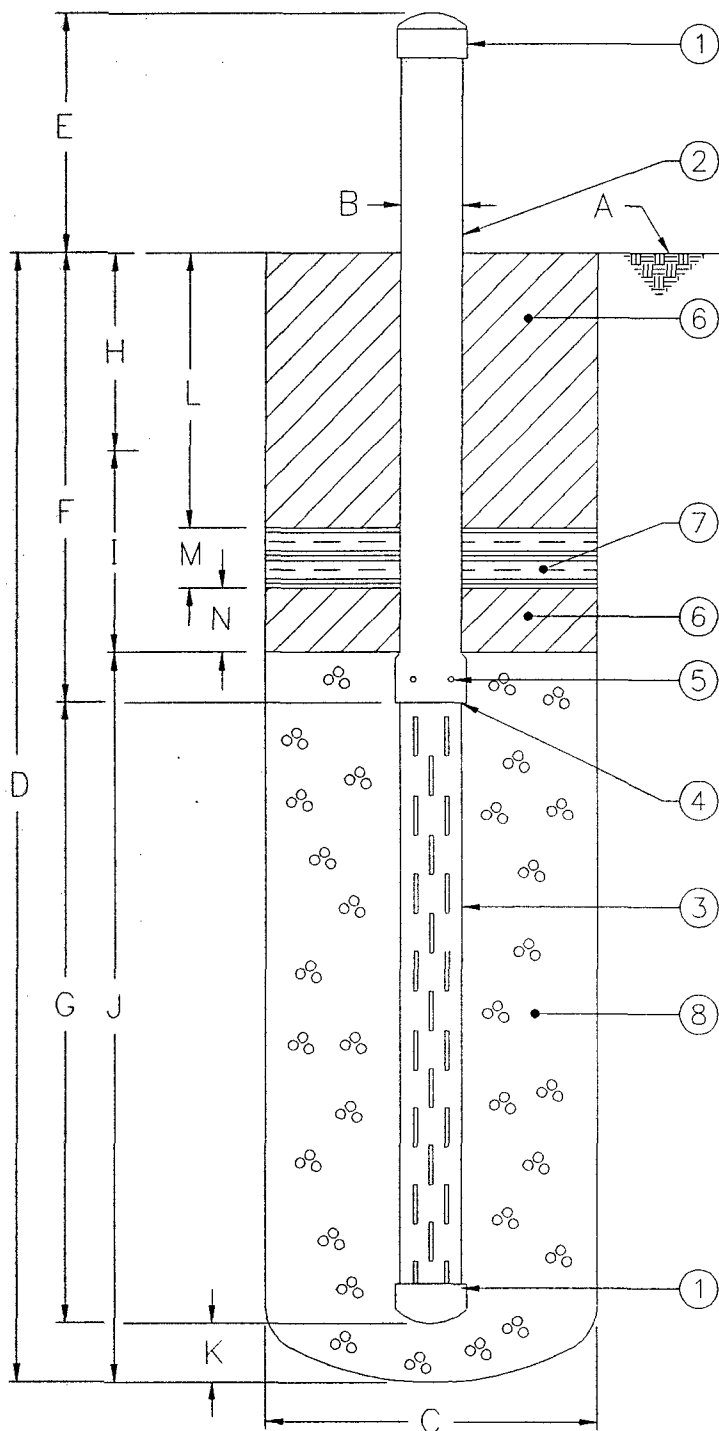
WELL ID	GRID		GROUND ELEV. (ft)	BOTTOM OF		WELL DEPTH (ft)	SOLID PIPE (ft)	SLOTTED PIPE (ft)
	COORDINATES			WELL				
	(north)	(east)		ELEV.				
GAS EXTRACTION WELLS								
W-1	9702	12211	191.8	136.8	55	28	27	
W-2	9755	11964	184.3	140.3	44	22	22	
W-3	9756	11741	187.4	143.4	44	22	22	
W-4	9732	11506	195.5	144.5	51	29	22	
W-36	8908	12434	187.6	138.6	49	25	24	
TOTALS					243	126	117	

**GAS WELL CONSTRUCTION AND BORING
LOGS**

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/15/98
 WET PROJECT NO: 98496

WELL NUMBER: T-1
 WELL LOCATION: N: 9508
 E: 12051



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	218.1 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	76 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	38 FT.
G SLOTTED PIPE LENGTH:	38 FT.
H COVER DEPTH:	3 FT.
I REFUSE DEPTH TO AGGREGATE:	33 FT.
J AGGREGATE PACK:	40 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	32 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR'S DRILLING/ A WET COMPANY
DRILLING DATE: 09/15/98

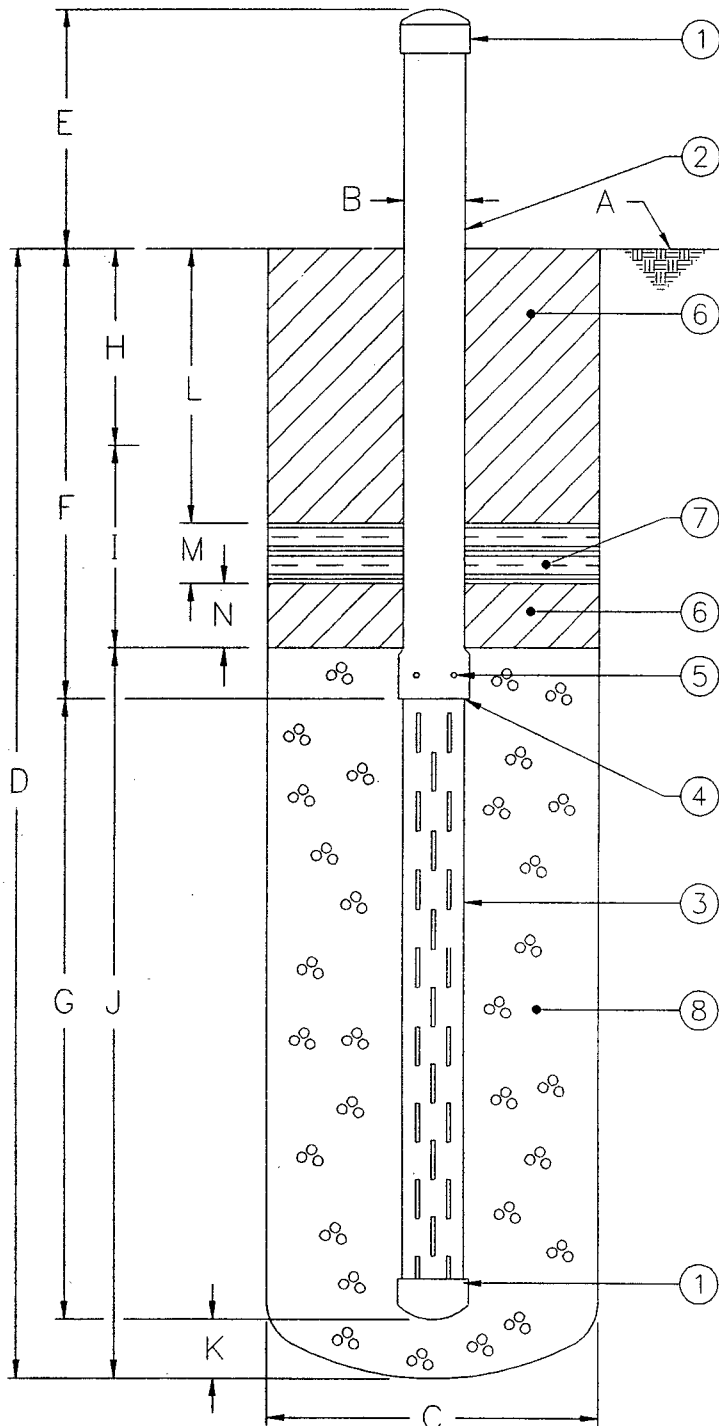
WELL NUMBER: T-1

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	PAPER, WOOD	SLIGHT	DRY		
5' - 10'	HOUSEHOLD GARBAGE, WOOD, PLASTIC	SLIGHT	DRY	91°	
10' - 15'	PAPER, PLASTIC, WOOD	MODERATE	MOIST		
15' - 20'	WOOD, FENCING	MODERATE	MOIST	108°	
20' - 22'	DAY COVER	N/A	MOIST		
22' - 30'	PAPER, PLASTIC, CONCRETE	HEAVY	MOIST		
30' - 36'	CARPET, WOOD, CLIPPINGS	HEAVY	MOIST		
36' - 38'	DAY COVER	N/A	MOIST		
38' - 40'	CARPET, WOOD, CLIPPINGS	HEAVY	MOIST		
40' - 50'	GRASS CLIPPINGS, HOUSEHOLD GARBAGE	HEAVY	MOIST	126°	
50' - 61'	WOOD, STEEL, WIRE	HEAVY	MOIST		
61' - 63'	DAY COVER	N/A	MOIST		
63' - 70'	PAPER, PLASTIC, WOOD	MODERATE	MOIST		
70' - 76'	HOUSEHOLD GARBAGE	MODERATE	MOIST	132°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/15/98
 WET PROJECT NO: 98496

WELL NUMBER: T-2
 WELL LOCATION: N: 9524
 E: 11774



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	216.7 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	71 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	36 FT.
G SLOTTED PIPE LENGTH:	35 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	31 FT.
J AGGREGATE PACK:	38 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	29 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/15/98

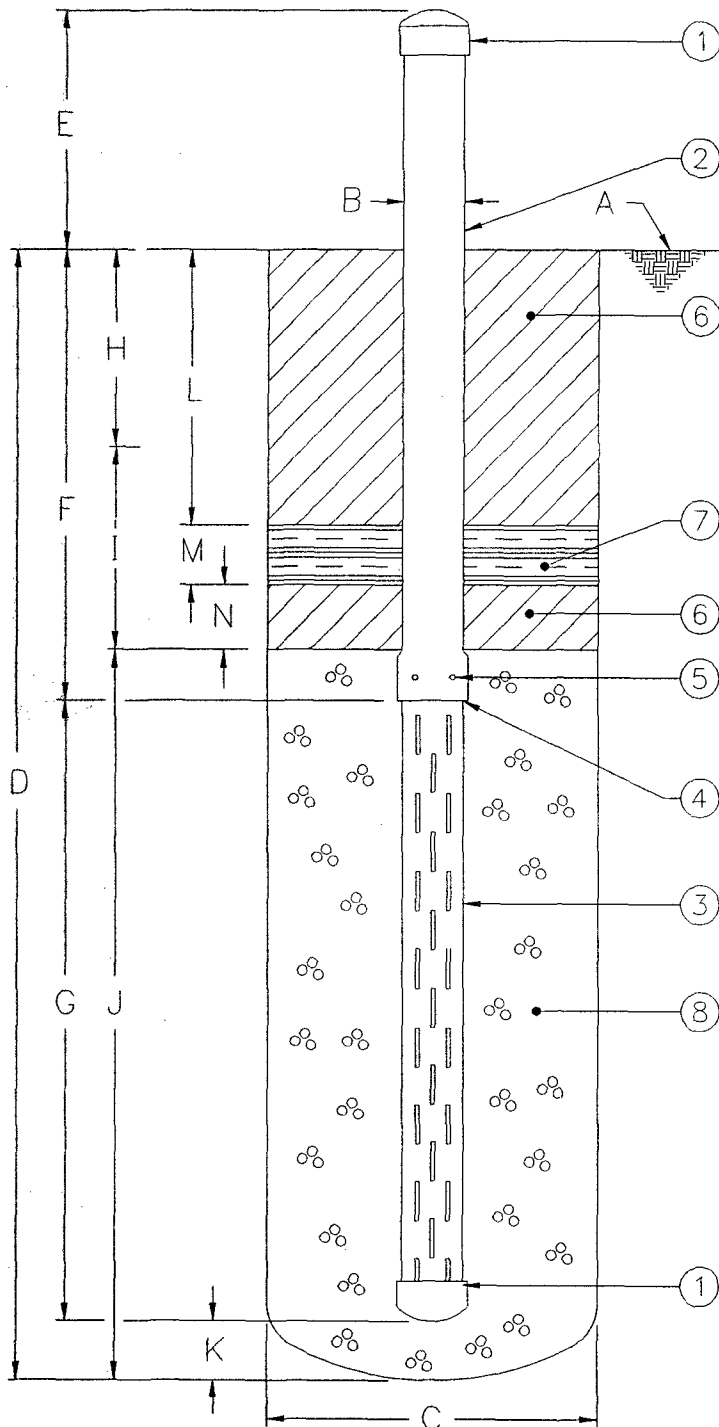
WELL NUMBER: T-2

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	DRY		
2' - 5'	WOOD, PAPER	SLIGHT	DRY		
5' - 10'	PAPER, PLASTIC, WOOD	SLIGHT	DRY	90°	
10' - 14'	PAPER, PLASTIC	SLIGHT	MOIST		
14' - 16'	DAY COVER	N/A	MOIST		
16' - 20'	HOUSEHOLD GARBAGE, WIRE	SLIGHT	MOIST	108°	
20' - 30'	HOUSEHOLD GARBAGE, WIRE	MODERATE	MOIST		
30' - 40'	HOUSEHOLD GARBAGE, WOOD, STEEL	MODERATE	MOIST	129°	
40' - 51'	HOUSEHOLD GARBAGE	HEAVY	MOIST		
51' - 53'	DAY COVER	N/A	MOIST		
53' - 60'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	134°	
60' - 70'	PAPER, PLASTIC, WOOD	HEAVY	MOIST		
70' - 71'	HOUSEHOLD GARBAGE	HEAVY	MOIST	134°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/14/98
 WET PROJECT NO: 98496

WELL NUMBER: T-2A
 WELL LOCATION: N: ABANDONED
 E:



MATERIAL LIST

1 CAP:	N/A
2 PIPE:	N/A
3 SLOTTED PIPE:	N/A
4 CONNECTION:	N/A
5 LAG BOLTS:	N/A
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	N/A FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	47 FT.
E SOLID PIPE ABOVE GROUND:	N/A FT.
F SOLID PIPE BELOW GROUND:	N/A FT.
G SLOTTED PIPE LENGTH:	N/A FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	N/A FT.
J AGGREGATE PACK:	N/A FT.
K AGGREGATE BASE:	N/A FT.
L SOIL BACKFILL:	N/A FT.
M BENTONITE LAYER:	N/A FT.
N SOIL BACKFILL:	N/A FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/14/98

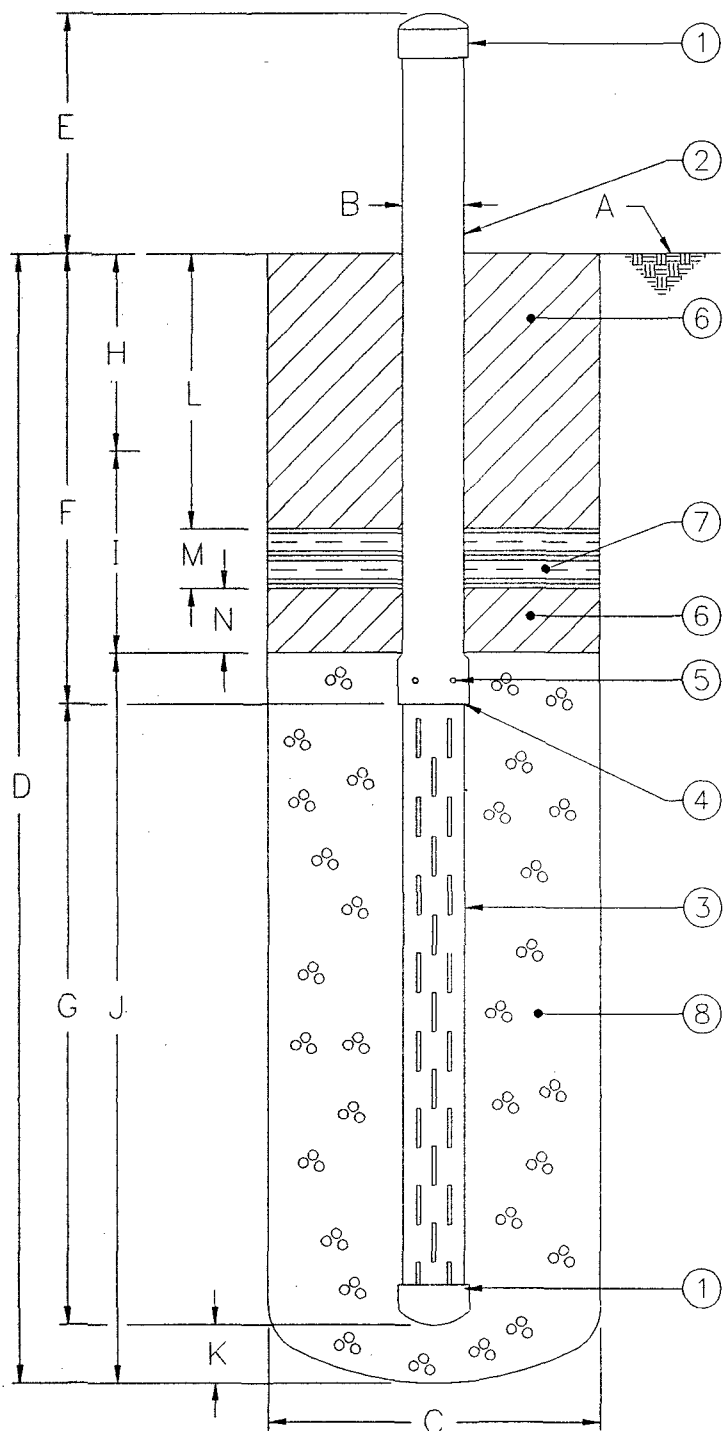
WELL NUMBER: T-2A
ABANDONED

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	DRY		
2' - 5'	HOUSEHOLD GARBAGE	SLIGHT	DRY	92°	
5' - 10'	HOUSEHOLD GARBAGE, COPPER WIRE	SLIGHT	MOIST	96°	
10' - 15'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST	100°	
15' - 20'	HOUSEHOLD GARBAGE, VINYL TARP	MODERATE	MOIST	102°	
20' - 25'	TREE TRUNKS, WIRE	MODERATE	MOIST	110°	
25' - 30'	3" RUBBER HOSE, HOUSEHOLD GARBAGE	HEAVY	MOIST	116°	
30' - 35'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	124°	
35' - 40'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	130°	
40' - 45'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	134°	
45' - 47'	HOUSEHOLD GARBAGE	HEAVY	MOIST	136°	ABANDONED

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/14/98
 WET PROJECT NO: 98496

WELL NUMBER: T-3
 WELL LOCATION: N: 9468
 E: 11557



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	212.6 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	63 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	32 FT.
G SLOTTED PIPE LENGTH:	31 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	28 FT.
J AGGREGATE PACK:	33 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	26 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
 DRILLING DATE: 09/14/98

WELL NUMBER: T-3

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	HOUSEHOLD GARBAGE	MODERATE	MOIST	90°	
5' - 10'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST	98°	
10' - 15'	HOUSEHOLD GARBAGE, 2" PVC PIPE	HEAVY	MOIST	104°	
15' - 20'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	108°	
20' - 25'	HOUSEHOLD GARBAGE, 5/8" WIRE ROPE	HEAVY	MOIST	116°	
25' - 30'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	120°	
30' - 35'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	122°	
35' - 40'	HOUSEHOLD GARBAGE	HEAVY	MOIST	130°	
40' - 45'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	132°	
45' - 48'	HOUSEHOLD GARBAGE	HEAVY	MOIST	132°	
48' - 50'	DAY COVER	N/A	MOIST		
50' - 53'	HOUSEHOLD GARBAGE	HEAVY	MOIST	134°	
53' - 55'	DAY COVER	N/A	MOIST		
55' - 60'	HOUSEHOLD GARBAGE, TREE LIMBS	HEAVY	MOIST	132°	
60' - 63'	HOUSEHOLD GARBAGE	HEAVY	MOIST	132°	

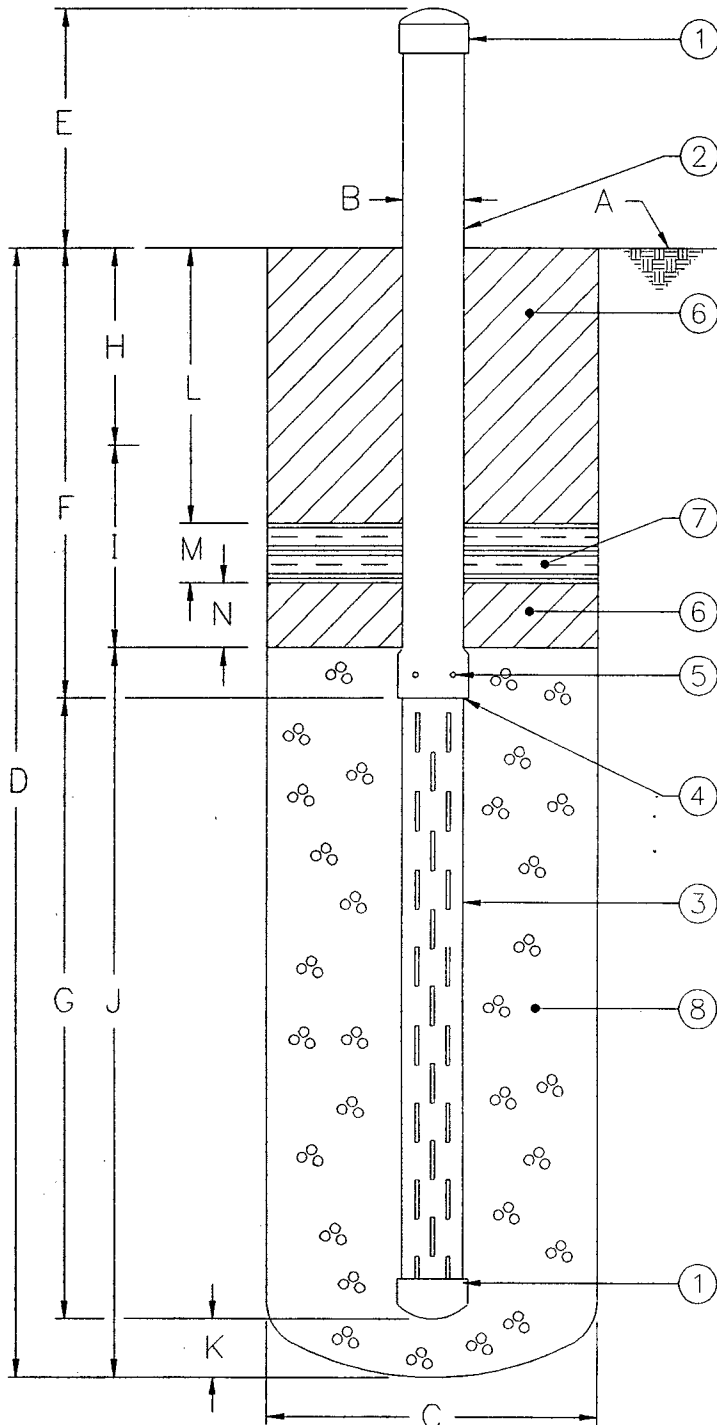
Waste Energy Technology, Inc.
 11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
 (850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/16/98
 WET PROJECT NO: 98496

WELL NUMBER: T-4
 WELL LOCATION: N: 9526
 E: 11317



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	201.2 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	50 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	25 FT.
G SLOTTED PIPE LENGTH:	25 FT.
H COVER DEPTH:	3 FT.
I REFUSE DEPTH TO AGGREGATE:	20 FT.
J AGGREGATE PACK:	27 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	19 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR'S DRILLING/ A. WET COMPANY
DRILLING DATE: 09/16/98

WELL NUMBER: T-4

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	PAPER	SLIGHT	DRY		
5' - 10'	PLASTIC, PAPER, WOOD	SLIGHT	DRY		
10' - 20'	ROCK, WIRE, CARPET	MODERATE	MOIST		
20' - 30'	MEDICAL WASTE, TIRES, WOOD	MODERATE	MOIST	106°	
30' - 32'	DAY COVER	N/A	MOIST		
32' - 40'	PLASTIC, STEEL, HOUSEHOLD GARBAGE	MODERATE	MOIST		
40' - 49'	WOOD, WIRE, ROCK	HEAVY	MOIST	115°	
49' - 50'	DAY COVER	N/A	MOIST	130°	

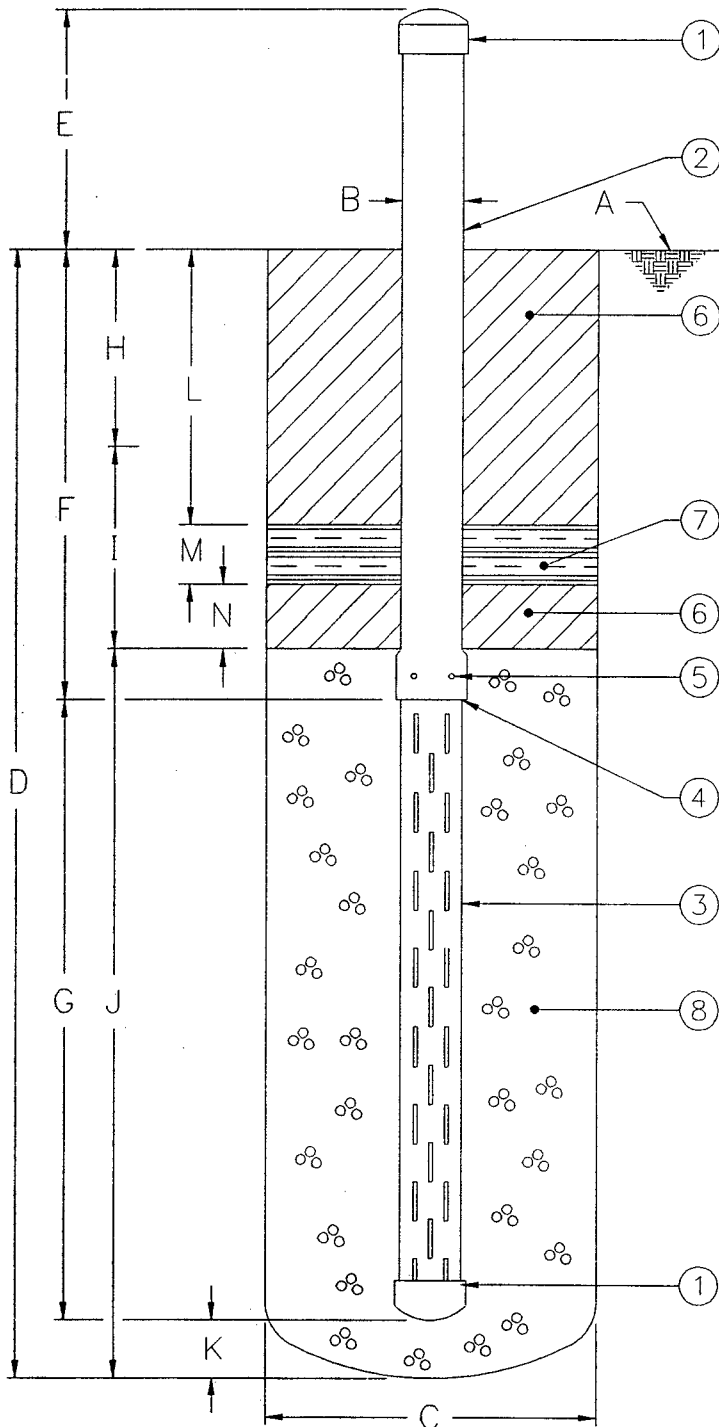
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/27/98
 WET PROJECT NO: 98496

WELL NUMBER: T-5
 WELL LOCATION: N: 9396
 E: 11210



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	183.2 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	34 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	20 FT.
G SLOTTED PIPE LENGTH:	14 FT.
H COVER DEPTH:	4 FT.
I REFUSE DEPTH TO AGGREGATE:	14 FT.
J AGGREGATE PACK:	16 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	14 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/27/98

WELL NUMBER: T-5

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 4'	SAND COVER	N/A	MOIST		
4' - 5'	HOUSEHOLD GARBAGE	SLIGHT	MOIST		
5' - 9'	HOUSEHOLD GARBAGE, WOOD	SLIGHT	DRY	90 °	
9' - 10'	DAY COVER	N/A	DRY		
10' - 15'	HOUSEHOLD GARBAGE, PAPER, PLASTIC	SLIGHT	DRY		
15' - 20'	PAPER, PLASTIC, CONCRETE	MODERATE	DRY	94 °	
20' - 27'	WOOD, HOUSEHOLD GARBAGE	MODERATE	DRY		
27' - 30'	DAY COVER	N/A	DRY		
30' - 34'	HOUSEHOLD GARBAGE, WOOD, CARPET	MODERATE	MOIST	118 °	

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/14/98

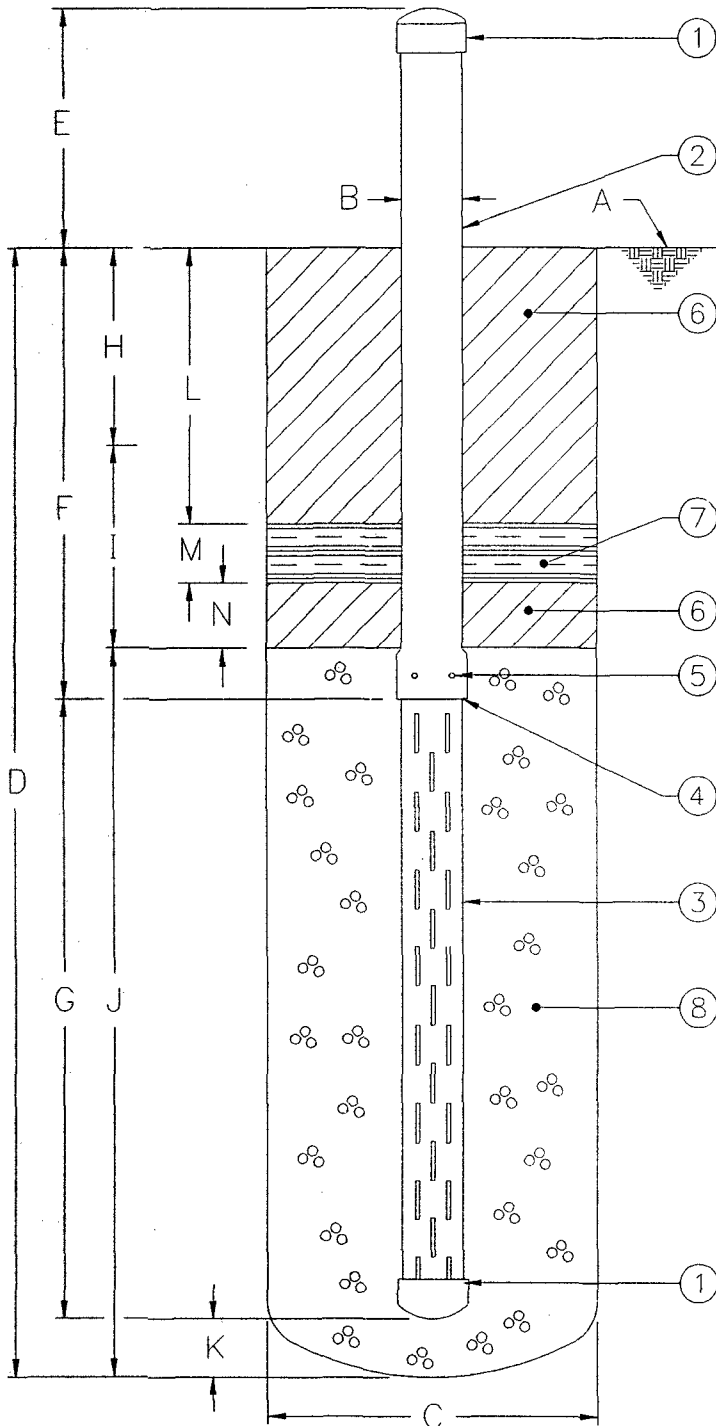
WELL NUMBER: T-6

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	PAPER	SLIGHT	DRY		
5' - 10'	WOOD, WIRE, PLASTIC	SLIGHT	DRY	90°	
10' - 20'	CARPET, WOOD	MODERATE	MOIST		
20' - 22'	DAY COVER	N/A	MOIST		
22' - 30'	MEDICAL WASTE, WIRE, WOOD	MODERATE	MOIST		
30' - 33'	DAY COVER	N/A	MOIST	115°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/21/98
 WET PROJECT NO: 98496

WELL NUMBER: T-7
 WELL LOCATION: N: 9449
 E: 11050



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	186.7 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	36 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	18 FT.
G SLOTTED PIPE LENGTH:	18 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	14 FT.
J AGGREGATE PACK:	20 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	12 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR'S DRILLING/ A WET COMPANY
DRILLING DATE: 09/21/98

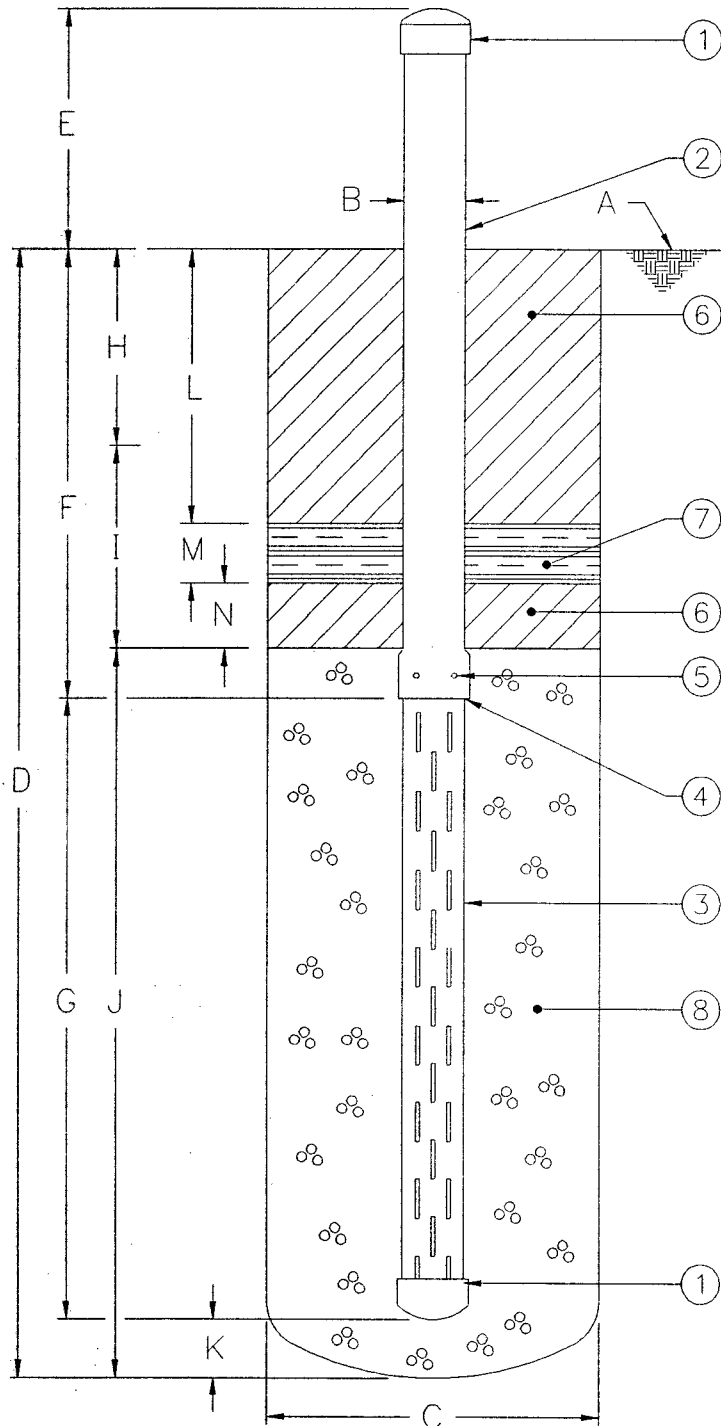
WELL NUMBER: T-7

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	DRY		
2' - 5'	CLAY, HOUSEHOLD GARBAGE	MODERATE	MOIST	88°	
5' - 10'	HOUSEHOLD GARBAGE	MODERATE	MOIST	90°	
10' - 15'	HOUSEHOLD GARBAGE, 1" METAL STRAPPING	HEAVY	MOIST	94°	
15' - 20'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	98°	
20' - 25'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	WET	100°	
25' - 30'	HOUSEHOLD GARBAGE, 5/8" WIRE	HEAVY	WET	104°	
30' - 35'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	WET	106°	
35' - 36'	HOUSEHOLD GARBAGE, SILT	HEAVY	WET	106°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/27/98
 WET PROJECT NO: 98496

WELL NUMBER: T-8
 WELL LOCATION: N: 9720
 E: 11038



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	191.6 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	43 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	22 FT.
G SLOTTED PIPE LENGTH:	21 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	18 FT.
J AGGREGATE PACK:	23 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	16 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/27/98

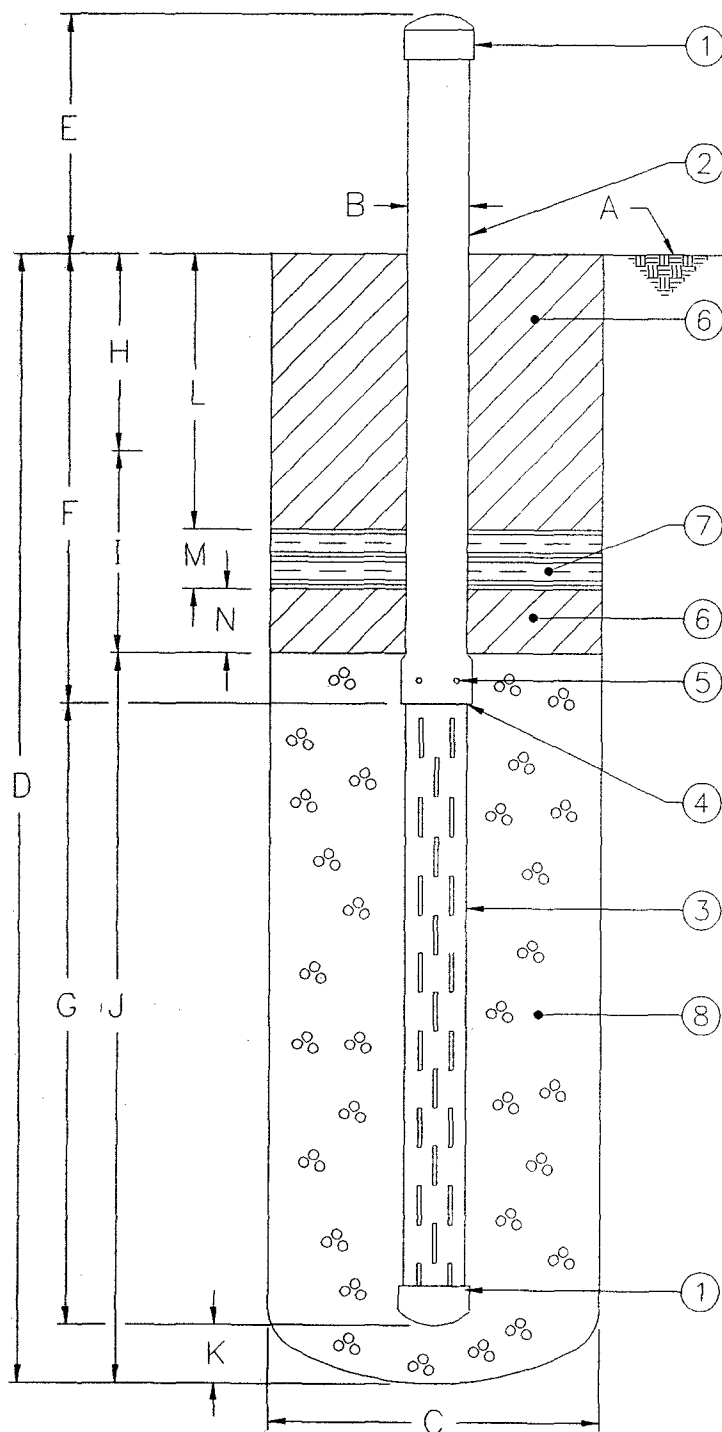
WELL NUMBER: T-8

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	CLAY, PAPER	SLIGHT	MOIST	90°	
5' - 10'	PLASTIC, PAPER	MODERATE	MOIST	96°	
10' - 15'	HOUSEHOLD GARBAGE, GLASS	HEAVY	MOIST	98°	
15' - 20'	PAPER, PADDING	HEAVY	MOIST	104°	
20' - 25'	WIRE, PLASTIC	HEAVY	MOIST	108°	
25' - 30'	CARPET, PAPER, METAL	HEAVY	MOIST	112°	
30' - 35'	WIRE, PAPER	HEAVY	MOIST	118°	
35' - 36'	DAY COVER	N/A	MOIST		
36' - 43'	PLASTIC, PAPER	HEAVY	MOIST	118°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/27/98
 WET PROJECT NO: 98496

WELL NUMBER: T-9
 WELL LOCATION: N: 9496
 E: 10913



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	188.1 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	35 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	20 FT.
G SLOTTED PIPE LENGTH:	15 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	16 FT.
J AGGREGATE PACK:	17 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	14 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR'S DRILLING/ A WET COMPANY
DRILLING DATE: 09/27/98

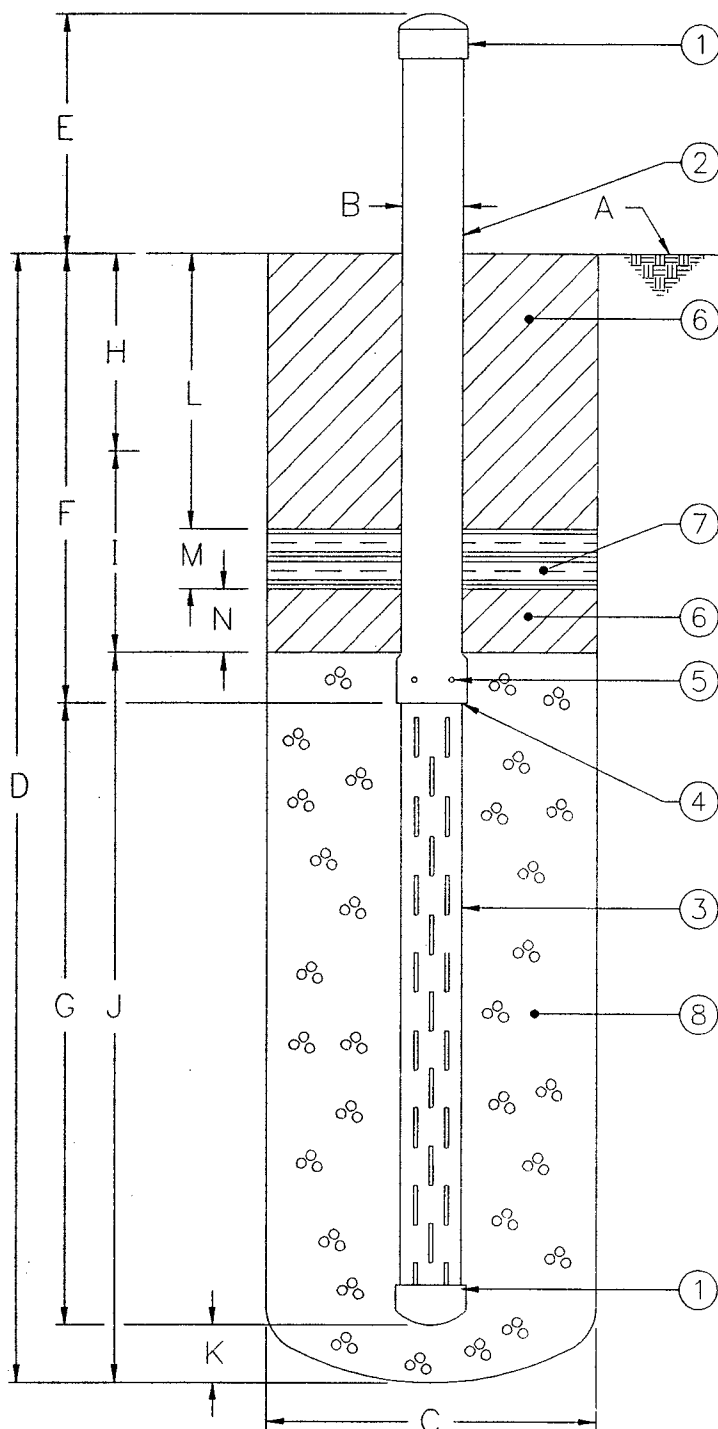
WELL NUMBER: T-9

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	CLAY, HOUSEHOLD GARBAGE	MODERATE	MOIST	90°	
5' - 9'	HOUSEHOLD GARBAGE	MODERATE	MOIST	94°	
9' - 10'	DAY COVER	N/A	MOIST		
10' - 15'	HOUSEHOLD GARBAGE, GRASS CLIPPINGS	HEAVY	MOIST	98°	
15' - 20'	HOUSEHOLD GARBAGE, CARPET PADDING	HEAVY	MOIST	102°	
20' - 25'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	108°	
25' - 30'	HOUSEHOLD GARBAGE, 1 1/4" ANGLE IRON	HEAVY	MOIST	112°	
30' - 35'	HOUSEHOLD GARBAGE, DIRT	HEAVY	MOIST	118°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/27/98
 WET PROJECT NO: 98496

WELL NUMBER: T-10
 WELL LOCATION: N: 9565
 E: 10803



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	191.4 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	36 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	20 FT.
G SLOTTED PIPE LENGTH:	16 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	16 FT.
J AGGREGATE PACK:	18 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	14 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/27/98

WELL NUMBER: T-10

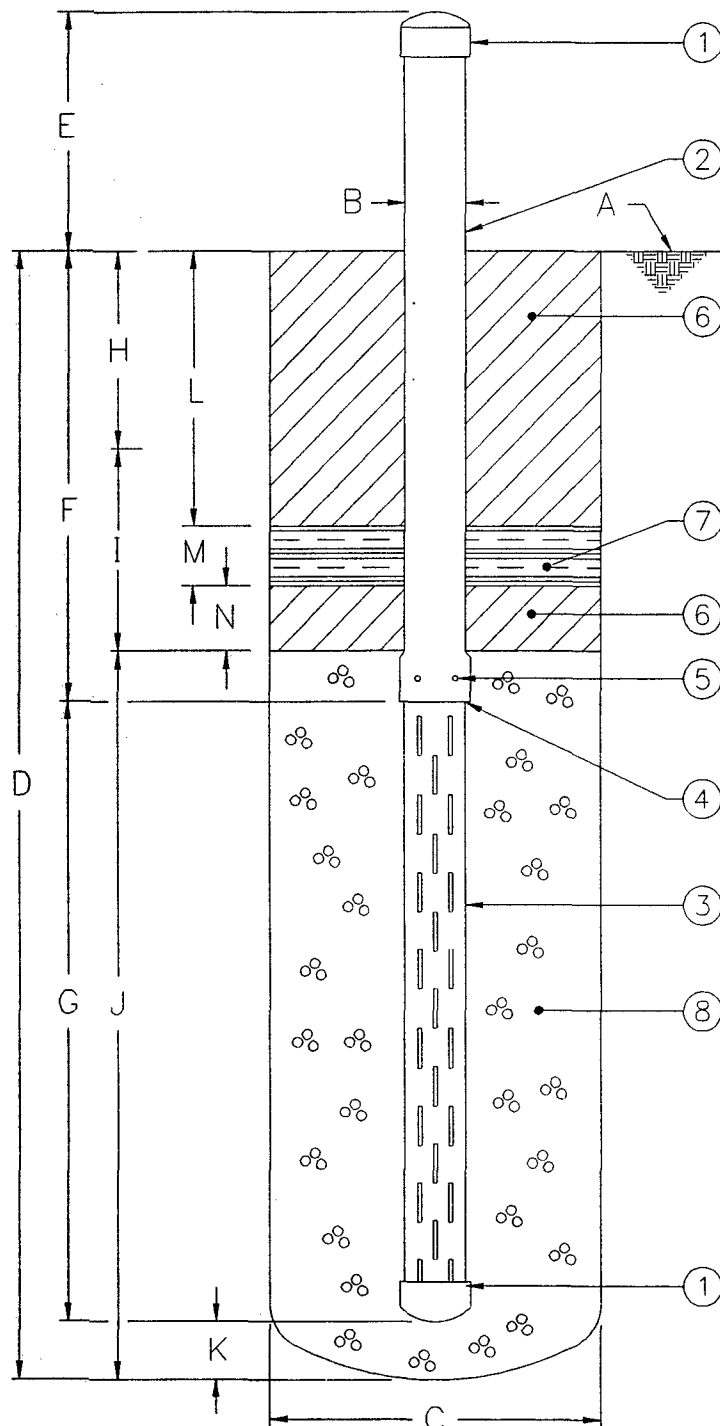
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	PLASTIC	SLIGHT	MOIST	92°	
5' - 10'	PAPER, WIRE	MODERATE	MOIST	94°	
10' - 15'	GLASS, PAPER, WIRE	HEAVY	MOIST	98°	
15' - 20'	HOUSEHOLD GARBAGE, PAPER	HEAVY	MOIST	115°	
20' - 25'	PLASTIC, PAPER	HEAVY	MOIST	124°	
25' - 30'	CLAY, PAPER, PLASTIC	HEAVY	MOIST	130°	
30' - 36'	PAPER, PLASTIC	HEAVY	MOIST	131°	

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496
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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 10/06/98
 WET PROJECT NO: 98496

WELL NUMBER: T-11
 WELL LOCATION: N: 9719
 E: 10698



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	207.1 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	51 FT.
E SOLID PIPE ABOVE GROUND:	6 FT.
F SOLID PIPE BELOW GROUND:	25 FT.
G SLOTTED PIPE LENGTH:	24 FT.
H COVER DEPTH:	8 FT.
I REFUSE DEPTH TO AGGREGATE:	15 FT.
J AGGREGATE PACK:	28 FT.
K AGGREGATE BASE:	2 FT.
L SOIL BACKFILL:	19 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 10/06/98

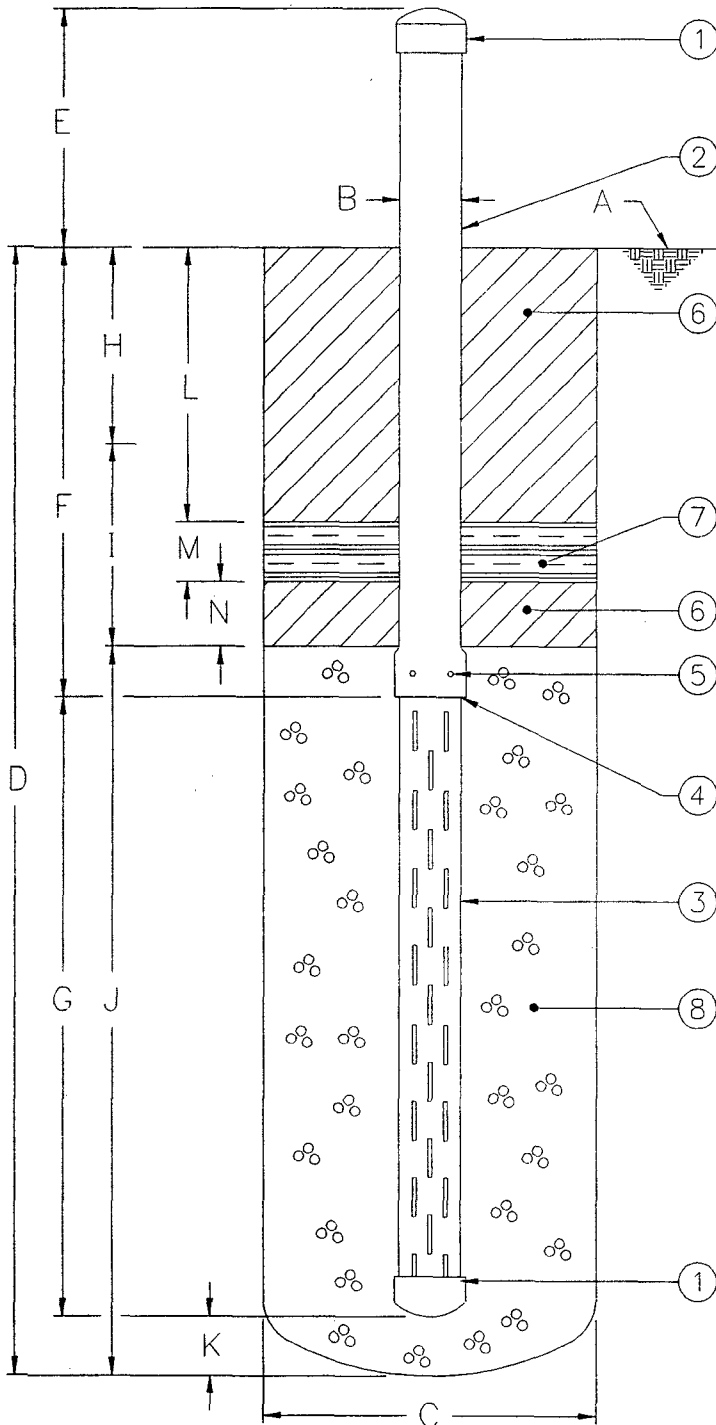
WELL NUMBER: T-11

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 8'	SAND COVER	N/A	DRY	100°	BENCH BUILT
8' - 10'	PAPER	SLIGHT	DRY	106°	
10' - 15'	PAPER, WOOD, PLASTIC	SLIGHT	DRY	110°	
15' - 20'	PAPER, WOOD, CLAY	SLIGHT	DRY	112°	
20' - 25'	CLAY, WOOD, TIRES, PAPER	SLIGHT	DRY	118°	
25' - 30'	PAPER, WOOD, METAL	SLIGHT	DRY	120°	
30' - 35'	PAPER, PLASTIC	SLIGHT	DRY	126°	
35' - 40'	PAPER, PLASTIC, CLAY	SLIGHT	DRY	130°	
40' - 45'	CARPET, WOOD, PLASTIC	SLIGHT	DRY	130°	
45' - 51'	PAPER, PLASTIC, WOOD	SLIGHT	MOIST	134°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/14/98
 WET PROJECT NO: 98496

WELL NUMBER: T-12
 WELL LOCATION: N: 9439
 E: 10688



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	218.3 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	59 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	30 FT.
G SLOTTED PIPE LENGTH:	29 FT.
H COVER DEPTH:	3 FT.
I REFUSE DEPTH TO AGGREGATE:	25 FT.
J AGGREGATE PACK:	31 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	24 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/14/98

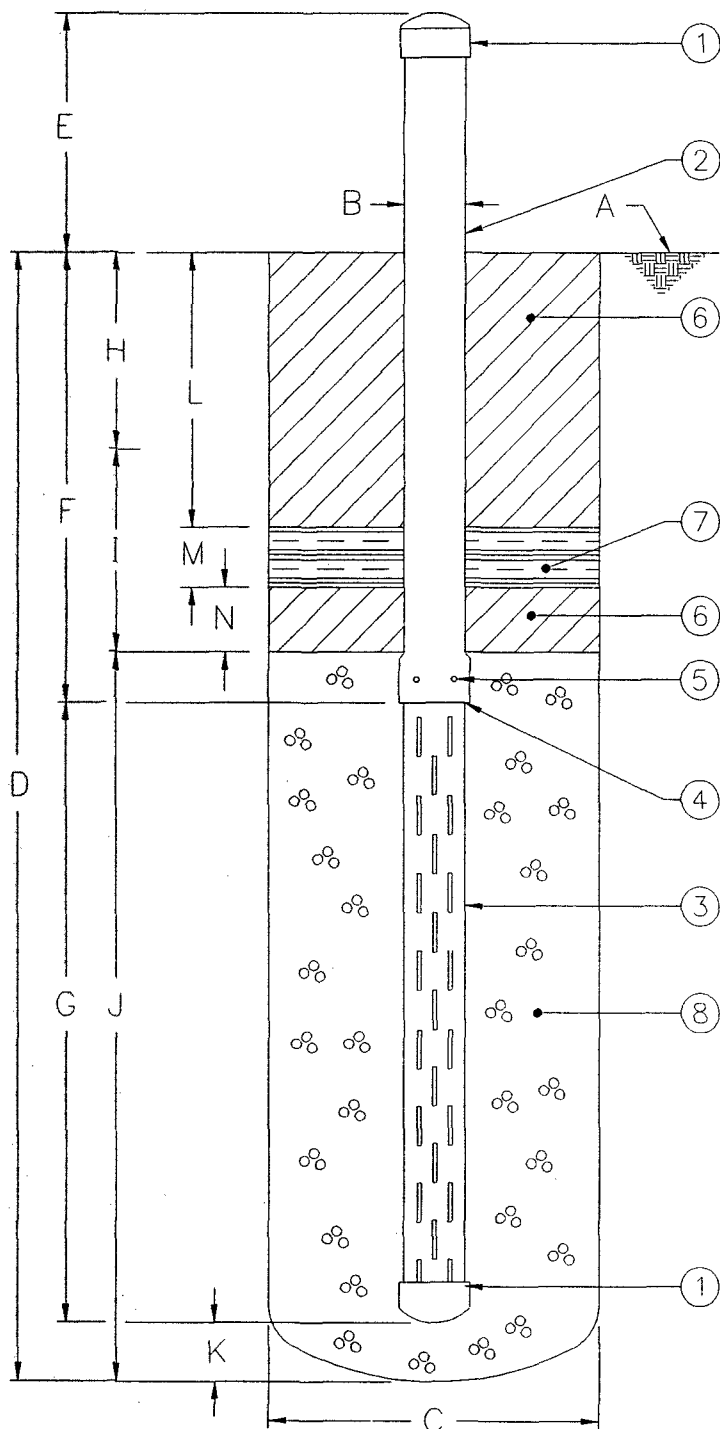
WELL NUMBER: T-12

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	HOUSEHOLD GARBAGE	SLIGHT	DRY	92°	
5' - 10'	HOUSEHOLD GARBAGE, WIRE	SLIGHT	DRY	96°	
10' - 15'	HOUSEHOLD GARBAGE	MODERATE	DRY	102°	
15' - 20'	HOUSEHOLD GARBAGE, TREE LIMBS	MODERATE	MOIST	110°	
20' - 25'	HOUSEHOLD GARBAGE, FOAM RUBBER	MODERATE	MOIST	112°	
25' - 30'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	118°	
30' - 32'	HOUSEHOLD GARBAGE	HEAVY	MOIST	120°	
32' - 35'	DAY COVER	N/A	MOIST		
35' - 40'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	120°	
40' - 45'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	124°	
45' - 50'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	124°	
50' - 55'	HOUSEHOLD GARBAGE	HEAVY	MOIST	124°	
55' - 59'	HOUSEHOLD GARBAGE	HEAVY	MOIST	124°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/11/98
 WET PROJECT NO: 98496

WELL NUMBER: T-13
 WELL LOCATION: N: 9452
 E: 10485



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	213.2 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	55 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	28 FT.
G SLOTTED PIPE LENGTH:	27 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	24 FT.
J AGGREGATE PACK:	29 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	22 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
 DRILLING DATE: 09/11/98

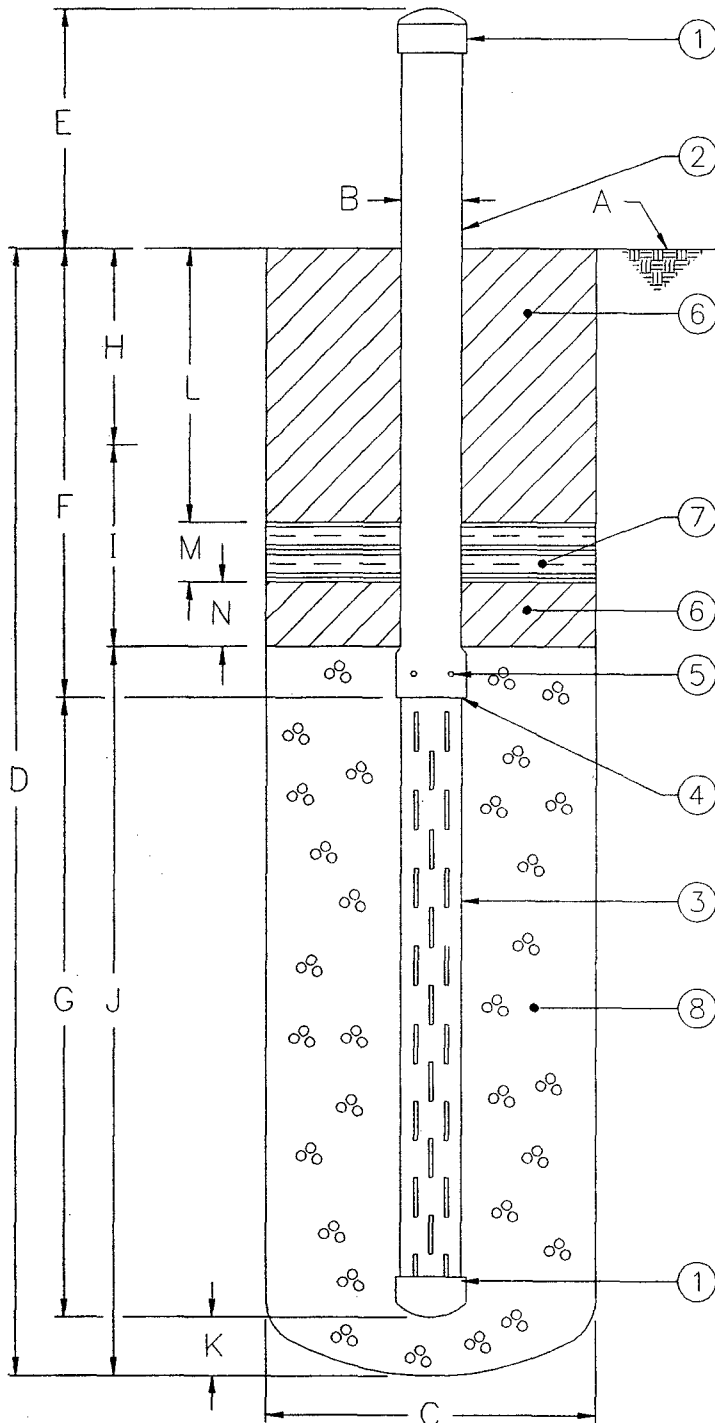
WELL NUMBER: T-13

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST			
2' - 5'	HOUSEHOLD GARBAGE	SLIGHT	MOIST	82°		
5' - 10'	HOUSEHOLD GARBAGE, PLYWOOD	SLIGHT	MOIST	98°		
10' - 15'	HOUSEHOLD GARBAGE, WOOD SCRAPS	MODERATE	MOIST	106°		
15' - 20'	HOUSEHOLD GARBAGE, WOOD SCRAPS	MODERATE	MOIST	112°		
20' - 25'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST	120°		
25' - 30'	HOUSEHOLD GARBAGE	HEAVY	MOIST	128°		
30' - 35'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	130°		
35' - 40'	HOUSEHOLD GARBAGE	HEAVY	MOIST	130°		
40' - 45'	HOUSEHOLD GARBAGE	HEAVY	MOIST	128°	1988	CHECK STUB
45' - 50'	HOUSEHOLD GARBAGE, CAR TIRE	HEAVY	MOIST	126°		
50' - 55'	HOUSEHOLD GARBAGE, SAND, SHOPPING CART	HEAVY	MOIST	126°		

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING DATE: 09/12/98
WET PROJECT NO: 98496

WELL NUMBER: T-14
WELL LOCATION: N: 9236
E: 10460



MATERIAL LIST

1	CAP:	6" SCH 80 CPVC
2	PIPE:	6" SCH 80 CPVC
3	SLOTTED PIPE:	6" SCH 80 CPVC
4	CONNECTION:	BELLED END
5	LAG BOLTS:	1" x 1/2"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	HOLEPLUG
8	AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	211.5 FT.
B	PIPE SIZE:	6 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	51 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	26 FT.
G	SLOTTED PIPE LENGTH:	25 FT.
H	COVER DEPTH:	3 FT.
I	REFUSE DEPTH TO AGGREGATE:	21 FT.
J	AGGREGATE PACK:	27 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	20 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
COVER/REFUSE INTERFACE AS ILLUSTRATED IN
DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
11 TUPELO AVENUE S. E.
FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/12/98

WELL NUMBER: T-14

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	HOUSEHOLD GARBAGE, ROPE	SLIGHT	DRY		
5' - 10'	HOUSEHOLD GARBAGE, WOOD SCRAPS	SLIGHT	DRY	86°	
10' - 15'	HOUSEHOLD GARBAGE, WOOD SCRAPS	SLIGHT	DRY		
15' - 20'	HOUSEHOLD GARBAGE, CARPET	SLIGHT	MOIST	92°	
20' - 28'	HOUSEHOLD GARBAGE	MODERATE	MOIST		
28' - 30'	DAY COVER	N/A	MOIST		
30' - 40'	HOUSEHOLD GARBAGE, HOSE	MODERATE	MOIST	106°	
40' - 50'	HOUSEHOLD GARBAGE, PLYWOOD	MODERATE	MOIST		
50' - 51'	HOUSEHOLD GARBAGE	HEAVY	MOIST	114°	

ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR'S DRILLING/ A WET COMPANY
DRILLING DATE: 09/12/98

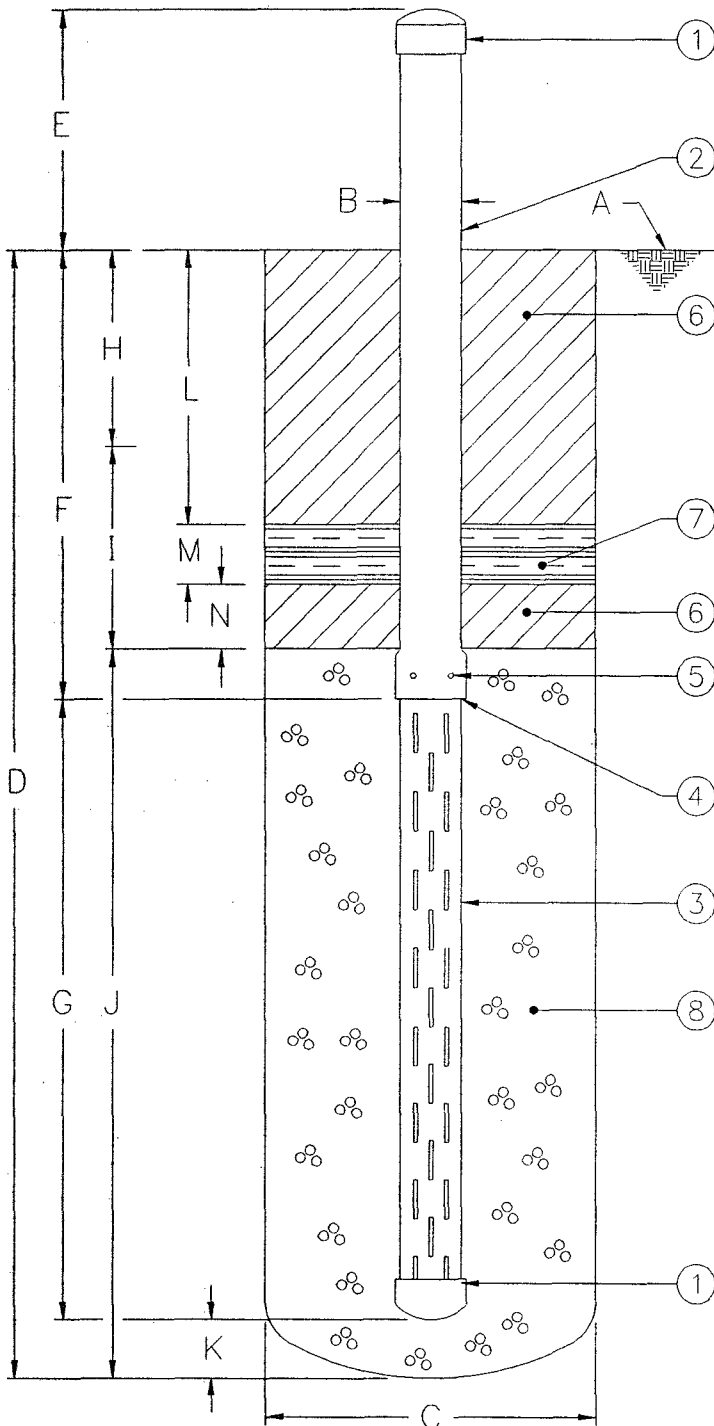
WELL NUMBER: T-15

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 4'	SAND COVER	N/A	DRY		
4' - 5'	HOUSEHOLD GARBAGE, PLYWOOD	SLIGHT	DRY		
5' - 10'	HOUSEHOLD GARBAGE, WOOD SCRAPS	SLIGHT	DRY	84°	
10' - 15'	HOUSEHOLD GARBAGE, ROPE, WIRE	SLIGHT	DRY		
15' - 20'	HOUSEHOLD GARBAGE, METAL PIPE	SLIGHT	MOIST	106°	
20' - 30'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST		
30' - 40'	HOUSEHOLD GARBAGE, METAL PIPE	MODERATE	MOIST	114°	
40' - 50'	HOUSEHOLD GARBAGE, SHRUBS	MODERATE	MOIST		
50' - 56'	HOUSEHOLD GARBAGE	HEAVY	MOIST	128°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/17/98
 WET PROJECT NO: 98496

WELL NUMBER: T-16
 WELL LOCATION: N: 9297
 E: 10889



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	216.1 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	61 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	21 FT.
G SLOTTED PIPE LENGTH:	20 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	27 FT.
J AGGREGATE PACK:	32 FT.
K AGGREGATE BASE:	20 FT.
L SOIL BACKFILL:	25 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/17/98

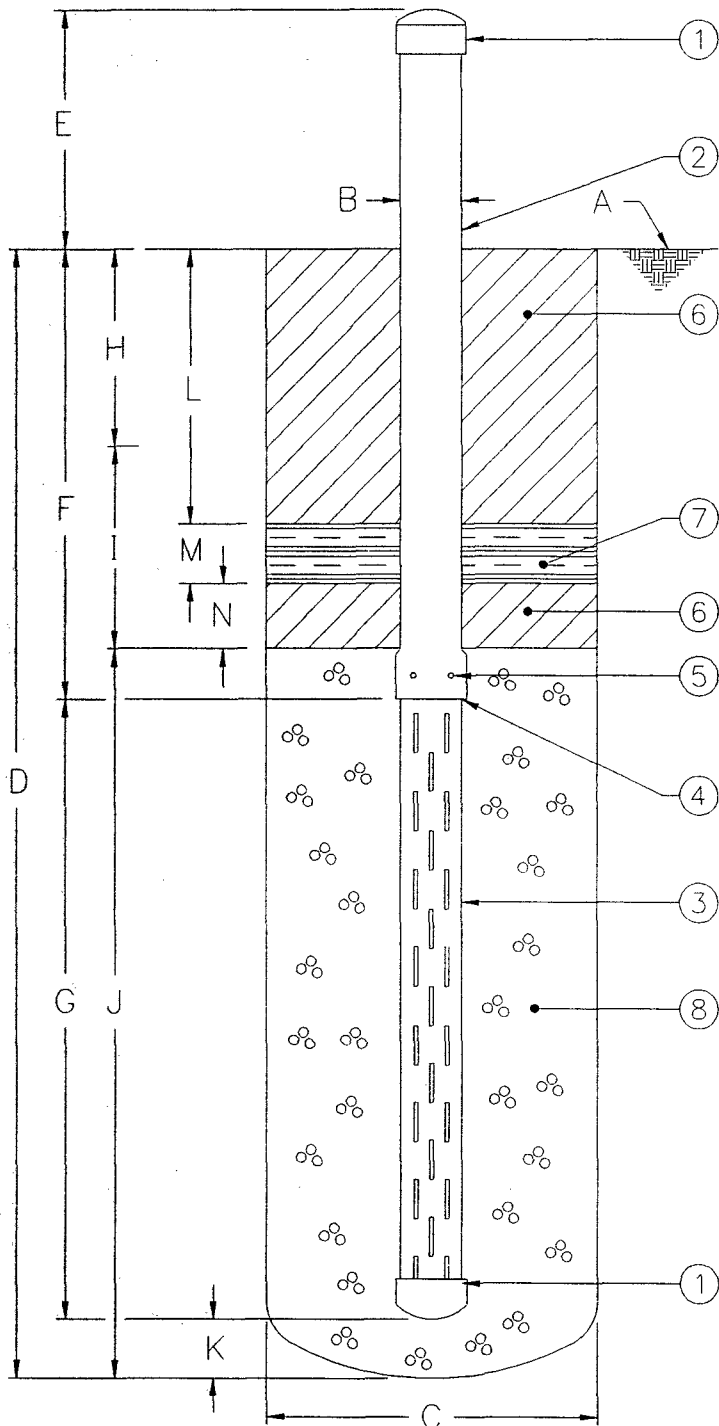
WELL NUMBER: T-16

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	HOUSEHOLD GARBAGE	MODERATE	MOIST	90°	
5' - 10'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST	92°	
10' - 15'	HOUSEHOLD GARBAGE, PLYWOOD	MODERATE	MOIST	98°	
15' - 20'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	106°	
20' - 25'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	110°	
25' - 30'	HOUSEHOLD GARBAGE	HEAVY	MOIST	114°	
30' - 35'	HOUSEHOLD GARBAGE, CANVAS TARP	HEAVY	MOIST	118°	
35' - 40'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	120°	
40' - 45'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	120°	
45' - 50'	HOUSEHOLD GARBAGE, TRUCK TIRE	HEAVY	MOIST	122°	
50' - 55'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	124°	
55' - 60'	HOUSEHOLD GARBAGE, CAR TIRE	HEAVY	MOIST	122°	
60' - 61'	HOUSEHOLD GARBAGE	HEAVY	MOIST	122°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/17/98
 WET PROJECT NO: 98496

WELL NUMBER: T-17
 WELL LOCATION: N: 9297
 E: 11122



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	206.8 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	52 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	26 FT.
G SLOTTED PIPE LENGTH:	26 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	22 FT.
J AGGREGATE PACK:	28 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	20 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/17/98

WELL NUMBER: T-17

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	DRY		
2' - 5'	CLAY, HOUSEHOLD GARBAGE	SLIGHT	DRY	90°	
5' - 8'	HOUSEHOLD GARBAGE	SLIGHT	DRY	92°	
8' - 10'	DAY COVER	N/A	DRY		
10' - 15'	HOUSEHOLD GARBAGE, CARPET PADDING	MODERATE	MOIST	96°	
15' - 20'	HOUSEHOLD GARBAGE, RE-BAR	HEAVY	MOIST	100°	
20' - 25'	HOUSEHOLD GARBAGE, FOAM RUBBER	HEAVY	MOIST	104°	
25' - 30'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	108°	
30' - 35'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	112°	
35' - 40'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	116°	
40' - 45'	HOUSEHOLD GARBAGE, CAR HUBCAP	HEAVY	MOIST	118°	
45' - 50'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	120°	
50' - 52'	HOUSEHOLD GARBAGE	HEAVY	MOIST	120°	

ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/17/98

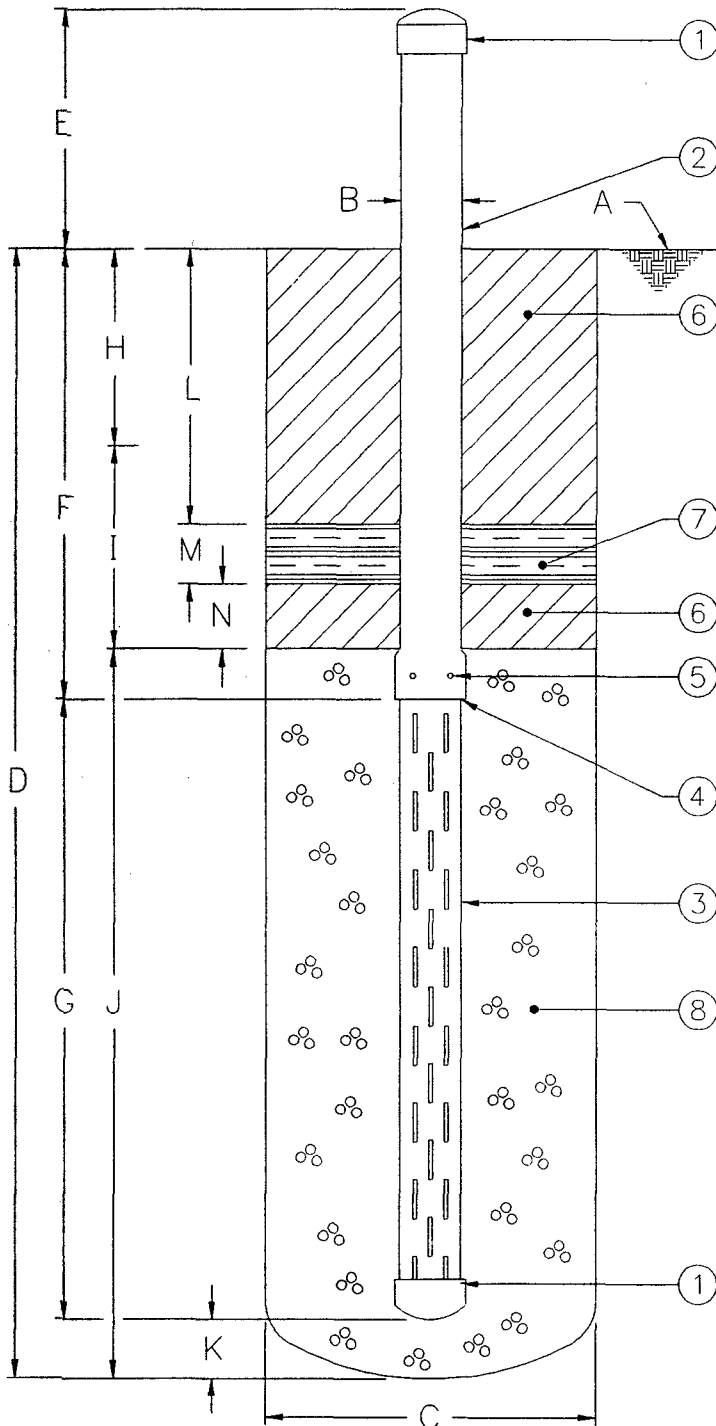
WELL NUMBER: T-18

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	DIRT, WOOD SCRAPS	HEAVY	MOIST	88°	
5' - 10'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	94°	
10' - 13'	HOUSEHOLD GARBAGE	HEAVY	MOIST	98°	
13' - 15'	DAY COVER	N/A	MOIST		
15' - 20'	HOUSEHOLD GARBAGE, BRAIDED WIRE ROPE	HEAVY	MOIST	102°	
20' - 25'	HOUSEHOLD GARBAGE, CARPET PADDING	HEAVY	MOIST	104°	
25' - 30'	HOUSEHOLD GARBAGE, TRUCK TIRE	HEAVY	MOIST	108°	
30' - 35'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	110°	
35' - 40'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	114°	
40' - 45'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	118°	
45' - 50'	HOUSEHOLD GARBAGE, ALUMINUM STRIPPING	HEAVY	MOIST	120°	
50' - 52'	HOUSEHOLD GARBAGE	HEAVY	MOIST	118°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/16/98
 WET PROJECT NO: 98496

WELL NUMBER: T-19
 WELL LOCATION: N: 9293
 E: 11659



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	214.4 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	66 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	33 FT.
G SLOTTED PIPE LENGTH:	33 FT.
H COVER DEPTH:	3 FT.
I REFUSE DEPTH TO AGGREGATE:	28 FT.
J AGGREGATE PACK:	35 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	27 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/16/98

WELL NUMBER: T-19

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	HOUSEHOLD GARBAGE, WIRE	SLIGHT	DRY		
5' - 10'	PLASTIC, WOOD, CARPET	SLIGHT	DRY	102°	
10' - 12'	HOUSEHOLD GARBAGE, WOOD	SLIGHT	DRY		
12' - 15'	DAY COVER	N/A	DRY		
15' - 20'	HOUSEHOLD GARBAGE, METAL, CARPET	MODERATE	DRY	118°	
20' - 30'	PAPER, RUBBER, WOOD	MODERATE	MOIST		
30' - 40'	PAPER, PLASTIC, CARPET	MODERATE	MOIST	122°	
40' - 42'	HOUSEHOLD GARBAGE	HEAVY	MOIST		
42' - 45'	DAY COVER	N/A	MOIST		
45' - 50'	HOUSEHOLD GARBAGE, TARP	HEAVY	MOIST		
50' - 60'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	120°	
60' - 66'	HOUSEHOLD GARBAGE	HEAVY	MOIST	120°	

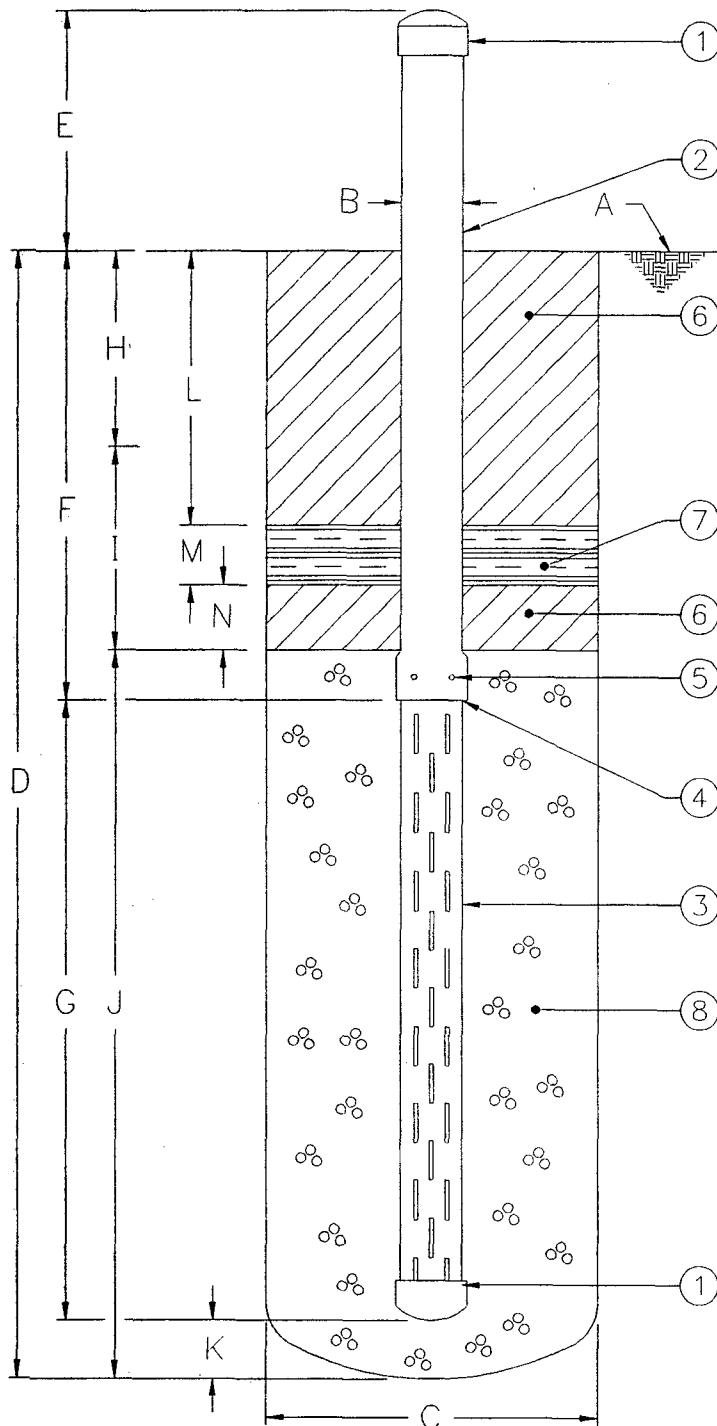
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING DATE: 09/16/98
WET PROJECT NO: 98496

WELL NUMBER: T-20
WELL LOCATION: N: 9292
E: 11934



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	218.4 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	73 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	37 FT.
G SLOTTED PIPE LENGTH:	36 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	33 FT.
J AGGREGATE PACK:	38 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	31 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
COVER/REFUSE INTERFACE AS ILLUSTRATED IN
DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
11 TUPELO AVENUE S. E.
FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
 DRILLING DATE: 09/16/98

WELL NUMBER: T-20

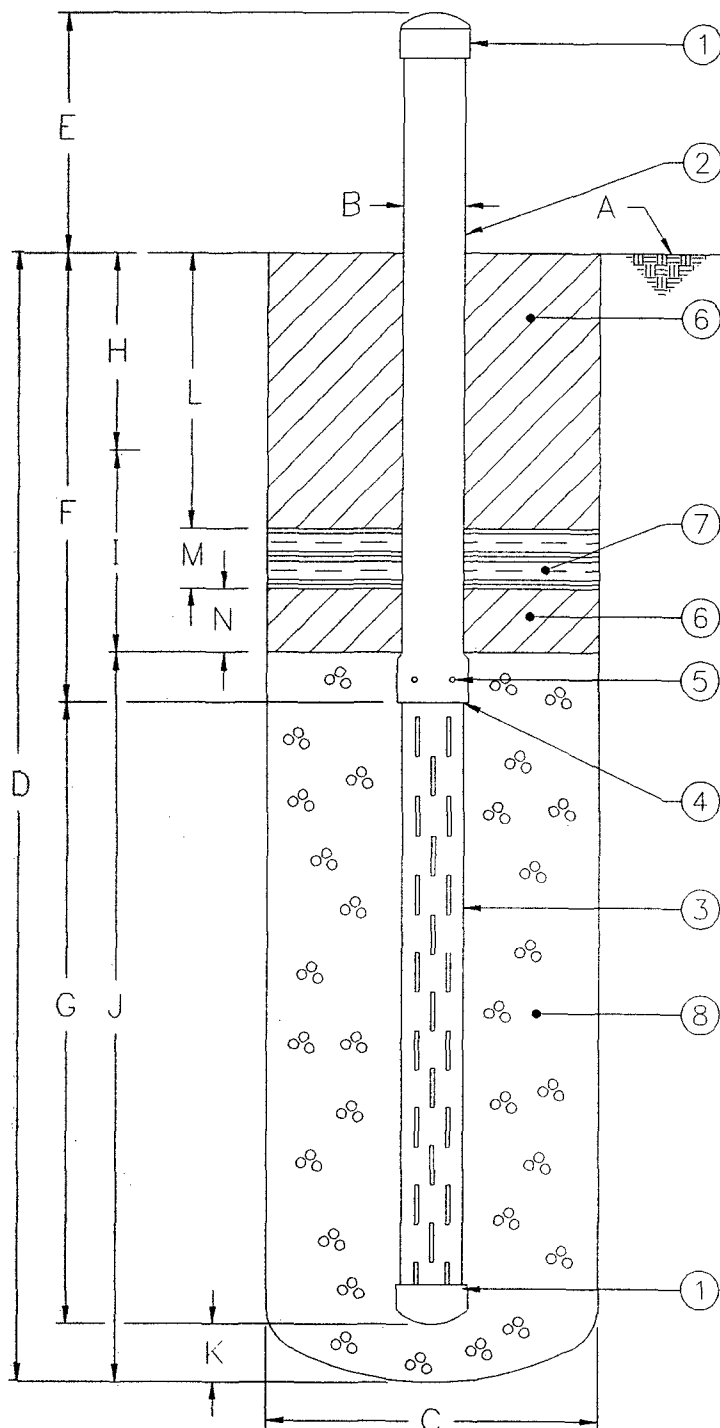
DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	DRY		
2' - 5'	HOUSEHOLD GARBAGE, CARPET	SLIGHT	DRY	92°	
5' - 10'	HOUSEHOLD GARBAGE, PLYWOOD	SLIGHT	DRY	96°	
10' - 15'	HOUSEHOLD GARBAGE, WOOD SCRAPS	SLIGHT	DRY	98°	
15' - 20'	HOUSEHOLD GARBAGE, 1" METAL STRAP	MODERATE	MOIST	104°	
20' - 25'	HOUSEHOLD GARBAGE, CARPET	MODERATE	MOIST	108°	
25' - 30'	HOUSEHOLD GARBAGE, WOOD SCRAPS	MODERATE	MOIST	116°	
30' - 35'	HOUSEHOLD GARBAGE, GRASS CLIPPINGS	MODERATE	MOIST	118°	
35' - 40'	HOUSEHOLD GARBAGE, CAR RIM	HEAVY	MOIST	120°	
40' - 45'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	122°	
45' - 50'	HOUSEHOLD GARBAGE	HEAVY	MOIST	124°	
50' - 55'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	128°	
55' - 60'	HOUSEHOLD GARBAGE, TREE LIMBS	HEAVY	MOIST	132°	
60' - 65'	HOUSEHOLD GARBAGE, CAR TIRES	HEAVY	MOIST	134°	
65' - 68'	HOUSEHOLD GARBAGE	HEAVY	MOIST	134°	
68' - 70'	DAY COVER	N/A	MOIST		
70' - 73'	HOUSEHOLD GARBAGE	HEAVY	MOIST	132°	

Waste Energy Technology, Inc.
 11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
 (850) 243-0033 WET Project No. 98496
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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/16/98
 WET PROJECT NO: 98496

WELL NUMBER: T-21
 WELL LOCATION: N: 9288
 E: 12208



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	213.0 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	71 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	36 FT.
G SLOTTED PIPE LENGTH:	35 FT.
H COVER DEPTH:	3 FT.
I REFUSE DEPTH TO AGGREGATE:	31 FT.
J AGGREGATE PACK:	37 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	30 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
 DRILLING DATE: 09/16/98

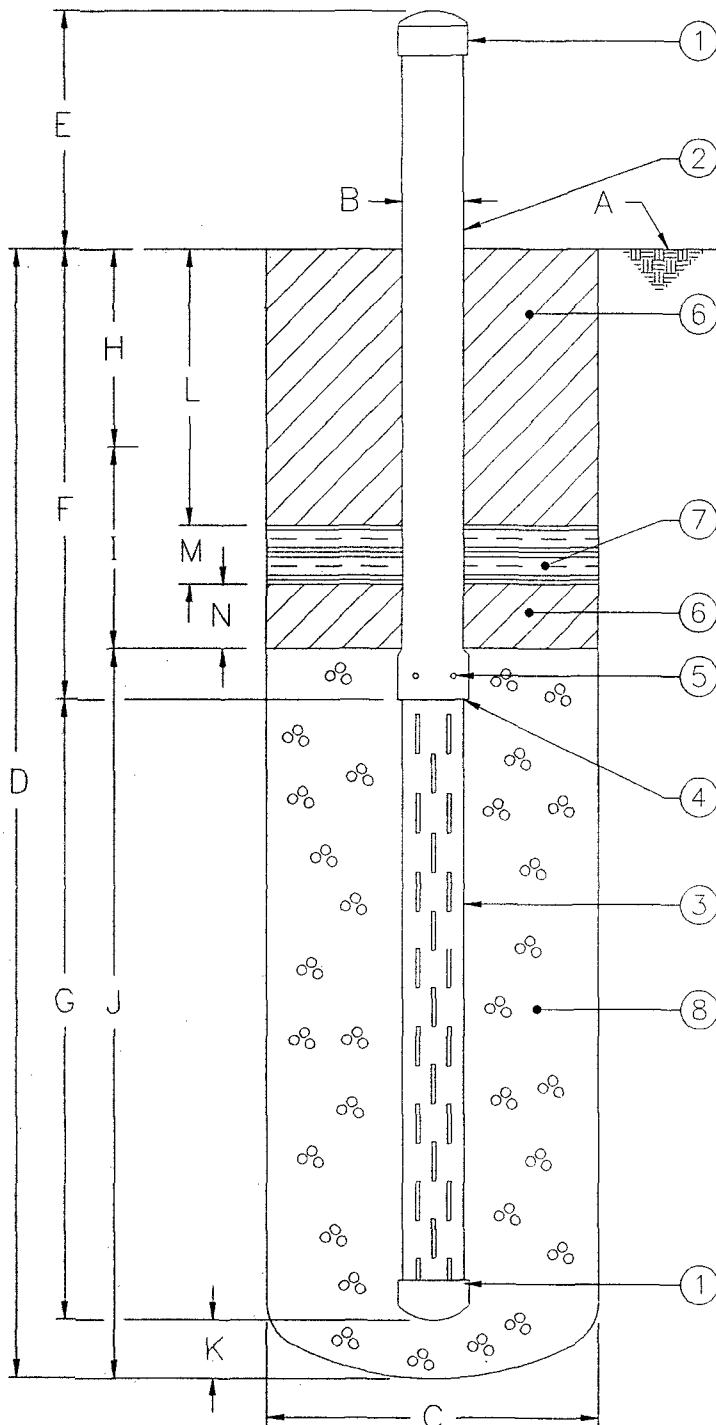
WELL NUMBER: T-21

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	SAND COVER	N/A	DRY		
3' - 5'	PLASTIC, PAPER	SLIGHT	DRY		
5' - 10'	WOOD, PAPER	SLIGHT	DRY	91°	
10' - 15'	PLASTIC, WOOD, PAPER	MODERATE	MOIST		
15' - 20'	PAPER, WOOD, PLASTIC	MODERATE	MOIST	112°	
20' - 22'	DAY COVER	N/A	MOIST		
22' - 30'	HOUSEHOLD GARBAGE, PAPER, PLASTIC	MODERATE	MOIST		
30' - 38'	WIRE, WOOD, TIRES	HEAVY	MOIST		
38' - 40'	DAY COVER	N/A	MOIST		
40' - 50'	WOOD, CARPET, STEEL	HEAVY	MOIST	133°	
50' - 60'	PLASTIC, WOOD, CARPET	HEAVY	MOIST		
60' - 64'	PAPER, WOOD	MODERATE	MOIST		
64' - 66'	DAY COVER	N/A	MOIST		
66' - 71'	PAPER, WOOD	MODERATE	MOIST	140°	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/23/98
 WET PROJECT NO: 98496

WELL NUMBER: T-22
 WELL LOCATION: N: 9580
 E: 10392



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	214.0 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	53 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	26.5 FT.
G SLOTTED PIPE LENGTH:	26.5 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	22.5 FT.
J AGGREGATE PACK:	28.5 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	20.5 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/23/98

WELL NUMBER: T-22

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	HOUSEHOLD GARBAGE	MODERATE	MOIST	88°	
5' - 10'	HOUSEHOLD GARBAGE, 3/8" FUEL LINE	MODERATE	MOIST	92°	
10' - 15'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	98°	
15' - 20'	HOUSEHOLD GARBAGE, BABY STROLLER	HEAVY	MOIST	102°	
20' - 25'	HOUSEHOLD GARBAGE, CARPET	N/A	MOIST	104°	
25' - 30'	HOUSEHOLD GARBAGE, 1" METAL STRAPPING	HEAVY	MOIST	110°	
30' - 35'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	112°	
35' - 40'	HOUSEHOLD GARAGE, CARPET	HEAVY	MOIST	116°	
40' - 45'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	120°	
45' - 50'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	124°	
50' - 53'	HOUSEHOLD GARBAGE	HEAVY	MOIST	124°	

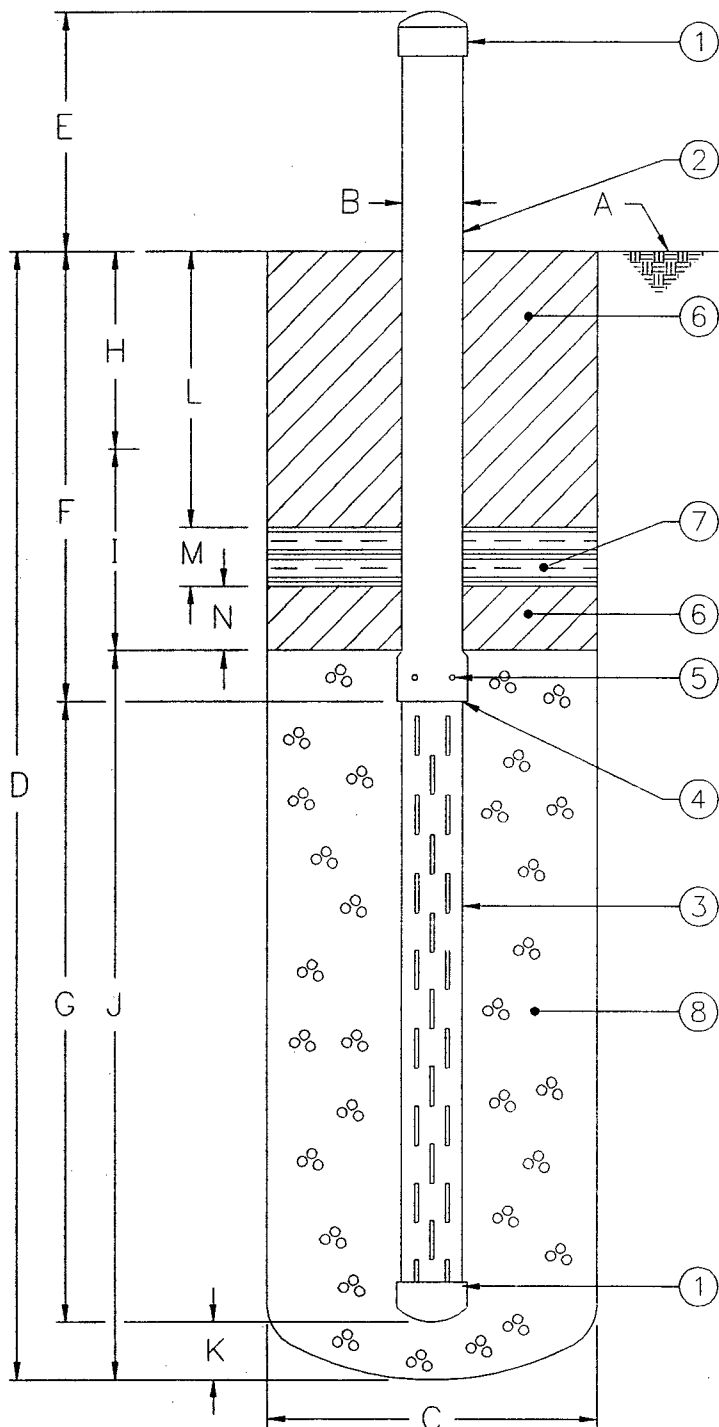
Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/23/98
 WET PROJECT NO: 98496

WELL NUMBER: T-23
 WELL LOCATION: N: 9585
 E: 10592



MATERIAL LIST

1 CAP:	6" SCH 80 CPVC
2 PIPE:	6" SCH 80 CPVC
3 SLOTTED PIPE:	6" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

SPECIFICATIONS

A GROUND SURFACE ELEVATION:	217.6 FT.
B PIPE SIZE:	6 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	57 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	28.5 FT.
G SLOTTED PIPE LENGTH:	28.5 FT.
H COVER DEPTH:	2 FT.
I REFUSE DEPTH TO AGGREGATE:	24.5 FT.
J AGGREGATE PACK:	30.5 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	22.5 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

BENTONITE MAT WAS INSTALLED AT THE LANDFILL
 COVER/REFUSE INTERFACE AS ILLUSTRATED IN
 DETAIL 1/5.

DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
 DRILLING DATE: 09/23/98

WELL NUMBER: T-23

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 2'	SAND COVER	N/A	MOIST		
2' - 5'	HOUSEHOLD GARBAGE	MODERATE	MOIST	88 ^v	
5' - 10'	HOUSEHOLD GARBAGE, GARDEN HOSE	MODERATE	MOIST	90 ^u	
10' - 15'	HOUSEHOLD GARBAGE, WOOD SCRAPS	MODERATE	MOIST	94 ^u	
15' - 20'	HOUSEHOLD GARBAGE, ELECTRICAL WIRE	HEAVY	MOIST	98 ^u	
20' - 25'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	104 ^o	
25' - 30'	HOUSEHOLD GARBAGE, ROCKS	HEAVY	MOIST	108 ^o	
30' - 35'	HOUSEHOLD GARBAGE, PLYWOOD	HEAVY	MOIST	112 ^o	
35' - 40'	HOUSEHOLD GARBAGE, TREE LIMBS	HEAVY	MOIST	118 ^o	
40' - 45'	HOUSEHOLD GARBAGE, 1 1/2" PVC PIPE	HEAVY	MOIST	120 ^o	
45' - 50'	HOUSEHOLD GARBAGE, 3/4" METAL PIPE	HEAVY	MOIST	122 ^o	
50' - 55'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	124 ^o	
55' - 57'	HOUSEHOLD GARAGE	HEAVY	MOIST	124 ^o	MET DRILLING REFUSAL

Waste Energy Technology, Inc.
 11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
 (850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 10/05/98
 WET PROJECT NO: 98496

WELL NUMBER: W-1
 WELL LOCATION: N: 9702
 E: 12211

MATERIAL LIST

1 CAP:	8" SCH 80 CPVC
2 PIPE:	8" SCH 80 CPVC
3 SLOTTED PIPE:	8" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

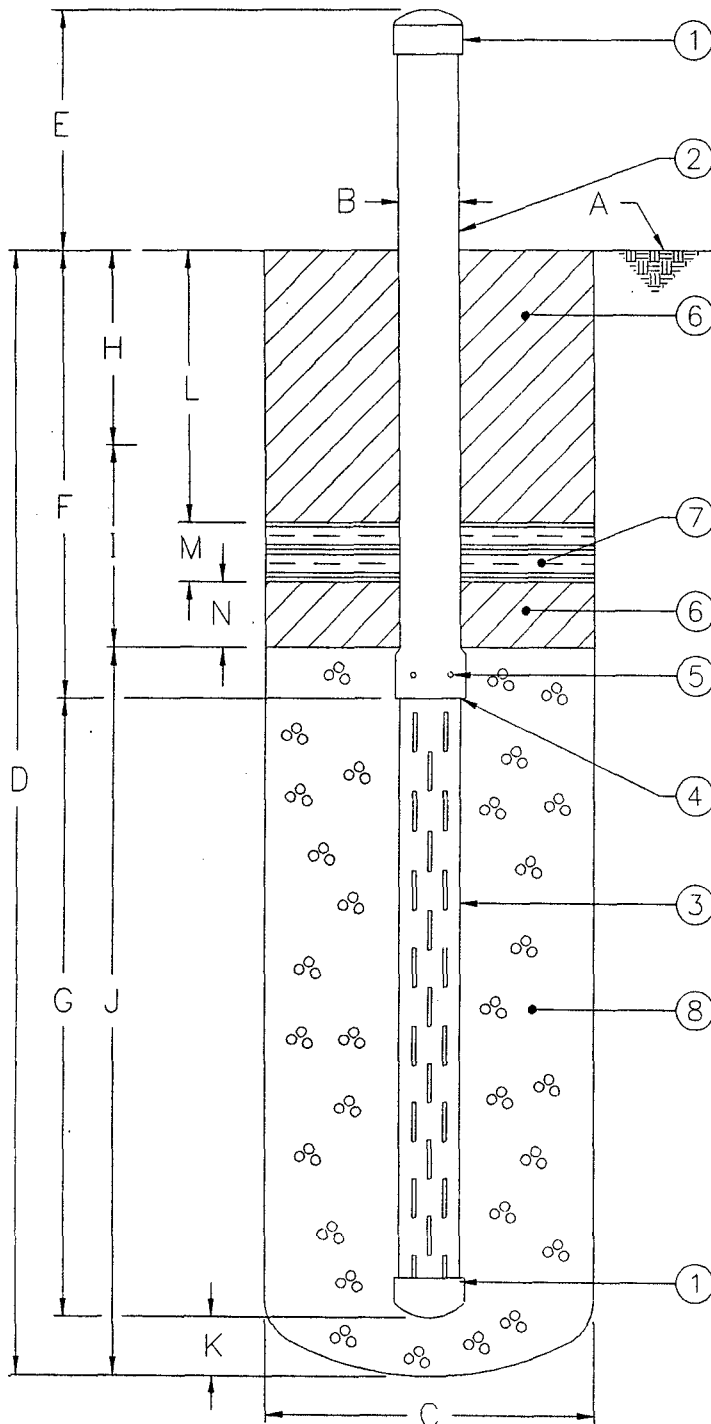
SPECIFICATIONS

A GROUND SURFACE ELEVATION:	191.8 FT.
B PIPE SIZE:	8 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	55 FT.
E SOLID PIPE ABOVE GROUND:	7 FT.
F SOLID PIPE BELOW GROUND:	28 FT.
G SLOTTED PIPE LENGTH:	27 FT.
H COVER DEPTH:	6 FT.
I REFUSE DEPTH TO AGGREGATE:	20 FT.
J AGGREGATE PACK:	29 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	22 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

"L" INCLUDES 2 FOOT OF SOIL LAYER, 1 FOOT OF RECONSTRUCTED CLAY LAYER, 1.5 FEET OF INITIAL COVER, AND A VARIABLE AMOUNT OF GENERAL BACKFILL AS ILLUSTRATED IN DETAIL 1/4.

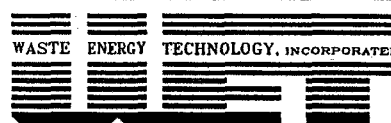
BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/4.



DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 10/05/98

WELL NUMBER: W-1

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 6'	TOP COVER	N/A	DRY	98°		BENCH BUILT
6' - 10'	PAPER, PLASTIC	SLIGHT	DRY	100°		
10' - 15'	PAPER, WOOD, PLASTIC	SLIGHT	DRY	100°		
15' - 20'	PAPER, PLASTIC, WOOD	SLIGHT	DRY	102°	1993	NEWSPAPER
20' - 25'	PAPER, PLASTIC, WOOD	SLIGHT	DRY	108°		
25' - 30'	WOOD, TIRES, PAPER	SLIGHT	DRY	110°		
30' - 35'	CARPET, PAPER, PLASTIC	SLIGHT	DRY	114°		
35' - 40'	PAPER, CLOTHING	SLIGHT	DRY	118°		
40' - 45'	PAPER, CLOTHING	SLIGHT	DRY	120°	1992	NEWSPAPER
45' - 50'	WOOD, PLASTIC, PAPER	SLIGHT	MOIST	124°		
50' - 55'	PAPER, WOOD, PLASTIC	SLIGHT	MOIST	124°		

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/30/98
 WET PROJECT NO: 98496

WELL NUMBER: W-2
 WELL LOCATION: N: 9755
 E: 11964

MATERIAL LIST

1	CAP:	8" SCH 80 CPVC
2	PIPE:	8" SCH 80 CPVC
3	SLOTTED PIPE:	8" SCH 80 CPVC
4	CONNECTION:	BELLED END
5	LAG BOLTS:	1" x 1/2"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	HOLEPLUG
8	AGGREGATE:	1"-3" WASHED STONE NON-CALCARIUS

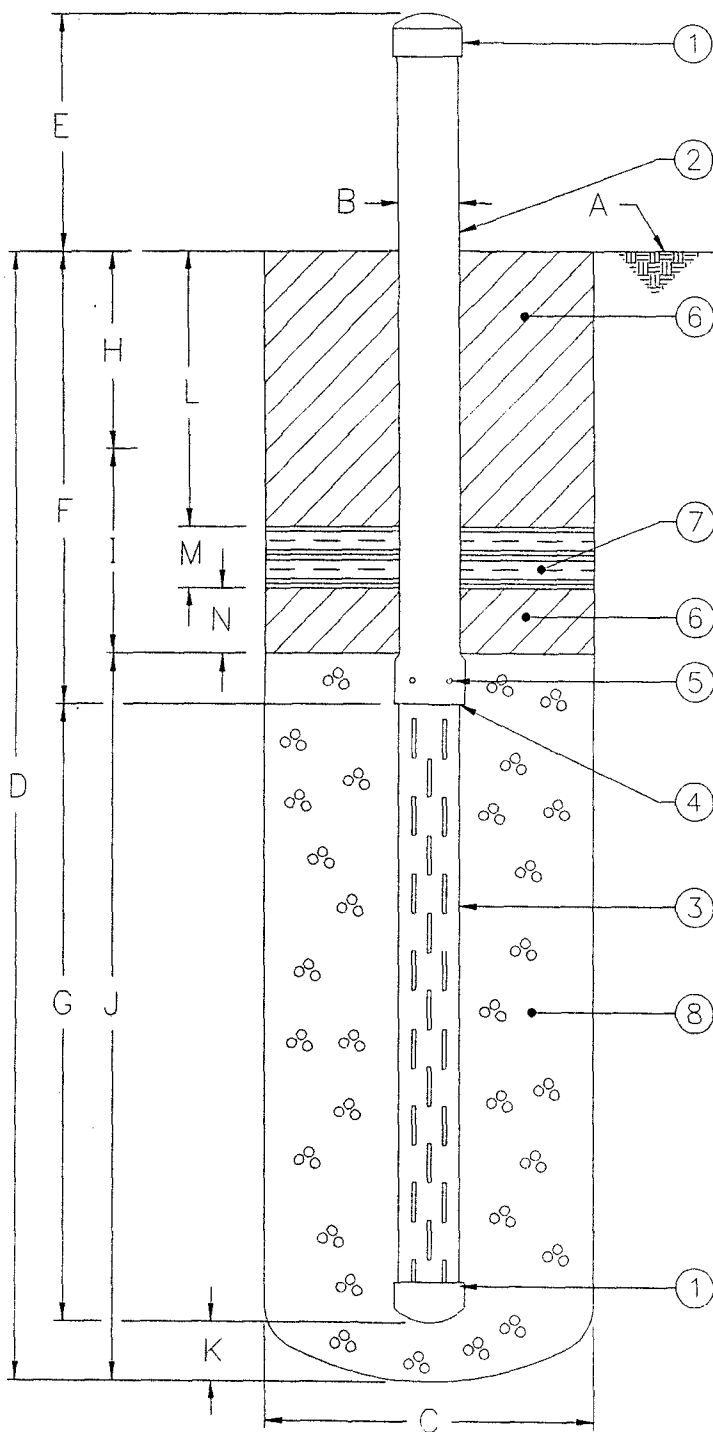
SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	184.3 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	44 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	22 FT.
G	SLOTTED PIPE LENGTH:	22 FT.
H	COVER DEPTH:	5 FT.
I	REFUSE DEPTH TO AGGREGATE:	16 FT.
J	AGGREGATE PACK:	23 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	17 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	2 FT.

NOTES

"L" INCLUDES 2 FOOT OF SOIL LAYER, 1 FOOT OF RECONSTRUCTED CLAY LAYER, 1.5 FEET OF INITIAL COVER, AND A VARIABLE AMOUNT OF GENERAL BACKFILL AS ILLUSTRATED IN DETAIL 1/4.

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/4.



DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/30/98

WELL NUMBER: W-2

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 5'	TOP COVER	N/A	DRY		
5' - 8'	PAPER	SLIGHT	DRY	88 °	
8' - 10'	DAY COVER	N/A	DRY		
10' - 13'	PAPER, WOOD	SLIGHT	DRY		
13' - 15'	DAY COVER	N/A	DRY		
15' - 18'	HOUSEHOLD GARBAGE	MODERATE	MOIST	92 °	
18' - 20'	DAY COVER	N/A	MOIST		
20' - 28'	HOUSEHOLD GARBAGE	MODERATE	MOIST		
28' - 30'	DAY COVER	N/A	MOIST		
30' - 38'	CARPET, WOOD	MODERATE	MOIST	104 °	
38' - 40'	DAY COVER	N/A	MOIST		
40' - 44'	PAPER, PLASTIC, WOOD	HEAVY	MOIST	106 °	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING DATE: 09/29/98
WET PROJECT NO: 98496

WELL NUMBER: W-3
WELL LOCATION: N: 9756
E: 11741

MATERIAL LIST

1	CAP:	8" SCH 80 CPVC
2	PIPE:	8" SCH 80 CPVC
3	SLOTTED PIPE:	8" SCH 80 CPVC
4	CONNECTION:	BELLED END
5	LAG BOLTS:	1" x 1/2"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	HOLEPLUG
8	AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

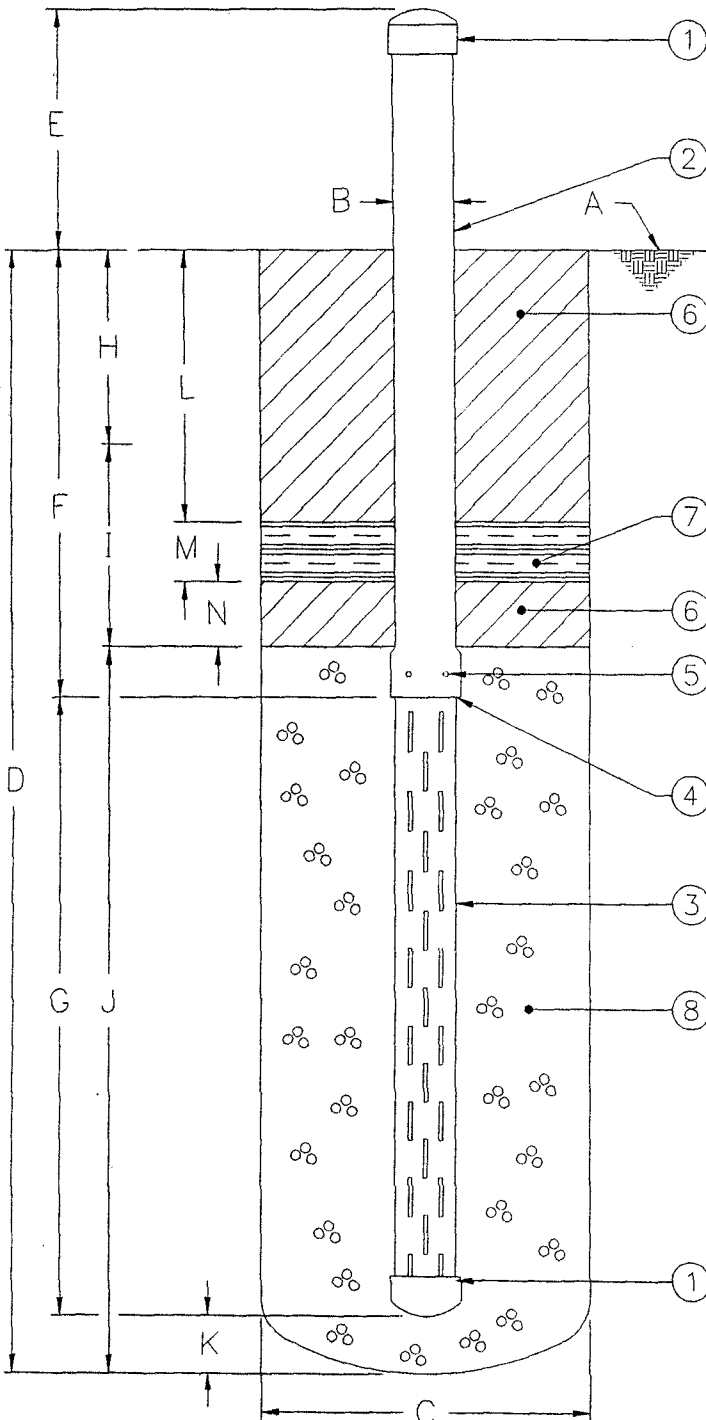
SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	187.4 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	44 FT.
E	SOLID PIPE ABOVE GROUND:	5 FT.
F	SOLID PIPE BELOW GROUND:	22 FT.
G	SLOTTED PIPE LENGTH:	22 FT.
H	COVER DEPTH:	3 FT.
I	REFUSE DEPTH TO AGGREGATE:	18 FT.
J	AGGREGATE PACK:	23 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	17 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	2 FT.

NOTES

"L" INCLUDES 2 FOOT OF SOIL LAYER, 1 FOOT OF RECONSTRUCTED CLAY LAYER, 1.5 FEET OF INITIAL COVER, AND A VARIABLE AMOUNT OF GENERAL BACKFILL AS ILLUSTRATED IN DETAIL 1/4.

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/4.



DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
11 TUPELO AVENUE S. E.
FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
ENGINEERS & CONTRACTORS
FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/29/98

WELL NUMBER: W-3

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 3'	TOP COVER	N/A	MOIST		
3' - 5'	GRASS	MODERATE	MOIST	80 °	
5' - 10'	DAY COVER	N/A	MOIST	84 °	
10' - 15'	DAY COVER	N/A	MOIST	88 °	
15' - 20'	HOUSEHOLD GARBAGE	HEAVY	MOIST	94 °	
20' - 23'	HOUSEHOLD GARBAGE	HEAVY	MOIST	98 °	
23' - 25'	DAY COVER	N/A	MOIST	102 °	
25' - 28'	HOUSEHOLD GARBAGE	HEAVY	MOIST	106 °	
28' - 30'	DAY COVER	N/A	MOIST		
30' - 35'	HOUSEHOLD GARBAGE, CARPET	HEAVY	MOIST	106 °	
35' - 40'	HOUSEHOLD GARBAGE, WOOD SCRAPS	HEAVY	MOIST	108 °	
40' - 44'	HOUSEHOLD GARBAGE	HEAVY	MOIST	108 °	

WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/30/98
 WET PROJECT NO: 98496

WELL NUMBER: W-4
 WELL LOCATION: N: 9732
 E: 11506

MATERIAL LIST

1 CAP:	8" SCH 80 CPVC
2 PIPE:	8" SCH 80 CPVC
3 SLOTTED PIPE:	8" SCH 80 CPVC
4 CONNECTION:	BELLED END
5 LAG BOLTS:	1" x 1/2"
6 SOIL BACKFILL:	CLAY
7 BENTONITE:	HOLEPLUG
8 AGGREGATE:	1"-3" WASHED STONE NON-CALCARIOUS

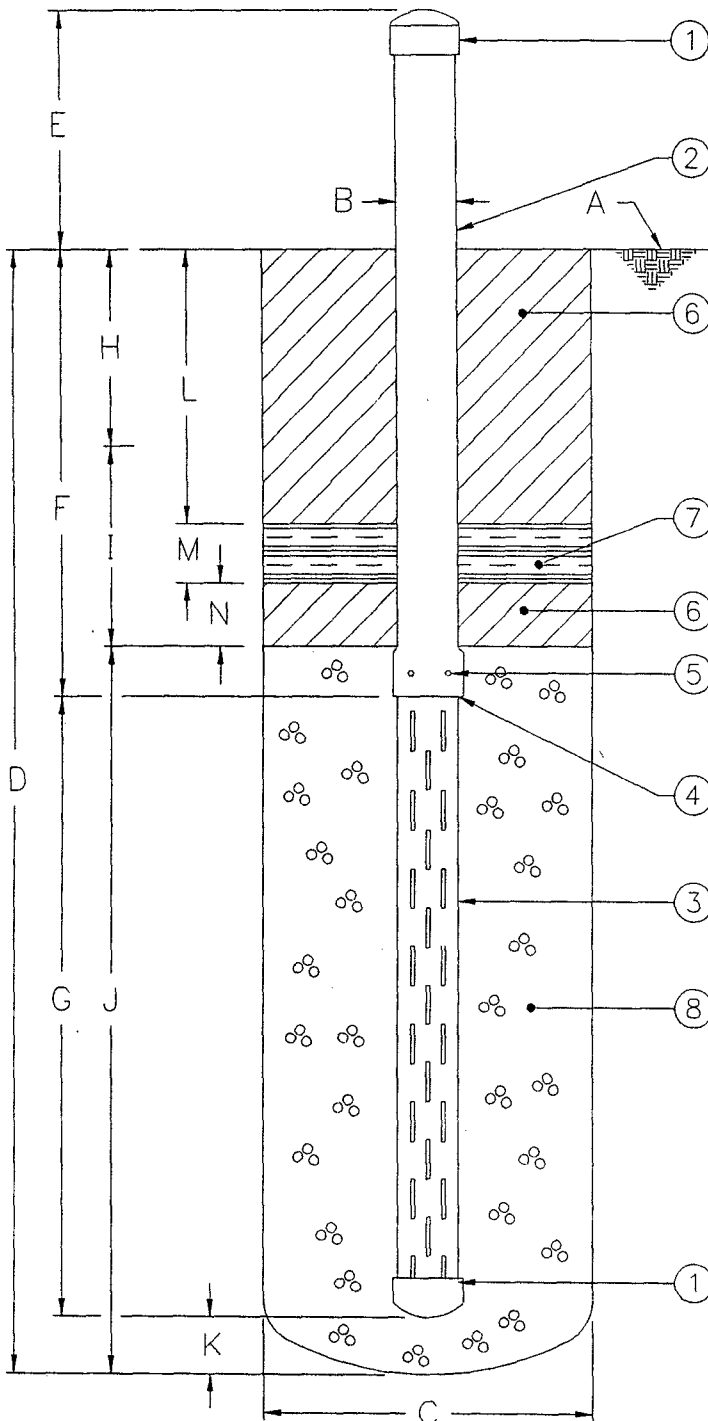
SPECIFICATIONS

A GROUND SURFACE ELEVATION:	195.5 FT.
B PIPE SIZE:	8 IN.
C BORE SIZE:	36 IN.
D BORE DEPTH:	51 FT.
E SOLID PIPE ABOVE GROUND:	5 FT.
F SOLID PIPE BELOW GROUND:	29 FT.
G SLOTTED PIPE LENGTH:	22 FT.
H COVER DEPTH:	5 FT.
I REFUSE DEPTH TO AGGREGATE:	15 FT.
J AGGREGATE PACK:	31 FT.
K AGGREGATE BASE:	0 FT.
L SOIL BACKFILL:	16 FT.
M BENTONITE LAYER:	2 FT.
N SOIL BACKFILL:	2 FT.

NOTES

"L" INCLUDES 2 FOOT OF SOIL LAYER, 1 FOOT OF RECONSTRUCTED CLAY LAYER, 1.5 FEET OF INITIAL COVER, AND A VARIABLE AMOUNT OF GENERAL BACKFILL AS ILLUSTRATED IN DETAIL 1/4.

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/4.



DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 09/30/98

WELL NUMBER: W-4

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP DATES (f)	COMMENTS
0' - 5'	TOP COVER	N/A	MOIST	90°	
5' - 10'	PLASTIC, PAPER	SLIGHT	MOIST	91°	
10' - 15'	WOOD, PAPER	MODERATE	MOIST	96°	
15' - 20'	HOUSEHOLD GARBAGE, WIRE	HEAVY	MOIST	98°	
20' - 25'	WIRE, PAPER	HEAVY	MOIST	104°	
25' - 30'	PLASTIC, WOOD	HEAVY	MOIST	106°	
30' - 35'	PAPER, PLASTIC	HEAVY	MOIST	108°	
35' - 40'	WOOD, PAPER, PLASTIC	HEAVY	MOIST	110°	
40' - 45'	WIRE, PAPER	HEAVY	MOIST	110°	
45' - 51'	WOOD, PLASTIC	HEAVY	MOIST	115°	

Waste Energy Technology, Inc.
11 Tupelo Avenue, SE Fort Walton Beach, FL 32548
(850) 243-0033 WET Project No. 98496

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WELL CONSTRUCTION LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
 DRILLING DATE: 09/30/98
 WET PROJECT NO: 98496

WELL NUMBER: W-36
 WELL LOCATION: N: 8908
 E: 12434

MATERIAL LIST

1	CAP:	8" SCH 80 CPVC
2	PIPE:	8" SCH 80 CPVC
3	SLOTTED PIPE:	8" SCH 80 CPVC
4	CONNECTION:	BELLED END
5	LAG BOLTS:	1" x 1/2"
6	SOIL BACKFILL:	CLAY
7	BENTONITE:	HOLEPLUG
8	AGGREGATE:	1"-3" WASHED STONE NON-CALCARIUS

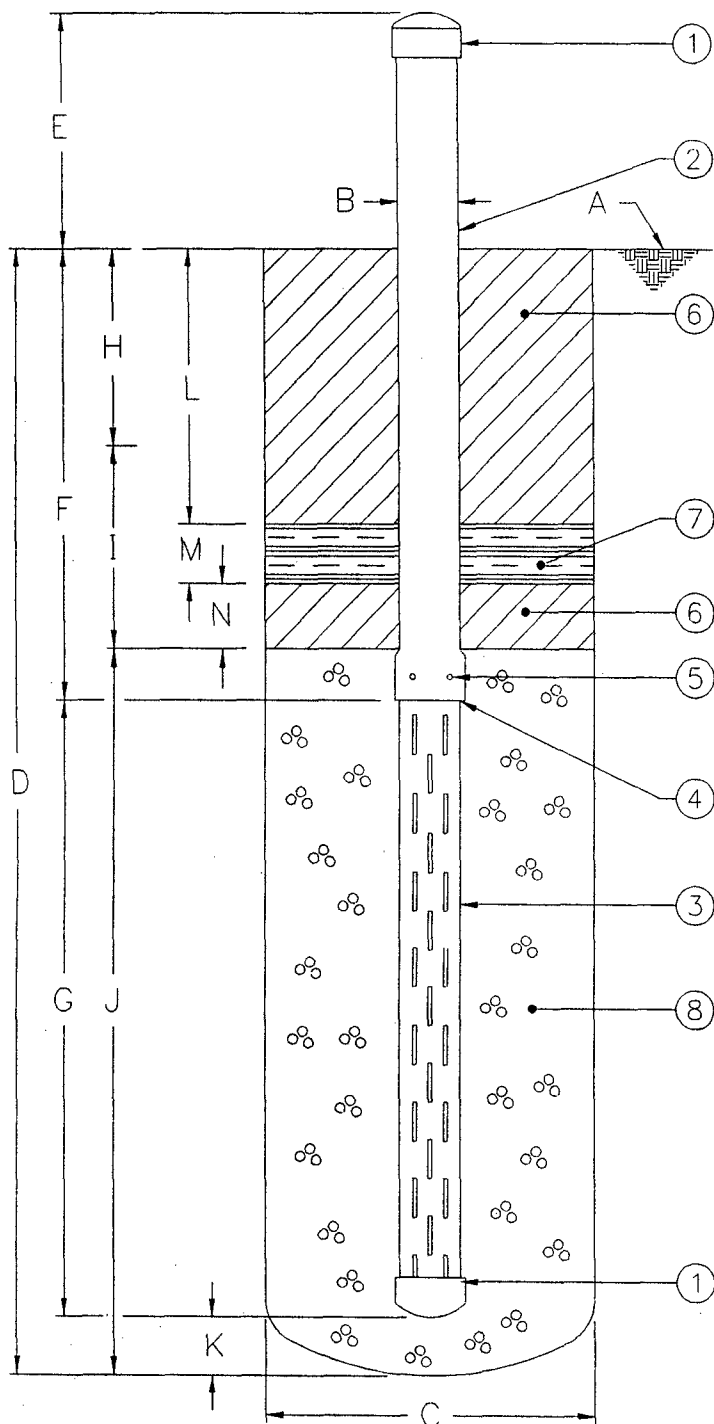
SPECIFICATIONS

A	GROUND SURFACE ELEVATION:	187.6 FT.
B	PIPE SIZE:	8 IN.
C	BORE SIZE:	36 IN.
D	BORE DEPTH:	49 FT.
E	SOLID PIPE ABOVE GROUND:	6 FT.
F	SOLID PIPE BELOW GROUND:	25 FT.
G	SLOTTED PIPE LENGTH:	24 FT.
H	COVER DEPTH:	10 FT.
I	REFUSE DEPTH TO AGGREGATE:	13 FT.
J	AGGREGATE PACK:	26 FT.
K	AGGREGATE BASE:	0 FT.
L	SOIL BACKFILL:	19 FT.
M	BENTONITE LAYER:	2 FT.
N	SOIL BACKFILL:	2 FT.

NOTES

"L" INCLUDES 2 FOOT OF SOIL LAYER, 1 FOOT OF RECONSTRUCTED CLAY LAYER, 1.5 FEET OF INITIAL COVER, AND A VARIABLE AMOUNT OF GENERAL BACKFILL AS ILLUSTRATED IN DETAIL 1/4.

BENTONITE MAT WAS INSTALLED AT THE LANDFILL COVER/REFUSE INTERFACE AS ILLUSTRATED IN DETAIL 1/4.



DRILLING CONTRACTOR

JR's DRILLING/ A WET COMPANY
 11 TUPELO AVENUE S. E.
 FORT WALTON BEACH FL 32548

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ENVIRONMENTAL MANAGEMENT
 ENGINEERS & CONTRACTORS
 FT. WALTON BEACH, FLORIDA

WELL BORING LOG

SITE LOCATION: TRAIL RIDGE LANDFILL
DRILLING CONTRACTOR: JR's DRILLING/ A WET COMPANY
DRILLING DATE: 10/06/98

WELL NUMBER: W-36

DEPTH (ft)	COMPOSITION	DEGREE OF DECOMPOSITION	MOISTURE	TEMP (f)	DATES	COMMENTS
0' - 10'	TOP COVER	N/A	DRY	98°		BENCH BUILT
10' - 15'	PAPER, PLASTIC	SLIGHT	DRY	106°		
15' - 20'	PAPER, PLASTIC, WOOD	SLIGHT	DRY	110°	1994	NEWSPAPER
20' - 25'	PAPER, WOOD, CARPET	SLIGHT	DRY	114°		
25' - 30'	PAPER, CARPET	SLIGHT	DRY	116°		
30' - 35'	PAPER, PLASTIC, WOOD	SLIGHT	DRY	120°		
35' - 40'	PAPER, TIRES, METAL	SLIGHT	DRY	124°		
40' - 45'	PAPER, PLASTIC, CARPET	SLIGHT	DRY	130°		
45' - 49'	PAPER, TIRES, WOOD, CARPET	SLIGHT	DRY	136°		

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)	HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION	
LINE A-A'							98 FT OF 2" ELECTRICAL CONDUIT FOLLOWS LINE A-A'	
0+00	9721	9949	140.9	145.0	4.1	-0.53%	12" BLIND FLANGE STA 0+00 LINE B-B'	98 FT OF 4" x 2" DIA PE FORCEMAIN FOLLOWS LINE A-A'
0+05	9726	9949	140.9	145.0	4.1		12" TEE	699 FT OF 12" DIA PE AT 0.53%
1+05	9826	9949	140.4	144.8	4.4			
2+01	9922	9950	139.9	144.9	5.1			
2+25	9946	9951	139.7	145.6	5.9			
2+51	9970	9959	139.6	145.4	5.8			
2+75	9993	9969	139.5	145.2	5.7			
3+00	10013	9984	139.3	145.0	5.6			
3+25	10029	10003	139.2	144.4	5.2			
3+99	10062	10069	138.8	145.6	6.8			
5+00	10063	10169	138.3	143.7	5.4			
5+99	10064	10269	137.8	143.3	5.5			
6+99	10063	10369	137.2	142.7	5.5	-1.00%		397 FT OF 12" DIA PE AT 1.00%
7+98	10064	10468	136.2	141.6	5.3			
8+99	10058	10568	135.2	140.8	5.6			
9+98	10058	10668	134.2	139.5	5.3			
10+94	10059	10764	133.3	137.9	4.7			
10+96	10059	10766	133.2	137.9	4.7	-1.32%	20" x 12" REDUCERS STA 0+00 LINE C-C'	102 FT OF 20" DIA PE AT 1.32%
10+98	10058	10768	133.2	137.9	4.7		20" TEE	
11+98	10063	10868	131.9	136.6	4.7	-0.83%		398 FT OF 20" DIA PE AT 0.83%
12+98	10065	10968	131.1	136.1	5.0			
13+97	10058	11067	130.2	136.0	5.7		20" VALVE V-4	
14+97	10058	11166	129.4	134.8	5.4		STA 0+00 LINE D-D'	
							20" TEE	
15+96	10058	11266	128.6	133.3	4.7	-1.12%		100 FT OF 20" DIA PE AT 1.12%
16+96	10062	11366	127.5	132.1	4.7	-1.08%		299 FT OF 20" DIA PE AT 1.08%
17+96	10056	11465	126.4	131.7	5.3			
18+70	10058	11539	125.6	131.4	5.8		STA 0+00 LINE E-E'	
							20" TEE	
18+96	10058	11565	125.3	130.9	5.6			
19+95	10057	11664	124.2	128.9	4.7	-1.27%		199 FT OF 20" DIA PE AT 1.27%
20+95	10057	11764	123.0	127.8	4.8			
21+94	10058	11863	121.7	126.4	4.7	-1.09%		300 FT OF 20" DIA PE AT 1.09%
22+79	10063	11948	120.8	125.7	4.9			
22+94	10064	11963	120.6	125.5	4.9			
23+84	10059	12053	119.7	125.1	5.4		STA 0+00 LINE O-O'	
							20" TEE	
23+94	10059	12063	119.5	124.9	5.4			
24+94	10058	12162	118.5	123.1	4.7	-0.50%		215 FT OF 20" DIA PE AT 0.50%
25+94	10055	12262	118.0	122.6	4.6			
26+00	10055	12268	117.9	122.7	4.7			
26+74	10046	12342	117.6	122.4	4.9		START OF CASING	
27+09	10036	12376	117.4	122.1	4.7	-1.65%	END CASING	192 FT OF 20" DIA PE AT 1.65%
27+99	10007	12461	115.9	120.0	4.1			
28+99	9961	12549	114.3	118.8	4.5		20" VALVE V-1	
29+01	9960	12551	114.2	118.9	4.6		24" x 20" REDUCER	2 FT OF 24" DIA PE AT 1.65%
29+03	9959	12553	114.2	118.9	4.7	-2.06%	STA 11+96 LINE G-G'	96 FT OF 24" DIA PE AT 2.06%
							24" TEE	
							START ELECTRICAL CONDUIT AND	
							4" x 2" DIA. PE FORCEMAIN	
29+99	9915	12638	112.2	117.5	5.3		26" x 24" REDUCER	6 FT OF 26" DIA PE AT 2.06%
30+01	9913	12640	112.2	117.5	5.3		STA 0+00 LINE FM-1	
							END ELECTRICAL CONDUIT AND	
							4" x 2" DIA. PE FORCEMAIN	
							26" INLET TO TANK	
30+05	9916	12643	112.1	117.6	5.5	0.50%	26" OULET TO BLOWER	3 FT OF 26" DIA PE AT 0.50%
30+08	9914	12645	112.1	117.7	5.5		26" x 24" REDUCER	83 FT OF 24" DIA PE AT 0.50%
30+91	9845	12692	112.5	117.2	4.7		24" RISER	
							24" BLIND FLANGE	
31+06	9836	12680		117.3			INLET TO BLOWER	
31+47	9869	12656		117.6			CENTER OF FLARE	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)	HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
LINE B-B'							
0+00	9726	9949	140.9	145.0	4.1	48.16%	8 FT OF 12" DIA PE AT CONTOUR
0+08	9726	9957	144.8	146.3	1.5	0.53%	75 FT OF 12" DIA PE AT 0.53%
0+17	9726	9965	144.8	142.3	-2.6		
0+31	9726	9978	144.9	146.3	1.3		
0+41	9726	9988	145.0	146.0	1.1		
0+53	9726	10000	145.0	147.0	2.0		
0+66	9726	10014	145.1	145.9	0.8		
0+74	9726	10021	145.2	143.8	-1.4		
0+83	9726	10030	145.2	145.6	0.4	31.15%	86 FT OF 12" DIA PE AT CONTOUR
1+39	9725	10083	162.6	164.1	1.5	15.64%	
						6" RISER	
1+69	9725	10111	167.2	173.0	5.8	3.65%	11 FT OF 12" DIA PE AT 3.65%
1+80	9725	10122	167.6	171.1	3.5		
						STA 0+00 LINE H-H'	
						STA 0+00 LINE U-U'	
						CONDENSATE KNOCKOUT CK-5	
LINE C-C'							
0+00	10058	10768	133.2	137.9	4.7	15.25%	2 FT OF 20" DIA PE AT CONTOUR
0+02	10056	10768	133.5	137.9	4.4	20.98%	13 FT OF 10" DIA PE AT CONTOUR
0+04	10054	10768	133.9	137.9	4.0		
0+15	10043	10768	136.3	137.3	1.1	0.59%	76 FT OF 10" DIA PE AT 0.59%
0+24	10035	10768	136.3	133.3	-3.0		
0+39	10022	10768	136.4	137.9	1.5		
0+48	10012	10768	136.4	138.3	1.9		
0+60	10000	10768	136.5	138.7	2.1		
0+73	9988	10768	136.6	138.4	1.8		
0+82	9979	10768	136.6	135.4	-1.2		
0+91	9970	10768	136.7	137.8	1.1	34.70%	171 FT OF 10" DIA PE AT CONTOUR
1+03	9959	10770	140.7	142.2	1.5	26.28%	
1+33	9931	10773	148.6	150.6	2.0	6.47%	
2+01	9865	10789	153.0	157.3	4.3		
2+62	9806	10806	157.0	160.9	3.9	3.00%	655 FT OF 10" DIA PE AT 3.00%
						10" TEE	
3+01	9769	10818	158.1	163.6	5.5		
4+01	9673	10844	161.1	169.9	8.7		
4+51	9628	10865	162.6	172.1	9.5		
4+92	9593	10887	163.9	174.5	10.7		
						STA 0+00 LINE I-I'	
						10" TEE	
5+29	9567	10914	165.0	175.4	10.4		
5+65	9550	10946	166.0	175.9	9.9		
						STA 0+00 LAT TO WELL T-9	
						10" TEE	
6+01	9533	10977	167.1	176.1	9.0		
6+58	9507	11028	168.8	178.3	9.5		
7+01	9486	11066	170.1	179.2	9.1		
						STA 0+00 LAT TO WELL T-7	
						10" TEE	
8+01	9441	11154	173.1	180.6	7.5	3.00%	STA 12+01 LINE M-M'
						10" TEE	
8+51	9408	11193	174.6	183.2	8.6		
8+73	9391	11207	175.3	183.7	8.5		
						STA 0+00 LAT TO WELL T-5	
						10" TEE	
9+02	9365	11220	176.2	185.0	8.9		
9+17	9351	11225	176.6	184.8	8.2	6.17%	89 FT OF 10" DIA PE AT CONTOUR
						STA 13+10 LINE J-J'	
						10" TEE	
10+02	9267	11234	181.8	185.7	3.9		STA 0+00 LINE S-S'
						10" TEE	
10+06	9263	11234	182.1	186.3	4.2		10" BLIND FLANGE
LINE D-D'							
0+00	10058	11166	129.4	134.8	5.4	25.00%	2 FT OF 20" DIA PE AT CONTOUR
0+02	10056	11166	129.9	134.5	4.7		12 FT OF 10" DIA PE AT CONTOUR
						10" VALVE V-3	
0+14	10043	11166	133.0	134.0	1.0	0.53%	76 FT OF 10" DIA PE AT 0.53%
0+23	10035	11166	133.0	130.0	-3.0		
0+37	10022	11166	133.1	134.5	1.3		
0+47	10012	11167	133.2	135.1	1.9		
0+59	10000	11167	133.2	135.2	2.0		
						START OF ROAD	
						CENTER LINE OF ROAD	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)		HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+71	9988	11167	133.3	134.6	1.3		END OF ROAD	
0+80	9979	11167	133.4	132.7	-0.6		CENTERLINE OF SWALE	
0+90	9970	11168	133.4	135.0	1.6	31.05%	END OF CASING	98 FT OF 10" DIA PE AT CONTOUR
1+88	9877	11183	164.0	165.5	1.5	3.98%		21 FT OF 10" DIA PE AT 3.98%
2+00	9866	11183	164.4	168.7	4.3		TOP OF BERM	
2+09	9858	11184	164.8	166.3	1.5	30.38%		61 FT OF 10" DIA PE AT CONTOUR
2+70	9799	11187	183.4	184.9	1.5	3.19%		11 FT OF 10" DIA PE AT 3.19%
2+81	9789	11188	183.8	187.5	3.7	3.06%	TOP OF BERM	8 FT OF 10" DIA PE AT 3.06%
2+89	9781	11189	184.0	185.0	1.0	23.57%		89 FT OF 10" DIA PE AT CONTOUR
3+03	9768	11193	187.4	188.9	1.5	19.55%		
3+78	9726	11253	202.0	203.5	1.5		10" x 6" REDUCING TEE EXISTING WELL W-5 10" BLIND FLANGE	
LINE E-E'								
0+00	10058	11539	125.6	131.4	5.8	28.42%	STA 18+70 LINE A-A'	2 FT OF 20" DIA PE AT CONTOUR
0+02	10056	11539	126.1	131.3	5.2		20" x 8" REDUCERS	13 FT OF 8" DIA PE AT CONTOUR
0+15	10043	11539	129.8	130.8	1.0	0.53%	BEGINNING OF CASING	75 FT OF 8" DIA PE AT 0.53%
0+24	10035	11539	129.8	126.8	-3.0		CENTER LINE OF DITCH	
0+38	10022	11539	129.9	131.3	1.4		END OF DITCH	
0+48	10012	11539	130.0	132.3	2.3		START OF ROAD	
0+60	10000	11539	130.0	132.0	2.0		CENTER LINE OF ROAD	
0+72	9988	11540	130.1	132.1	2.0		END OF ROAD	
0+81	9979	11541	130.2	132.1	2.0		CENTERLINE OF SWALE	
0+90	9970	11542	130.2	131.8	1.6	30.12%	END OF CASING	110 FT OF 8" DIA PE AT CONTOUR
2+00	9865	11547	163.4	164.9	1.5	4.27%		19 FT OF 8" DIA PE AT 4.27%
2+11	9855	11548	163.8	168.0	4.2		TOP OF BERM	
2+19	9847	11548	164.2	165.7	1.5	28.40%		152 FT OF 8" DIA PE AT CONTOUR
2+48	9820	11552	172.3	173.8	1.5	27.88%	STA 0+00 LAT TO WELL W-3 8" TEE	
2+81	9788	11556	181.6	183.1	1.5	6.62%		
2+92	9777	11558	182.4	185.7	3.3		TOP OF BERM	
3+03	9767	11558	183.1	184.6	1.5	23.78%		
3+13	9757	11558	185.5	187.0	1.5	23.00%		
3+22	9751	11552	187.5	189.0	1.5	13.12%		
3+71	9732	11506	194.0	195.5	1.5		WELL W-4	
LINE F-F'								
0+00	9763	11720	182.4	186.0	3.6	3.61%	STA 1+77 LAT TO WELL W-3	12 FT OF 8" DIA PE AT 3.61%
0+12	9751	11718	182.8	184.3	1.5		8" BLIND FLANGE	
LINE G-G'								
								134 FT OF 2" ELECTRICAL CONDUIT FOLLOWS LINE A-A'
								134 FT OF 4" x 2" DIA PE FORCEMAI FOLLOWS LINE A-A'
0+00	8905	12440	184.7	185.9	1.2	-3.00%	22" BLIND FLANGE	99 FT OF 22" DIA PE AT 3.00%
0+05	8910	12440	184.5	185.8	1.3		STA 0+00 LINE T-T'	
							22" TEE	
0+99	9004	12450	181.7	183.2	1.5	-3.25%		199 FT OF 22" DIA PE AT 3.25%
1+68	9073	12455	179.4	180.8	1.4		STA 0+00 LAT TO WELL W-35 22" TEE	
1+99	9104	12457	178.4	179.8	1.4			
2+36	9140	12462	177.2	178.6	1.3		STA 0+00 LAT TO LSR-5 6" RISER	
2+98	9202	12469	175.2	176.7	1.5	-20.90%		18 FT OF 22" DIA PE AT CONTOUR
3+16	9220	12472	171.4	175.9	4.5	-4.00%	START OF CASING	28 FT OF 22" DIA PE AT 4.00%
3+44	9247	12476	170.3	174.8	4.5	-4.30%	END OF CASING	29 FT OF 22" DIA PE AT 4.30%
							22" 90 DEGREE ELBOW	
3+58	9247	12489	169.7	171.7	2.0			
3+73	9247	12504	169.1	170.6	1.5	-3.13%	22" 90 DEGREE ELBOW	173 FT OF 22" DIA PE AT 3.13%
3+98	9272	12510	168.3	169.2	0.9			
4+09	9283	12512	168.0	168.7	0.7		STA 0+00 LINE J-J'	
							22" TEE	
4+98	9371	12523	165.2	165.7	0.5			
5+46	9418	12523	163.7	165.2	1.5	-5.25%	STA 0+00 LAT TO LSR-3 6" RISER	95 FT OF 22" DIA PE AT CONTOUR
5+98	9470	12523	161.0	162.5	1.5	-27.05%		

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)		HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
6+41	9512	12522	149.3	153.8	4.5	-3.09%	CENTER OF BERM	19 FT OF 22" DIA PE AT 3.09%
6+49	9521	12522	149.1	156.1	7.1		TOP OF BERM	
6+60	9531	12522	148.7	153.0	4.2	-5.73%		13 FT OF 22" DIA PE AT CONTOUR
6+73	9544	12522	148.0	149.5	1.5	-3.05%	22" 90 DEGREE ELBOW	24 FT OF 22" DIA PE AT 3.05%
6+97	9551	12499	147.2	148.7	1.5	-5.59%		22 FT OF 22" DIA PE AT CONTOUR
7+19	9558	12478	146.0	147.5	1.5	-3.72%		98 FT OF 22" DIA PE AT 3.72%
7+44	9565	12454	145.1	146.5	1.4			
7+69	9578	12433	144.1	145.4	1.3			
7+74	9581	12429	144.0	145.4	1.5		STA 0+00 LAT TO WELL W-17 22" TEE	
8+17	9624	12423	142.3	143.8	1.5	-5.12%		73 FT OF 22" DIA PE AT CONTOUR
8+82	9689	12428	139.0	142.0	3.0	-33.43%	STA 0+00 LAT TO WELL W-1 22" TEE	
8+90	9697	12428	136.4	141.9	5.5		STA 0+00 LINE R-R' CONDENSATE KNOCKOUT CK-2	
8+90	9697	12428	140.4	141.9	1.5	-4.68%	STA 0+00 LINE R-R' CONDENSATE KNOCKOUT CK-2	27 FT OF 22" DIA PE AT 4.68%
9+04	9710	12430	139.7	141.2	1.5		STA 0+00 LAT TO LSR-1 6" RISER	
9+17	9723	12432	139.1	140.6	1.5	-3.84%		100 FT OF 22" DIA PE AT 3.84%
10+17	9822	12446	135.3	136.8	1.5	-17.08%		65 FT OF 22" DIA PE AT CONTOUR
10+32	9833	12455	132.7	134.2	1.5	-5.80%		
10+62	9855	12477	130.9	132.4	1.5	-53.66%	STA 0+00 LINE FM-2 START ELECTRICAL CONDUIT AND 4" x 2" DIA. PE FORCEMAIN TOP OF BERM	
10+82	9868	12488	120.4	123.0	2.6	-3.04%	START OF CASING	68 FT OF 22" DIA PE AT 3.04%
11+23	9900	12514	119.2	123.0	3.8		END OF CASING	
11+37	9911	12522	118.8	120.2	1.4		START DITCH CROSSING	
11+50	9921	12529	118.4	115.4	-3.0	-9.23%	CENTER OF DITCH	42 FT OF 22" DIA PE AT CONTOUR
11+64	9932	12535	117.2	119.4	2.2		END DITCH CROSSING	
11+92	9956	12551	114.5	119.0	4.5		START OF CASING 24" x 22" REDUCER	4 FT OF 24" DIA PE AT CONTOUR
11+94	9957	12551	114.4	118.9	4.5		END OF CASING 24" VALVE V-2	
11+96	9959	12553	114.2	118.9	4.7		STA 29+03 LINE A-A' END ELECTRICAL CONDUIT AND 4" x 2" DIA. PE FORCEMAIN	
LINE H-H'								
0+00	9725	10122	165.6	171.1	5.5	19.17%	STA 1+80 LINE B-B' STA 0+00 LINE U-U' CONDENSATE KNOCKOUT CK-5	25 FT OF 12" DIA PE AT CONTOUR
0+25	9700	10124	170.3	171.8	1.5	3.75%		26 FT OF 12" DIA PE AT 3.75%
0+51	9675	10126	171.3	172.8	1.5	3.02%	STA 0+00 LAT TO WELL W-9 12" TEE	149 FT OF 12" DIA PE AT 3.02%
1+00	9626	10130	172.8	174.3	1.5			
2+00	9526	10140	175.8	177.2	1.4	3.00%		99 FT OF 12" DIA PE AT 3.00%
2+63	9463	10146	177.7	179.1	1.4		STA 8+07 LINE I-I' 12" TEE	
2+92	9435	10148	178.6	180.0	1.4		STA 0+00 LAT TO LCR-4 6" RISER	
2+99	9427	10149	178.8	180.2	1.4	4.93%		50 FT OF 12" DIA PE AT 4.93%
3+49	9378	10156	181.3	182.8	1.5	8.75%	12" 90 DEGREE ELBOW	13 FT OF 12" DIA PE AT CONTOUR
3+62	9377	10167	182.3	186.3	4.0	3.00%		17 FT OF 12" DIA PE AT 3.00%
3+70	9377	10175	182.6	188.6	6.0		TOP OF BERM	
3+79	9377	10184	182.9	186.4	3.5	37.09%	CENTER OF BERM	20 FT OF 12" DIA PE AT CONTOUR
3+89	9377	10194	186.5	188.8	2.4			
3+99	9377	10203	190.1	191.6	1.5	3.03%	12" 90 DEGREE ELBOW	66 FT OF 12" DIA PE AT 3.03%
4+65	9311	10207	192.1	193.5	1.4	3.14%		32 FT OF 12" DIA PE AT 3.14%
4+97	9279	10208	193.1	194.6	1.5	5.74%	STA 10+40 LINE S-S' 12" TEE	77 FT OF 12" DIA PE AT CONTOUR
5+31	9245	10214	195.1	196.6	1.5	5.14%	STA 0+00 LINE L-L' 12" TEE	
5+69	9208	10220	197.0	198.5	1.5	8.54%	STA 0+00 LAT TO LCR-6 6" RISER	
5+74	9204	10222	197.4	198.8	1.4		12" BLIND FLANGE	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES		HEADER INVERT ELEV.	GROUND ELEV.	HEADER DEPTH	HEADER SLOPE	CONSTRUCTION NOTES	PIPE INFORMATION
	(NORTH)	(EAST)	(FT)	(FT)	(FT)	(%)		
LINE I-I'								
0+00	9593	10887	163.9	174.5	10.7	28.27%	STA 4+92 LINE C-C'	2 FT OF 10" DIA PE AT CONTOUR
0+02	9591	10886	164.4	174.9	10.5		10" x 6" REDUCERS	287 FT OF 6" DIA PE AT CONTOUR
0+04	9590	10885	164.9	175.3	10.4		6" VALVE V-9	
0+77	9539	10835	185.6	189.2	3.6	17.58%	STA 0+00 LAT TO WELL T-10 6" TEE	
1+89	9477	10743	205.3	208.9	3.6	13.73%		
2+57	9443	10685	214.7	218.3	3.6	6.04%	STA 0+00 LAT TO WELL T-12 6" TEE	
2+89	9444	10654	216.6	218.1	1.5	-4.45%	HIGH POINT	167 FT OF 6" DIA PE AT 4.45%
3+89	9444	10553	212.1	216.1	4.1			
4+56	9460	10488	209.1	213.4	4.3	-3.04%	STA 0+00 LAT TO WELL T-23 6" TEE	241 FT OF 6" DIA PE AT 3.04%
4+58	9460	10486	209.0	213.4	4.3		STA 0+00 LAT TO WELL T-13 6" TEE	
5+86	9464	10359	205.2	210.7	5.6		STA 0+00 LAT TO WELL T-22 6" TEE	
6+55	9476	10290	203.0	209.2	6.2			
6+72	9478	10273	202.5	211.7	9.2		TOP OF BERM	
6+97	9483	10250	201.8	206.3	4.5	-22.68%	STA 0+00 LAT TO WELL W-10 6" TEE	110 FT OF 6" DIA PE AT CONTOUR
7+64	9469	10187	186.7	188.0	1.3	-20.94%	6" VALVE V-10	
8+07	9463	10146	177.7	179.1	1.4		STA 2+63 LINE H-H' 12" x 6" REDUCERS	
LINE J-J'								
0+00	9283	12512	168.0	168.7	0.7	3.04%	STA 4+09 LINE G-G'	2 FT OF 22" DIA PE AT 3.04%
0+02	9283	12510	168.0	169.4	1.3		22" x 6" REDUCERS	18 FT OF 6" DIA PE AT 3.04%
0+10	9283	12502	168.3	171.6	3.3		6" VALVE V-11	
0+14	9282	12498	168.4	172.3	3.9		TOP OF BERM	
0+20	9283	12493	168.6	170.4	1.8	30.45%		57 FT OF 6" DIA PE AT CONTOUR
0+77	9284	12438	186.0	187.5	1.5	3.01%	STA 0+00 LAT TO WELL W-18 6" TEE	23 FT OF 6" DIA PE AT 3.01%
0+92	9283	12424	186.5	191.4	5.0		TOP OF BERM	
1+00	9283	12416	186.7	189.0	2.3	26.00%		55 FT OF 6" DIA PE AT CONTOUR
1+55	9282	12363	201.1	205.0	3.9	3.00%		48 FT OF 6" DIA PE AT 3.00%
1+68	9281	12352	201.5	209.3	7.8		TOP OF BERM	
1+79	9281	12340	201.8	207.1	5.3			
2+03	9280	12317	202.5	209.8	7.3	3.02%		112 FT OF 6" DIA PE AT 3.02%
2+16	9280	12304	202.9	213.4	10.5		TOP OF BERM	
2+29	9279	12291	203.3	213.7	10.4		TOP OF BERM	
2+39	9279	12282	203.6	211.3	7.7			
3+15	9281	12205	205.9	212.7	6.8	3.00%	STA 0+00 LAT TO WELL T-21 6" TEE	354 FT OF 6" DIA PE AT 3.00%
3+84	9282	12137	207.9	213.9	6.0			
4+83	9285	12037	210.9	216.3	5.4			
5+57	9286	11963	213.2	217.7	4.5			
5+87	9286	11934	214.0	218.1	4.0		STA 0+00 LAT TO WELL T-20 6" TEE	
6+69	9287	11852	216.5	218.0	1.5	-3.00%	HIGH POINT	372 FT OF 6" DIA PE AT 3.00%
6+83	9289	11837	216.1	217.8	1.7			
7+83	9288	11737	213.1	216.1	3.0			
8+63	9284	11658	210.7	214.4	3.7		STA 0+00 LAT TO WELL T-19 6" TEE	
8+84	9285	11637	210.0	214.4	4.4			
9+84	9284	11537	207.0	212.3	5.2			
10+41	9282	11480	205.3	211.3	6.0	-3.45%		28 FT OF 6" DIA PE AT 3.45%
10+50	9281	11471	205.0	213.1	8.1		TOP OF BERM	
10+69	9285	11453	204.4	209.9	5.5	-9.59%		177 FT OF 6" DIA PE AT CONTOUR
11+24	9299	11400	199.1	202.7	3.6	-16.35%	STA 0+00 LAT TO WELL T-18 6" TEE	
11+84	9316	11344	189.4	193.0	3.6	-17.35%		
12+46	9334	11285	178.5	182.3	3.8	-3.00%	START OF CASING	64 FT OF 6" DIA PE AT 3.00%
12+54	9336	11277	178.3	182.8	4.5		START OF ROAD	
12+85	9346	11249	177.3	183.2	5.8		END OF ROAD	
12+95	9349	11239	177.0	181.4	4.3		END OF CASING	
13+06	9351	11228	176.7	184.5	7.9		6" VALVE V-12	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)	HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
13+08	9351	11226	176.6	184.3	7.6	10" x 6" REDUCERS	
13+10	9351	11225	176.6	184.8	8.2	STA 9+17 LINE C-C'	
LINE L-L'							
0+00	9245	10214	195.1	196.6	1.5	22.93%	2 FT OF 12" DIA PE AT CONTOUR
0+02						12" x 8" REDUCERS	35 FT OF 8" DIA PE AT CONTOUR
0+32	9249	10245	202.5	206.7	4.2	STA 0+00 LAT TO WELL W-25	
						8" TEE	
0+37	9248	10250	203.6	208.1	4.5	8" BLIND FLANGE	
LINE M-M'							
0+00	9495	12320	177.0	178.4	1.5	7.42%	195 FT OF 6" DIA PE AT CONTOUR
0+10	9502	12312	177.7	179.2	1.5	18.49%	
0+20	9505	12303	179.5	181.0	1.5	25.95%	
0+30	9505	12294	182.0	183.5	1.5	30.78%	
0+44	9504	12280	186.6	188.1	1.5	5.66%	
0+58	9503	12267	187.4	191.6	4.2	TOP OF BERM	
0+65	9502	12260	187.8	189.3	1.5	27.31%	
1+19	9500	12208	202.5	204.0	1.5	8.22%	
1+35	9499	12192	203.8	208.4	4.6	TOP OF BERM	
1+45	9498	12183	204.6	206.1	1.5	7.70%	
1+95	9495	12134	208.5	216.9	8.4	3.16%	34 FT OF 6" DIA PE AT 3.16%
2+11	9496	12118	209.0	220.6	11.6	TOP OF BERM	
2+29	9496	12101	209.5	218.1	8.6	3.03%	220 FT OF 6" DIA PE AT 3.03%
2+80	9501	12050	211.1	218.4	7.3	STA 0+00 LAT TO WELL T-1	
						6" TEE	
3+25	9503	12005	212.4	218.5	6.1		
3+99	9507	11931	214.7	217.9	3.2		
4+49	9510	11881	216.2	217.7	1.5	-3.01%	375 FT OF 6" DIA PE AT 3.01%
4+99	9514	11832	214.7	217.5	2.8		
5+56	9517	11775	213.0	216.5	3.5	STA 0+00 LAT TO WELL T-2	
						6" TEE	
5+99	9515	11732	211.7	216.3	4.6		
6+99	9510	11632	208.7	214.4	5.7		
7+84	9500	11547	206.1	212.3	6.1	STA 0+00 LAT TO WELL T-3	
						6" TEE	
8+24	9501	11507	204.9	211.1	6.2	-3.12%	34 FT OF 6" DIA PE AT 3.12%
8+37	9502	11495	204.5	213.6	9.1	TOP OF BERM	
8+58	9502	11474	203.9	209.6	5.7	-5.45%	269 FT OF 6" DIA PE AT CONTOUR
9+58	9511	11374	198.4	207.0	8.6	TOP OF BERM	
10+07	9499	11327	195.7	199.3	3.6	-16.86%	STA 0+00 LAT TO WELL T-4
						6" TEE	
11+06	9494	11230	179.0	182.5	3.5		
11+27	9487	11211	175.6	178.1	2.5	-3.33%	71 FT OF 6" DIA PE AT 3.33%
						6" TEE	
						START CASING	
11+32	9484	11207	175.4	178.4	3.0	START OF ROAD	
11+75	9456	11174	174.0	177.5	3.5	END OF ROAD	
11+87	9449	11165	173.6	177.5	3.9	END OF CASING	
11+96	9443	11158	173.3	179.7	6.4	6" VALVE V-8	
11+98	9442	11156	173.2	180.1	6.9	10" x 6" REDUCERS	3 FT OF 10" DIA PE AT 3.33%
12+01	9441	11154	173.1	180.6	7.5	STA 8+01 LINE C-C'	
LINE N-N'							
0+00	9806	10806	157.0	160.9	3.9	13.99%	2 FT OF 10" DIA PE AT CONTOUR
0+02	9806	10804	157.3	161.2	3.9	22.95%	323 FT OF 6" DIA PE AT CONTOUR
0+38	9797	10771	165.5	169.1	3.6	26.53%	
0+95	9782	10718	180.5	184.1	3.6	12.15%	STA 0+00 LAT TO WELL T-11
						6" TEE	
1+05	9781	10709	181.7	187.8	6.0	TOP OF BERM	
2+00	9763	10615	193.3	194.8	1.5	7.96%	
3+25	9739	10493	203.3	204.8	1.5	EXISTING WELL W-8	
LINE O-O'							
0+00	10059	12053	119.7	125.1	5.4	28.97%	1 FT OF 20" DIA PE AT CONTOUR
0+01	10057	12053	120.1	125.1	5.0	20" x 6" REDUCERS	15 FT OF 6" DIA PE AT CONTOUR
0+16	10043	12053	124.2	125.2	1.0	0.51%	78 FT OF 6" DIA PE AT 0.51%
0+25	10035	12053	124.2	121.2	-3.0	BEGINING OF CASING	
						CENTERLINE OF DITCH	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)		HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+38	10022	12053	124.3	125.6	1.3		END OF DITCH	
0+48	10012	12053	124.4	126.0	1.6		START OF ROAD	
0+62	10000	12053	124.4	132.0	7.6		CENTERLINE OF ROAD	
0+75	9988	12052	124.5	125.8	1.3		END OF ROAD	
0+85	9979	12052	124.6	128.8	4.2		CENTERLINE OF SWALE	
0+94	9970	12052	124.6	131.8	7.2	32.31%	END OF CASING	74 FT OF 6" DIA PE AT CONTOUR
1+57	9909	12054	144.7	146.2	1.5	11.78%		
1+68	9898	12054	146.1	149.9	3.8	4.26%	TOP OF BERM	8 FT OF 6" DIA PE AT 4.26%
1+76	9891	12054	146.4	147.9	1.5	27.92%		70 FT OF 6" DIA PE AT CONTOUR
2+34	9836	12055	162.6	164.1	1.5	7.41%		
2+46	9824	12055	163.5	167.8	4.3	3.58%	TOP OF BERM	7 FT OF 6" DIA PE AT 3.58%
2+53	9817	12056	163.8	165.3	1.5	28.80%		38 FT OF 6" DIA PE AT CONTOUR
2+81	9791	12056	171.7	173.2	1.5	29.01%	STA 0+00 LAT TO WELL W-2	
							6" TEE	
2+91	9781	12056	174.6	176.1	1.5		6" BLIND FLANGE	
LINE R-R'								
0+00	9697	12429	135.3	141.8	6.5	-69.84%	STA 8+90 LINE G-G'	6 FT OF 6" DIA PE AT CONTOUR
							CONDENSATE KNOCKOUT CK-2	
0+03	9697	12432	133.1	140.9	7.7		DRIPLEG DL-2	
0+06	9696	12434	131.0	140.0	9.0	-4.02%	DRIPLEG DL-2	14 FT OF 6" DIA PE AT 4.02%
0+20	9696	12448	130.5	137.7	7.2		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LINE S-S'								
0+00	9267	11234	181.8	185.7	3.9	21.19%	STA 10+02 LINE C-C'	2 FT OF 10" DIA PE AT CONTOUR
0+02	9266	11232	182.2	186.4	4.1		10" x 6" REDUCERS	191 FT OF 6" DIA PE AT CONTOUR
0+04	9267	11230	182.7	186.6	4.0		6" VALVE V-13	
0+94	9271	11141	201.9	205.5	3.6	6.67%	STA 0+00 LAT TO WELL T-17	
							6" TEE	
1+93	9271	11043	208.4	212.0	3.6	3.44%		200 FT OF 6" DIA PE AT 3.44%
2+93	9283	10944	211.9	214.3	2.5			
3+48	9287	10889	213.8	216.0	2.2		STA 0+00 LAT TO WELL T-16	
							6" TEE	
3+93	9276	10846	215.3	216.8	1.5	-3.00%	HIGH POINT	498 FT OF 6" DIA PE AT 3.00%
4+92	9256	10748	212.3	216.3	4.0			
5+63	9247	10678	210.2	214.4	4.2		STA 0+00 LAT TO WELL T-15	
							6" TEE	
5+92	9247	10649	209.3	213.7	4.4			
6+92	9245	10549	206.3	212.5	6.2			
7+82	9243	10460	203.6	211.3	7.7		STA 0+00 LAT TO WELL T-14	
							6" TEE	
8+91	9262	10352	200.3	208.7	8.4	-3.02%		95 FT OF 6" DIA PE AT 3.02%
9+10	9265	10333	199.7	208.3	8.5			
9+28	9267	10315	199.2	211.9	12.7		TOP OF BERM	
9+40	9269	10304	198.8	211.5	12.6		TOP OF BERM	
9+60	9273	10285	198.3	207.2	8.9			
9+86	9279	10259	197.5	205.4	7.9	-3.25%		25 FT OF 6" DIA PE AT 3.25%
9+96	9282	10250	197.1	207.6	10.5		TOP OF BERM	
10+11	9282	10236	196.6	202.8	6.2	-12.12%	6" VALVE V-14	29 FT OF 6" DIA PE AT CONTOUR
							12" x 6" REDUCERS	
10+40	9279	10208	193.1	194.6	1.5		STA 4+97 LINE H-H'	
LINE T-T'								
0+00	8910	12440	184.5	185.8	1.3	22.30%	STA 0+05 LINE G-G'	2 FT OF 22" DIA PE AT CONTOUR
0+02	8910	12438	184.9	186.4	1.5	31.76%	22" x 8" REDUCER	8 FT OF 8" DIA PE AT CONTOUR
0+10	8911	12431	187.5	189.0	1.5		STA 0+00 LAT TO WELL W-36	
							8" TEE	
							8" BLIND FLANGE	
LINE U-U'								
0+00	9725	10118	164.3	170.8	6.5	-5.04%	STA 0+00 LINE H-H'	7 FT OF 6" DIA PE AT COTOUR
							STA 1+80 LINE B-B'	
							CONDENSATE KNOCKOUT CK-5	
0+04	9724	10115	164.1	172.0	7.9		DRIPLEG DL-5	
0+07	9722	10112	159.6	172.9	13.3	-3.27%	DRIPLEG DL-5	45 FT OF 6" DIA PE AT 3.27%
0+52	9709	10071	158.1	160.5	2.4		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES		HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
	(NORTH)	(EAST)						
LINE V-V'								
0+00	9487	11211	175.6	178.1	2.5	4.01%	STA 11+27 LINE M-M'	303 FT OF 6" DIA PE AT 4.01%
0+68	9538	11167	178.3	183.8	5.5			
1+07	9563	11137	179.9	185.1	5.2		STA 0+00 LAT TO WELL T-6 6" TEE	
1+68	9606	11094	182.3	187.0	4.7			
2+17	9637	11055	184.3	188.7	4.4			
3+03	9720	11038	187.8	191.7	3.9		WELL T-8	
LINE FM-1								
0+00	9913	12640	112.2	117.5	5.3	9.13%	STA 30+01 LINE A-A'	11 FT OF ELECTRICAL CONDUIT FOLLOWS LINE FM-1
0+11	9907	12631	113.2	118.2	5.0		36" PUMP STATION	11 FT OF 4" x 2" DIA PE FORCEMAIN AT CONTOUR
LINE FM-2								
0+00	9855	12477	130.9	132.4	1.5	0.73%	STA 10+62 LINE G-G'	135 FT OF ELECTRICAL CONDUIT FOLLOWS LINE FM-1
1+00	9755	12483	131.7	133.2	1.5	0.13%		135 FT OF 4" x 2" DIA PE FORCEMAIN AT CONTOUR
1+35	9720	12484	131.7	133.2	1.5		TIE INTO EXISTING FORCEMAIN	
LATERAL TO LSR-1								
0+00	9710	12430	139.7	141.2	1.5	-35.10%	STA 9+04 LINE G-G'	16 FT OF 6" DIA PE AT CONTOUR
0+03	9710	12434	138.7	140.2	1.5	-17.73%	REMOTE WELLHEAD RW-1	
0+16	9711	12447	136.3	137.8	1.5		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO LCR-2								
0+00	9725	10083	162.6	164.1	1.5	-15.18%	STA 1+39 LINE B-B'	20 FT OF 6" DIA PE AT CONTOUR
0+03	9723	10081	162.1	163.6	1.5	-24.15%	REMOTE WELLHEAD RW-2	
0+20	9709	10071	158.1	160.5	2.4		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO LSR-3								
0+00	9418	12523	163.7	165.2	1.5	-32.45%	STA 5+46 LINE G-G'	45 FT OF 6" DIA PE AT CONTOUR
0+03	9418	12526	162.7	164.2	1.5	-32.74%	REMOTE WELLHEAD RW-3	
0+45	9417	12566	148.9	152.0	3.1	-3.00%		20 FT OF 6" DIA PE AT 3.00%
0+53	9418	12573	148.7	154.3	5.6		TOP OF BERM	
0+65	9417	12584	148.3	150.2	1.8	-23.09%		50 FT OF 6" DIA PE AT CONTOUR
1+15	9415	12634	136.7	138.2	1.5		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO LCR-4								
0+00	9435	10148	178.6	180.0	1.4	-28.96%	STA 2+92 LINE H-H'	42 FT OF 6" DIA PE AT CONTOUR
							REMOTE WELLHEAD RW-4	
0+42	9423	10109	166.3	167.8	1.5	-3.93%		21 FT OF 6" DIA PE AT 3.93%
0+51	9421	10101	166.0	170.2	4.2		TOP OF BERM	
0+63	9417	10090	165.5	167.0	1.5	-33.28%		18 FT OF 6" DIA PE AT CONTOUR
0+81	9413	10073	159.3	160.8	1.5		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO LSR-5								
0+00	9140	12462	177.2	178.6	1.3	-35.89%	STA 2+36 LINE G-G'	36 FT OF 6" DIA PE AT CONTOUR
0+03	9140	12464	176.2	177.7	1.5	-28.91%	REMOTE WELLHEAD RW-5	
0+36	9135	12496	166.6	168.0	1.4	-3.28%		20 FT OF 6" DIA PE AT 3.28%
0+44	9135	12503	166.4	170.5	4.1		TOP OF BERM	
0+56	9133	12515	166.0	167.5	1.5	-29.33%		125 FT OF 6" DIA PE AT CONTOUR
1+17	9123	12572	148.2	149.7	1.5	-10.08%		
1+24	9122	12579	147.5	151.5	4.1		TOP OF BERM	
1+35	9120	12589	146.4	147.9	1.5	-23.53%		
1+81	9113	12633	135.5	137.0	1.5		TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO LCR-6								
0+00	9208	10220	197.0	198.5	1.5		STA 5+69 LINE H-H'	41 FT OF 6" DIA PE AT CONTOUR
0+03	9207	10218	196.1	197.6	1.5	-24.12%	REMOTE WELLHEAD RW-6	

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
LANDFILL GAS MANAGEMENT SYSTEM
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)	HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+41	9187	10186	186.9	188.4	1.5	-4.58%	22 FT OF 6" DIA PE AT 4.58%
0+51	9182	10178	186.5	190.3	3.8		
0+63	9176	10169	185.9	187.4	1.5	-25.22%	119 FT OF 6" DIA PE AT CONTOUR
1+36	9135	10111	167.3	168.8	1.5	-5.20%	
1+45	9130	10103	166.9	171.0	4.1		
1+57	9124	10093	166.2	167.7	1.5	-27.59%	
1+82	9112	10073	159.4	160.9	1.5		
						TIE INTO EXISTING LEACHATE COLLECTION SYSTEM	
LATERAL TO WELL T-1							
0+00	9501	12050	211.1	218.4	7.3	48.07%	7 FT OF 6" DIA PE AT CONTOUR
0+07	9508	12051	214.5	218.1	3.6		
LATERAL TO WELL T-2							
0+00	9517	11775	213.0	216.5	3.5	3.68%	7 FT OF 6" DIA PE AT 3.68%
0+07	9524	11774	213.2	216.7	3.5		
LATERAL TO WELL T-3							
0+00	9500	11547	206.1	212.3	6.1	8.59%	34 FT OF 6" DIA PE AT CONTOUR
0+34	9468	11557	209.0	212.6	3.6		
LATERAL TO WELL T-4							
0+00	9499	11327	195.7	199.3	3.6	6.63%	28 FT OF 6" DIA PE AT CONTOUR
0+28	9526	11317	197.6	201.2	3.6		
LATERAL TO WELL T-5							
0+00	9391	11207	175.3	183.7	8.4	71.15%	2 FT OF 10" DIA PE AT CONTOUR
0+02						10" x 6" REDUCER	4 FT OF 6" DIA PE AT CONTOUR
0+06	9396	11210	179.6	183.2	3.6		
LATERAL TO WELL T-6							
0+00	9563	11137	179.9	185.1	5.2	31.57%	8 FT OF 6" DIA PE AT CONTOUR
0+08	9569	11143	182.5	186.1	3.6		
LATERAL TO WELL T-7							
0+00	9486	11066	170.1	179.2	9.1	31.61%	2 FT OF 10" DIA PE AT CONTOUR
0+02	9485	11065	170.6	179.5	8.9		39 FT OF 6" DIA PE AT CONTOUR
0+41	9449	11050	183.1	186.7	3.6		
LATERAL TO WELL T-9							
0+00	9550	10946	166.0	175.9	9.9	28.39%	2 FT OF 10" DIA PE AT CONTOUR
0+02	9549	10945	166.5	176.2	9.7		63 FT OF 6" DIA PE AT CONTOUR
0+65	9496	10913	184.5	188.1	3.6		
LATERAL TO WELL T-10							
0+00	9539	10835	185.6	189.2	3.6	5.31%	42 FT OF 6" DIA PE AT CONTOUR
0+42	9565	10803	187.8	191.4	3.6		
LATERAL TO WELL T-11							
0+00	9782	10718	180.5	184.1	3.6	14.95%	91 FT OF 6" DIA PE AT CONTOUR
0+10	9772	10717	182.0	185.6	3.6	15.98%	
0+91	9693	10709	194.9	198.5	3.6		
LATERAL TO WELL T-12							
0+00	9443	10685	214.7	218.3	3.6	4.61%	5 FT OF 6" DIA PE AT 4.61%
0+05	9439	10688	214.9	218.5	3.6		
LATERAL TO WELL T-13							
0+00	9460	10486	209.0	213.4	4.3	6.88%	8 FT OF 6" DIA PE AT CONTOUR
0+08	9452	10485	209.6	213.2	3.6		
LATERAL TO WELL T-14							
0+00	9243	10460	203.6	211.3	7.7	59.82%	7 FT OF 6" DIA PE AT CONTOUR
0+07	9236	10460	207.9	211.5	3.6		
LATERAL TO WELL T-15							
0+00	9247	10678	210.2	214.4	4.2	5.04%	7 FT OF 6" DIA PE AT CONTOUR
0+07	9240	10679	210.5	214.1	3.6		

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)	HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
LATERAL TO WELL T-16							
0+00	9287	10889	213.8	216.0	2.3	3.31%	STA 3+48 LINE S-S'
0+10	9297	10889	214.1	216.1	2.0		WELL T-16
LATERAL TO WELL T-17							
0+00	9271	11141	201.9	205.5	3.6	3.88%	STA 0+94 LINE S-S'
0+33	9297	11122	203.2	206.8	3.6		WELL T-17
LATERAL TO WELL T-18							
0+00	9299	11400	199.1	202.7	3.6	21.34%	STA 11+24 LINE J-J'
0+07	9292	11403	200.6	204.2	3.6		WELL T-18
LATERAL TO WELL T-19							
0+00	9284	11658	210.7	214.4	3.7	3.20%	STA 8+63 LINE J-J'
0+09	9293	11659	211.0	214.5	3.6		WELL T-19
LATERAL TO WELL T-20							
0+00	9286	11934	214.0	218.1	4.0	13.25%	STA 5+87 LINE J-J'
0+06	9292	11934	214.8	218.4	3.6		WELL T-20
LATERAL TO WELL T-21							
0+00	9281	12205	205.9	212.7	6.8	46.07%	STA 3+15 LINE J-J'
0+08	9288	12208	209.4	213.0	3.6		WELL T-21
LATERAL TO WELL T-22							
0+00	9464	10359	205.2	210.7	5.6	4.35%	STA 5+86 LINE I-I'
1+00	9560	10386	209.5	213.2	3.7		
1+21	9580	10392	210.4	214.0	3.6		WELL T-22
LATERAL TO WELL T-23							
0+00	9460	10488	209.1	213.4	4.3	3.04%	STA 4+56 LINE I-I'
1+01	9538	10551	212.2	216.5	4.3		
1+63	9585	10592	214.1	217.7	3.6		WELL T-23
LATERAL TO WELL W-1							
0+00	9689	12428	139.0	142.0	3.0	90.51%	STA 8+82 LINE G-G'
0+02	9689	12426	141.1	142.6	1.5	31.82%	22" x 6" REDUCERS
0+29	9691	12401	149.6	151.1	1.5	4.05%	
0+40	9691	12389	150.0	154.3	4.3		TOP OF BERM
0+50	9692	12380	150.4	151.9	1.5	31.69%	
0+98	9696	12335	165.6	167.1	1.5	8.19%	
1+10	9697	12324	166.6	170.5	4.0		TOP OF BERM
1+18	9698	12316	167.3	168.8	1.5	28.74%	
1+70	9701	12266	182.3	183.8	1.5	6.27%	
1+82	9702	12254	183.1	187.2	4.1		TOP OF BERM
1+90	9703	12246	183.6	185.1	1.5	18.47%	
2+27	9703	12211	190.3	191.8	1.5		WELL W-1
LATERAL TO WELL W-2							
0+00	9791	12056	171.7	173.2	1.5	6.25%	STA 2+81 LINE O-O'
0+10	9789	12046	172.4	173.9	1.5	10.81%	
0+20	9785	12037	173.4	174.9	1.5	11.78%	
1+00	9755	11964	182.8	184.3	1.5		WELL W-2
LATERAL TO WELL W-3							
0+00	9820	11552	172.3	173.8	1.5	7.07%	STA 2+48 LINE E-E'
0+99	9788	11646	179.3	180.8	1.5	3.97%	
1+77	9763	11720	182.4	186.0	3.6	11.11%	STA 0+00 LINE F-F'
							8" TEE
							8" x 6" REDUCER
1+99	9756	11741	184.9	187.4	2.5		WELL W-3
LATERAL TO WELL W-9							
0+00	9675	10126	171.3	172.8	1.5	32.50%	STA 0+51 LINE H-H'
0+07	9675	10132	173.4	174.9	1.5	29.66%	12" x 6" REDUCERS
0+51	9690	10172	186.6	188.1	1.5	6.94%	
0+65	9694	10185	187.6	192.1	4.5		TOP OF BERM

RECORD CONSTRUCTION HEADER ROUTE SURVEY DATA
 LANDFILL GAS MANAGEMENT SYSTEM
 TRAIL RIDGE LANDFILL
 BALDWIN, FLORIDA

STATION (FT)	GRID COORDINATES (NORTH) (EAST)		HEADER INVERT ELEV. (FT)	GROUND ELEV. (FT)	HEADER DEPTH (FT)	HEADER SLOPE (%)	CONSTRUCTION NOTES	PIPE INFORMATION
0+75	9697	10193	188.3	189.8	1.5	24.51%		
1+59	9724	10271	209.0	210.5	1.5		EXISTING WELL W-9	
LATERAL TO WELL W-10								
0+00	9483	10250	201.8	206.3	4.5	36.08%	STA 6+97 LINE I-I'	10 FT OF 6" DIA PE AT CONTOUR
0+10	9492	10250	205.2	206.7	1.5		EXISTING WELL W-10	
LATERAL TO WELL W-17								
0+00	9581	12429	144.0	145.4	1.5	25.53%	STA 7+74 LINE G-G'	2 FT OF 22" DIA PE AT CONTOUR
0+02	9580	12428	144.5	146.0	1.5	23.38%	22" x 6" REDUCERS	37 FT OF 6" DIA PE AT CONTOUR
0+04	9580	12426	144.9	146.4	1.5	27.67%	6" VALVE V-7	
0+25	9566	12410	150.9	152.4	1.5	7.03%		
0+39	9558	12400	151.8	155.0	3.2	3.42%	TOP OF BERM	7 FT OF 6" DIA PE AT 3.42%
0+46	9554	12394	152.1	153.6	1.5	27.87%		73 FT OF 6" DIA PE AT CONTOUR
1+05	9519	12350	168.4	169.9	1.5	23.69%		
1+19	9510	12340	171.8	174.4	2.6	3.86%	TOP OF BERM	9 FT OF 6" DIA PE AT 3.86%
1+28	9505	12333	172.2	173.7	1.5	29.03%		42 FT OF 6" DIA PE AT CONTOUR
1+45	9495	12320	177.0	178.5	1.5	36.18%	STA 0+00 LINE M-M'	
							6" TEE	
1+70	9480	12302	186.0	187.5	1.5		EXISTING WELL W-17	
LATERAL TO WELL W-18								
0+00	9284	12438	186.0	187.5	1.5	11.30%	STA 0+77 LINE J-J'	14 FT OF 6" DIA PE AT CONTOUR
0+14	9297	12434	187.6	189.1	1.5		EXISTING WELL W-18	
LATERAL TO WELL W-25								
0+00	9249	10245	202.5	206.7	4.2	55.18%	STA 0+32 LINE L-L'	6 FT OF 6" DIA PE AT CONTOUR
							8" x 6" REDUCER	
0+06	9255	10246	205.9	207.4	1.5		EXISTING WELL W-25	
LATERAL TO WELL W-35								
0+00	9073	12455	179.4	180.8	1.4	24.57%	STA 1+68 LINE G-G'	2 FT OF 22" DIA PE AT CONTOUR
0+02	9073	12453	180.0	181.5	1.5	31.81%	22" x 6" REDUCERS	21 FT OF 6" DIA PE AT CONTOUR
0+23	9075	12433	186.6	188.1	1.5		EXISTING WELL W-35	
LATERAL TO WELL W-36								
0+00	8911	12431	187.5	189.0	1.5	3.06%	STA 0+10 LINE T-T'	5 FT OF 6" DIA PE AT 3.06%
							8" x 6" REDUCER	
0+05	8916	12431	187.7	188.9	1.3		EXISTING WELL W-36	

DAILY WORK REPORTS

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-7-98 WEEK ENDING 9-13-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI worked on survey. Drilled and installed
T-13 well At 55' slotted 6" well pipe

SAT worked on survey Drilled and installed
well #15 At 56.5, # T-14 At 51.5
slotted 6" well pipe Drilled and installed
well # T-15 At 56.7'

SUN


WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-14-98 WEEK ENDING 9-20-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 1 OF 2

MON worked on survey. slotted 6" well pipe received 1 loaded of 6", 12" and 20" Hdpc pipe. Drilled and installed wells T-12 At 59.5, # T-2 At 47' had to Abandoned. T-3 At 63.3' and well #T-6 At 30'

TUE welded 1400' 6" pipe Air tested 6" pipe Above Ground. welded 200' 12" pipe worked on survey Drilled and installed wells # T2 At 71', #T-1 At 76'

WED welded 1000' 20" pipe. Air tested 200' 12" pipe Above ground. Order all fittings for Job. worked on survey Drilled and installed wells #T-4 At 50', #T-19 At 60', #T-20 At 73' and #T-21.

THU worked on survey. Drilled and installed wells #16 At 61, #T-18 At 52'. Drilled well #TW-17 At 52'

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-14-98 WEEK ENDING 9-20-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2


FRI

Installed well # T-17 at 52'. Had to
stop work due to Rain - worked on
Survey

SAT

Rain out

SUN



WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-21-98 WEEK ENDING 9-27-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 1 OF 2

MON unloaded 12" pipe. started welded
12" pipe. Rain out at 10 AM.
Drilled and Installed TW-7 at 36'

TUE welded 1000' 12" pipe. And 400' 10" pipe
Air tested 12" Above ground. Started
digging Line A-A at 1000 had to stop
due to water 10" Above grade.

WED welded 10" pipe unloaded 3 Loads of pipe
And fitting. Installed Line J-5 from 3431 to
5400. Drilled And Installed wells TW-23
at 57' And TW-22 at 53'

THU Installed Line J-5 from 5400 to 6404
Rain out at 10 AM. worked on Drill
rigs.

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-21-98 WEEK ENDING 9-27-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

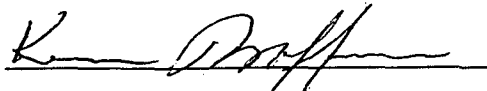
Installed Line J-J from 5+00 to 7+25.
Installed Lateral #20 from 0+00 to 0+07
Hauled 2 Loads of Dirt for Back Fill
Welded Air tested 900' 20" pipe Above
ground, worked on well Heads.

SAT

Installed Line J-J from 7+25 to 9+25 And
Line J-J from 3+31 to 2+50. Installed
Lateral #19 from 0+00 to 0+07 And Lateral
#21 from 0+00 to 0+07. made Branch to well #2
weld on 10" and 12" Tee's. And Reducers.
Hauled 8 Loads of Dirt from pit to Backfill
Trench

SUN

Drilled And Installed wells #T5 At 34', #T8 At
43', #T9 At 35' And T10 At 36'. started to
trench Line m-m At 1+45, Dug to station
2+00. stop to Build Branch for wells. Fabbred
Tee's And Reducers.



WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-28-98

WEEK ENDING 10-4-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed line m-m from 1+45 to 3+00.
Installed Lateral to T1# from 0+00 to 0+07
Hauled Dirt for Branch to wells on CLAY
CAP. Started Drilling well #11 At 20'
Abandon Due to 30" Down drain.

TUE

Installed Line m-m from 3+00 to 5+90
Drilled And installed W-4 At 51'; well #3 At 44' and
well #2 At 44'. Birt Branch for wells #1 and #36
worked on well heads.

WED

Rain out All day

THU

Rain out until 9am welded 1600' of
6" pipe. Had weekly meeting.

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 9-28-98

WEEK ENDING 10-4-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 2 OF 2

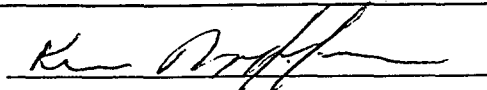
FRI

welded 12" pipe for Line A-A. Installed Line
A-A from 0+00 to 3+50.

SAT

Installed Line A-A from 3+50 to 6+50. hit
ground water had to stop.

SUN



WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-5-98

WEEK ENDING 10-11-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed Line m-m from 5+90 to 7+50. Repair
30" Blind Flange near well #T-11 due to being hit
by Drill rig. Drill and installed w-T at 55'.
Worked on Lander. Clean up Branches for Drill
rig. Bilt Branch for well T-11.

TUE

Bilt Branches for wells w-[#]36 and T-[#]11.
Drill and installed wells w-[#]36 at and T-11 at
49'. Installed Lateral #3 from 0+00 to 0+34
Installed Line m-m from 7+50 to 8+75

WED

Installed Line m-m from 8+75 to 10+30.
Installed Line I-5 from 9+25 to 11+80
Installed Lateral well T-[#]4 from 0+00 to 0+25
Installed Lateral well T-[#]18 from 0+00 to 0+11
Hauled 21 Loads Dirt for Backfill

THU

Installed Line I-I from 0+40 to 5+20
Installed Lateral well T-[#]10 from 0+00 to 0+41
Installed Lateral well T-12 from 0+00 to 0+07
Installed Lateral well T-13 from 0+00 to 0+07
Installed Lateral well T-23 from 0+00 to 1+63
Hauled 26 Loads of Backfill Total pipe 258

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-5-98 WEEK ENDING 10-11-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

Installed Lateral T-32 from 0+00 to 1+21
Installed Line T-T from 5+20 to 6+40
Installed Line S-S from 0+20 to 6+50
Installed Lateral #17 from 0+00 to 0+33
welded 1200' 6" pipe. Installed Lateral 57/6 from 0+00 to
0+10, Lateral T-15 from 0+00 to 0+08.

SAT

Installed Line S-S from 6+50 to 10+36
Installed Lateral T-14 from 0+00 to 0+08
Hauled 17 Loads Dirt for Backfill 80 yard Truck
Air tested 1000' 10" pipe Above ground.
welded on 10" Tee's.

SUN

K. Proffner
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-12-98 WEEK ENDING 10-18-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 1 OF 2

MON

Installed Line C-C from 10+05 to 6+75.
Installed Lateral T-7 from 0+00 to 0+41
welded 800' 6" pipe. Hauled 12 Loads Dirt for
Back fill.

TUE

Installed Line C-C from 6+75 to 2+61
Hauled 20 Loads dirt For Back
fill. Had to haul dirt due to
Baker truck Broke down.

WED

Installed Lateral # T-9 from 0+00 to 0+65
Installed Lateral # T-11 from 0+00 to 0+91
Installed Line N-N from 3+26 to 0+75
Installed Line I-I from 0+40 to 0+00

THU

Installed Line C-C from 2+61 to 1+30
Installed Line N-N from 0+75 to 0+00
Installed Line U-C from 3+03 to 2+00

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-12-98 WEEK ENDING 10-18-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

Installed Line V-V from 2+00 to 6+00
Installed Lateral #T-6 from 0+00 to 0+07
Installed Line M-M 10+30 to 12+01
Installed Line J-J from 11+80 to 13+25

SAT

Installed Line A-A from 6+50 to 10+98

SUN


WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-19-98 WEEK ENDING 10-25-98

DATE: DAILY DESCRIPTION OF WORK PERFORMED: PAGE 1 OF 2

MON

Installed Line A-A from 10+98 to 14+97
Air tested 300' 20" pipe Above ground.

TUE

Installed Line J-J from 2+50 to 1+84.
Trenched Line Line D-D from 3+76 to 1+00
welded 400' 10" Air tested Above ground.
worked on Dress up.

WED

Installed Line D-D from 3+76 to 1+00
Installed Line O-O from 2+77 to 1+00
Installed Lateral W-2 from 0+00 to 1+00

THU

Installed Line E-E from 3+69 to 1+00
Installed Lateral W-~~3~~⁴ from 0+00 to 2+00
Installed Line F-F from 0+00 to 0+12

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-19-98 WEEK ENDING 10-25-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

Installed Benonite mats on well T-6, T-8, T-4, T-18, T-5, T-7, T-9, T-11, T-10 and T-17. Installed Benonite mats on 6" Valve Line F-I, I-I and m-m. Installed Line H-H from 1+00 to 3+89.

SAT

Installed Line H-H from 3+89 to 5+65.
Installed Line L-L from 0+00 to 0+32
Installed Line I-I from 6+40 to 8+08
Installed Lateral well #70 from 0+00 to 0+10
Installed Line S-S from 10+36 to 10+40

SUN

Ric Driff
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-26-98

WEEK ENDING 11-1-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed Line H-H from 1+00 to 0+00.
Installed Lateral to LCR-5 from 0+00 to 0+81
Installed Lateral to LCR-6 from 0+00 to 1+82
Installed Lateral to well #9 from 0+00 to 1+59
Installed Compacted clay in Berm Crossing.

TUE

Installed Lateral well #1 from 0+00 to 2+27
Installed Lateral well #17 from 0+00 to
Installed Lateral well #18 from 0+00 to
Installed Line J-J from 1+84 to 0+00
Installed Line m-m from 1+48 to 0+00
Received fitting for 20" Ted's.

WED

Installed clay in Berm for Laterals #1, #17 Line
J-J and Line m-m. Installed sample Riser
on 6" Valve Line S-S. Installed Lateral well #25
from 0+00 to 0+07. Installed Line L-L from 0+00
to 0+37.

THU

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 10-26-98 WEEK ENDING 11-1-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

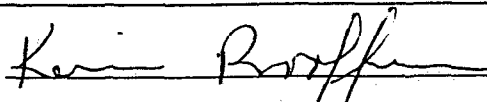
FRI

Installed Line B-B from 1+80 to 1+00
Installed Knock out CK-5. Installed Line U-U
from 0+00 to 0+52. Installed Line A-A
from 14+97 to 15+96. Dressed up Line A-A
Haul off dirt from trench area.

SAT

Installed Line A-A from 15+96 to 22+79
moved 6" pump to start dewatering Line
A-A

SUN


WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-2-98

WEEK ENDING 11-8-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed Line A-A from 22+79 to 28+99
Installed 40'-24" cnp on Line A-A.

TUE

Installed Clay cap on Line B-B And CK-5
Installed Steel Casing on Line B-B.
Installed Line B-B from 1+00 to 0+00.
welded on steel casing for Line C-C.
Cut concrete Ditch for Line C-C

WED

Installed steel casing for Line C-C.
Installed Line C-C from 1+32 to 0+00
Installed 10" valve Line C-C.
welded Steel casing Line D-D
Cut

THU

Installed steel casing for Line D-D And
E-E Installed Line D-D from 1+00 to
0+00. Installed 10" valve Line D-D.
Installed Line E-E from 1+00 to 0+00

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-2-98

WEEK ENDING 11-8-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 2 OF 2

FRI

Installed Steel CASing for Line O-O.
Installed Line O-O from 1400 to 0400
welded 26" CASing Line C-C.
Cut Road for Line C-C.
Installed 4" Sample Riser on Valve
Line C-C And D-D.

SAT

Installed Benonite mats on wells,
Welded 480' 22" Pipe. Started to Fab
24" Knock out.

SUN

Finished 24" Knock out. Welded 22"
Tee's. And Reducers.

Ken Anff
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-9-98

WEEK ENDING 11-15-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Cut concrete ditch for Line B-C Crossing
Installed Branch saddle for Tie-in to
LC-R #6. Installed clay for Barm at
Tie-in LCR #6.

Cut concrete ditch for 30" drain for
Land fill. Received flare and electric panel

TUE

Received 750' 22" pipe. Installed Branch saddle
for Tie-in of LCR-S. welded 22" Tees
and Reducers. Installed 14" Blind on Knock-
out. Dug out Road Crossing for R-B-Baker
to install concrete. Dug out for flare
slab. Received Blower

WED

Dressed west slope for final Grade.
welded 22" pipe. Broke Face on 22" welder
Installed 6" Blinds on LCR #5, #6 Risers
Installed 4" Blinds on Sample Risers
Line B-B.

THU

Installed well head on wells T-17, T-7, T-9
T-10, T-11, T-5, T-6, T-8, T-4 and T-18.
Installed Line to LCR-4 from 0+00 to 0+20
Installed Branch saddle for Drig leg Tie-in
of Line U-U. Hauled dirt from Line
A-A to north slope.

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-9-98 WEEK ENDING 11-15-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI Installed Line G-G from 0+00 to 3+20
Hauled dirt ~~to~~ To cover 22" pipe with
3' of dirt.

SAT Installed Line G-G from 3+20 to 6+50
Installed 26" steel casing on Line G-G
at Compactor Road. Installed clay over
26" casing

SUN Installed Line G-G from 6+50 to 8+82
Installed Lateral to W-35 from 0+00 to 0+23
Installed Line T-T from 0+00 to 0+10
Installed Line J-J
Installed Lateral #36 from 0+00 to 0+05

K. Dwyer
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-16-98

WEEK ENDING _____

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed LSR #3 from 0 to 1 to 1+81

Installed LSR #2 from 0 to 1 to 1+15

Installed Line m-m - tie-in to Line G-G

Installed 6" valve line m-m. Installed 4"

Sample Risers Line m-m and G-G and

Line J-J and G-G. order Generator for 36" machine

TUE

Made Tie-ins to LSR #3 and LSR #2.

Started to install well heads. And 4"

Blinds on sample Risers. Hauled dirt to

Line G-G to cover with 3' of dirt.

WED

Welded 30" pipe for down cover.

Started well heads. Air tested Line m-m

A-A, C-C, J-J, I-I, n-n. placed top

soil on Line G-G

THU

Started installing 30" down cover. finished

installing well heads. Installed 22" Blind

Flange Line G-G at 0 to 0.

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING _____ WEEK ENDING _____

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

welded and Installed 30" down Cover.
Installed 24" Knock out on Line G-G

SAT

welded and Installed 30" down Cover
Installed Valve head on 10" Valves.
clean up fusing Area,

SUN

Finished 30" pipe for down Cover.
Installed Line G-G from 8+82 to 11+00.

K. D. [Signature]
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-23-98

WEEK ENDING 11-29-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Welded 18" pipe for Road Crossing on
down corner for Landfill

TUE

Welded on 18" Road Crossing on 30" down
corner. Clean trash up around work Trailer.
Installed Valve stem on 6" valve at 14" Knock
out.

WED

made Tie in of Lateral #1 to Line B-G.
placed Clay on Line B-G near CK-2.
work on 4" valve for well heads

THU

Thanksgiving. Holiday off

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 11-23-98 WEEK ENDING 11-29-98

DATE: DAILY DESCRIPTION OF WORK PERFORMED: PAGE 2 OF 2

FRI Installed Test ports, Thermometer and
clamp on 4" Riser for sound cable.

SAT Finished installing clay near CK-2 on
Line B-G. Clean up Truck.

SUN

WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 12-30-98

WEEK ENDING 12-31-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 2 OF 2

FRI

Installed Line E-E 3 to 4 to 3+71. Air tested
20" Line A-A, 16" Line P-D, 8" Line E-E And
6" Line O-O. dug out Leachate Risers for
drip leg Line for CK-2.

SAT

welded 30" Flange on down corner pipe.
Installed drip leg Line R-R. Installed LSR-1
from atop to otib.

SUN

K. Roessler
WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 12-30-98 WEEK ENDING 12-6-98

DATE: DAILY DESCRIPTION OF WORK PERFORMED: PAGE 1 OF 2

MON

Started to dig hole for concrete to
Condensate Tank. Level Area Around Flar
And Blower slabs.

TUE

Finished hole for condensate Tank.
Poured concrete slab for Condensate Tank.
Electric Company Banned the Road near
work shop.

WED

Installed Line G-G from 8/100 to 11/196.
Installed steel casing for Line G-G And
Force main Crossing, C-C Electric worked on
conduit

THU

Installed flue, Electric panel And Blower.
Installed 4" dual containment Line with
Line G-G to Condensate storage tank
Area. C-C Electric Ran Conduit to Panel
near storage tanks to 24" valve Line G-G.

PROJECT NAME: Trail Ridge Landfill

WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 12-06-98

WEEK ENDING 12-13-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed Clay Around C/K-2. Finished
Installing Top Soil AN Line B-B. Installed
12" stone on Concrete Pad for Tank. Installed
4" Dual containment Line to Storage Tank Area
C-C Electric work of conduits to Blower
and Flare.

TUE

welded 24" Line and part to flare Area
Installed well head on well #35 and LSR #1

WED

Installed propane Line to flare
Bolt pipe stands for Discharge Pipe
to flare.

THU

Installed Condensate Tank.
Installed 24" Pipe from Tank to Blower
Tee. Back fill Around Tank Installed
4" and 2" pvc on Condensate Installed
26" and 24" piping on Tank.

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 12-06-98 WEEK ENDING 12-13-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

Installed discharge from Blower to flare
Installed a flame arrestor.
Dressed around flare station.

SAT

Trenched and welded pipe from 24" and 20"
Valves on Line B-G and A-A to Condensate
Tank.

SUN

Installed 24" and 20" Valve Line A-A and
B-G. Installed 4" Branch for sample Risers
on 20" and 24" Valve. Back fill 24" Header
at Condensate Tank


WET SUPERVISOR SIGNATURE

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98446

DAILY WORK REPORT

WEEK BEGINNING 12-14-98

WEEK ENDING 12-20-98

DATE:

DAILY DESCRIPTION OF WORK PERFORMED:

PAGE 1 OF 2

MON

Installed 36" Riser on Condensate Tank.
Stacked Backfilling Around Tank. Installed 12" Valve
on inlet side of Blower. Installed pipe stand
on Discharge pipe. C-C Electric work on Flare
Panel.

TUE

Installed 24" Blind on CK-2. Installed 36", 24"
24" Blind on Tank. Installed pipe stand on
inlet. Installed

WED

Installed nitrogen Bottle and propane Bottle.
Clean up work trailer. Installed pvc fitting on
Tank. Installed flow meters.

THU

worked on punch list. Started. Started Flare.
Air tested Condensate Tank And 24" Header
Pipe. Installed sample port on 4" sample Riser.

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

DAILY WORK REPORT

WEEK BEGINNING 12-14-98 WEEK ENDING 12-20-98

DATE: _____ DAILY DESCRIPTION OF WORK PERFORMED: _____ PAGE 2 OF 2

FRI

Installed leak detector on 4" dual containment
force main. Tie in Force main to Condensate Tank.
Worked on punch list. Labeled wells; Blue
4" caps on well heads

SAT

Installed Aluminum Around discharge Line at flare
Installed stone Around flare Area. Back fill
Around tank

SUN

WET SUPERVISOR SIGNATURE

CONSTRUCTION MEETING NOTES/ STATUS REPORTS

Supplied by England-Thims & Miller, Inc.

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MATERIAL TEST REPORTS

①

PROJECT NAME: Trail Ridge Land Fill
WET PROJECT NO.: 98496

BELOW GROUND FINAL PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>12-4-98</u>
PERSON PERFORMING TEST:	<u>K. Rooffener</u> <i>K.B.</i>	TIME: <u>3:30 PM</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total Pipe Length = 3,156'</u>	<u>20" Line A-A, 10" Line P-P, 8" Line E-E, F-F, 6" Line O-O, Laterals</u>

T_i = Initial temperature in °C - 36 °C

P_i = Initial test pressure in psig - 10 psig

P_c = Initial pressure in psig corrected for temperature

(T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in °C at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_t + 14.7)(T_i + 273)}{(T_t + 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_t)}{P_c} \times 100$$

NOTE: $^{\circ}\text{C} = \frac{(^{\circ}\text{F} - 32)}{1.8}$

TIME (min.)	T_i TEMP READING (°C)	P_i GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	36	10	10	6
20	35	10	10	6
30	33	10	10	6
40	31	10	10	6
50	30	10	10	6
60	29	10	10	<1%

Pass/Failure: PASS Retest (yes/no): N/A

Description: Nature of Leaks and Repairs of retest segment: N/A

(2)

PROJECT NAME: Trial Ridge
WET PROJECT NO.: 98496

BELOW GROUND FINAL PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>11-18-98</u>
PERSON PERFORMING TEST:	<u>K. Roostener</u> <u>ICB</u>	TIME: <u>2:00 pm</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total Pipe Length = 5,319'</u>	<u>12" 10" and 6" Lines</u> <u>C-C: A-A, and A-A and</u> <u>All laterals</u>

T_i = Initial temperature in °C - 37 °C
 P_i = Initial test pressure in psig - 10 psig
 P_c = Initial pressure in psig corrected for temperature

(T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in °C at time 't'

P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_t + 14.7)(T_i + 273)}{(T_t + 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{(P_c - P_i)}{P_i} \times 100$$

NOTE: $^{\circ}\text{C} = \frac{(^{\circ}\text{F} - 32)}{1.8}$

TIME (min.)	T_i TEMP READING (°C)	P_i GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	37	10	10	0
20	36	10	10	0
30	34	10	10	0
40	33	10	10	0
50	31	10	10	0
60	30	10	10	<1%

Pass/Failure: PASS Retest (yes/no): N/A

Description: Nature of Leaks and Repairs of retest segment: _____

PROJECT NAME: Trail Ridge
WET PROJECT NO.: 98496

BELOW GROUND FINAL PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>11-18-98</u>
PERSON PERFORMING TEST:	<u>K. Reiffner</u> <i>kb</i>	TIME: <u>12:00 pm</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total Pipe Length = 4,268'</u>	<u>6" pipe line I-5</u> <u>m-m. I-I, V-V</u> <u>and laterals</u>

T_i = Initial temperature in °C - 37 °C

P_i = Initial test pressure in psig - 10 psig

P_c = Initial pressure in psig corrected for temperature

(T_i) at time 't'

t = Time in minutes from initiation of test

T_i = Temperature in °C at time 't'

P_i = Test pressure in psig at time 't'

$P_c = \frac{(P_i + 14.7)(T_i + 273)}{(T_i - 273)} - 14.7$

Percent Pressure Drop = $\frac{(P_c - P_i)}{P_c} \times 100$

NOTE: °C = $\frac{(F - 32)}{1.8}$

TIME (min.)	T_i TEMP READING (°C)	P_i GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	37	10	10	0
20	36	10	10	0
30	34	10	10	0
40	31	10	10	0
50	30	10	10	0
60	28	10	10	<1%

Pass/Failure: PASS Retest (yes/no): nil

Description: Nature of Leaks and Repairs of retest segment: _____

PROJECT NAME: Trail Ridge Landfill
 WET PROJECT NO.: 98496

BELOW GROUND FINAL PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>12-5-98</u>
PERSON PERFORMING TEST:	<u>K. Roofner</u> <i>KB</i>	TIME: <u>11:00 AM</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total Pipe Length = 1,793'</u>	<u>Line G-G 22" 6" L after wall fl. Line T-T 11" 6" L after pls on Line G-G.</u> <u>Line R-R'</u>

T_i = Initial temperature in °C - 37 °C
 P_i = Initial test pressure in psig - 10 psig
 P_c = Initial pressure in psig corrected for temperature
 (T_i) at time 't'

*Revised 02/14/99
by MB*

t = Time in minutes from initiation of test
 T_t = Temperature in °C at time 't'
 P_t = Test pressure in psig at time 't'
 $P_c = \frac{(P_t + 14.7)(T_i + 273)}{(T_t + 273)} - 14.7$

Percent Pressure Drop = $\frac{(P_c - P_i)}{P_c} \times 100$
 (P_c)

NOTE: °C = $\frac{(°F - 32)}{1.8}$

TIME (min.)	T_t TEMP READING (°C)	P_t GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	37	10	10	0
20	36	10	10	0
30	34	10	10	0
40	33	10	10	0
50	31	10	10	0
60	30	10	10	<1%

Pass/Failure: PASS Retest (yes/no): N/A
 Description: Nature of Leaks and Repairs of retest segment: N/A

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

**BELOW GROUND FINAL PE PIPE PRESSURE TEST
REPORT**
FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>12-18-98</u>
PERSON PERFORMING TEST:	<u>K. Roofenser Ken Smith</u>	TIME: <u>1:00 pm</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total pipe length = 146'</u>	<u>2" Force MAIN</u>

T_i = Initial temperature in °C - 35 °C
 P_i = Initial test pressure in psig - 35 psig
 P_c = Initial pressure in psig corrected for temperature
(T_i) at time 't'

Revised 02/14/99
by MZ

t = Time in minutes from initiation of test
 T_i = Temperature in °C at time 't'
 P_i = Test pressure in psig at time 't'
 $P_c = \frac{(P_i + 14.7)(T_i + 273)}{(T_i - 273)} - 14.7$

Percent Pressure Drop = $\frac{(P_c - P_i)}{(P_i)} \times 100$

NOTE: $^{\circ}\text{C} = \frac{(^{\circ}\text{F} - 32)}{1.8}$

TIME (min.)	T_i TEMP READING (°C)	P_i GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	35	35	35	0
20	34	35	35	0
30	33	35	35	0
40	30	35	35	0
50	30	35	35	0
60	29	35	35	<1%

Pass/Failure: PASS Retest (yes/no): N/A
Description: Nature of Leaks and Repairs of retest segment: N/A

(6)

PROJECT NAME: Trail Ridge Landfill
WET PROJECT NO.: 98496

BELOW GROUND FINAL PE PIPE PRESSURE TEST REPORT

FORM II

CONTRACTOR:	WASTE ENERGY TECHNOLOGY, INC.	DATE: <u>12-17-98</u>
PERSON PERFORMING TEST:	<u>K. Rooster</u> 146	TIME: <u>8:00 AM</u>
DESCRIPTION/LOCATION OF TEST SEGMENT:	(Pipe, Diameter, Length, & SDR's) <u>Total Pipe Length = 203'</u>	<u>Condensate Storage TANK</u> <u>Line A-A'</u>

T_i = Initial temperature in °C - 36 °C

P_i = Initial test pressure in psig - 3 psig

P_c = Initial pressure in psig corrected for temperature

(T_i) at time 't'

t = Time in minutes from initiation of test

T_t = Temperature in °C at time 't'

P_t = Test pressure in psig at time 't'

$P_c = \frac{(P_t + 14.7)(T_i + 273)}{(T_t + 273)} - 14.7$

Percent Pressure Drop = $\frac{(P_c - P_i)}{P_i} \times 100$

NOTE: °C = $\frac{(F - 32)}{1.8}$

TIME (min.)	T_i TEMP READING (°C)	P_i GAUGE READING (psig)	P_c CORRECT PRESSURE (psig)	PERCENT PRESSURE DROP (%)
0	36	3	3	0
20	32	3	3	0
30	31	3	3	0
40	30	3	3	0
50	28	3	3	0
60	26	3	3	<1%

Pass/Failure: PASS Retest (yes/no): N/A
Description: Nature of Leaks and Repairs of retest segment: N/A



CONRAD YELVINGTON

January 12, 1999

DISTRIBUTORS, INC.

Susanne Glenn
Waste Energy Technology
11 Tupelo Avenue SE
Fort Walton Beach, FL 32548
Tel: 800/441-6822
Fax: 850/243-0077

REF: Material Specifications for #4 Mod Granite
Project: Trailridge Landfill, Hwy 301, Baldwin, FL

Dear Susanne:

This letter is to certify the above referenced material that *CONRAD YELVINGTON DISTRIBUTORS, INC.* proposes to supply your project complies with non-calcareous requirements. A typical gradation and physical properties are as follows;

<u>Sieve Size</u>	<u>#Mod 4 % passing</u>	<u>Physical Properties</u>
3"	100	
2 1/2"	100	LA Abrasion 18
2"	92	Specific Gravity 2.68
1 1/2"	57	Unit Weight 165 lbs./cu. ft.
1"	10	Absorption <2%
3/4"	5	Sodium Soundness Sulfate Loss <1%
1/2"	<2	

If you have any questions or need additional information, please do not hesitate to contact me at (904) 257-5504 Ext. #135.

Sincerely,

CONRAD YELVINGTON DISTRIBUTORS, INC.

Kim Thompson
Vice President of Sales & Quality Control

KT:bt



P. O. BOX 1686 ▲ 800 BIG TREE ROAD ▲ DAYTONA BEACH, FLORIDA 32115 ▲ (904) 767-5500
DAYTONA ▲ ORLANDO ▲ DEBARY ▲ JACKSONVILLE ▲ TAMPA ▲ MIAMI ▲ SEGRAVE ▲ CITY POINT
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1-800-GRAVELS

FINAL COVER RECONSTRUCTION REPORT

Supplied by England-Thims & Miller, Inc.

MATERIAL SPECIFICATIONS

HDPE PIPE SPECIFICATIONS

Manufacturer: Phillips Driscopipe, Inc.
P. O. Box 83-3866
Suite 100
Richardson, Texas 75083
(800) 527-0662

Model: 1000 Series

Size: Varies

Wall Thickness: SDR 11, SDR 17; SDR 17 or heavier fittings

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

Customer Benefits

High quality Driscopipe® 1000 is manufactured from extra high molecular weight, high density PE3408 polyethylene pipe grade resin.

This black, weather-resistant pipe exhibits

- Outstanding Chemical & Corrosion Resistance
- High Environmental Stress Cracking Resistance
- Improved Flow Characteristics
- Toughness & Ductility
- Flexibility with lightweight
- Non-Toxic
- Abrasion Endurance
- Fatigue Endurance
- Long-term Hydrostatic Strength / Physical strength
- Reliability

Suggested Industries & Applications

- | | | |
|-----------------------------------|----------------------------|----------------------------|
| • Industrial Water Distribution | • Municipal | • Hard rock mining |
| • Agriculture | • Gravity sewers | • Coal Slurry / Processing |
| • Landfills | • Forced main sewers | • Dredging |
| • Marine | • Water distribution | • Water intakes |
| • Pollution Control | • Sewer treatment | • Water outfalls |
| • Pulp / paper / wood | • Sludge handling | • Fire-water |
| • Power Plants | • Leachate collection | • De-Watering |
| • Petrochemical | • Dual Containment | • Fly-Ash disposal |
| • Mining / Mineral Processing | • Brine | • Temporary pipelines |
| • Dredging / sand / gravel | • Fertilizer | • Cable Stayed Bridges |
| • Organic Chemicals | • Acid / Caustic lines | • Golf course irrigation |
| • Inorganic Chemicals | • Utility / Process piping | • Farmland irrigation |
| • Aquaculture | • Slurry | • Swimming pools |
| • Hazardous Waste | • SX acid mining | • Ice rinks |
| • Local / State / Federal Gov'ts. | • Tailings disposal | • and many others |
| • Cement Plants | • Marinas | |
| • Irrigation | • Snow melting / making | |

Available in sizes
1" thru 54"

Specification Data

The resin, pipe & fittings comply with these accepted (and other) industry standards

ASTM F-714 - Pipe Standard

ASTM D3261 - Fittings Standard

Cell Classification -
ASTM D3350 - PE345434C

ASTM D1248 - Type III, Class C
Category 5, Grade P34

EPA 9090

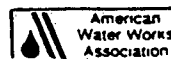
ISO #161

PPI Designation - PE3408

NSF - Listed, Standard #14 (by size, per order)

Factory Mutual (by size, per order) ◀ FM ▶

CGSB41 - GP-25M-Pipe Standard
AWWA C906 - 4"-63" HDPE PIPE FOR TRANS. & DIST.
AWWA C901 - Potable Water Pipe & Tubing



Printed: 9-93



Typical Physical Properties[⊕]

Property	Specification	Unit	Nominal Value
Material Designation	PPI / ASTM		PE 3408
Material Classification	ASTM D-1248		III C 5 P34
Cell Classification	ASTM D-3350		3 4 5 4 3 4 C
Density (3)	ASTM D-1505	gm/cm ³	0.955
Melt Index (4)	ASTM D-1238 (216 kg/190°C)	gm/10 min.	0.11 ♦
Flex Modulus (5)	ASTM D-790	psi	135,000
Tensile Strength (4)	ASTM D-638	psi	3,200
ESCR (3)	ASTM D-1693	Fo, Hours	> 5,000**
HDB @73° F (4)	ASTM D-2837	psi	1,600
U-V Stabilizer (C)	ASTM D-1603	% C	2.5
Hardness	ASTM D-2240	Shore "D"	65
Compressive Strength (yield)	ASTM D-695	psi	1,600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2" / min.)	psi	3,200
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	psi	5,000
Elongation @ Break	ASTM D-638	%, minimum	750
Modulus of Elasticity	ASTM D-638	psi	130,000
ESCR (Cond. A,B,C: Mold. Slab)	ASTM D-1693	Fo, Hours	> 5,000
(Compressed Ring - pipe)	ASTM F-1248	Fo, Hours	> 3,500
Slow Crack Growth	Battelle Method	Days to Failure	> 64
Impact Strength (IZOD) (.125" Thick)	ASTM D-256 (Method A)	In-lb / in notch	42
Linear Thermal Expansion Coef.	ASTM D-696	in / in /°F	1.2 x 10 ⁻⁴
Thermal Conductivity	ASTM D-177	BTU-in/ft ² /hrs/°F	2.7
Brittleness Temp.	ASTM D-746	° F	< -180
Vicat Soft. Temp.	ASTM D-1525	° F	257
Heat Fusion Cond.		psi @ ° F	75 @ 400

⊕ This list of typical physical properties is intended for basic characterization of the material and does not represent specific determinations of specifications. The physical properties values reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928 and may differ from specimens taken from pipe.

** Tests were discontinued because no failures and no indication of stress crack initiation.

♦ Average Melt Index value with a standard deviation of 0.01

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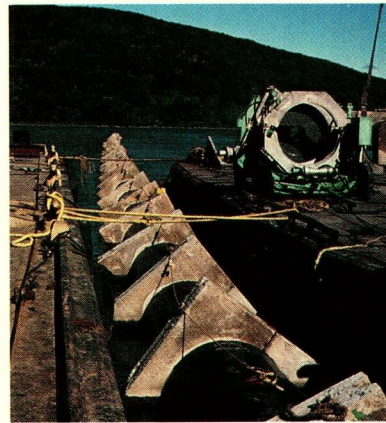
DRISCOPIPE

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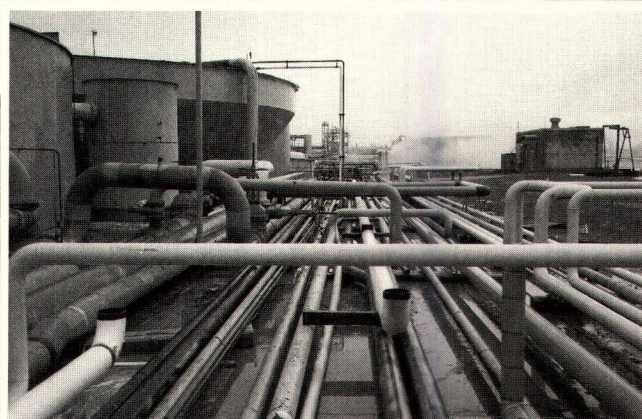
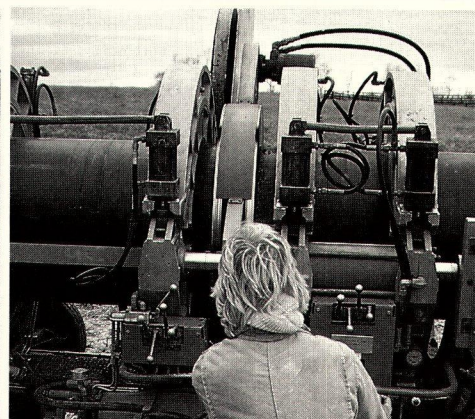
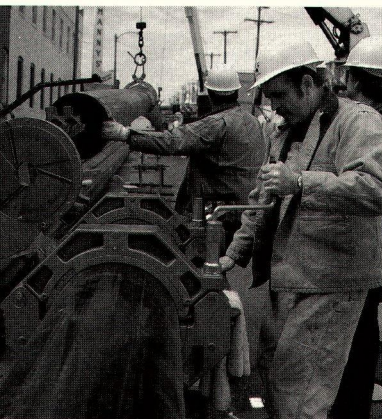
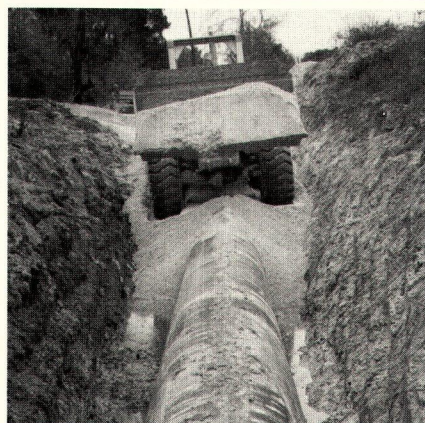
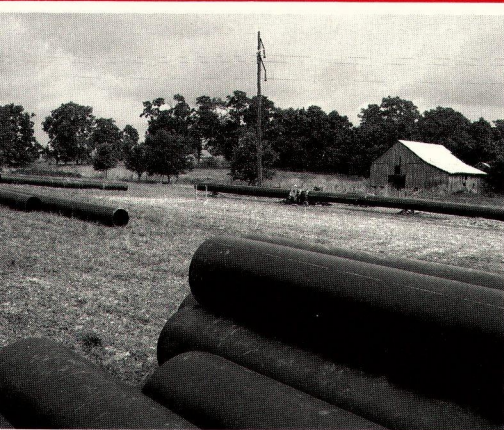
Engineering Characteristics



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Photographs shown are typical Driscopipe installations.



Driscopipe® Engineering Characteristics

Introduction

Driscopipe high density polyethylene piping systems offer the modern engineer the opportunity to take advantage of the unusual characteristics of these materials and use them to solve many old problems and to design systems for applications where traditional materials are either unsuitable or too expensive. When compared to the older traditional piping materials, Driscopipe polyethylene piping systems offer a new freedom in environmental design, extended service life, significant savings for installation labor and equipment costs, and reduced maintenance for pipeline systems where operating conditions are within the pressure and temperature capabilities of the material.

This brochure outlines the Engineering Characteristics of Driscopipe high density polyethylene pipe and fittings and points out many of the advantages and benefits to be realized through the use of these systems. The discussion is directed primarily toward the large diameter (3" through 54") Driscopipe 8600 and Driscopipe 1000 Industrial and Municipal product lines. However, these engineering characteristics are also typical of other Driscopipe polyethylene product lines.

Physical Properties

Driscopipe 8600 is manufactured from Marlex M-8000 very high molecular weight high density PE 3408 resin. Pipe and fittings made from Marlex M-8000 are extremely tough and durable, and possess exceptional long term strength. Marlex M-8000 is a proprietary product and is extruded only by Phillips Driscopipe, Inc.

Driscopipe 1000 is manufactured from Marlex TR-480, a PE 3408 polyethylene pipe resin in a molecular weight range which permits the pipe to be extruded by conventional methods. In this respect, Driscopipe 1000 is comparable to other extra high molecular weight, high density, PE 3408 polyethylene pipes commercially available in North America.

Sheets detailing typical physical properties for Driscopipe 1000 and Driscopipe 8600 are available upon request.

Long Term Hydrostatic Strength

One of the outstanding engineering characteristics of Driscopipe high density polyethylene pipe is its long term hydrostatic strength under various thermal and environmental conditions. Life expectancy is conservatively estimated to be in excess of 50 years using the standard design basis. This strength is determined by standardized methods and procedures which the plastic pipe industry has used for many years to evaluate the long term strength of all types of plastic pipe.

Pipe hoop stress versus time to failure plots of long term hydrostatic pressure data for thermoplastic pipe have been studied and analyzed for many years. The mathematical equations used to evaluate the test data and extrapolate values to longer periods of time were chosen after careful evaluation of more than 1,000 sets of long term test data representing more than 400 plastic pipe compounds. Continued testing on new compounds and extended testing of older compounds have proven the validity of these test methods. Actual data from more than 11½ years (100,000 hours) of continuous testing shows the industry methods to be slightly conservative in that actual values are slightly higher than those calculated by the industry-accepted ASTM method.

The reduction in strength which occurs with time, as indicated by the stress-life curves, does not represent a strength degradation of the material but is more in the nature of a relaxation effect. Plastic pipe samples which have been on test for periods up to 70,000 hours have been de-pressurized and checked for permanent reduction of strength by using the quick-burst test. No loss has been found when compared to samples previously quick-burst from the same test lot.

All evidence confirms that the methods used to predict the long term strength of plastic pipe are sound methods. Through the years, these policies and procedures, used to develop recommended hydrostatic design strengths, have influenced manufacturers to research and develop improved piping products such as Driscopipe 8600 and Driscopipe 1000.

Typical calculated long term strengths are shown below:

Long Term Strength @ 73.4°F(23°C)

Time	Hoop Stress, psi
100,000 hrs. (11.43 yrs.)	1635
438,000 hrs. (50 yrs.)	1604
500,000 hrs. (57 yrs.)	1601
1,000,000 hrs. (114 yrs.)	1586

The 114-year long term strength has been included to show more about the nature of the method used by the industry to evaluate the long term strength of plastic pipe and to illustrate the very slow reduction in strength as time progresses.

Long term hoop stresses for design purposes are normally selected at a level which is much lower than the long term strength of the materials. This ensures that the pipe is operating in a hoop stress range where creep (relaxation) of the materials is nil and assures service life in excess of 50 years. Design stress levels are discussed further in the next section.

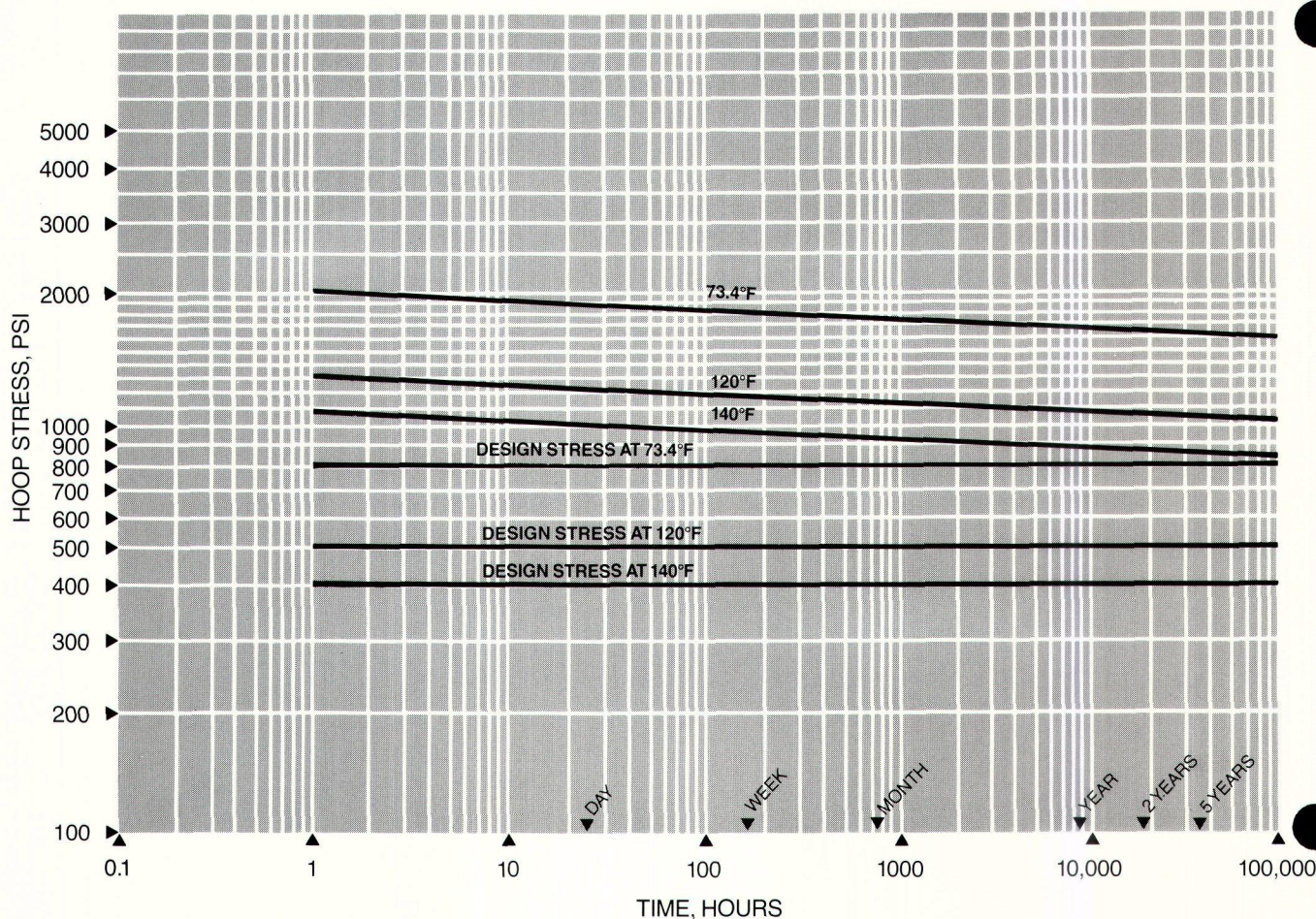
The long term hydrostatic tests are conducted by using ASTM standard test procedures which may be applied to all types of plastic pipe (ASTM D 1598 Test for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure). Stress-life tests are conducted by using numerous pipe samples which are filled with water (or other environmental fluids) and subjected to a controlled pressure at a controlled temperature.

Samples are held on test until they fail. The pressure, temperature and time-to-failure data from all samples are used to calculate and plot stress-life curves for the particular type pipe being tested (ASTM D 2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials). This data is then used to predict the probable safe life of the pipe at various stress levels (working pressures) and various temperatures. Because it is not practical to test at all temperature levels, these tests are generally conducted at temperatures of 73.4°F and one or more higher temperatures such as 100°F, 120°F and 140°F.

These stress-life curves give a relationship of the expected life span of the pipe when subjected to various internal stress levels (working pressures) at various temperatures. By comparing stress-life curves, one can compare relative long term performance ability of different plastic pipes. Stress-life curves for Driscopipe 8600 and Driscopipe 1000 are shown in Figure 1.

Figure 1

Stress-Life of Driscopipe® 8600 and Driscopipe® 1000



These stress-life curves were obtained using water as the test medium. However, years of laboratory testing and field experience have shown that these same curves may be used to design Driscopipe systems for natural gas, salt water, sewage and hundreds of other industrial and municipal fluids, mixtures and effluents. The long term strength of Driscopipe indicated by these curves must be de-rated in some environmental circumstances, such as in the presence of liquid hydrocarbons or abrasive fluids, although the pipe is very suitable for use in these environments. An outstanding engineering advantage of Driscopipe is its exceptionally long term service life in the presence of internal and external corrosive service conditions.

Design Pressure Ratings

Since plastic pipe was introduced in the late 50s, the safety factor for design of water systems at standard temperature has been 2 to 1. The 2:1 design factor which was officially adopted by the plastic pipe industry in 1963, was based on allowances for many sources of variation. The guiding principle has always been to make the selection on a conservative basis but not to be unreasonably conservative.

The sources of variation for which allowances are made include ... variation in test methods and procedures among laboratories ... variation among lots of the same compound ... variation of lots of pipe from the compound in different plants and from different extruders ... variation in compounds of the same general class ... variations in handling and installation techniques ... variation in operating pressures (water hammer and surge) ... a strength-time allowance to give service life well beyond 50 years ... and, finally, the great unknown. Each of the

factors was judged to reduce the 100,000 hour design strength by 5%-10% or 20% ... for a total of 100% ... or a design factor of 2:1. This is why polyethylene pipe, with a designated 100,000 hour strength of 1600 psi at 73.4°F, has a hydrostatic design strength of 800 psi hoop stress.

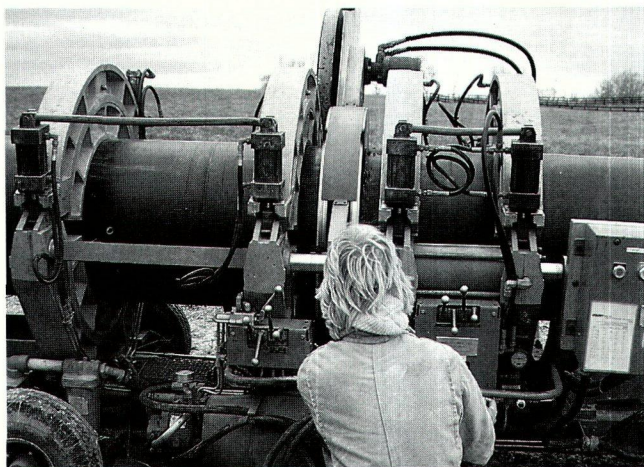
The design pressures for Driscopipe are determined by the following equation, adopted internationally by the industry for this purpose:

$$P = \frac{2S}{SDR-1} \times F \quad \text{or} \quad P = 2S \frac{t}{D-t} \times F$$

Where: D = Specified Outside Diameter, Inches
P = Design Pressure, psi
S = Long Term Hydrostatic Strength, psi, at the design temperature
t = Minimum Wall Thickness, Inches
F = Service Design Factor
SDR = Standard Dimension Ratio of D/t

The traditional Service Design Factor for water at standard temperature (73.4°F) is one-half (.5). The Service Design Factor for oil or liquid hydrocarbons is 0.25 @ 73°F. The service design factor may be adjusted by the design engineer to reflect the particular conditions anticipated for the application. The temperature selected for design should consider both internal and external conditions. The design temperature should be based on the temperature of the pipe itself. For practical purposes, it is safer to design to the highest temperature.

The design service factor for water may also be used for solutions of inorganic salts, alkaline fluids, non-oxidizing acids, low concentrations of oxidizing acids and many other solutions. See the discussion on chemical resistance for more information.



All standard design pressure ratings shown in Driscopipe literature are based on water at 73.4°F temperature; ie, a safety factor of 2:1 based on the long term hydrostatic strength of the material. Driscopipe is applicable at pressures from 0 to 265 psi and temperatures from below 32°F up to 180°F. Standard Dimension Ratios (SDR) are available from SDR 32.5 to SDR 7.0

Flow Characteristics

Driscopipe polyethylene has excellent flow characteristics as compared to traditional materials. An extremely smooth interior surface offers low resistance to flow. It maintains these excellent flow properties throughout its service life in most applications due to the inherent chemical and abrasion resistance of the material. Because of smooth walls and the non-wetting characteristic of polyethylene, higher flow capacity and less friction loss is possible with Driscopipe. In many cases this higher flow capacity may permit the use of smaller pipe at a lower cost.

A "C" factor of 155 is commonly used in the Hazen-Williams formula for calculating flow in pressure applications. For gravity flow, an "n" factor of .009 is used in Manning's formula.

Experimental test data regarding pumping and pressure drop through Driscopipe is available upon request. This study compares the flow through 8" Driscopipe with and without internal fusion beads using clear water. It also includes flow data for some clay-water slurries and clay-water-sand slurries. Velocities up to 20 fps are studied. Data includes determination of Hazen-Williams "C" factor, Reynolds number, boundary drag, relative roughness, sand grain roughness and friction loss at various velocities.

Lightweight – Flexible

The inherent light weight and flexibility of Driscopipe provides many cost saving benefits related to handling, storage, hauling, unloading, stringing, joining and installation. Because of its light weight, Driscopipe can be moved, handled and placed in the ditch with smaller and less expensive construction equipment. Usually, manpower requirements are also reduced.

Driscopipe weighs less than water; it has a specific gravity of .955-.957. Because it will float, it can be joined in long strings and easily towed into position on job sites where water is encountered. The combination of light weight and flexibility provides opportunity to fusion join the pipe in a convenient work area and pull it into position in difficult work areas where terrain or other obstacles present installation problems. The pipe can be joined above ground and rolled or lowered into the trench thus allowing the use of smaller trench widths and eliminating the necessity of placing men and equipment inside the trench. Such installation methods can dramatically reduce the time required for installation in many instances.

The flexibility of Driscopipe allows it to be curved over, under and around obstacles and to make elevation and directional changes, thus eliminating fittings and reducing installation costs. The pipe can be cold bent as it is installed to a radius of 20-40 times the pipe diameter. This flexibility and the butt fusion joining method make Driscopipe ideally suited for inserting it inside older piping systems to renew and renovate such systems at a much lower cost than would be possible otherwise.

Pipe flexibility and toughness also allow small diameter Driscopipe to be plowed-in or pulled-in with suitable equipment.



Toughness – “Ductile PE Pipe”

The overall “toughness” of Driscopipe is an important characteristic of the pipe which is derived from many of the chemical and physical properties of the material as well as the extrusion method. The pipe is ductile. It flexes, bends and absorbs impact loads over a wide temperature range of -180°F up to $+180^{\circ}\text{F}$. This inherent resiliency and flexibility allow the pipe to absorb surge pressures, vibration and stresses caused by soil movement. Driscopipe can be deformed without permanent damage and with no adverse effect on long term service life. It is flexible for contouring to installation conditions. The toughness of Driscopipe is one of its outstanding engineering characteristics leading to innovative piping design.

Even though “toughness” has become generally recognized by the industry as a highly desirable characteristic ... there is no standard test which can be used to directly compare the “toughness” among polyethylenes ... as well as among the different plastic materials which are considered suitable for piping.

A “toughness” test has not been devised is simply because it is influenced by so many of the physical and chemical properties of the material. The extreme toughness of Driscopipe has been noted as one of its outstanding features since its introduction to the industry ... yet to explain “toughness”, many properties are discussed and demonstrated. To obtain a complete evaluation of the toughness of a plastic material, it is necessary to see demonstrations

of tests and to conduct some tests in person in order to compare it with materials which are more familiar, such as cast iron, steel, cement, copper, etc.

Toughness is related to ... Environmental Stress Crack Resistance (ESCR) ... Notch sensitivity ... Resistance to secondary stresses from external loading ... Impact strength ... Tear strength ... Flexibility ... Kink resistance ... Abrasion and scratch resistance ... Flexural strength ... Elongation ... Chemical resistance ... Tensile strength ... Ductility ... Creep resistance ... Temperature resistance ... Density ... Molecular weight ... and the thermoplastic nature of the material. Part of the toughness of any polyethylene material can be attributed to its flexibility, flexural strength and impact resistance as compared to the more rigid thermoplastic materials such as PVC. Polyethylene is ductile and will elongate many times more than PVC. Consequently, it will absorb more impact without damage or failure. PE will flex or elongate and stress relieve itself rather than rupture. Generally, impact strength is greater for the higher molecular weight PE resins. Impact resistance is also important from the standpoint of a piping system being able to absorb energy imposed on it by external forces.

The expansive force of water freezing inside Driscopipe will not damage it.

ESCR is one of the properties closely related to “toughness” and has been studied as a possible means to define and measure toughness. The exceptional resistance of Driscopipe 8600 to environmental stress cracking as compared to other PE materials is discussed further in the next section.



Driscopipe 8600 is unique and differs from Driscopipe 1000 and from all other polyethylene pipes. Driscopipe 8600 exhibits a superior toughness which gives the pipe the highest impact strength, highest tear strength and lowest notch sensitivity of any polyethylene pipe currently available. Driscopipe 8600 offers the highest resistance to cuts, scratches and abrasions which occur when handling and installing the pipe.

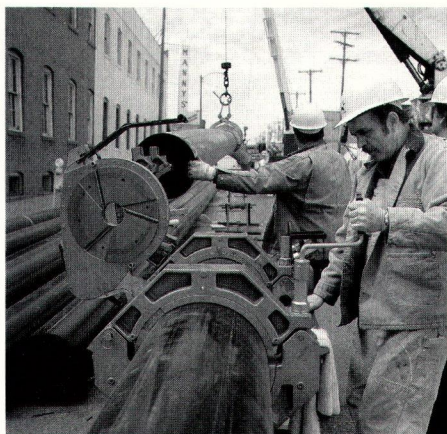
These properties are maintained throughout its temperature range without a loss of ductility or reduced resistance to notch sensitivity. Driscopipe has been successfully installed in numerous arctic applications. Some of these applications have included direct burial in the unstable arctic permafrost.

To learn more of the relative toughness of Driscopipe 8600, we encourage you to take a piece of pipe with a butt fusion joint and try to tear it up without using sharp tools. Pound it flat with a sledge hammer ... slam it against a corner of angle iron ... run over it with a truck ... then do the same with steel, copper, PVC, cast iron and the less rugged PEs. It's not very scientific ... but we believe you'll be convinced that Driscopipe 8600 has extremely high toughness. We have evaluated Driscopipe many times in laboratory and field test experiments to demonstrate and prove this toughness.

- One excellent indicator of the relative toughness of Driscopipe 8600, as compared to other polyethylene pipe materials, can be observed in the ASTM Standard Test for determination of flow rate of the thermoplastic materials.

When Driscopipe 8600 is heated to 190°C (374°F) to measure the flow rate, it requires 432.5 pounds/sq. in. force, applied for 10 minutes, to flow 1½ grams of 8600 material through the orifice of the test unit! Other commercially available polyethylene pipe materials will flow 10 to 20 times this amount under the same conditions.

- When Driscopipe 8600 is heated to 475-500°F to melt it for fusion joining, it requires 150 pounds pressure per square inch of material to make the melted surfaces flow together. This is another indicator of toughness. Other commercially available polyethylene pipe materials require about one-half that amount of pressure and some competitive pipes require less than 25 psi!
- Driscopipe 8600 has been pressure tested for long periods at temperatures up to 140°F and performance requirements at these high temperatures can be used in purchase specifications to assure that the user is getting the highest performing polyethylene pipe.



Environmental Stress Crack Resistance

The most recent ASTM specification written to identify polyethylene plastic pipe and fittings materials is ASTM D 3350, "Polyethylene Plastics Pipe and Fittings Materials", adopted in 1974. This specification uses six (6) properties to classify PE material ... one of these is ESCR.

ASTM D 3350 lists three cell limits for ESCR classification which use the ESCR test outlined in ASTM D 1693, Test Method for Environmental Stress Cracking of Ethylene Plastics. The cell limits are:

Cell Classification Limit	Test Condition ASTM D 1693	Test Duration Hours	Percent of Failures Allowed	Test Temp. °C
1	A	48	50	50°
2	B	24	50	50°
3	C	192	20	100°

Minimum Notch for A is .020"; for B and C is .012".
Minimum Thickness for A is .120"; for B and C is .070".
A and B use a diluted aqueous solution reagent, C uses full strength reagent.

This method of testing for ESCR was first written in 1959 and was developed primarily to evaluate polyethylene as a jacketing material for power and communications cable. Although the method requires the use of laboratory compression molded specimens rather than pipe, it became the generally accepted method for evaluating ESCR of PE materials used for piping. Its wide use was responsible for its inclusion in ASTM D 3550 to describe one of the six primary properties of a PE pipe material.

The test method, ASTM D-1693, is an accelerated test method to determine the resistance of a polyethylene material to environmental stress cracking. It is a measure of the ability of the polyethylene to withstand secondary stress loadings. These loadings are typically thought of as low-level, long-term, external stresses which may act upon the polyethylene pipe in field installations.

Under conditions of the test, high local multiaxial stresses are developed through the introduction of a controlled imperfection (notch). The notched sample is subjected to an elevated temperature bath of a surface active agent. Environmental stress cracking has been found to occur most readily under such conditions.

A note in the test specifications states that, generally, low density (Type I) polyethylenes are tested under Condition A, medium and high density (Type II and Type III) polyethylenes are generally tested under Condition B and high density resins with high melt viscosity, such as pipe grade P34, are tested under Condition C.

As pipe grade polyethylenes have improved, the testing requirements of ASTM D-1693 have become less stringent for P34 pipe grade polyethylenes such as Driscopipe 8600 and Driscopipe 1000. As a result, a more severe stress crack resistance test has been developed to evaluate high density polyethylene pipe. The ASTM F-1248 stress crack resistance test method was developed by a gas distribution company for quality control purposes and is often referred to as Ring ESCR since it tests actual produced pipe ring samples rather than molded specimens.



ASTM F-1248 utilizes rings cut from a pipe sample. The rings are notched on one side and compressed between parallel plates until the distance between the plates is three times the specified pipe minimum wall thickness. The compressed ring samples are subjected to an elevated temperature bath of a surface active agent and visibly inspected for crack formation or propagation.

The Ring ESCR test provides useful information regarding the different polyethylene pipe grade materials. Driscopipe 8600 shows no tendency for sample failures when tested in excess of 10,000 hours. This further reinforces the unique ability of Driscopipe 8600 to provide the highest degree of resistance to the external stresses inherent to a pipeline installation.

Driscopipe 1000, an extra high molecular weight HDPE pipe, will exhibit a ring ESCR of $F_{50} > 1000$ hours. Other lower molecular weight pipes may exhibit lower F_{50} values.

Chemical Corrosion Resistance

The outstanding resistance of Driscopipe to attack by most chemicals makes it suitable to transport these chemicals or to be installed in an environment where these chemicals are present. Factors which determine the suitability and service life of each particular application include the specific chemical and its concentration, pressure, temperature, period of contact and service conditions which may introduce stress concentrations in the pipe or fittings.

Driscopipe is, for all practical purposes, chemically inert within its temperature use range. This advantageous engineering characteristic is one of the primary reasons for the wide use of Driscopipe in industrial applications. It does not rot, rust, pit, corrode or lose wall thickness through chemical or electrical reaction with the surrounding soil, whether acid, alkaline, wet or dry. It neither supports the growth of, nor is affected by, algae, bacteria or fungi and is resistant to marine biological attack. It contains no ingredients which make it attractive to rodents, gophers, etc.

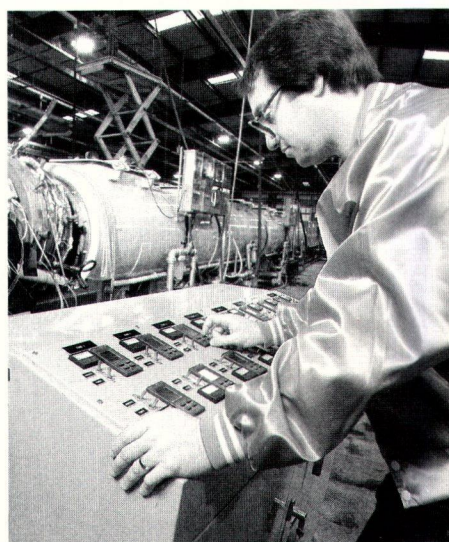
Information relative to the resistance of Driscopipe to a wide range of chemicals is shown in the following tables. This information is based on results of immersion tests (usually 3 months) at various temperatures. Changes in tensile strength and elongation are evaluated at a rapid strain rate to emphasize any strength decay in the material.

Most acids, bases and other chemicals can be transported by Driscopipe using the same design parameters as would apply to water, natural or manufactured gas and water solutions of inorganic salts. Strong oxidizing agents such as fuming sulfuric acid may adversely affect the pipe, depending upon concentration, temperature and period of contact. In many cases, such as gravity flow waste lines, these chemicals can be handled because of dilution and intermittent flow.

Some chemicals, such as all types of liquid hydrocarbons, will mechanically absorb into the wall of the pipe and cause a reduction in hoop stress but this does not degrade the material. This effect is temporary if exposure is intermittent. Where exposure is continuous, it is necessary to derate the pressure capability of the pipe for long term service. This includes such products as gasoline, ethyl alcohol, benzene, carbon tetrachloride, crude and refined oils, etc. Where 5-100% hydrocarbon liquids are continuously present in a pressure system, a service design factor of .25 should be used to calculate design pressures instead of the service design factor of .5 used with water.

$$P = \frac{2S}{SDR - 1} \times F \quad \text{or} \quad P = 2S \frac{t}{D - t} \times F$$

Where: D = Outside Diameter, Inches
P = Design Pressure, psi
S = Long Term Hydrostatic Strength, psi, at the design temperature
t = Minimum Wall Thickness, Inches
F = Service Design Factor
SDR = Standard Dimension Ratio of D/t



CHEMICAL RESISTANCE OF DRISCOPIPE

S – Satisfactory
U – Unsatisfactory
M – Marginal
N – Not known

All concentrations are 100% unless noted otherwise.

On reagents marked marginal, chemical attack will be recognized by a loss of physical properties of the pipe which may require a change in design factors.

Reagent	70°F (21°C)	140°F (60°C)
Acetic Acid 1-10%	S	S
Acetic Acid 10-60%	S	M
Acetic Acid 80-100%	S	M
Acetone	M	U
Acrylic Emulsions	S	S
Aluminum Chloride-Dilute	S	S
Aluminum Chloride Conc.	S	S
Aluminum Fluoride Conc.	S	S
Aluminum Sulfate Conc.	S	S
Alums (All Types) Conc.	S	S
Ammonia 100% Dry Gas	S	S
Ammonium Carbonate	S	S
Ammonium Chloride Sat'd	S	S
Ammonium Fluoride 20%	S	S
Ammonium Hydroxide 0.88 S.G.	S	S
Ammonium Metaphosphate Sat'd	S	S
Ammonium Nitrate Sat'd	S	S
Ammonium Persulfate Sat'd	S	S
Ammonium Sulfate Sat'd	S	S
Ammonium Sulfide Sat'd	S	S
Ammonium Thiocyanate Sat'd	S	S
Amyl Acetate	M	U
Amyl Alcohol 100%	S	S
Amyl Chloride 100%	N	U
Aniline 100%	S	N
Antimony Chloride	S	S
Aqua Regia	U	U
Barium Carbonate Sat'd	S	S
Barium Chloride	S	S
Barium Hydroxide	S	S
Barium Sulfate Sat'd	S	S
Barium Sulfide Sat'd	S	S
Beer	S	S
Benzene	M	U
Benzene Sulfonic Acid	S	S
Bismuth Carbonate Sat'd	S	S
Bleach Lye 10%	S	S
Black Liquor	S	S
Borax Cold Sat'd	S	S
Boric Acid Dilute	S	S

Reagent	70°F (21°C)	140°F (60°C)	Reagent	70°F (21°C)	140°F (60°C)
Boric Acid Conc.	S	S	Diazo Salts	S	S
Bromic Acid 10%	S	S	Diethylene Glycol	S	S
Bromine Liquid 100%	M	U	Diglycolic Acid	S	S
Butanediol 10%	S	S	Dimethylamine	M	U
Butanediol 60%	S	S	Emulsions, Photographic	S	S
Butanediol 100%	S	S	Ethyl Acetate 100%	M	U
Butyl Alcohol 100%	S	S	Ethyl Alcohol 100%	S	S
Calcium Bisulfide	S	S	Ethyl Alcohol 35%	S	S
Calcium Carbonate Sat'd	S	S	Ethyl Butyrate	M	U
Calcium Chlorate Sat'd	S	S	Ethyl Chloride	M	U
Calcium Chloride Sat'd	S	S	Ethyl Ether	U	U
Calcium Hydroxide	S	S	Ethylene Chloride	U	U
Calcium Hypochlorite BL'GH Sol.	S	S	Ethylene Chlorohydrin	U	U
Calcium Nitrate 50%	S	S	Ethylene Dichloride	M	U
Calcium Sulfate	S	S	Ethylene Glycol	S	S
Camphor Oil	N	U	Ferric Chloride Sat'd	S	S
Carbon Dioxide 100% Dry	S	S	Ferric Nitrate Sat'd	S	S
Carbon Dioxide 100% Wet	S	S	Ferrous Chloride Sat'd	S	S
Carbon Dioxide Cold Sat'd	S	S	Ferrous Sulfate	S	S
Carbon Disulfide	N	U	Fish Solubles	S	S
Carbon Monoxide	S	S	Fluoboric Acid	S	S
Carbon Tetrachloride	M	U	Fluorine	S	U
Carbonic Acid	S	S	Fluosilicic Acid 32%	S	S
Castor Oil Conc.	S	S	Fluosilicic Acid Conc.	S	S
Chlorine Dry Gas 100%	S	M	Formaldehyde 40%	S	N
Chlorine Moist Gas	M	U	Formic Acid 0-20%	S	S
Chlorine Liquid	M	U	Formic Acid 20-50%	S	S
Chlorobenzene	M	U	Formic Acid 100%	S	S
Chloroform	M	U	Fructose Sat'd	S	S
Chlorosulfonic Acid 100%	M	U	Fruit Pulp	S	S
Chrome Alum Sat'd	S	S	Fuel Oil	S	U
Chromic Acid 20%	S	S	Furfural 100%	M	U
Chromic Acid Up to 50%	S	S	Furfuryl Alcohol	M	U
Chromic Acid and Sulfuric Acid	S	M	Gallic Acid Sat'd	S	S
Cider	S	S	Gas Liquids*	S	M
Citric Acid Sat'd	S	S	Gasoline*	M	U
Coconut Oil Alcohols	S	S	Gin	S	U
Cola Concentrates	S	S	Glucose	S	S
Copper Chloride Sat'd	S	S	Glycerine	S	S
Copper Cyanide Sat'd	S	S	Glycol	S	S
Copper Fluoride 2%	S	S	Glycolic Acid 30%	S	S
Copper Nitrate Sat'd	S	S	Grape Sugar Sat'd Aq.	S	S
Copper Sulfate Dilute	S	S	Hexanol, Tert.	S	S
Copper Sulfate Sat'd	S	S	Hydrobromic Acid 50%	S	S
Cottonseed Oil	S	S	Hydrocyanic Acid Sat'd	S	S
Crude Oil*	S	M	Hydrochloric Acid 10%	S	S
Cuprous Chloride Sat'd	S	S	Hydrochloric Acid 30%	S	S
Cychohexanol	S	S	Hydrochloric Acid 35%	S	S
Cyclohexanone	M	U	Hydrochloric Acid Conc.	S	S
Detergents Synthetic	S	S	Hydrofluoric Acid 40%	S	S
Developers, Photographic	S	S	Hydrofluoric Acid 60%	S	S
Dextrin Sat'd	S	S	Hydrofluoric Acid 75%	S	S
Dextrose Sat'd	S	S	Hydrogen 100%	S	S
Dibutylphthalate	S	M	Hydrogen Bromide 10%	S	S
Disodium Phosphate	S	S	Hydrogen Chloride Gas Dry	S	S

*HDPE Resin Service Design Factor for hydrocarbons per the formula on page 3 and 8 is $F = 0.25$ to compensate for hydrocarbon saturation effects on long term hydrostatic strength.

continued from page 9

CHEMICAL RESISTANCE OF DRISCOPIPE

Reagent	70°F (21°C)	140°F (60°C)	Reagent	70°F (21°C)	140°F (60°C)	Reagent	70°F (21°C)	140°F (60°C)
Hydrogen Peroxide 30%	S	S	Phosphorous (Yellow) 100%	S	N	Sodium Bicarbonate Sat'd	S	S
Hydrogen Peroxide 90%	S	M	Phosphorus Pentoxide 100%	S	N	Sodium Bisulfate Sat'd	S	S
Hydrogen Phosphide 100%	S	S	Photographic Solutions	S	S	Sodium Bisulfite Sat'd	S	S
Hydroquinone	S	S	Pickling Baths			Sodium Borate	S	S
Hydrogen Sulfide	S	S	Sulfuric Acid	S	S	Sodium Bromide Dilute Sol.	S	S
Hypochlorous Acid Conc.	S	S	Hydrochloric Acid	S	S	Sodium Carbonate Con.	S	S
Inks	S	S	Sulfuric-Nitric	S	U	Sodium Carbonate	S	S
Iodine (Alc. Sol.) Conc.	S	U	Plating Solutions			Sodium Chlorate Sat'd	S	S
Lactic Acid 10%	S	S	Brass	S	S	Sodium Chloride Sat'd	S	S
Lactic Acid 90%	S	S	Cadmium	S	S	Sodium Cyanide	S	S
Latex	S	S	Chromium	N	N	Sodium Dichromate Sat'd	S	S
Lead Acetate Sat'd	S	S	Copper	S	S	Sodium Ferricyanide	S	S
Lube Oil*	S	M	Gold	S	S	Sodium Ferrocyanide Sat'd	S	S
Magnesium Carbonate Sat'd	S	S	Indium	S	S	Sodium Fluoride Sat'd	S	S
Magnesium Chloride Sat'd	S	S	Lead	S	S	Sodium Hydroxide Conc.	S	S
Magnesium Hydroxide Sat'd	S	S	Nickel	S	S	Sodium Hypochlorite	S	S
Magnesium Nitrate Sat'd	S	S	Rhodium	S	S	Sodium Nitrate	S	S
Magnesium Sulfate Sat'd	S	S	Silver	S	S	Sodium Sulfate	S	S
Mercuric Chloride Sat'd	S	S	Tin	S	S	Sodium Sulfide 25%	S	S
Mercuric Cyanide Sat'd	S	S	Zinc	S	S	Sodium Sulfide Sat'd Sol.	S	S
Mercurous Nitrate Sat'd	S	S	Potassium Bicarbonate Sat'd	S	S	Sodium Sulfite Sat'd	S	S
Mercury	S	S	Potassium Borate 1%	S	S	Stannous Chloride Sat'd	S	S
Methyl Alcohol 100%	S	S	Potassium Bromate 10%	S	S	Stannic Chloride Sat'd	S	S
Methyl Bromide	M	U	Potassium Bromide Sat'd	S	S	Starch Solution Sat'd	S	S
Methyl Chloride	M	U	Potassium Carbonate	S	S	Stearic Acid 100%	S	S
Methyl Ethyl Ketone 100%	M	U	Potassium Chlorate Sat'd	S	S	Sulfuric Acid 0-50%	S	S
Methylsulfuric Acid	S	S	Potassium Chloride Sat'd	S	S	Sulfuric Acid 70%	S	M
Methylene Chloride 100%	M	U	Potassium Chromate 40%	S	S	Sulfuric Acid 80%	S	U
Milk	S	S	Potassium Cyanide Sat'd	S	S	Sulfuric Acid 96%	M	U
Mineral Oils	S	U	Potassium Dichromate 40%	S	S	Sulfuric Acid 98%	M	U
Molasses Comm.	S	S	Potassium Ferri/ Ferro Cyanide Sat'd	S	S	Sulfuric Acid, Fuming	U	U
Nickel Chloride Sat'd	S	S	Potassium Fluoride	S	S	Sulfurous Acid	S	S
Nickel Nitrate Conc.	S	S	Potassium Hydroxide 20%	S	S	Tallow*	S	M
Nickel Sulfate Sat'd	S	S	Potassium Hydroxide Conc.	S	S	Tannic Acid 10%	S	S
Nicotine Dilute	S	S	Potassium Nitrate Sat'd	S	S	Tanning Extracts Comm.	S	S
Nicotinic Acid	S	S	Potassium Perborate Sat'd	S	S	Tartaric Acid Sat'd	N	N
Nitric Acid 0-30%	S	S	Potassium Perchlorate 10%	S	S	Tetrahydrofurane	N	U
Nitric Acid 30-50%	S	M	Potassium Sulfate Conc.	S	S	Titanium Tetrachloride Sat'd	N	U
Nitric Acid 70%	S	M	Potassium Sulfide Conc.	S	S	Toluene	M	U
Nitric Acid 95-98%	U	U	Potassium Sulfite Conc.	S	S	Transformer Oil	S	M
Nitrobenzene 100%	U	U	Potassium Persulfate Sat'd	S	S	Trisodium Phosphate Sat'd	S	S
Octyl Cresol	S	U	Propargyl Alcohol	S	S	Trichloroethylene	U	U
Oils and Fats*	S	M	Propyl Alcohol	S	S	Urea Up to 30%	S	S
Oleic Acid Conc.	S	U	Propylene Dichloride 100%	U	U	Urine	S	S
Oleum Conc.	U	U	Propylene Glycol	S	S	Vinegar Comm.	S	S
Orange Extract	S	S	Rayon Coagulating Bath	S	S	Vanilla Extract	S	S
Oxalic Acid Dilute	S	S	Sea Water	S	S	Wetting Agents	S	S
Oxalic Acid Sat'd	S	S	Selenic Acid	S	S	Whiskey	S	N
Ozone 100%	S	U	Shortening	S	S	Wines	S	S
Perchloric Acid 10%	S	S	Silicic Acid	S	S	Xylene	M	U
Petroleum Ether	U	U	Silver Nitrate Sol.	S	S	Yeast	S	S
Phenol 90%	U	U	Soap Solution Any Conc'n	S	S	Zinc Chloride Sat'd	S	S
Phosphoric Acid Up to 30%	S	S	Sodium Acetate Sat'd	S	S	Zinc Sulfate Sat'd	S	S
Phosphoric Acid Over 30%	S	S	Sodium Benzoate 35%	S	S			
Phosphoric Acid 90%	S	S						

For additional chemical resistance listings, consult the P.P.I. technical report #TR 19/10-84, Table I and the ISO technical report #ISO/Data 8-1979, Tables I, II, III.

Temperature Characteristics

Since polyethylene is a thermoplastic material, many of its physical and chemical properties are dependent on temperature and will change as the temperature of the material is increased or decreased. However, the exposure of Driscopipe to temperature variations within the recommended operating range does not result in degradation of the material. As these temperature changes are reversed, the material properties also reverse to their original values.

You will note from the information on physical properties that Driscopipe has a brittleness temperature below -180°F and a softening temperature of $+257^{\circ}\text{F}$. The recommended operating temperature is limited only on the higher temperature side to a range of $140\text{--}180^{\circ}\text{F}$, dependent upon the pressure of the application and other operating and installation considerations. On the lower temperature side, Driscopipe gains strength without becoming brittle and is ideal for use at sub-zero temperatures.

Driscopipe becomes molten at $400\text{--}500^{\circ}\text{F}$ and temperatures in this range are used to fusion join the piping system. Pipe is extruded at about the same temperature. To protect the material against degradation at the higher temperature, it is chemically stabilized. This stabilizer protects the material against thermal degradation which might otherwise occur during manufacture, outside storage and installation.

Driscopipe has been tested for thousands of hours at elevated temperatures of 140°F and 180°F without thermal degradation. These long term pressure tests at the higher temperatures are used to obtain recommended design strengths for the pipe at these temperatures.

Since all thermoplastic piping materials are affected by temperature, it is a general practice to characterize these materials at ambient temperature of 23°C (73.4°F). Nearly all ASTM tests relating to physical, mechanical and chemical properties of thermoplastic materials are conducted at this temperature. If a test is conducted, or a property defined, at other than 73.4°F , it is always noted.

One example of the effect of temperature on Driscopipe is the change in long term strength of the material as shown on the stress-life curves. This type behavior is true for all thermoplastics but there are large differences between the performance of specific materials at the higher temperatures.

Knowledge of the long term strength of Driscopipe at the various temperatures allows selective design of a system. Accurate interpolations can be made for other temperatures between those which are known when data at three or more temperature levels is available.

Other properties of thermoplastic pipe which change with temperature and can affect system design and installation procedures include the following.

Burst strength – Short term (1 minute) burst tests on Driscopipe at various temperatures show these typical hoop stress values:

Temperature, $^{\circ}\text{F}$	Hoop Stress, psi
73.4°	3250
32°	4300
0°	5290
-20°	5670
-40°	6385

Driscopipe will quick-burst at a pressure approximately four times greater than the rated operating pressure.



Chemical Resistance – The ability of most thermoplastics to resist degradation in the presence of corrosive chemicals is reduced as temperature increases. This is also true for Driscopipe but to a lesser extent because of its high density and high molecular weight. The effect of temperature on Driscopipe in the presence of various chemicals is shown in the chemical resistance tables.

Flexibility – As temperature is decreased, the flexibility of Driscopipe is also decreased. This has very little effect on installation except that at the lower winter temperatures, coiled pipe becomes more difficult, mechanically, to uncoil and stretch out in the ditch. Although Driscopipe becomes stiffer at low temperature, it can be bent, uncoiled or plowed in with sufficient mechanical power and no damage will occur to the pipe because of bending it at cold temperatures.

Other Physical Properties – There is a slight change with temperature of impact strength, notch sensitivity, flexural modulus, hardness and elongation ... but none are of such extent as to affect design parameters or installation procedures over the normal range of temperatures.

Modulus of Elasticity – Typical values for the variance in modulus of elasticity with temperature change is shown below.

Temperature °F	Modulus of Elasticity, psi
– 20°	300,000
0°	260,000
32°	200,000
75°	130,000
100°	105,000
140°	60,000

Thermal Expansion and Contraction – Polyethylene, like other thermoplastics, has a coefficient of expansion higher than metals. This coefficient is usually determined by a standard test method which employs the use of molded specimens.

Measurements are made with a quartz dilatometer while the test specimen is held at elevated temperature. Typical coefficient values by this method range from $.75 \times 10^{-4}$ for Driscopipe 8600 to $.83 \times 10^{-4}$ for Driscopipe 1000.

The coefficient of linear expansion may also be determined by measuring the change in length of unrestrained pipe samples at different temperatures. The calculated coefficient is somewhat higher on extruded pipe than on molded test specimens. This appears to be true for all polyethylene pipe. The average coefficient calculated from measurements made on Driscopipe in the temperature range 0°F to 140°F, is 1.2×10^{-4} in/in/°F.

The circumferential coefficient of expansion and contraction for Driscopipe is approximately $.6 \times 10^{-4}$ in/in/°F in the range of 0° to 140°F ... or about $\frac{1}{2}$ the linear coefficient. This circumferential change with temperature rarely presents any problems in system design. There may be need to consider this factor if compression fittings are used.

The expansion or contraction for Driscopipe can be stated in an easy rule of thumb ... the pipe will expand or contract approximately 1.4" per 100 feet for each 10°F change in temperature. Thus a 1000 foot unrestrained line which undergoes a 20°F increase in temperature change will increase in length 28 inches. The relatively large amount of expansion and contraction of plastic pipe generally presents no real problems in installation. The pipe has a relatively low elastic modulus and consequently there is less stress build-up. These stresses, caused by temperature change, are easily dissipated due to the thermoplastic nature of the material which relaxes and adjusts with time.



Tests have been conducted wherein the temperature of more than 100 feet of unrestrained pipe was changed 130°F in a period of a few minutes. The total force created by contraction was measured and proved to be about (½) one-half the theoretical calculated value. Thermoplastic materials are unique in their ability to stress-relieve themselves. Actual changes in temperature in most applications take place slowly over an extended period of time. The total stresses imposed will vary but are generally much lower than the calculated values.

Direct buried pipe will generally have ample soil friction and interference to restrain movement of the pipe under normal application temperature changes. It is a good idea to make the final tie-ins on a system at a temperature which is as close to operating temperature as possible. This is particularly true for insert liner systems where there is no soil restraint.

Normal good direct burial installation practices which include snaking the pipe in the ditch, proper backfill and compaction, making the tie-in at the proper temperature, etc. should be used at all times and will substantially reduce the possibility of pull out at tie-in connections on such installations. However, planning the transition tie-in becomes more important when Driscopipe is used for insert renewal inside another pipe because there is no restraint from earth loading. Any contraction of the pipe due to reduction in temperature is freely transmitted to the transition connection and may result in pull-out if proper design

precautions are not taken. In those cases, it may be necessary to provide additional anchoring at the terminations of the insert liner. Concrete anchors poured into undisturbed soil and cast around anchor projections in the Driscopipe line will restrict movement at the end of the line. Anchor projections on the Driscopipe liner can be made by fusing a blind tee into the line or by the use of two reducers, to the next larger size of pipe, fused together in the line.

Thermal Conductivity – This property of Driscopipe is lower than that for metals and can sometimes be exploited in the design of the system. It may eliminate or reduce the need for insulating pipe which carries water or other fluids through freezing temperatures. Thermal Conductivity of Driscopipe is 2.7 BTU per hour per sq. ft. per °F per inch of thickness. The slow heat transfer inhibits freezing and, if normal burial precautions are used, accidental freezing is usually eliminated. If the pipe does freeze, it does not fracture but fluid flow will be stopped. It will resume its function upon thawing. Direct application of intense heat should not be used to thaw a line. Antifreeze compounds such as methanol, isopropanol and ethylene glycol can be used without detrimental effect on the pipe.

Ignition Temperatures – The flash point for high density polyethylene using the Cleveland open cup method (ASTM D92) is 430°F. The flash ignition and self ignition temperatures using ASTM D1929 are 645°F and 660°F.



Weatherability

Two principal factors influence the weathering of plastic pipe in outside above ground applications ... temperature changes caused by seasonal variations and solar heating and solar radiation of ultraviolet rays. Effects of temperature variations on Driscopipe were discussed in the preceding section. Expansion and contraction of a line above ground, due to differential heating, will cause the line to move laterally, particularly if it is empty. This movement can easily be controlled within desired limits through the use of restraints.

Driscopipe is also protected against degradation caused by ultraviolet rays when exposed to direct sunlight. The material contains 2½% of finely divided carbon black which also accounts for the black color of Driscopipe. Carbon black is the most effective single additive capable of enhancing the weathering characteristic of plastic materials. The protection even relatively low levels of carbon black impart to the plastic is so great that it is not necessary to use other light stabilizers or UV absorbers.

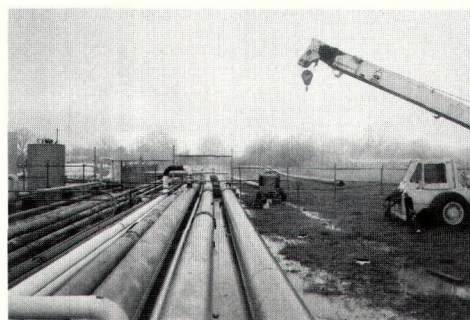
Weatherability tests indicate that Driscopipe can be safely used outside in most climates for periods of many years without danger of loss of physical properties due to UV exposure. Phillips has done extensive testing of polyethylene compounds containing 2 to 3% carbon black and compared these to other UV stabilizers to determine their effectiveness for protection against UV degradation in outdoor exposure. Samples were aged in outdoor exposure in three geographical locations: Phoenix,

Arizona, Bartlesville, Oklahoma (Phillips 66 headquarters) and Akron, Ohio. From these actual tests, it was determined that one year exposure in Arizona was equivalent to at least two years in Bartlesville and greater than three and one-half years in Akron.

Weather-Ometer tests were run under standard conditions as set out in ASTM D 1499-64 and compared with the actual test samples in the three locations described above. From this test work, it was determined, conservatively, that 5000 hours (approximately 7 months) in the Weather-Ometer compares to greater than 42 months exposure in Arizona. Samples containing 2 to 3% carbon black and thermal stabilizers as used in Driscopipe have been tested for greater than 25,000 hours (2.85 years) in the Weather-Ometer without any brittleness or loss of physical properties. This is equivalent to over 17 years in Arizona and over 60 years in Akron, Ohio.

Permeability

The permeability of gases, vapors or liquids through a plastic membrane is generally considered to be an activated diffusion process. That is, the gas, vapor or liquid dissolves in the membrane and then diffuses to a position of lower concentration. The permeation rate is determined by the functional groups of the permeating molecules and by the density of the plastic ... the higher the density, the lower the permeability. Listed below are typical permeability rates for HDPE.



Gas	Permeability Rate*
Carbon Dioxide	345
Hydrogen	321
Oxygen	111
Helium	247
Ethane	236
Natural Gas	113
Freon 12	95
Nitrogen	53

*Cubic centimeters per day per 100 sq. inches per mil thickness at atmospheric pressure differential.

These permeation rates are considered very low. They result in negligible loss of product and create no hazard. For example, polyethylene piping systems are the predominant material used to construct new gas distribution systems and to renew old deteriorated systems. The permeation rate will vary in direct proportion to the differential pressure applied.

If the internal operating pressure is 60 psi, for example, the permeability rate would be approximately 4 times that shown above but volume losses would still be extremely low. Calculated volume loss in one mile of SDR 11 pipe (any size) in one day, for natural gas, would be $\frac{1}{4}$ of one cubic foot. At 120 psi, it would be $\frac{1}{2}$ cubic foot per day.

Abrasion Resistance

One of the many outstanding characteristics of Driscopipe polyethylene is its resistance to abrasion. The inherent resilience and toughness of Driscopipe allows the mining industry to use this pipe in numerous surface applications where more conventional materials would be unsatisfactory, either because of the terrain encountered or the abrasiveness of the slurry to be moved. Quite often, a Driscopipe system offers substantial economic advantage as a means of transport over more conventional transportation methods used in the mining industry. Some of the more common applications include tailings lines and the transport of gypsum, limestone, sand, slimes and coal.

Due to its unique toughness, as indicated by low melt flow values, Driscopipe 8600 provides improved abrasion resistance over all other polyethylene piping materials. Controlled pipe loop pumping tests have demonstrated that Driscopipe can outlast steel pipe by as much as 4 to 1. One such test, performed by Williams Brothers Engineering, Tulsa, Oklahoma, compared Driscopipe to steel in pumping a coarse particle size magnetite iron ore slurry. At $13\frac{1}{2}$ ft/sec velocity, Driscopipe was better by a factor of 4:1 and at 17 ft/sec by a factor of 3:1.



Heat Fusion Joining

The heat fusion joining technique has a long history of use for joining polyethylene pipe materials. The heat fusion method of joining PE pipe began shortly after the first commercial production of high density polyethylene in the early 1950s ... both developed by Phillips 66.

The integrity and superiority of heat fusion are now recognized universally. The modern day heat fusion joint is the same joint made in 1956 ... only the fusion equipment has evolved to gain efficiency, reliability and convenience. The principles learned on early equipment for making a successful joint are still in use today. Phillips designed, developed and built many models of heat fusion equipment from 1956 until the early 1970s. Since that time, Phillips has guided this development by others. The extensive line of high quality, efficient fusion equipment offered by McElroy Manufacturing, Inc., Tulsa, Oklahoma is one of the results of this long history of development. Phillips pioneered the idea and development of heat fusion and has used it exclusively in every high density polyethylene piping system sold by Phillips since 1956. There are millions of these joints in service today. In fact, 92% of all natural gas distribution pipe to homes, farms and factories is installed with polyethylene pipe and fittings. Heat fusion joints are industry accepted and field proven.

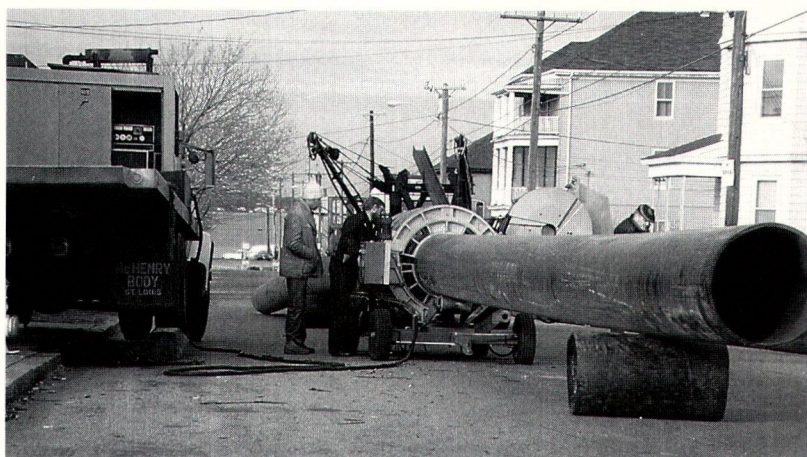
The heat fusion joining system has been so successful that it is the "standard" joining system for polyethylene. There are many reasons ... here are some.

Heat fusion joining ideally meets the requirements for a fast joining method to facilitate all phases of construction work in a safe and reliable manner.

The heat fusion joint is structurally superior to the socket fusion joint by configuration and, therefore, better meets the requirements of service. The heat joint configuration allows it to better disperse stresses initiated by pipe deflection and external loading. Stress concentration is minimized when the joint is placed in a strain and the joint is more "forgiving" when ground settlement occurs. In a socket joint, there is an extremely high ratio of "joint wall" to "pipe wall", resulting in stress intensification from external loading.

The Driscopipe heat fusion joining system is a simple, visual procedure with straight forward instructions. No "timing cycles" are necessary. The visual procedure allows the operator to concentrate on his work rather than a clock. Visually, he knows when the pipe ends have melted to the degree required to fuse them together. Visually, he observes and controls fusion pressure by observing the amount and configuration of the fusion bead as it is formed.

In the course of this work, the fusion operator is faced with a wide variety of job conditions. Changes in air temperature, material temperature, wind velocity, sun exposure, humidity, as well as condition of the terrain and the equipment all influence the joining requirements. Quality work under field conditions is more consistent with a simple, straight-forward, visual procedure.



One heat fusion operator, with equipment, typically does the whole operation himself, sometimes using a second person as a helper. Pipe tolerances, ovality and curvature are no problem and "melt" is easily controlled by the visual procedure.

Heat fusion joints offer a large advantage over socket coupled joints for plow-in installation and for insert renewal applications. Socket coupled pipe requires larger size plow chutes and bore holes. Heat fused pipe one size larger can usually be handled and installed through bore holes and plow chutes selected for socket coupled pipe. Larger sizes of heat fused pipe can be used inside old mains for insert renewal because it does not require the extra space for the coupling.

Heat fusion joints may easily be cut out and re-done. This fact has a bearing on the quantity and quality of training necessary and favorably affects operator attitude toward quality in the field. These joints can be easily cut out and destructively tested in the field to check joining proficiency and equipment condition and it's inexpensive. There is no coupling to destroy and throw away.

The heat fusion joining system is especially effective with Driscopipe 8600. The melt of this material is very viscous and tough. The operator can apply ample pressure to form the heat fusion joint with little danger of forcing the molten material from between the two ends of the joint, as can be done with the softer, less viscous, high density materials.



Driscopipe 8600 can be fusion joined to other polyethylene piping materials when necessary. Special joining techniques are required to achieve good joints. Phillips Driscopipe technical personnel are available to instruct and demonstrate the fusion joining procedure for joining Driscopipe to other polyethylene materials.

Fatigue Resistance

Driscopipe 8600 very high molecular weight, high density polyethylene has superior resistance to fatigue failure caused by cyclic loading. Independent laboratory tests were conducted to determine the suitability of Driscopipe 8600 for use as the cold water supply pipe and the barge mooring leg of the Mini-OTEC Project (Hawaii, 1979). In that application, 2150' of 24" 60 psi Driscopipe 8600 was deployed vertically in a deep ocean trench just offshore Keahole Point and was subject to cyclic distortion caused by wave action, current, and barge motion.

Cyclic tests showed that Driscopipe 8600 very high molecular weight PE could endure more than 100,000 cycles at a stress of 1800 psi without failure. Copies of this test report are available upon request.

Driscopipe 1000 offers good fatigue service life also, but not equal to 8600. Neither requires de-rating like PVC AWWA C-900 pipe. In fact, per AWWA C-906 for 4" to 63" HDPE pipe, no water hammer or fatigue de-rating factor need be applied to Driscopipe 8600 or Driscopipe 1000 ductile PE pipe.

The Driscopipe performance team offers you innovative solutions to your piping requirements. Contact your nearest Driscopipe Sales Representative. He'll give you personalized technical service, installation assistance and all the cost-saving advantages of a Driscopipe Piping System. Engineered for Performance!





Phillips Driscopipe, Inc.
A Subsidiary of Phillips 66 Company

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P.O. Box 83-3866
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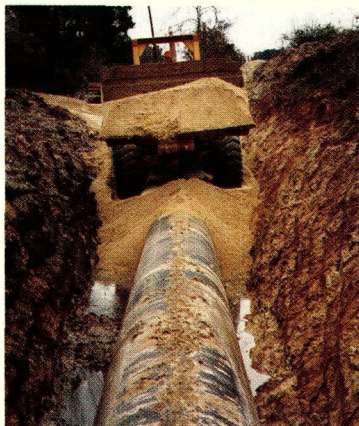
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**PLASTICS WITH
POWER TO WIN™** 



Systems Installation



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Photographs shown are typical Driscopipe installations.

Driscopipe® Systems Installation

SHIPPING

Driscopipe is easy to ship, handle and store, due to its lightweight, yet rugged, characteristics. The normal method of shipment is by truck. Standard packaging for Driscopipe is shown in Chart 1. When hauling Driscopipe, care should be taken that it is not damaged nor surface cut by sharp projections from other equipment or from the truckbed itself.

Chart 1.
Standard Packaging for Driscopipe Industrial Pipe

Pipe Description		Bundle		Truck Load Bundled		40 Ft. Float Truckload – Loose	
Nominal Size	O.D. (Inches)	Number of Joints	Linear Feet	Number of Bundles	Linear Feet	Number of Joints	Linear Feet
2"	2.375	88	3,520	14	49,280	—	—
3"	3.500	46	1,840	14	25,760	—	—
4"	4.500	29	1,160	14	16,240	—	—
5"	5.563	15	600	14	8,400	—	—
6"	6.625	13	520	14	7,280	—	—
7"	7.125	11	440	12	5,280	—	—
8"	8.625	8	320	12	3,840	—	—
10"	10.750	—	—	—	—	80	3,200
12"	12.750	—	—	—	—	52	2,080
14"	14.000	—	—	—	—	48	1,920
16"	16.000	—	—	—	—	35	1,400
18"	18.000	—	—	—	—	28	1,120
20"	20.000	—	—	—	—	20	800
22"	21.500	—	—	—	—	18	720
24"	24.000	—	—	—	—	16	640
28"	27.953	—	—	—	—	10	400
32"	31.496	—	—	—	—	9	360
36"	36.000	—	—	—	—	6	240
42"	42.000	—	—	—	—	4	160
48"	47.244	—	—	—	—	4	160
54"	54.000	—	—	—	—	1	40 to 50**

Note: Obtain truckload weight by multiplying linear feet times pipe weight per foot.

**Truck shipment is the standard mode of transport and shipment for all Driscopipe pipe. However, rail shipment *may* be considered under special circumstances for pipe sizes 40" and larger on an order by order basis.

HANDLING

Driscopipe can be easily handled with fork lifts or cherry pickers. The joints should be handled *near the middle with wide web slings and spreader bars*. Rope slings also work well with straight lengths. Coils can be handled in a similar manner. The use of chains, end hooks or cable slings that may scar the pipe are not recommended. The following procedures should be observed when handling Driscopipe:

- Always stack the heaviest series of pipe at the bottom.
- Protect the pipe from sharp edges when overhanging the bed of a truck or trailer by placing a smooth, rounded protecting strip on the edge of the bed.
- Driscopipe has a very smooth inner and outer surface. The load should be anchored securely to prevent slippage.

Lengths of small-diameter, lightweight pipe can be unloaded manually.

Driscopipe applications are normally handled by:

- Unloading the pipe from the truck in a row along the side of the installation area and moving the fusion unit along the row of joints.
- Stacking the pipe beside the fusion unit and trailing the pipe out after fusion, then dragging the long length of pipe into place for installation. It is suggested that as the pipe is fused and moved through the fusion machine, additional joints of pipe should be placed in the moveable jaw side of the machine for each subsequent fusion. This prevents the hydraulic system of the machine from having to pull the previously fused long length.

Dragging the pipe into place can be an economical method of installation, provided the pipe isn't damaged from sharp rocks or excessive abrasion created by pulling the pipe great distances.

STORAGE

If the pipe must be stacked for storage, avoid excessive stacking heights. Out-of-roundness can be created in the lower rows of pipe, due to excessive stacking heights. The limitation on storage height is based on the weight on the bottom layer of pipe, and will vary depending on the storage facilities, size and wall thickness of the pipe and the temperature. General recommendations for stacking heights developed by the Plastic Pipe Institute for polyolefin pipe are shown in Chart 2.

Care should be taken to ensure that the pipe is stacked in straight rows. It is satisfactory to store black Driscopipe either inside or outside in direct sunlight as it will not be damaged in any way by long exposure to direct sunlight. However, the expansion and contraction caused by uneven heating by the sunlight may cause the pipe to bow if not restrained by racks. This does not damage the pipe but does reduce convenience of handling the pipe when taken out of storage for installation.

When the pipe is laid directly on the ground, care should be taken to place the pipe on an area free of loose stones or sharp objects. This will avoid scarring or gouging the pipe.

Chart 2.

Allowable Stacking Heights for Storage of Polyolefin Pipe

Nominal Pipe Size (in.)	Number of Rows High		
	for SDRs* 18 and under	for SDRs* over 18, up to 26	for SDRs* over 26, up to 32.5
4	45	26	14
6	31	17	10
8	24	13	8
10	17	10	6
12	13	8	5
14	12	7	4
16	11	6	4
18	10	6	4
20	9	6	3
22	8	5	3
24	7	4	3
28	6	4	3
32	4	3	2
36	3	3	2
40	2	2	2
48	—	2	2
54	—	—	1

*NOTE: SDR = Standard Dimension Ratio = $\frac{\text{Pipe Diameter}}{\text{Min. Wall Thickness}}$

JOINING PROCEDURE

The heat fusion method is a highly efficient, economical method of joining Driscopipe. The heat fusion method of joining high density polyethylene pipe began shortly after the first commercial production of high density polyethylene in the mid-1950s by Phillips Petroleum Company.

The modern day heat fusion joint is the same as the joint which was made on the first crude heat fusion equipment in 1956 . . . only the fusion equipment has evolved to gain efficiency, reliability, and convenience. The many principles learned on that early equipment for making a successful joint are still in use today. Phillips Petroleum Company designed, developed and built many new models of heat fusion equipment from 1956 until the early 1970s. Since that time, Driscopipe personnel have guided this development by others. The extensive line of fusion equipment offered by McElroy Manufacturing, Inc., Tulsa, Oklahoma is one of the results of this long history of development. Phillips pioneered the idea and development of the heat fusion joining system . . . and has used it exclusively in every high density polyethylene piping system sold by Phillips since 1956 . . . there are millions of these joints in service today.

The heat fusion method is an uncomplicated, visual procedure with straight-forward instructions. No "timing cycles" are necessary. The visual procedure allows the operator to concentrate on his work, rather than a clock . . . visually, he knows when the butt ends have melted to the degree required to fuse them together. Visually, he observes and controls fusion pressure by observing the amount and configuration of the fusion bead as it is formed.

The principle of heat fusion is to heat two surfaces to a fusion temperature, then make contact between the two surfaces and allow the two surfaces to fuse together by application of pressure. The pressure causes flow of the melted materials which effects mixing and, thus, fusion. On cooling, the original interfaces are gone and the two parts are united. Nothing is added to or changed chemically between the two pieces being joined. The picture below shows a cross section of heat fused Driscopipe.



Molten high density, high molecular weight Driscopipe 8600 is very viscous and tough. During heat fusion of this material, the operator can apply relatively high pressure to form the heat fusion joint (approximately 150 pounds of pressure per square inch of pipe material) . . . with no danger of forcing the molten material from between the two ends of the pipe. Lower fusion pressures are necessary with the softer, less viscous, high and medium density materials. When high pressure is applied to the higher melt flow material most of the molten material can be forced from the fusion joint. This produces a "cold joint" or poor fusion. Pressure control can be difficult, unless the fusion equipment is designed to compensate for the melt strength of the pipe being fused. The equipment discussed in this section can be regulated for the different melt strength materials. Compatibility fusion techniques should be used when polyethylenes of different melt indexes are fused together.

Heat fusion joints may easily be cut out and re-done. This fact has a bearing on the quantity and quality of training necessary and favorably affects operator attitude toward quality in the field. These joints can be easily cut out and destructively tested in the field to check joining proficiency and equipment condition . . . and at very little cost, since there is no coupling to destroy and throw away.

In the course of heat fusion joining, the fusion operator is faced with a wide variety of job conditions. Changes in air temperature, material temperature, wind velocity, sun exposure, humidity, as well as condition of the terrain and the equipment . . . all influence the joining requirements. Estimating pre-heat timing cycles under different conditions, can become extremely confusing. Quality work under field conditions is more consistent with the straight-forward, visual procedure offered by Driscopipe. Thus, the operator can consistently produce high quality joints.

Heat fusion has successfully been accomplished in the rain with a canopy covering the fusion machine and operator as well as in below freezing conditions.

Fusion equipment is available for piping systems that range from 1/2 inch diameter tubing through 54-inch diameter pipe. Although the size range is great, the procedure and principle remain the same. You just heat Driscopipe, pressure it together, let it cool and forget it.

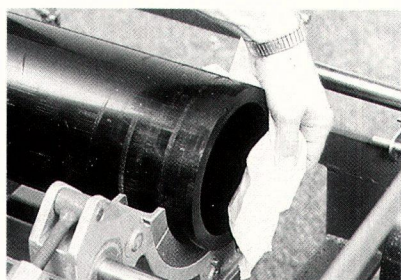
Heat Fusion

Heat fusion for Driscopipe Systems was pioneered and developed by Phillips Petroleum Company. Heat fusion techniques are recognized in the industry as cost effective joining systems of very high integrity and reliability. They do not require couplings and joints are stronger than the pipe itself – in both tension and pressure conditions. There are seven joining steps – simple, visual procedures with straight-forward, uncomplicated instructions.

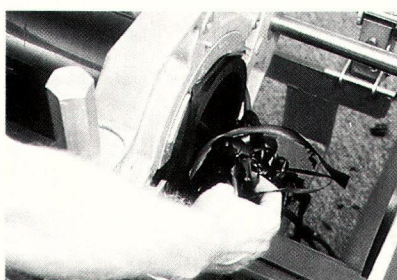
Note: It is most important to maintain the proper temperature of the heater plate. Check it with a tempilstik or pyrometer for correct surface temperature.

Driscopipe	Thermometer Readings	
	Coated Plates	Uncoated Plates
8600	500°F-525°F	475°F-500°F
1000	400°F-425°F	375°F-400°F

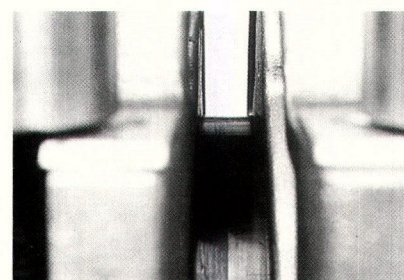
Driscopipe	Surface Temperature	
	Coated Plates	Uncoated Plates
8600	475°F-500°F	475°F-500°F
1000	375°F-400°F	375°F-400°F



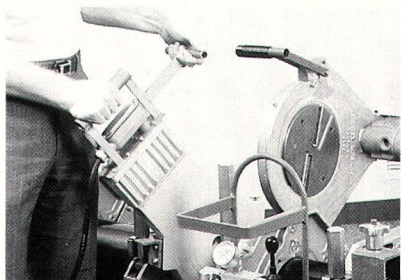
1. Clean pipe ends inside and outside with a clean cotton cloth to remove dirt, water, grease and other foreign materials.



2. Square (face) the pipe ends using facing tool of the fusion machine.



3. Check line-up of pipe-ends in fusion machine to see that pipe ends meet squarely and completely over the entire surface to be fused. This is commonly referred to as "adjusting high-low." It is advisable at this point to make sure the clamps are tight so that the pipe does not slip during the fusion process.

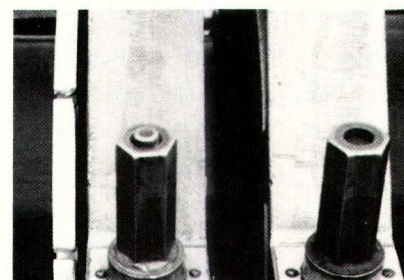


4. Insert *clean* heater plate between aligned ends, and bring ends firmly in contact with plate but **DO NOT APPLY PRESSURE** while achieving melt pattern. Allow pipe ends to heat and soften. Approximate softening depths are as follows:

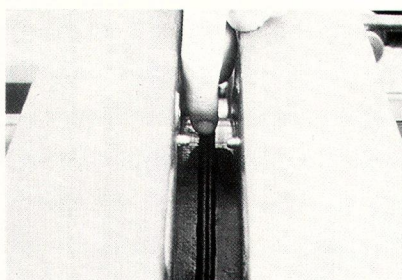
Pipe Size	Approximate Melt Bead
2" and below	1/16"
3" – 5"	1/8"
6" – 12"	3/16"
12" – 22"	1/4" – 5/16"
24" – 54"	5/16" – 7/16"



5. Carefully move the pipe ends away from the heater plate and remove the plate (If the softened material sticks to the heater plate, discontinue the joint. Clean heater plate, resquare pipe ends and start over.). Note: One pipe end usually moves away from the heater plate first. It is good practice to "bump" the plate away from the other side and then lift it out. Never drag or slide it over the melted pipe end.



6. Bring melted ends together rapidly. **DO NOT SLAM.** Apply enough pressure to form a double roll-back bead to the body of the pipe around the entire circumference of the pipe about 1/8" to 3/16" wide. Pressure is necessary to cause the heated material to flow together.



7. Allow the joint to cool and solidify properly. This occurs when the bead feels hard and your finger can remain comfortably on the bead. Remove the pipe from the clamps and inspect the joint appearance.

Sidewall Fusion

Side fusion procedure for Driscopipe can be accomplished in the field using 2" through 12" McElroy fusion units and proper heater plate adapters. Where branch outlets are larger than 12" outside diameter, sidewall fusions must be accomplished in a fitting fabrication shop. Size, availability and pricing can be obtained through Phillips Driscopipe representatives.

The following nine steps should be observed during the sidewall fusion procedure:

1. Install fusion machine on the pipe (main).
2. Clean the pipe with a clean cotton cloth. Prepare surface of pipe (main) by roughing with 60 grit or coarser utility cloth.
3. Prepare the base of the branch by roughing with 60 grit or coarser utility cloth.
4. Align branch on the main and tighten clamp.
5. Check branch for square alignment on main.
6. Retract moveable clamp, roll in and center heater plate with adapter between base of branch and main.
7. For all sizes, apply a strong, firm, continuous pressure until complete melt bead can be seen on main. Release pressure to light pressure. Continue heat soak cycle on branch and main. Watch base of branch for:

Main Sizes	Heat Soak Cycle Fitting Base Bead
1 1/4"	1/16" Melt Bead
2"	1/8" Melt Bead
3" and larger	1/8" - 3/16" Melt Bead

8. Retract moveable clamp and cleanly remove heater plate.
9. Bring melted surfaces together rapidly. **DO NOT SLAM.** Apply continuous progressive pressure until proper fusion bead is formed. Maintain pressure until joint has cooled (Until finger can remain comfortably on bead.).

Note: Contact Phillips Driscopipe, Inc. for additional details on sidewall parameters and procedures.

Compatibility Fusion

Driscopipe 8600 and Driscopipe 1000 materials can be compatibly fused together and still maintain fusion joint integrity. Although the two materials have different melt characteristics, they can be properly fused using the procedure outlined below. Phillips Driscopipe sales and technical personnel are available to instruct and demonstrate the fusion procedure for joining Driscopipe.

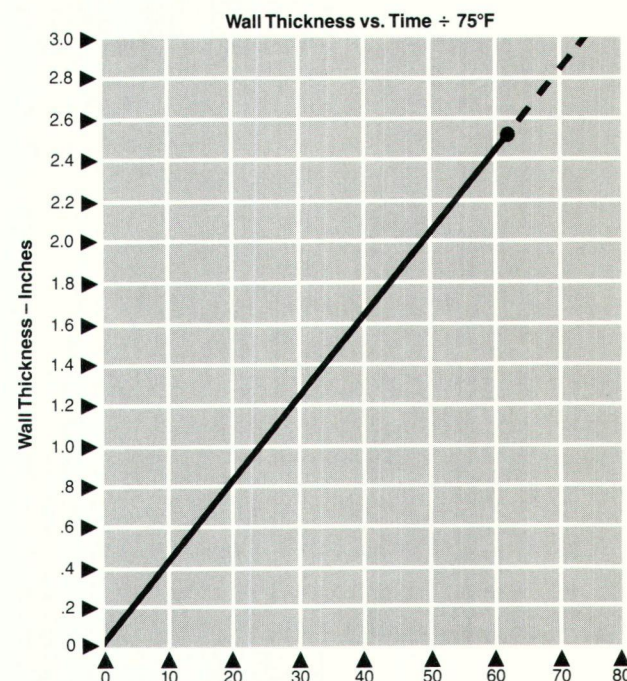
Compatibility heat fusion and sidewall fusion should be accomplished in the same manner as described before with the following exceptions:

- To achieve proper melt pattern, insert the heater plate and place a compatibility insulator between the heater plate and the Driscopipe 1000 material. After the Driscopipe 8600 achieves proper melt, then remove the insulator and bring the heater plate in contact with the Driscopipe 1000 material for proper melt. Continue heating both surfaces until proper melt develops. For manually operated fusion equipment, form a double roll-back bead as previously described in the fusion procedures.
- The fusion pressures for compatibility fusion of Driscopipe 1000 and 8600 on hydraulically operated equipment should be set at approximately 50% of the 8600 fusion pressures (ie: @ 75 psi). The fusion pressure will depend on the fusion conditions involved to achieve the proper roll-back bead.
- The fusion temperature for compatibility fusion should be the one normally used to fuse Driscopipe 8600, 475°F-500°F surface temperature.

Note: The fabricated fittings furnished by Phillips Driscopipe are made (with few exceptions) from the same material as the pipe.

Chart 3.

Fusion Joint Cooling Time



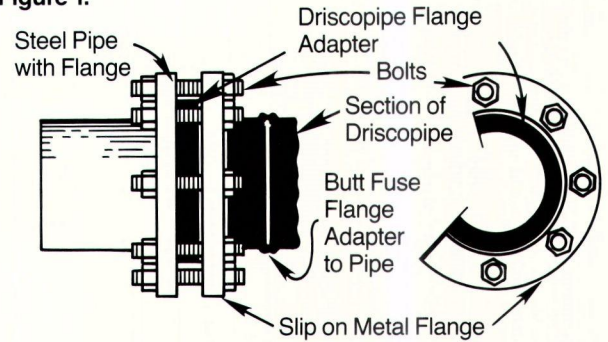
Mechanical Joining

Mechanical joining to other piping materials – fittings, valves, tanks, pumps, etc. – may be accomplished with Driscopipe flange adapters and metal back-up flanges. Flanges are also used to connect lengths of Driscopipe together when heat fusion is impractical.

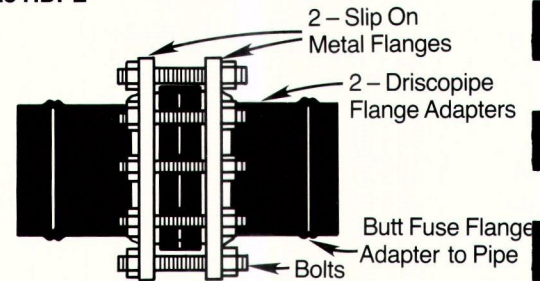
Flange Adapters are pressure rated the same as the pipe. Flange adapters can be heat fused to the pipe as outlined in the heat fusion section.

Figure 1 illustrates the flanged method for joining polyethylene pipe to itself or to steel pipe. Although ductile iron is now used for the slip-on flanges, other materials are available from your local supplier. Gaskets may be used between the polyethylene flange adapters but it is not generally necessary. Sufficient torque should be applied evenly to the bolts to prevent leaks. After initial installation and tightening of flanged connections, it is a good practice to allow the connections to set for a period of time (usually a few hours). Then conduct a final tightening of the bolts. Mechanical joining of 2" – 8" pipe may also be accomplished using the low cost, quick assembly, smaller O.D. profile Driscopipe threaded union. The union can be joined in about a minute or less. Contact your Driscopipe distributor for product information.

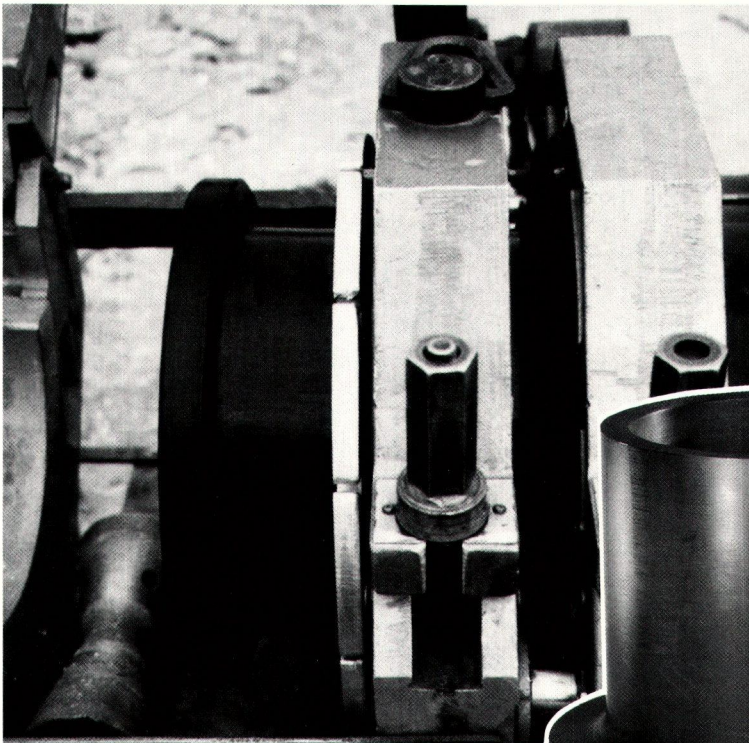
Figure 1.



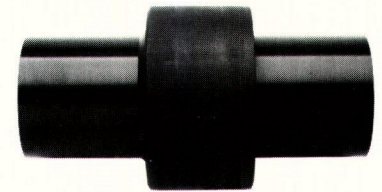
Joining Steel to HDPE



Joining HDPE to HDPE Without Permanent Fusion



Butt Fusing a Molded Flange Adapter to Pipe.



Threaded Union



Flange Adapter

Other Joining Methods

Extrusion gun welding using PE rod has been used with limited success with Driscopipe 1000 material for special low pressure fabrications, non-pressure applications and for very low pressure repairs. It is not recommended for general use in joining Driscopipe 1000 nor for any use with Driscopipe 8600. No welder qualification nor joint qualification standards or tests exist.

Standard tapered pipe threading is not recommended for polyethylene materials. Solvent or epoxy cementing are unsatisfactory methods of joining Driscopipe. There is no known solvent cement available for proper joining of HDPE.

Mechanical joining with bolt-on wrap-around clamps is generally not recommended as a permanent, long-term method of joining polyethylene unless the connection is stabilized in some manner. Due to the magnitude of thermal expansion and contraction of polyethylene materials and its creep characteristics under load, it can be difficult to maintain a permanent leak-proof seal with certain mechanical wrap-around clamps. However, in certain low pressure, or non-pressure, non-critical applications they have been used when it is not feasible to flange or fuse the sections together. Even in these low pressure or gravity flow uses, the wraparound clamp length should be at least $1\frac{1}{2}$ – 2 pipe diameters long.

Compression type couplings with internal stiffeners are available in some sizes and are generally satisfactory where temperature changes within the system are small.

Heat shrinkable polyethylene sleeves may be used for non-pressure applications to achieve effective seals but are also subject to tension pull-out with thermal contraction of the pipe.

Electro-Fusion couplings and wrap-around electro-fusion tapes are being used with some success in low-pressure applications for joining. While Driscopipe does not offer these joining systems, it is recommended they be studied, analyzed and reviewed for applicability, suitability and compatibility with either Driscopipe 1000 or Driscopipe 8600, before using. For pressure applications, long-term pressure performance and stress-life curves should be provided.

Consideration must be given to pull-out forces caused by circumferential as well as longitudinal thermal contraction when certain mechanical joints are used. If necessary, provisions must be made for sealing as well as restraining to compensate for the axial loading due to expansion or contraction and/or pipe settlement.

Bending Driscopipe

Driscopipe may be cold-bent to a minimum radius of 20-40 times the pipe diameter as it is installed, thus eliminating the need for elbows for slight bends. The minimum bending radius that can be applied to the pipe without kinking it varies with the diameter and wall thickness of the pipe. If adequate space is not available for the required radius, a fitting of the desired angle may be fused into the piping system to obtain the necessary change in direction.



INSTALLATION BELOW GROUND

This section sets out the general installation considerations and recommendations for below ground pipe. Although the requirements for installing plastic pipe are similar to that for rigid piping, there are some important differences. These differences arise due to the difference in basic physical properties, differences in joining techniques, differences in the effect of environmental conditions during installation, and differences in experience of installation. Recognition of these differences in piping design and installation procedures is essential to obtain the desired objective of a piping system that will provide long-term service.

Information contained in this section, along with the recommendations of the Plastics Pipe Institute (PPI), American Society for Testing and Materials (ASTM), and other Standards organizations, provide pertinent facts relating to the installation of Driscopipe. We want to provide the engineer, purchaser, and contractor with essential information about the properties, advantages and cost saving benefits of polyethylene pipe.

Trenching and Bed Preparation

Since Driscopipe can be butt fused above ground in long lengths, narrow trench widths can be used to save on installation costs. Due to the ease of handling Driscopipe, it may be readily placed in the trench, thus necessitating a minimum amount of open trench. The length of open trench required should be such that bending and lowering of the pipe into the ditch does not exceed the minimum recommended bend radius, and result in kinking.

The trench width will vary depending on its depth and type of soil. The bed width should be great enough to allow for adequate compaction around the pipe. Generally, a bed width one foot wider than the nominal

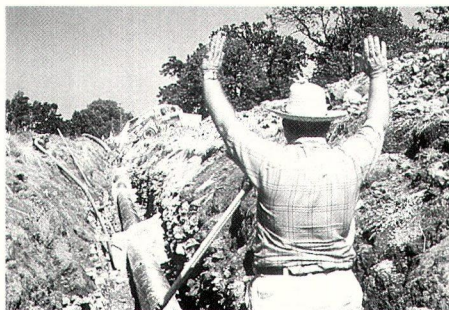
pipe diameter is adequate. However, to reduce trenching costs, narrow trench and/or bed widths are possible for small diameter pipe. Normally the excavated material, if it is rock free and well broken up by the ditcher, will provide a suitable bedding material.

The trench bottom should be relatively smooth and free of rock. When rocks, boulders, or large stones are encountered which may cause point loading on the pipe, they should be removed and the trench bottom padded using 4-6 inches of tamped bedding material below and on all sides of the pipe and fittings. The bedding should consist of a free flowing material such as gravel, sand, silty sand or clay-like sand that is free of stones or hard particles larger than ½ inch. For most pressurized systems, accurate levelling of trench bottoms is not necessary unless specified. For gravity flow systems the slope should be graded evenly as is done for other piping materials.

If an unstable soil condition exists, such as mucky or sandy soils with poor bearing strength, the trench bottom should be undercut and filled to proper trench depth with a selected material of gravel or small crushed stone.

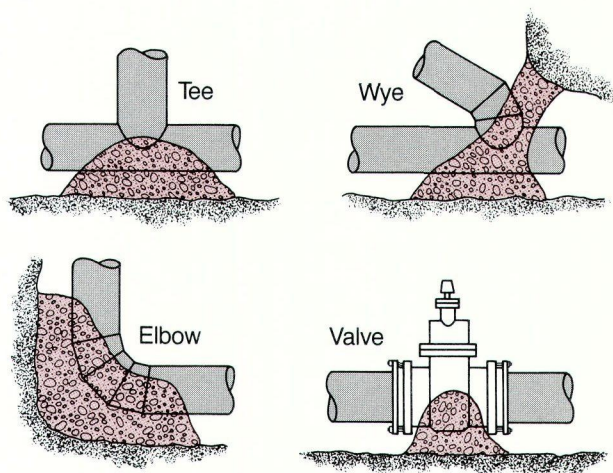
Consider all precautions necessary to prevent trench cave-ins. No part of the country is immune to cave-ins. Trench failure is influenced by the presence of construction equipment near the edge of an excavation or adverse climatic conditions. OSHA and other regulatory agencies specify the maximum vertical height of unbraced trench which is permitted (usually 4 to 5 ft.) and the suggested angle of repose for the soil type involved.

To protect the pipe from traffic loading and/or frost penetration, consideration should be given to establishing minimum earth cover requirements. Refer to the *Driscopipe Systems Design* brochure for load bearing capabilities.

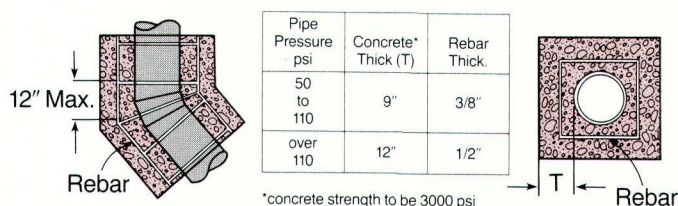


Generally, slight changes in direction of the pipe can be accommodated by field sweeping of the pipe in the ditch. If proper compaction is obtained, field sweeps do not require thrust blocks. Good soil compaction around fittings such as elbows or tees is usually sufficient. If thrust blocks are required in poor soils, concrete encasement or concrete bearing surfaces set in undisturbed soil will provide adequate protection. The encasement or thrust block should be constructed of reinforced concrete and act as an anchor between pipe or fitting and the solid trench wall. Figure 2 illustrates various types of concrete blocking and encasement of fittings.

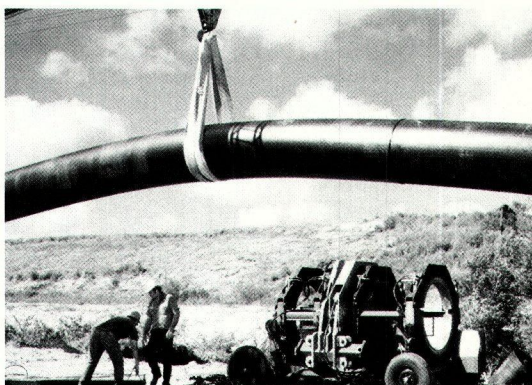
Figure 2.



Thrust Blocks and Bearing Surfaces



Fitting Encasement



Pipe Laying

Driscopipe can be joined at ground level and lowered into the ditch. Care should be taken not to drop the pipe. Avoid excess stress or strain conditions during installation. Flanged connections should be used as necessary to facilitate handling pipe and fittings in and out of the fusion machine and installation in the ditch. This is particularly important at fabricated fitting junctures.

The length of Driscopipe which can be pulled into position alongside the trench depends on the pipe size and field conditions. Generally, the maximum pulling length for smaller sizes is approximately 1,000 feet; for larger pipe about 500 feet.

The maximum pulling force that can be applied to a pipe on level ground can be estimated using the following formula:

$$F = SA$$

Where: F = maximum pulling force (lbs)
 S = maximum allowable stress
 (1000-1500 psi)
 A = cross-sectional area of pipe wall
 (square inches)

Cross-sectional area of pipe wall is:

$$A = \pi(D - t)t$$

Where: D = outside diameter (inches)
 t = minimum wall thickness (inches)

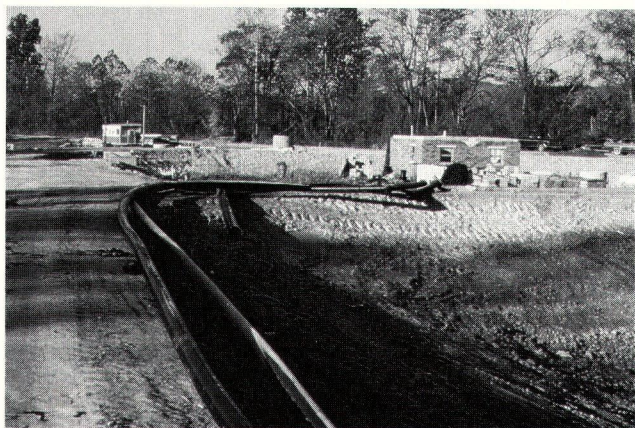
When pulling pipe, either a pulling head or a suitable wraparound sleeve with rubber protective cover should be used to prevent the pulling cables from damaging the pipe. Never pull the pipe by the flanged end.

Thermal Expansion and Contraction

It is important that the expansion and contraction characteristics of Driscopipe be considered in the design and installation of most systems. Driscopipe expands and contracts at a rate higher than that for rigid metal piping. The rate and resulting amount of stress is discussed in detail in the *Driscopipe Systems Design* brochure. Although the coefficient of thermal expansion and contraction for polyethylene is approximately 10 times greater than for steel or concrete, this material has the advantage of viscoelastic properties which make it quite adaptable to relaxing or adjusting with time to stresses imposed by thermal changes.

Direct buried Driscopipe applications will generally have ample soil friction and interference to restrain movement of the pipe caused by the normal application temperature changes. Stresses induced by temperature change and resisted by soil containment do not damage the pipe. It is a good idea to make final tie-ins on a system at a temperature that is as close to operating temperature as possible. This is particularly true for insert renewal liner systems where there is no soil restraint.

For summer time installations with two fixed connection points, a slightly longer length of Driscopipe may be required to compensate for contraction of the pipe in the cooler trench bottom. The snaking in the trench which naturally occurs with pipe diameters 4" and below is normally sufficient to compensate for any anticipated thermal contraction. This snaking is desirable but not absolutely necessary. Pipe above 4" generally has sufficient soil friction to resist movement. During a winter installation the exact length of pipe should be used. Pipe which is too short or not aligned must not be drawn up by the bolts of a flanged connection because of overstressing the flange adapter and ultimately, the valve, tank, etc. to which it is connected.



When the backfill is soft or becomes fluid, as in marshes or river bottoms, the pipe may not be restrained by the backfill from movement caused by thermal expansion and contraction. Also, the stress induced in the pipe is transmitted to the end terminations. This can damage weak connections. If this possibility exists, adequate anchors should be installed just ahead of the termination to isolate and protect these connections.

The calculated force induced by thermal change is the product of the stress in the pipe wall and the cross sectional area of the pipe wall. The length of pipe required to anchor the pipeline against this calculated force depends on the circumference of the pipe, the average contact pressure between the soil and the pipe and the coefficient of friction between the soil backfill and the pipe.

The stress and the corresponding force developed by temperature change in a restrained pipeline are independent of the length and the burial conditions of the pipe. If pipe movement at the end sections cannot be tolerated, the pipe must be anchored mechanically to resist the thermal forces. Concrete blocks or other special anchors designed to fit the situation are usually used to transfer the thermal force into the soil adjacent to the pipe lay trench. Adequate frictional resistance must also be provided to transfer the force from the pipe into the concrete block.

If the pipe is not anchored at the ends to resist movement, the end sections will expand or contract as the temperature changes. This change in length will extend into the burial trench to a point at which the frictional resistance of the backfill is equal to the thermal force. These movements must be considered in the design of such physical features as connections to pumps, catch basins, sewer manholes, etc.

Once a line is installed and in service, the temperature variation is usually small, occurring over an extended period of time and is not likely to induce any significant stress into the pipe.

Fitting Installation

Driscopipe polyethylene flanged connections with metal back up flanges should be used to connect Driscopipe to metal fittings, valves, pumps or other piping materials. Where pipe or fittings are connected to rigid structures, movement or bending at that point should be prevented. Either well compacted fill should provide full support or a support pad should be constructed beneath the pipe and fitting. This pad, usually of reinforced concrete, should be fixed to a rigid structure and extend one pipe diameter, or a minimum of 12", from the flanged joint. See Figure 3 for suggested methods.

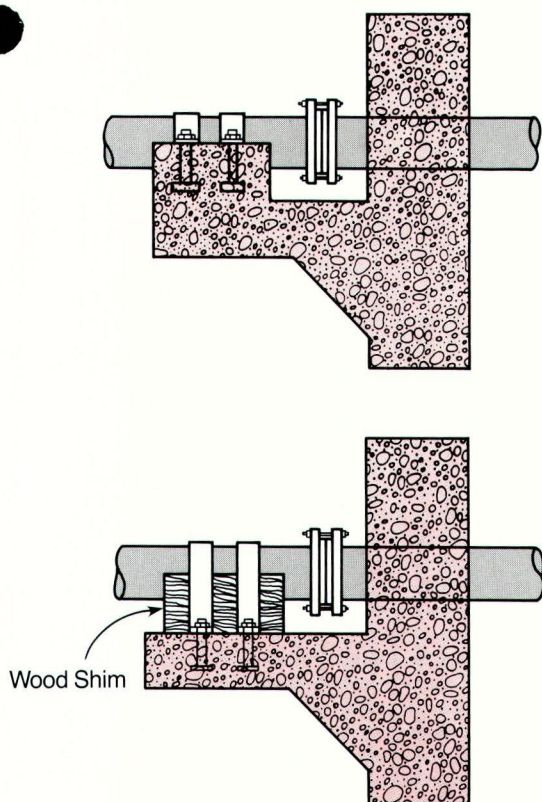
It is recommended that the bolts in the flanged connection, as well as the clamps in a support pad undergo one final retightening. This should be done after initial installation, just before final backfill if it is a buried application. Surface connections can be observed while in operation. Particular attention should be given to the compaction achieved around the fittings, and extending several pipe diameters beyond the ends of the fitting. Compaction of 90% Proctor density or greater in these areas is recommended.

Polyethylene pipe or fittings may be totally enclosed in concrete if required in the design. Reinforced concrete encasement can be used to raise pressure rating of fittings, stabilize heavy valves or fittings, and control thermal expansion or contraction.

Grouting (Continuous or at Manholes)

Pipe running through a manhole wall can be anchored by attaching a collar or side fused branch saddles to the pipe and encasing them in the wall of the manhole. Expandable rubber seals and grouting have proven successful in sealing an annulus between a casing pipe and polyethylene pipe when it enters a manhole. (Refer to manhole terminations on last page of this book.)

Figure 3.



Grouting the annulus between the inner Driscopipe and an outer pipe is not required, but sometimes may be done for several reasons. Continuous grouting, with few voids, can provide structural strength to the liner pipe both in the form of increased resistance to external hydrostatic collapse pressure as well as increased internal pressure capability. However, please realize that only a few small single voids in the grouted annulus are allowed, or the higher pressure capability of the piping system is lost. In actual grouting procedures, it is extremely difficult to achieve a void free annulus. Professional grouting companies should be used.

The table below illustrates the increase in hydrostatic collapse resistance for non-grouted and grouted PE pipe:

SDR	Unsupported* Condition		Grouted-or-** Buried Pipe	
	1 Month	50 Yrs	1 Month	50 Yrs
32.5	6 ft	4 ft	24 ft	16 ft
26.0	10 ft	9 ft	40 ft	36 ft
21.0	22 ft	17 ft	88 ft	68 ft
19.0	28 ft	22 ft	112 ft	88 ft
17.0	34 ft	29 ft	136 ft	116 ft
15.5	54 ft	44 ft	216 ft	176 ft
11.0	147 ft	97 ft	588 ft	388 ft
9.0	195 ft	160 ft	780 ft	640 ft
7.0	249 ft	204 ft	996 ft	816 ft

*External hydrostatic pressure differential shown in feet of water head @ 73.4°F per ASTM D-585.

**Burial in solid soils or grouting increases the buckling or hydrostatic collapse resistance by a factor nominally 4 times the unsupported condition. Exact critical buckling pressures can be calculated using shallow burial design formulae from the Driscopipe "Systems Design" Manual.

If continuous grouting is specified, consider weighting the pipe to hold line and grade while the grout sets. If the length of pipe to be grouted is long, consider construction techniques to limit the grout pressure to less than the short-term unsupported hydrostatic collapse resistance, or consider plugging and filling the sliplined pipe with water to weight the pipe and avoid localized buckling under high grout pressures.

Localized grouting can also be used at connections to manholes and to stabilize movement of the liner pipe where break outs for laterals exist. Caution must be exercised during the grouting process not to exceed the collapse pressure of the polyethylene pipe.

Careful consideration should be given to these two key points, especially in slip lining installations:

(a) anchoring the polyethylene pipe within the casing pipe to eliminate expansion and contraction if this constitutes a problem and (b) sealing the annulus to prevent infiltration and/or contamination.

Backfilling and Tamping

The purpose of backfilling the trench is to provide firm, continuous support around the pipe. Achieving this proper soil backfill around the pipe is probably the most important aspect of a successful buried application.

As stated in the bedding section, the material excavated from the trench can usually be used as the initial backfill if it is smooth, free of rocks, crumbles and breaks up easily. Economics usually dictate maximum reuse of the excavated material. Where trenches are located within roadways and are subject to vehicular traffic, cohesionless, granular soils are generally specified. The best initial backfill material is sand. When loading conditions are severe, such as road crossings, sand should be used where the pipe is laid in low quality soils such as heavy gumbo or muck. Coarse sand will usually reach the required density during placement without compaction. Initial backfill should be placed in two phases. The first is up to or slightly above the spring line of the pipe. Then compact or flush with water to assure that the lower part of the pipe (haunches) is supported.

Compaction of the soil around the pipe is accomplished by applying an external force to the individual layers of backfill as they are placed in the trench. Compacting brings the soil particles closer together and thus increases their density and shear strength. Compaction depends upon soil properties, moisture content, layer thickness, compactive effort and other factors. Compaction is usually accomplished by a mechanical tamper, vibrating plate or water flushing.

Care should be used while flushing to prevent the pipe from floating out of position in the trench. To keep the pipeline from floating or shifting, it can be filled with water prior to flushing until initial backfilling procedures are complete. This also assures that the horizontal diameter does not shorten excessively during compaction to the springline. The water flushing method of achieving compaction should only be used with "free draining" granular materials and a positive drainage outlet provided.

In the second phase of initial backfill, additional fill in 8"-10" layers should be added and well compacted until about 6"-12" above the top of the pipe. Larger

diameter pipe requires the higher initial backfill. At this point, the on-site material excavated from the trench can be used for final backfill to ground level. In a heavy traffic area, this excavated backfill of granular material should be compacted to a minimum of 90% to 95% density.

Standard tests are available to determine the density of the compacted soil such as Standard Proctor Laboratory Test Procedure, ASTM D 698. Compaction is measured in terms of the dry density achieved in the field compared to the laboratory dry density determined on a sample of the same soil type when compacted under a given effort.

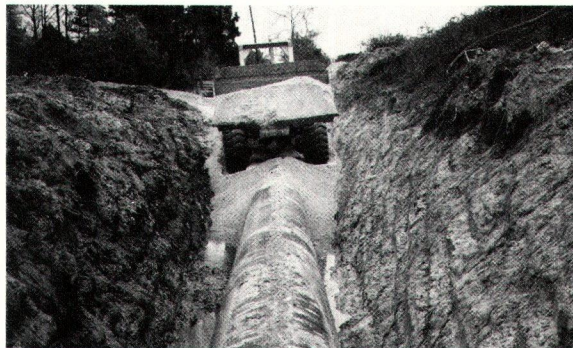
The optimum moisture content (usually about 20%) at which maximum density is obtained can be estimated in the field by squeezing it in your hand. If it just holds together, it is near optimum moisture. Similarly, a corner heel impression while walking probably indicates a soil density of 90%. A full heel print may indicate a density of 80%. And a full footprint may indicate a density of 70%.

Tests conducted on Driscopipe at Utah State University by Dr. Reynold K. Watkins show that Driscopipe will not buckle under ordinary conditions if the backfill is compacted and if it is in full contact with the pipe. A virtual failsafe installation can be assured if soil density is generally over 85% of Standard Proctor (AASHTO T-99) density. Additional information on Underground Installation is given in ASTM D 2321, Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe, ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping, Plastic Pipe Institute Technical Report TR-31/9-79 and the Driscopipe *Systems Design* brochure.

In order to locate the underground polyethylene pipe in the future, a copper or galvanized tracer wire should be laid next to the pipe during installation to later permit use of locating devices. The metal wire should not touch the pipe in case of lightning.

Inspection and Testing

After installation or a portion thereof is complete, the pipeline should be pressure tested in accordance with recommended practice. Refer to the "Testing Polyethylene Pipelines" section of this brochure for detailed testing recommendations.



Anchoring

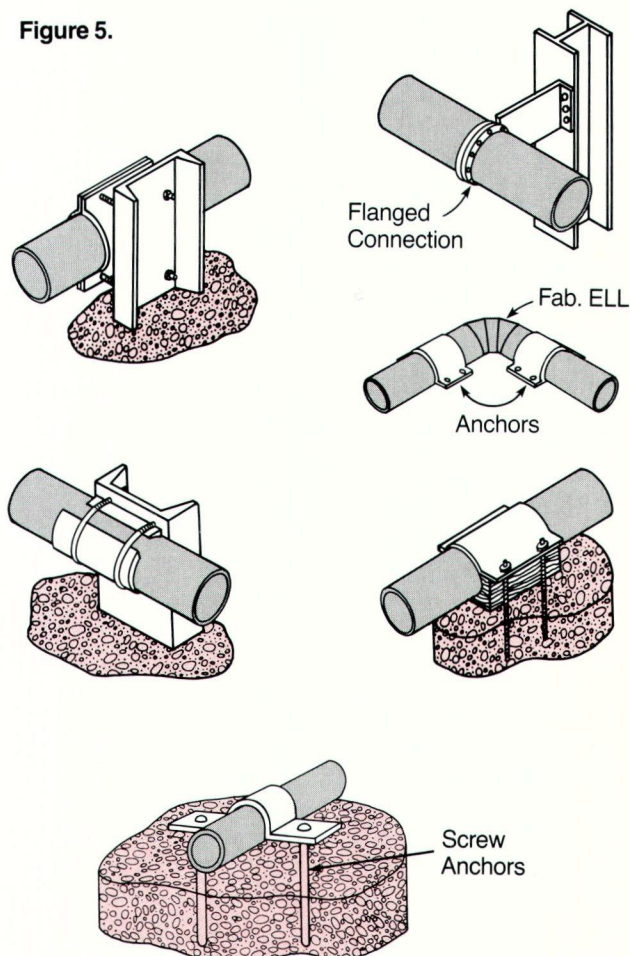
Proper anchoring should be considered to prevent lateral displacement and movement at fittings. Anchors should be placed as close to an elbow as possible. If flanged connections are required, anchors can be attached to these flanges. However, it is important that bending does not occur between the pipe and the flange. Some typical anchors for polyethylene pipe are illustrated in Figure 5.

Slurry Applications

The toughness qualities and smooth inner surface that is resistant to abrasion make Driscopipe an excellent candidate for transporting slurries of all types. Typical slurry applications are dredging lines, coal or limestone slurry, wood chips, sand, mine tailings, and many others.

Installation of slurry pipelines is generally above ground. This provides easy access to the lines if plugging occurs and also permits rotation to distribute wear evenly around the inside diameter of the pipe. In order to rotate the slurry lines, they are often flanged every 3-4 pipe lengths. Evaluation of pipe wear over the first few months of use will determine when to rotate.

Figure 5.



Grade changes in slurry pipelines should be gradual. Exercise caution when slopes become excessive. Turbulence often increases abrasion. Drop boxes are often used to reduce turbulence. They are also used to relieve pressure buildup caused by surface gradients. Generally, drop boxes are used on gravity lines, however, pressure lines can also empty into drop boxes.

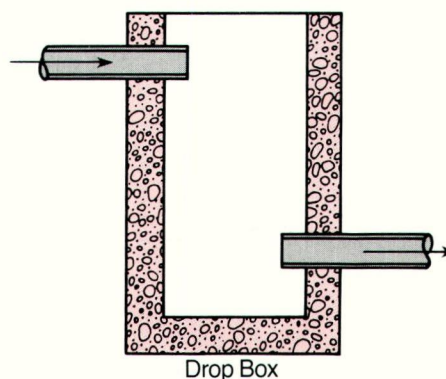
Design of the drop box should either allow the slurry to fall freely into the fluid in the bottom of the box or utilize a rubber liner on the wall opposite the inlet pipe. A typical drop box is shown below (Figure 6).

It is difficult to predict wear characteristics that will be experienced using Driscopipe to transport slurries. Every application has somewhat different parameters, whether it be flow velocity, solid concentration, particle size, and/or temperature.

When transporting slurries with Driscopipe, minimum wear will be realized if velocity is minimized while keeping the solids suspended. A maximum of 12-15 feet per second is preferred. It is generally recommended that very sharp – abrasive solids such as bottom ash, should not exceed 10 feet per second. A solid concentration below 25% by volume with particle size of $\frac{1}{4}$ " or less is generally recommended. Temperatures as close to ambient as possible are preferred. Maximum wear and flow properties will be obtained if long radius elbows, sweep elbows, and molded flange adapters are used in the installation.

Driscopipe, with its smooth inner surface, will withstand some sliding action of abrasive particles along the inside of the pipe. However, where the solids are in turbulence and the angle of impingement of the solid with the inner wall of the pipe is sharp or direct, polyethylene pipe will not wear well. For instance, in a dredging operation, the section of pipe directly off the pump may experience very high turbulence and vibration; hence, excessive wear.

Figure 6.



INSTALLATION UNDERWATER

This section discusses some of the different aspects to be considered in marine pipeline installations. Design engineering phases, such as selecting the proper size and wall thickness as well as critical buckling pressures are discussed in the *Systems Design* brochure. Concrete weight determinations will be discussed in this section.

Driscopipe can be buried, rest on the bottom, or floated on the surface of lakes, rivers, marshes, or oceans. Its characteristics of flexibility, lightweight, inertness to salt water and chemicals, continuous pipeline due to butt fusion and the ability to float, even when full of water, give polyethylene many advantages.

Joining and Assembly

Proper planning of all assembly and installation phases will help alleviate problems.

Depending on site conditions, various procedures have been used to assemble the pipeline. Some common ones are:

- Fuse the pipe together on shore into continuous lengths, assemble the ballast weights to the pipe on shore after fusion and before the pipe is launched into the water.
- Fuse the pipe together on shore and pull or push the pipe into the water as in the previous procedure, except assemble the weights to the pipe at some later time from a barge.
- All pipe can be fused on land in pre-determined lengths with flanged connections added to each end. The flanged ends are capped and the sections are launched onto the water to be later assembled on the water. Such floating lines are often used in dredging operations.

Any pipe which is temporarily stored on a body of water should be protected from all forms of marine traffic as well as preventing wave actions from pushing the pipe against rocks or sharp objects that could damage the pipe.

Anchoring and Weighting

Since polyethylene pipe floats just under the surface even when full of water, it is necessary to add ballast weights in order to sink the pipe and hold it on bottom. The most common form of weight is steel reinforced concrete, although other forms have been used. There are many companies which make the concrete weights whether in the factory or at the job site. These weights are generally round, rectangular or square and are clamped to the pipe using non-corrosive bolts, clamps,

or straps. A compressible protective wrap around the pipe is advisable between the concrete weights and the pipe. It will protect the pipe surface and prevent the weights from sliding on the pipe. This protective wrapping of 1/8" rubber sheet or similar material should extend beyond both edges of the concrete block weights.

A cylindrical weight is commonly used on small diameter pipe; however, this configuration could allow the pipeline to roll on the bottom if subjected to currents. The rectangular or square weight is the most common type used. They are reinforced collars constructed in two halves to fit the pipe outside diameter and usually incorporate lifting lugs built into the weights.

In determining a pipe system's specific gravity or sink factor, the engineer should consider all variables to sufficiently provide the required stability under water. Items such as tides, condition of the bottom material and the possibility of air in the pipe should be considered.

Normally, the weighted pipe is buried in a trench under water. However, it can lay on the bottom or be suspended (float) above the bottom with anchored tie lines. Under most conditions the pipe and weights will embed themselves in the soil or muck on the bottom. Driscopipe works well in extremely soft bottoms, in which little or no support is achieved, by adjusting the anchoring required.

For operating conditions where the pipe will not always be liquid full, or where the product is lighter than water, check to determine whether or not the empty pipe (air inside) with attached weights will float during installation. If the pipe will not float, attach floats at each concrete weight before towing onto the surface of the water.

Concrete weight requirements may be calculated by the following equation:

$$W_C = \frac{K D_W V_O - (W_D + W_P)}{1 - K D_W / D_C}$$

Where: W_C = concrete weight, lbs/ft.
 K = pipe system specific gravity, (sink factor)
 D_W = water density, lbs/cu. ft.
 V_O = pipe outside volume (water displaced), cu. ft./ft.
 W_D = pipe weight, lbs/ft.
 W_P = product weight (pipe contents), lbs/ft.
 D_C = concrete density, lbs/cu. ft.

Chart 5 on pages 18 and 19 contains the concrete weights required for Driscopipe pipelines in fresh water for $K = 1.1, 1.2$ and 1.3 and specific gravity of flowing product of 0.00 (gas), 1.00 (water), 1.10 and 1.20 (fluids heavier than water). To calculate neutral buoyancy use $K = 1$.

INSTALLATION ABOVE GROUND

Generally, Driscopipe is installed below ground. However, there are many situations in which above ground piping has advantages. Some advantages are:

- Slurry or mine tailings lines which are often relocated and can be rotated to distribute wear in the pipe.
- Environmental conditions: The toughness and flexibility of Driscopipe often allows installation through marshes and bogs as well as over frozen areas.
- Installations over solid rock or across water are sometimes the most economical methods of installation.
- Its lightweight and ease of assembly results in immediate availability of a temporary, above ground pipe line.

Thermal Expansion and Contraction

Temperature changes both externally and internally should be considered in the design of an above ground Driscopipe application. Temperature changes cause all types of pipe to expand and contract. Chart 3 illustrates the amount of expansion and contraction to anticipate for Driscopipe during design and construction stages. These values are based on an empty pipe which is free to move. Generally, pipe laid over relatively smooth terrain and allowed to move freely in every direction will perform adequately. However, if large changes in temperature take place in short periods of time, movement of the pipe can concentrate in one area, and kinking can occur. By using proper anchors or restraints, the possibility of this occurrence can be minimized.

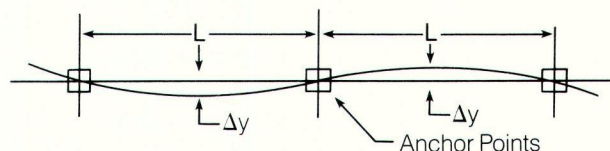
Normally, if fluid flow is continuous, expansion and contraction of the line will be minimal after operating conditions are established.

Driscopipe contains 2½% carbon black which protects it from the ultra-violet rays of the sun. Although the sun will not damage Driscopipe, the heat absorbed from

the sun will greatly increase the amount of expansion and contraction that will take place. The sun alone can raise the surface temperature of an empty pipe 40-50°F. Protection from the sun is generally accomplished by covering with a foot of fill dirt on buried installations. For above ground installations, there is generally no economical means to protect large diameter pipe from the sun. The effect of daily and seasonal temperature changes should be anticipated for installation and operation conditions.

One very good method of limiting expansion and contraction is to properly anchor the pipe at given intervals along its length. When expansion occurs, it will, depending on the spacing, deflect laterally. Adequate space must be available to accommodate this curvature. When contraction occurs, the pipe will tend to become taut between the anchor points. This does not damage the pipe because of polyethylene's unique ability to stress relieve and relax with time.

An approximation of the amount of lateral deflection, as shown in the sketch below (neglecting soil-pipe friction), can be calculated as follows:



Where: Δy = lateral deflection, inches
 L = length of pipe between anchors, inches
 α = coefficient of thermal expansion, in/in/°F
 ΔT = change in temperature, °F

FOR EXAMPLE:

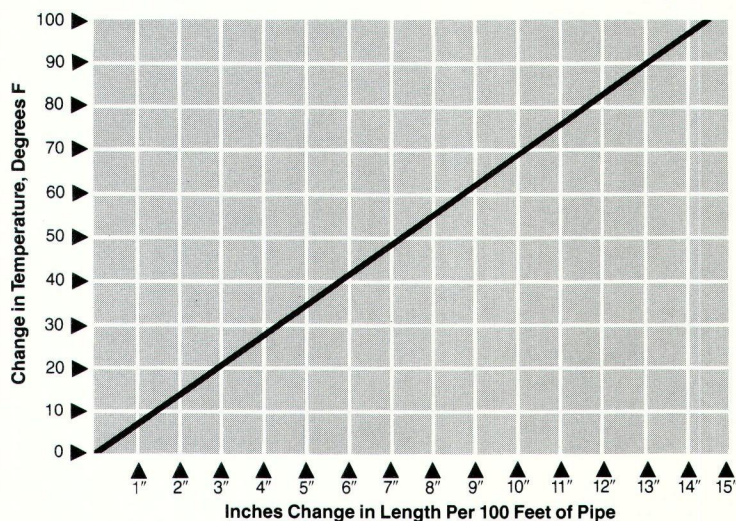
A pipeline installed on top of the ground in a straight condition and anchored at 50-foot intervals undergoes an increase in temperature of 50°F.

$$\Delta y = 50 \text{ ft.} \times 12 \text{ in./ft.} \sqrt{.50 \times .00012 \times 50^\circ\text{F}}$$

$$\Delta y = 33 \text{ in.}$$

Chart 4.

Linear Expansion & Contraction of Driscopipe



Note: Expansion or contraction is not a function of diameter or wall thickness

If installed in a straight condition and the operating temperature decreases, the stresses produced by the temperature change will be absorbed by the pipe. Remember, these calculations are only theoretical. Actual thermal movement will be less than the theoretical because of the pipe's ability to undergo stress relaxation. As stated in the *Systems Design* brochure, the actual measured stress has been estimated to be approximately one-half that of the calculated stress. The bending strain for the fixed end condition will be maximum at the anchor points. The distance between anchors can be related to the desired maximum strain by:

$$\varepsilon = \frac{D\sqrt{96\alpha\Delta T}}{L} \quad \text{or} \quad L = \frac{D\sqrt{96\alpha\Delta T}}{\varepsilon}$$

Where: ε = strain. (usually 1% or less)
 D = pipe outside diameter, inches.
 α , ΔT and L are noted on page 13.

As temperature decreases, Driscopipe becomes stronger. However, even at temperatures below freezing, Driscopipe is flexible. Should water inside Driscopipe freeze, the pipe does not burst and will resume its function upon thawing. Of course, the pipe should not be pressurized while it is frozen nor heated externally with an open flame. Thawing should be allowed to occur naturally, by the use of chemicals, or by a heat source which will not damage the pipe, such as warm air or warm water (not steam). Low thermal conductivity values for Driscopipe slows the heat transfer and inhibits freezing.

Pipe Support

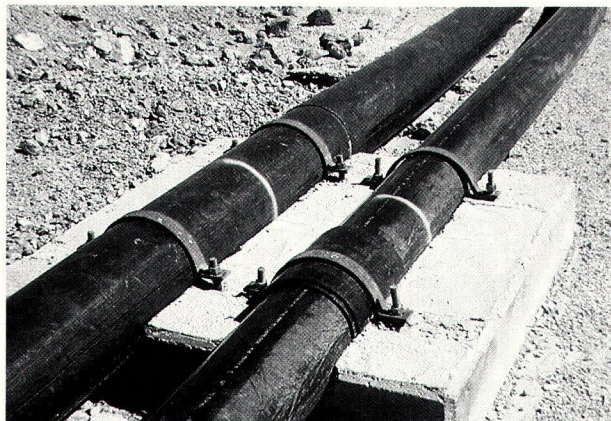
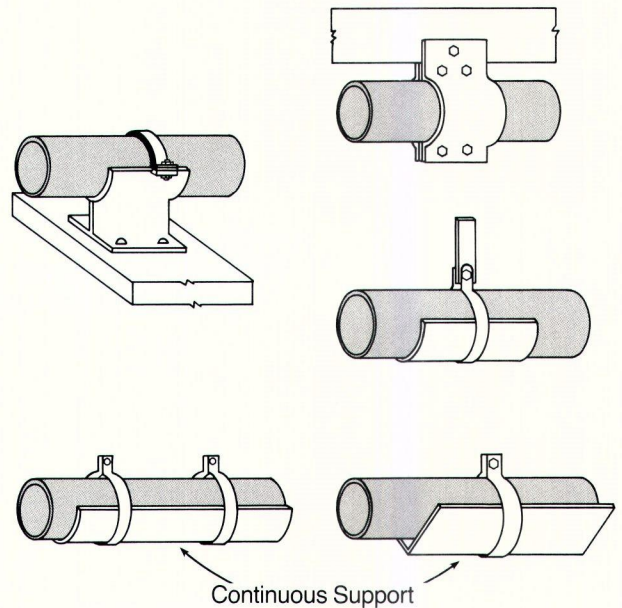
Following are recommendations for proper support of all types of above ground piping.

- If temperature or weights of the pipe and fluid are excessive, continuous support is recommended. Installation above 100°F should have continuous support or shorter support spacing. For temperatures over 150°F, continuous support is required.

- Supports which run underneath the pipe and do not grip it should cradle the pipe for a length equivalent to approximately 1/2-1 pipe diameter and not less than 120° of the pipe diameter. The supports should be free of sharp edges.
- The support should be capable of restraining the pipe from lateral or longitudinal movement if so designed. If the pipeline is designed to move during expansion, the sliding supports should provide a guide without restraint in the direction of movement.
- Pipe lines across bridges may require insulation to minimize thermal movement.
- Heavy fittings and metal flanged connections should be supported on either side.

Refer to the *Systems Design* brochure for proper spacing of pipe supports. Figure 4 illustrates some typical pipe hangers and supports for plastic piping.

Figure 4.



The spacing of the concrete weights will depend on the size of the weight and is normally limited to 10 to 15 feet apart. A conservative *maximum* spacing between weights may be obtained from Chart 4. This spacing is based on a maximum of one percent strain in the wall of the pipe due to deflection between weights and a maximum deflection of no more than 5% of the spacing.

EXAMPLE:

Install a 16" SDR 15.5 line across a fresh water lake to carry a brine solution with a density of 72.9 lbs/cu. ft. Weights shall be fabricated from 150 lbs/cu. ft. concrete.

$$K = 1.3, D_W = 62.4, D_C = 150$$

$$V_O = (\pi/4) (16)^2 / 144 = 1.396 \text{ cu. ft./ft.}$$

$$W_D = 20.64 \text{ lbs./ft.}$$

$$\text{Pipe inside diameter} = 16 - 2(1.032) = 13.936 \text{ in.}$$

$$W_P = (\pi/4) (13.936)^2 (72.9) / 144 = 77.22 \text{ lbs/ft.}$$

$$W_C = \frac{(1.3)(62.4)(1.396) - (20.64 + 77.22)}{1 - (1.3)(62.4)/150} = 33.5 \text{ lbs./ft.}$$

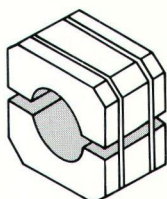
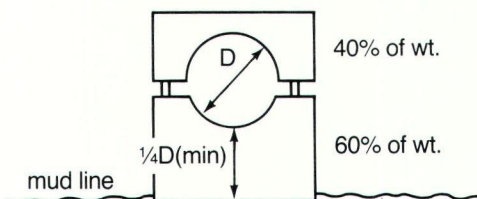
Maximum spacing of weights is 30.5' (See Chart 4).

With weights 10 feet apart, each will weigh $10 \times 33.5 = 335 \text{ lbs.}$ If 400 lb. weights are available, spacing will be $400 \div 33.5 = 11.94 \text{ ft.} = 12 \text{ ft.}$

If it is possible that air can get into the pipe, extra weight should be allowed and the weight spacing shortened. Gas pipelines (specific gravity = 0.00) must be designed for underwater stability when full of gas at zero pressure and thus have a design K greater than 1.00. Therefore, the pipeline, with weights attached, will sink. In this situation, floats will always be required to float the pipeline onto the water.

In general, the pipe can deflect considerably between weights with only a small resulting strain value which is well within the strength of the pipe. If a current is present, movement of the pipe itself is not harmful, however, any sharp rocks or objects it might contact may damage it. If waves or currents present a problem, the best solution is to trench and bury the weighted pipeline.

Anchor Weight Designs



Strap-on



Round Bolt-on

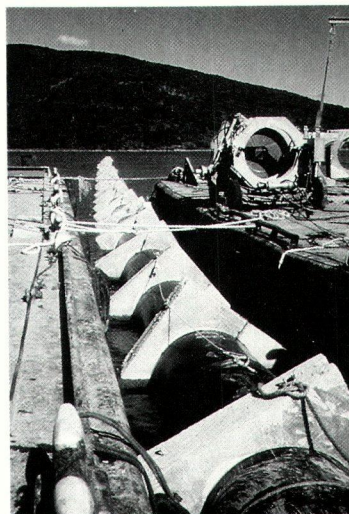
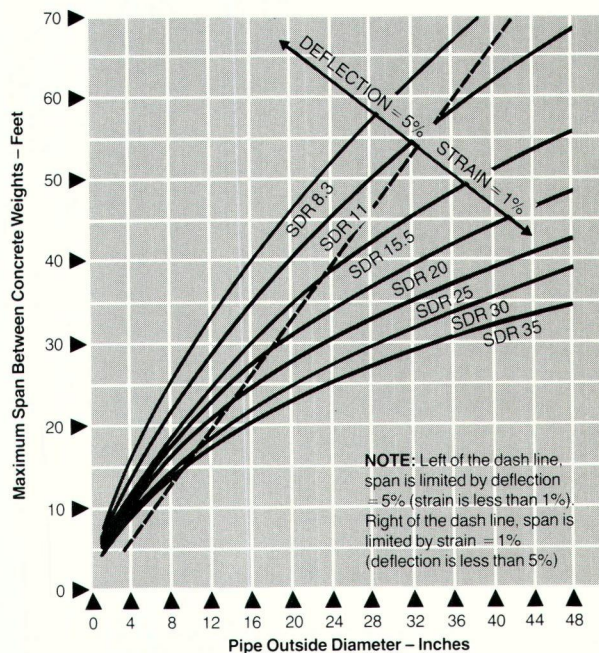


Chart 5.

Maximum Span Between Concrete Weights for Underwater Driscopipe Pipelines



Installation of the ballast weights to the pipe is usually accomplished on shore. Several weights can be installed at one time depending on manpower and work space. To minimize drag and aid movement of the weighted pipe into the water, a wooden or steel ramp can be fabricated at water's edge.

Ballast weights may also be installed from a barge or raft to the pre-assembled pipe stored on the water. The pipe is lifted from the water onto the raft to install the weights.

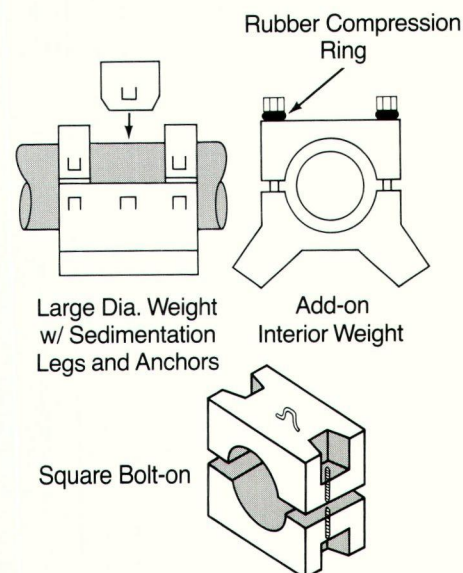


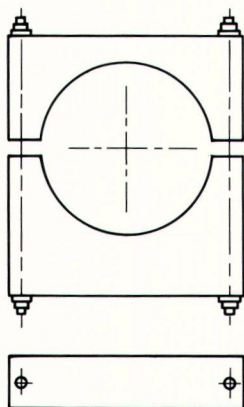
Chart 5.

Concrete Weights*

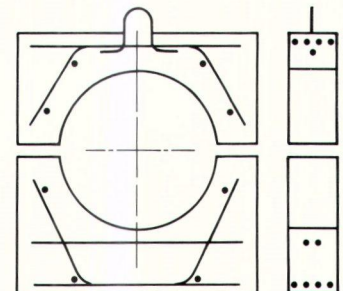
(Dry weight in pounds per foot of pipeline)

NOM. SIZE	SDR	Specific Gravity of Flowing Product											
		0.00	1.00	1.10	1.20	0.00	1.00	1.10	1.20	0.00	1.00	1.10	1.20
		K = 1.1				K = 1.2				K = 1.3			
		LOW PRESSURE				50 PSI							
3	32.5	7.6	0.8	0.1	- 0.5	9.0	1.7	1.0	0.2	10.7	2.8	2.0	1.2
4	32.5	12.5	1.3	0.2	- 0.9	14.9	2.8	1.6	0.4	17.8	4.6	3.3	2.0
5	32.5	19.1	2.0	0.3	- 1.4	22.8	4.3	2.5	0.6	27.1	7.0	5.0	3.0
6	32.5	27.1	2.9	0.5	- 1.9	32.3	6.1	3.5	0.9	38.5	9.9	7.1	4.2
7	32.5	31.3	3.4	0.6	- 2.2	37.4	7.1	4.2	1.0	44.5	11.5	8.2	4.9
8	32.5	45.9	4.9	0.8	- 3.3	54.7	10.4	6.0	1.5	65.2	16.8	12.0	7.2
10	32.5	71.3	7.3	1.3	- 5.1	85.0	16.1	9.2	2.4	101	26.2	18.7	11.1
12	32.5	100	10.8	1.8	- 7.1	120	22.7	13.0	3.3	142	36.8	26.2	15.7
14	32.5	121	13.0	2.2	- 8.6	144	27.4	15.7	4.0	172	44.4	31.6	18.9
16	32.5	158	16.9	2.9	- 11.2	188	35.7	20.5	5.2	224	58.0	41.3	24.7
18	32.5	200	21.4	3.6	- 14.2	238	45.2	25.9	6.6	284	73.4	52.3	31.2
20	32.5	245	26.5	4.5	- 17.6	294	55.9	32.0	8.2	351	90.6	64.6	38.5
21.5	32.5	285	30.6	5.1	- 20.3	340	64.5	37.0	9.4	405	105	74.6	44.5
24	32.5	355	38.1	6.4	- 25.3	424	80.4	46.1	11.8	505	130	93.0	55.5
28	32.5	483	51.9	8.7	- 34.4	577	109	62.7	16.0	687	178	127	75.6
31.5	32.5	612	65.7	11.0	- 43.6	730	139	79.4	20.2	870	225	160	95.6
36	32.5	799	85.6	14.4	- 56.9	954	181	104	26.4	1136	293	209	125
42	32.5	1088	117	19.6	- 77.5	1298	246	141	36.0	1546	399	285	170
48	32.5	1376	148	24.6	- 98.0	1642	312	179	45.5	1957	505	360	215
54	32.5	1800	193	32.0	- 128.0	2150	407	233	60.0	2560	660	471	281
65 PSI													
6	23.5	25.8	3.0	0.7	- 1.6	31.0	6.2	3.7	1.2	37.1	10.0	7.3	4.6
8	27	44.8	5.0	1.0	- 3.0	53.6	10.4	6.1	1.8	63.9	16.9	12.2	7.5
10	25.3	68.9	7.8	1.6	- 4.5	82.5	16.3	9.6	3.0	98.6	26.3	19.1	11.8
20	25.3	239	26.8	5.7	- 15.5	286	56.3	33.3	10.4	341	91.0	66.0	41.0
24	25.3	344	38.7	8.2	- 22.3	411	81.0	48.0	15.0	491	131	95.0	59.0
30	26	539	60	12.0	- 35.0	645	126	75	23.0	770	205	148	92
36	26	776	87	18.0	- 53.0	929	182	107	33.0	1110	295	213	132
42	26	1057	118	24.0	- 70.0	1264	248	146	45.0	1510	400	290	180
48	26	1380	154	32.0	- 93.0	1651	324	191	58.0	1972	525	380	234
54	26	1747	195	40.0	- 115.0	2090	410	242	74.0	2500	663	480	300

NOTE: Contact your area Driscopipe Distributor for references of concrete weight Designer /Suppliers.



Small Bolt-thru Design



Inner View of Rebar

Chart 5.

Concrete Weights*

(Dry weight in pounds per foot of pipeline)

NOM. SIZE	SDR	Specific Gravity of Flowing Product											
		0.00	1.00	1.10	1.20	0.00	1.00	1.10	1.20	0.00	1.00	1.10	1.20
		K = 1.1				K = 1.2				K = 1.3			
110 PSI													
2	15.5	3.1	0.4	0.1	− 0.1	3.7	0.8	0.5	0.2	4.4	1.3	1.0	0.7
3	15.5	6.6	0.9	0.3	− 0.3	8.0	1.8	1.1	0.5	9.7	2.8	2.1	1.5
4	15.5	11.0	1.4	0.5	− 0.5	13.3	2.9	1.9	0.8	16.0	4.7	3.5	2.4
5	15.5	16.8	2.2	0.7	− 0.8	20.3	4.4	2.9	1.3	24.4	7.1	5.4	3.7
6	15.5	23.8	3.1	1.0	− 1.1	28.7	6.3	4.1	1.8	34.6	10.1	7.7	5.2
8	15.5	40.3	5.2	1.7	− 1.8	48.7	10.7	6.9	3.1	58.6	17.2	13.0	8.9
10	15.5	62.6	8.1	2.6	− 2.9	75.6	16.6	10.7	4.8	91.0	26.6	20.2	13.8
12	15.5	88.0	11.3	3.7	− 4.0	106	23.3	15.0	6.7	128	37.5	28.4	19.4
14	15.5	106	13.7	4.4	− 4.8	128	28.1	18.1	8.1	154	45.2	34.3	23.3
16	15.5	139	17.8	5.8	− 6.3	168	36.7	23.6	10.6	202	59.0	44.8	30.5
18	15.5	175	22.6	7.3	− 8.0	212	46.5	29.9	13.4	255	74.7	56.6	38.6
21.5	15.5	250	32.2	10.4	− 11.4	302	66.3	42.7	19.1	364	107	80.8	55.1
24	15.5	312	40.1	13.0	− 14.2	377	82.6	53.2	23.8	454	133	101	78.1
160 PSI													
1¼	11	1.3	0.2	0.1	− 0.1	1.6	0.4	0.3	0.2	2.0	0.6	0.5	0.4
1½	11	1.8	0.3	0.1	− 0.1	2.1	0.5	0.4	0.2	2.6	0.8	0.7	0.5
2	11	2.7	0.4	0.2	− 0.1	3.4	0.8	0.6	0.3	4.1	1.3	1.0	0.8
3	11	6.0	0.9	0.4	− 0.1	7.3	1.8	1.2	0.7	8.9	2.9	2.3	1.7
4	11	9.9	1.5	0.6	− 0.2	12.1	3.0	2.1	1.1	14.6	4.7	3.7	2.7
5	11	15.1	2.2	1.0	− 0.3	18.4	4.5	3.1	1.7	22.4	7.2	5.7	4.2
6	11	21.4	3.2	1.4	− 0.5	26.1	6.4	4.4	2.5	31.7	10.3	8.1	6.0
8	11	36.2	5.4	2.3	− 0.8	44.3	10.9	7.5	4.2	53.8	17.4	13.7	10.1
10	11	56.2	8.3	3.6	− 1.2	68.8	16.9	11.7	6.5	83.6	27.0	21.3	15.7
12	11	79.1	11.7	5.0	− 1.7	96.7	23.8	16.5	9.2	118	38.0	30.0	22.1
14	11	95.4	14.2	6.0	− 2.1	117	28.7	19.9	11.1	142	45.8	36.2	26.6
16	11	125	18.5	7.9	− 2.7	152	37.4	25.9	14.4	185	59.8	47.3	34.7
18	11	158	23.4	10.0	− 3.5	193	47.4	32.8	18.3	234	75.7	59.8	44.0
24	11	280	41.6	17.7	− 6.1	343	84.2	58.4	32.5	417	135	106	78.1
190 PSI													
¾	9.3	0.5	0.1	0.1	− 0.1	0.6	0.2	0.1	0.1	0.8	0.3	0.2	0.2
1	9.3	0.8	0.1	0.1	− 0.1	1.0	0.3	0.2	0.1	1.2	0.4	0.3	0.3
1¼	9.3	1.3	0.2	0.1	− 0.1	1.5	0.4	0.3	0.2	1.9	0.6	0.5	0.4
2	9.3	2.6	0.4	0.2	− 0.1	3.2	0.8	0.6	0.4	3.9	1.3	1.1	0.8
3	9.3	5.6	0.9	0.4	− 0.1	6.9	1.8	1.3	0.8	8.4	2.9	2.3	1.8
4	9.3	9.2	1.5	0.7	− 0.1	11.3	3.0	2.2	1.3	13.9	4.8	3.9	2.9
6	9.3	19.2	3.2	1.6	− 0.1	24.6	6.5	4.7	2.9	30.0	10.3	8.4	6.4
8	9.3	33.8	5.5	2.7	− 0.2	41.6	11.0	7.9	4.9	50.9	17.5	14.2	10.8
220 PSI													
4	8.3	8.7	1.5	0.8	0.1	10.8	3.0	2.2	1.5	13.3	4.8	3.9	3.1
6	8.3	18.9	3.3	1.7	0.2	23.4	6.5	4.9	3.2	28.8	10.4	8.6	6.7
8	8.3	32.0	5.6	2.9	0.3	40.0	11.1	8.2	5.4	48.8	17.6	14.5	11.4

NOTE: Where the concrete weight requirement is shown as a negative number, no weights are required for that operating condition, e.g. specific gravity of the flowing product is 1.2 and K = 1.1. However, in order to sink the line into position, it must be filled with the heavier operating fluid or weights must be added.

*Calculations of weights are based on density of fresh water, $D_w = 62.4 \text{ lb./ft}^3$, and density of concrete, $D_c = 150 \text{ lb./ft}^3$.

Launching and Sinking

To allow the pipeline to float in the water until the sinking operation, it is necessary to install a bulkhead on each end of the pipeline to prevent water from entering the pipe. This is done with a flange assembly and metal blind flange. This provides an airtight seal, thus allowing the line to float. The pipeline is then moved into position for sinking by marine craft.

The transition of the pipeline from land to water should be done in a trench before the sinking operation begins. It is important that this trench be adequate enough to protect the pipeline from damage by debris, ice, boat traffic, or wave action.

The sinking operation is controlled by the addition of water to one end and the evacuation of the enclosed air through the opposite end. The addition of water to the pipeline at a controlled rate will ensure that the pipe lies in the trench or adjusts to the profile of the bottom. The rate of sinking should also be controlled to prevent an excessive bending radius (about 1000 ft per hour).

During the sinking, water must be prevented from running the full length of the pipe. This can be done by inducing a water pocket at the shore end by lifting the off shore pipe above the water. Water is introduced into the pipeline closest to shore allowing it to sink. Once the pipe seeks an equilibrium, additional water can be added gradually to complete sinking the line.

After the pipeline is installed on the bottom or in the trench, a thorough inspection should be made of the pipe installation. All weights should be properly positioned, with the pipe positioned in the center of the trench, or within the right-of-way. As stated before, the trenched area where the pipe leaves the shore and enters the water, should be adequate to protect the pipe from damage. And where backfill is used, inspect for proper installation and required depth.

For deep lake or ocean out-falls (ie: 50 ft – 2000 ft), the weighted pipe must be sunk full of water, or sunk by displacing pressurized air (65 psi) by pumping pressurized water in at a controlled rate as described above. This prevents hydrostatic collapse of the pipe and slippage of the concrete weights as deep depths are reached.



It is better for a marine pipeline to be too long than too short. Never attempt to flange up a pipeline that is too short by drawing the bolts together, thus stretching the line. This places the flanged connection in severe tension and could cause eventual problems. Extra length can often be accommodated by snaking the pipe.

Intake and Outfall Diffusers

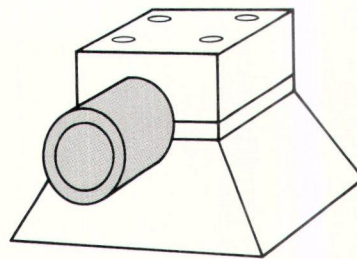
Phillips Driscopipe has the capability of providing special diffuser assemblies used in terminating outfall pipelines. Special sinking provisions are sometimes required, so that the vertical diffuser is exposed, yet is subject to as little damage from navigational hazards as possible. Your Phillips Driscopipe representative will be very glad to assist with diffuser design capability.

INSERT RENEWAL INSTALLATIONS

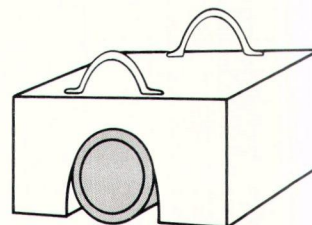
Insert renewal, or slip lining, is an effective and economical method for rehabilitating a deteriorated pipeline. Installation is simple and fast with a minimum of interruption to the pipeline operation.

The pipeline to be relined is cleaned of obstructions and debris. A closed circuit TV survey of the clean pipeline is recommended to locate connections and reveal existing defects. After a test run with the pulling head, the liner may be attached, pulled into place, and secured. The pulling head may be either a flexible, field fabricated type or a rigid type made of steel that is bolted to the end of the pipe (Ref: Tech Note #19).

Installation procedures for insert renewal are found in ASTM F585 *Insertion of Flexible Polyethylene Pipe into Existing Sewers* and PPI bulletin, *Pipeline Rehabilitation with Polyethylene Pipe*. Refer to *Systems Design* brochure for proper insert renewal design. Ensure that the sliplined pipe is in thermal equilibrium with the ground and sewer before cutting the PE pipe to length in the manhole.



Trapezoidal Base Design for Poor Load Bearing Subaqueous Mud or Soil



Drop-On Horseshoe Anchor

TESTING POLYETHYLENE PIPELINES

Driscopipe piping systems should be hydrostatically pressure tested before being put into service. Water is the preferred test medium. After all free air is removed from the test section, raise the pressure at a steady rate to the required pressure. The pressure in the section shall be measured as close as possible to the lowest point of the test section.

Pressure Piping Systems

The initial pressure test can be conducted before or after the line is backfilled. However, it is advisable to cover the pipe at intervals, or particularly at curves to hold the pipe in place during pressure tests. Flanged connections may be left exposed for visual leak inspection.

Test pressure should not exceed 1.5 times the rated operating pressure of the pipe or the lowest rated component in the system. The initial pressure test shall be applied and allowed to stand without makeup pressure for a sufficient time to allow for diametric expansion or pipe stretching to stabilize. This usually occurs within 2-3 hours. After this equilibrium period, the test section can be returned to the 1.5 times operating pressure, the pump turned off and a final test pressure held for 1-3 hours.

Remember that pressure drop will not only occur due to pressure expansion, but also due to fluctuations in temperature during the test. As the temperature increases, the gauge pressure will decrease.

Allowable amounts of makeup water for expansion during the pressure test is shown in Chart 6, taken from PPI Technical Report TR 31/9-79. If there are no visual leaks or significant pressure drops during the final test period, the pipeline passes the test.

The preparations for the pressure test are usually made the afternoon before, the test period run in the morning, and the de-watering with clean-up done after lunch.

Refer to American Society of Mechanical Engineers code for pressure piping B 31.8 Appendix N for a general recommended practice and procedure for hydrostatic testing.

Chart 7.

Allowance for Expansion Under Test Pressure*

Nominal Pipe Size (in.)	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0
54	22.0	35.0	55.0

*These allowances only apply to the test period and not to the initial expansion phase.



Non-Pressure Piping Systems

Testing of non-pressure, gravity flow pipes, whether above or below ground, may be accomplished by closing all openings below the top of the section to be tested. For test purposes, provide a means to raise the water level to a height of at least 3-5 feet above the highest point in the line being tested. The water level only need be maintained long enough to determine there are no leaks. If impractical to raise the water level as suggested, the line can be pressurized with low pressure water or air. Pressure normally should not exceed 5-10 psi over a time period of 5-10 minutes.

REPAIRING DAMAGED POLYETHYLENE PIPE

Hauling, unloading, stringing and installing Driscopipe should be done with the care necessary to prevent damage to the pipe. Since all plastics are softer than steel, poor handling can result in abrasions, cuts, gouges, punctures, etc.

All pipe should be carefully examined before installation and damaged pipe removed. Damage that results in reduction of the wall thickness by more than approximately 10% should be cut out and discarded as it may impair long-term service life. Minor scuffing or scratching will have no adverse effect on the serviceability of Driscopipe.

Damaged pipe may be repaired by any of the joining methods previously discussed. *Heat fusion is preferable for all applications where conditions permit.* Some of the joining methods are not satisfactory for continuous pressure systems.

Kinks – Normally, kinks do not impair the serviceability in low pressure applications. For high pressure applications, severe kinks should be cut out and the pipe re-joined by fusing.

Ovality – Out-of-roundness due to excess loading during shipment or storage will not hinder the serviceability of the pipe. The pipe should not be considered damaged unless the fusion machine clamps cannot successfully round out the section for a good fusion joint. Occasionally the pipe can be placed in an unstressed condition so that it will relax and gradually round out.

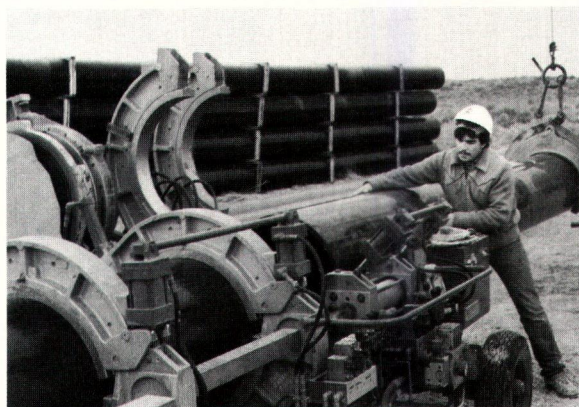
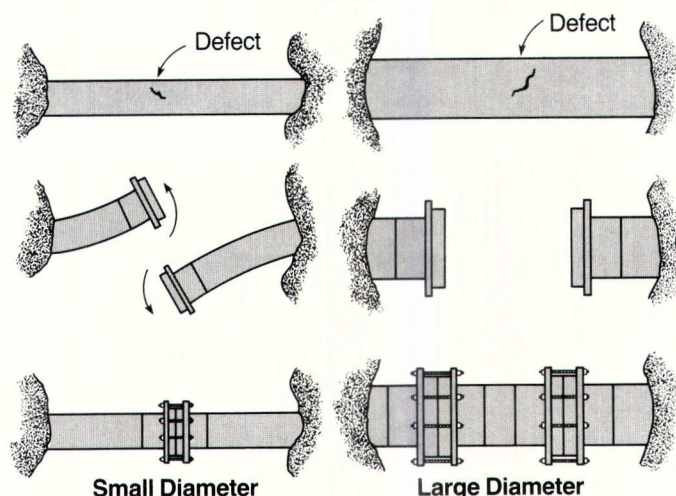
Permanent Repair

Repair after installation can be accomplished on small diameter pipe by removing a minimal amount of backfill, cutting out the defect, move the pipe ends to one side and fuse flanged connections to each end. The flanges are then bolted together. It is preferable that the flanged connection be under a slight compression when reconnected. The bolts should never be used to pull up a flanged joint.

Repairing large diameter pipe which is not as flexible as smaller pipe can be accomplished with a flanged spool piece. The damaged section is removed, the butt fusion machine is lowered into the ditch to fuse flanged connections to each open end and the flanged spool assembly is bolted into place. The flanged spool must be precisely made to fit the resulting gap in the pipeline.

Figure 7 illustrates these methods.

Figure 7.



Mechanical Repair

A wrap-around-type repair clamp with integral gasket can be used but is not as permanent as a flanged or fused repair. This type of repair is principally used in buried applications because the compacted soil restrains the pipe from thermal movement and pull-out forces caused by internal pressure. A longer repair clamp generally provides greater sealing capability on the thermoplastic pipe.

A clamp length of 1½-2 times the nominal pipe diameter works best. Tighten the clamp evenly around the pipe which has been wiped clean of all foreign material. Afterwards, properly backfill and compact around and over the pipe before it is pressurized.

Fitting Repair

Repairing an installed fitting is normally accomplished by replacement with a new flanged fitting. Various attempts have been made to repair or join ultra high molecular weight Driscopipe using a common hot air melt welding gun. Driscopipe 8600 material does not lend itself to this form of repair, especially in trying to achieve a pressure tight repair or joint.

Underwater Repair

To accomplish underwater repair on a pipeline, the pipe ends must be floated or raised above the water so that a flange assembly can be fused to each end. The ends are then lowered into position on the bottom and bolted together underwater.

Appropriate lifting equipment must be used to ensure that the pipe does not kink and that the minimum bend radius is not exceeded. Normally, it is not necessary to remove the weights before lifting but extreme care should be exercised when lifting the pipe above the water level with weights attached.

Miscellaneous Repair Methods

Under certain situations, a thermofit heat shrink sleeve can be used to seal a puncture or leaking joint. Many types of sleeves are available, such as those fabricated by Raychem Corporation out of crosslinked polyethylene. The sleeves are coated on the inside with a special thixotropic sealant which, when heated, is forced into a puncture or joint to seal and encapsulate.

Electro-fusion couplings have been used with some success. Consult with product manufacturers and Driscopipe distributors for proper application prior to use.

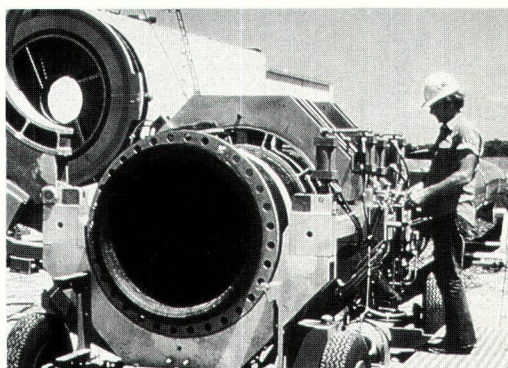
STATIC ELECTRICITY

Static electricity charges are generated on polyethylene pipe by friction, particularly during the handling of pipe in storage, shipping and installation. The flow of air or gas containing dust or scale will also build up significant static charges, as will the flow of dry materials through the pipe, such as in the case of gravity flow grain chutes. These charges are a safety hazard, particularly in areas where there is leaking gas, or an explosive atmosphere.

Plastic pipe is a non-conductor of electricity and the static charge will remain in place until some grounding device comes close enough to allow it to discharge.

The discharge of these static electric charges generally happens when workmen touch the pipe themselves or upon application of mechanical tools to the pipe. The result of the discharge will vary from an insignificant physical shock to possible ignition of a flammable gas-air mixture. The most effective and simple method to minimize the hazard of the discharge is to apply a film of water to the work surface, to drain away the static electricity. A ground wire on the plastic pipe will only discharge from that point, since the plastic is a non-conductor.

When workmen must enter a bellhole to hot tap a line or make emergency repairs to a damaged or leaking line, it is important that all safety precautions be observed. The exposed working surface of the polyethylene line should be doused with water before entering the area and a wet cloth should be kept on the pipe to drain off static charge build up while working on the line.



INSTALLATION PRECAUTIONS FOR FABRICATED FITTINGS

Driscopipe fabricated tees, elbows and wyes are made by heat fusing or sidewall fusing together special cut segments of Driscopipe pipe to obtain the desired fitting. The configuration of these fittings, and the fact that they are fabricated rather than molded, requires that certain precautions be taken when installing them into a piping system.

There have been a few instances where fabricated fittings, after being fused to the pipe, have been damaged due to excessive strain imposed by improper handling. Driscopipe pipe and fittings are generally very tough and forgiving of mishandling due to the flexible nature of the material itself. However, the tensile strength of a polyethylene material is much less than steel and it will not support the excessive lifting and pulling forces that can be exerted by powered installation equipment.

The installation procedures should provide the least possible amount of lifting and moving of the assembled pipe and fabricated fittings. If it becomes necessary to pull the assembly beside the ditch to properly position it, the fabricated fitting should never be used as the point of attachment for the pulling line.

The fusion joining of a fabricated tee and wye into a system becomes complicated because of the third side. It is not too difficult to keep strain off the fitting

when fusing pipe to the running side of the tee and lifting and lowering this much of the assembly into position in a ditch. It is when sufficient pipe is added to the third (branch) side to permit the laying of pipe in this direction, that the assembly becomes very difficult to handle. Final handling and positioning of these assemblies requires extra handling equipment and additional precautions to prevent damage to the fabricated fitting.

Recommended Alternate Method: The need for extra equipment and much of the possibility of damage can be eliminated by altering the method of installing the fabricated tee and wye to include the use of a flanged connection on the branch side. This will allow final positioning to take place before the branch side is connected. There will be some instances where it will prove very advantageous from an installation viewpoint to use flanged connections on two sides of a tee or wye and also on one side of the elbow. This allows the pipe to be laid from either direction, pushed or pulled into tight locations, rolled into the ditch, and generally handled much easier and faster . . . before the final connection is made at the tee, wye or elbow. From the standpoint of economy, speed and ease of installation, and to eliminate the occurrence of excessive installation stresses on fabricated fittings, it is recommended that flanged connections always be used on the branch side of tees and wyes and on one end of elbows.

For example, if, when installing a tee in the line, long lengths of pipe are fused to each of the three sides of the tee and it is then lifted up and out of the heat fusion unit without supporting the excess weight of the pipe hanging and being lifted at the same time, the tee might be torn apart. If the assembly of the tee into the piping system is done in the manner described, then precautions must be taken to lift and support the pipe on all sides of the tee as it is removed from the fusion unit and lowered to the ground or into the ditch. The fabricated tee (or elbow or wye) must not be allowed to carry the weight of the pipe that is heat fused to it.

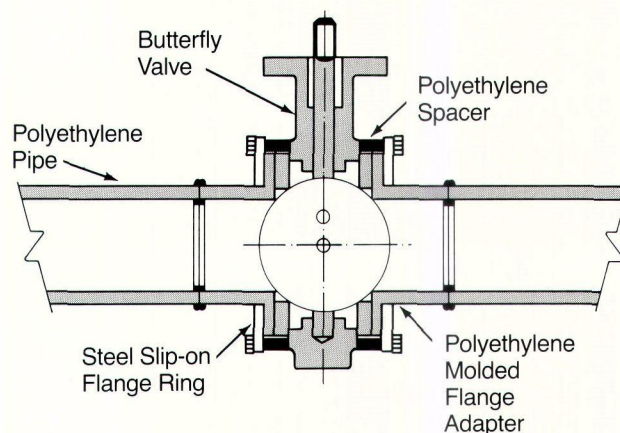
SPECIAL NOTE

Driscopipe Butterfly Valve Connections

When connecting a Driscopipe molded stub end or flange adapter to a butterfly valve make sure the butterfly disc will freely swing to the open position without hitting the face of the stub end or flange adapter. This is especially true with flangeless or wafer type valves used with higher pressure (thicker walled) Driscopipe.

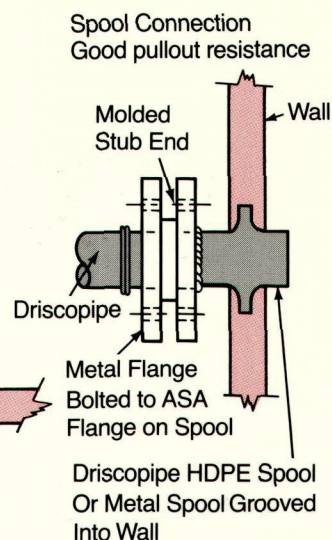
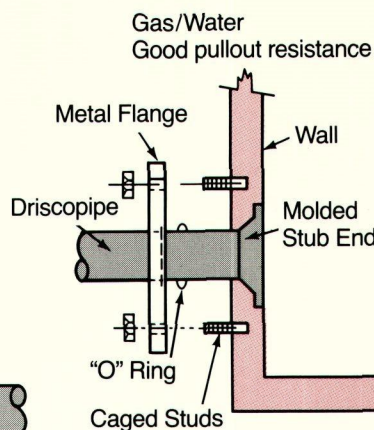
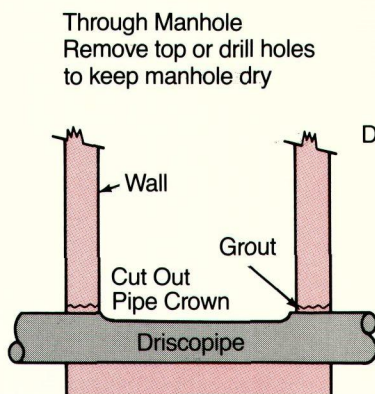
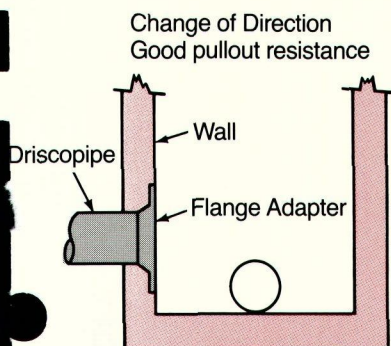
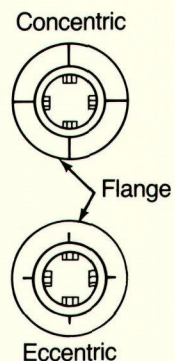
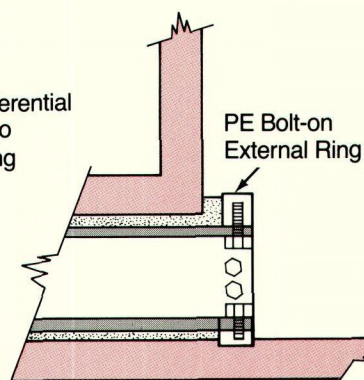
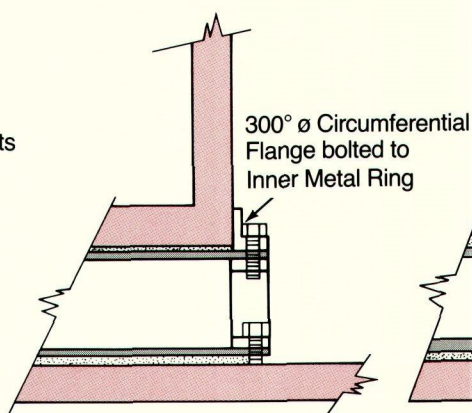
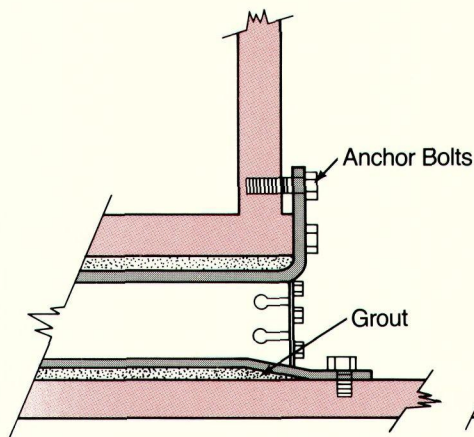
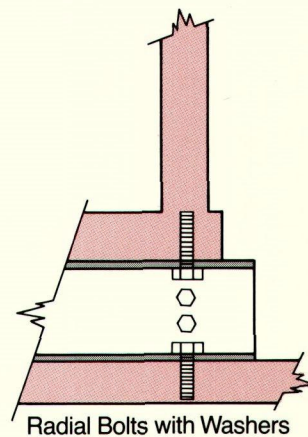
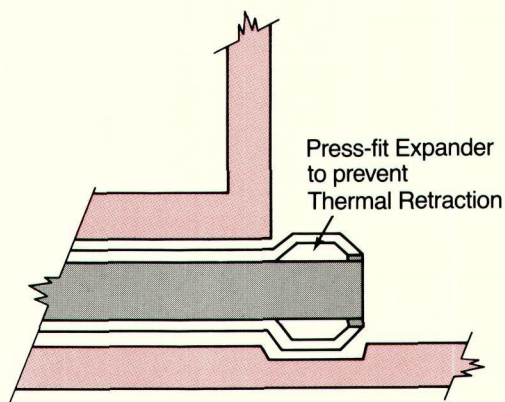
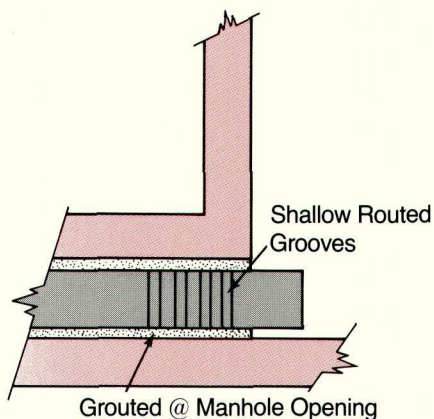
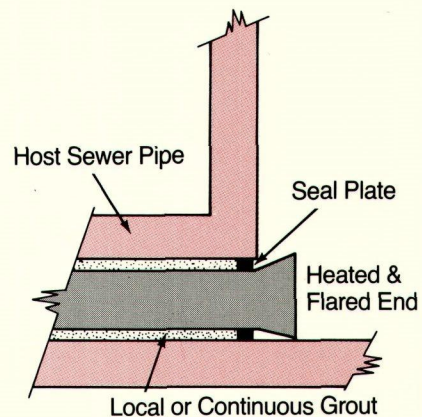
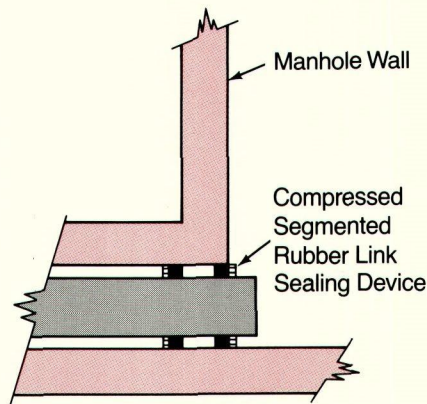
As can be seen in the sketch, if there is interference a spacer can be used between the flange face and the valve. This provides clearance for the butterfly disc to open and close. Driscopipe can furnish these spacers out of high density polyethylene sheet material if necessary. In most cases a one inch thick spacer will provide the required clearance.

However, each Driscopipe to butterfly valve connection should be analyzed for proper clearance.



Manhole Terminations, Sealing, and Anchoring

NOTE: Phillips Driscopipe, Inc. recommends manhole and vault termination installations which provide *both* a hydraulic seal and axial restraint, especially when seasonal water temperatures change causing axial expansion or contraction of the thermoplastic HDPE pipe (Terminations using activated Oakum or O-Ring seals *alone* are not recommended.).





Phillips Driscopipe, Inc.

A Subsidiary of Phillips 66 Company

To Secure Product Information or Leave a
Message for a Sales Engineer or Technical
Service Representative:

Mail:

Attn: Customer Service Department
P.O. Box 83-3866
2929 North Central Expressway
Suite 100
Richardson, Texas 75083

Phone:

U.S. Domestic Toll Free (800) 527-0662

Fax:

214-783-2689

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**PLASTICS WITH
POWER TO WIN®** 

CPVC PIPE SPECIFICATIONS

Manufacturer: Lasco Fluid Distribution Products
540 Lasco Street
Brownsville, Tennessee 38012
(901) 772-3180

Model: CPVC Type 1, Grade 1

Size: Varies

Wall Thickness: Schedule 40, 80 Pipe and Fittings

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

Physical Properties of PVC and CPVC

Poly(Vinyl Chloride) PVC

This thermoplastic material is the largest volume member of the vinyl family. It is the most widely used material for plastic pipe, valves, and fittings.

PVC has many advantages over conventional piping materials. Just a few are:

Corrosion Resistance - outstanding chemical resistance to nearly all acids, alkalis, alcohols, halogens and many other corrosive materials.

Fluid Friction - less friction loss as compared to metallics. Lower pressure drop = smaller pumps = less electricity.

Thermal - lower thermal conductivity than for metallics. Less moisture condensation, reduced heat loss, and more uniform fluid temperature. (Insulation is usually not required.)

Electrical - a non-conductor of electricity. Eliminates galvanic or electrolytic corrosion that causes expensive repairs.

Other - weather resistant, high strength-to-weight ratio, dent resistant, non-toxic, maintains properties over long periods of time, easy to install, maintenance-free.

Chlorinated Poly(Vinyl Chloride) CPVC

An industrial thermoplastic piping material which can be used for higher temperature applications. It is a specialty polymer with a higher glass transition point, which means advantages over regular PVC pipe and fittings while retaining the excellent chemical resistant properties of PVC.

CPVC retains its mechanical strength at higher temperatures.

CPVC = 200°F Max.

PVC = 140°F Max.

Eslon PVC and CPVC pipe and fittings compounds are blended according to strict industry guidelines. Specifications and requirements are set forth by agencies such as the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF). Compliance with these standards assures the customer that they are receiving products manufactured from materials that will perform the tasks for which they are designed.

BASIC MATERIAL DATA

	PVC	CPVC
• Base Resin	Poly(vinyl chloride) Homopolymer	Chlorinated Poly(vinyl chloride)
• Commercial Classification of Rigid Compound *	Type I, Grade 1 PVC 1120	Type IV, Grade 1 CPVC 4120
• Class Designation	12454-B	23447

* Rigid Material is also known as Un-Plasticized (U-PVC)

Specific Material Data

MECHANICAL

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Tensile Strength @ 73°F	PSI	7,280	8,000	Same in Circumferential Direction	D-638
Modulus of Elasticity in Tension @ 73°F	PSI	420,000	360,000	Ratio of Stress to Elongation (Young's Modulus)	D-638
Compressive Strength @ 73°F	PSI	9,600	10,920		D-695
Flexural Strength @ 73°F	PSI	12,700	15,100	Tensile Stress on Bent Sample at Failure	D-790
Izod Impact @ 73°F	Ft-Lbs/in of Notch	1.6	1.5	Impact Resistance of a Notched Sample to a Sharp Blow	D-256
Relative Hardness @ 73°F	Durometer "D" Rockwell "R"	80 ± 3 110-120	— 119	Equivalent to Aluminum —	D-2240 D-785

THERMODYNAMICS

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Coefficient of Thermal Linear Expansion per °F	in/in/°F	2.8×10^{-5}	3.8×10^{-5}		D-696
Thermal Conductivity	BTU/hr/ft ² /°F/in	1.3	0.95	Average Specific Heat of 0-100°C	
Specific Heat	CAL/g/°C	0.20-0.28		Ratio of Thermal Capacity to that of Water at 15°C	
Maximum Operating Temperature	°F	140	200	Pressure Rating is Directly Related to Temperature	
Heat Deflection Temperature @ 264 PSI	°F	165	217	Thermal Vibration and Softening Occurs	D-648
Decomposition Point	°F	400+	400+	Scorching by Carbonization and Dehydrochloration	

ELECTRICAL

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Dielectric Strength	VOLTS/MIL	1,400	1,250	Electric Insulator and Non-Magnetic	D-147
Dielectric Constant 60 Hz @ 30°F		3.70	3.25 @ 1,000 Hz		D-150
Power Factor 60 Hz @ 30°F	%	1.255	.007 @ 1,000 Hz		D-150
Specific Volume Resistivity @ 73°F	Ohm/CM	3.5×10^{15}	3.4×10^{15}		D-257

OTHER

Properties	Unit	PVC	CPVC	Remarks	ASTM Test
Specific Gravity	g/cc	1.38	1.55	Relative Density	D-792
Water Absorption	%	+0.05%	+0.03 @ 73°F +0.55 @ 180°F	Weight Gain in 24 Hrs.	D-570
Poisson's Ratio @ 73°F		0.38	0.27		
Cell Designation		12454-B	23447		D-1784

Weights and Dimensions

PVC AND CPVC SCHEDULE 80 PIPE

Nominal Pipe Size in. (mm)	Outside Diameter in.	Min. Wall Thickness in.	Max. Working Pressure PSI @ 73°F		Approx. Weight lbs./ft.	
			Plain End	Threaded	PVC	CPVC
¼ (6.35)	0.540	0.119	1130	570	0.101	—
⅜ (9.53)	0.675	0.126	920	460	0.139	—
½ (12.7)	0.840	0.147	850	420	0.208	0.228
¾ (19.05)	1.050	0.154	690	340	0.280	0.308
1 (25.4)	1.315	0.179	630	320	0.411	0.453
1¼ (31.75)	1.660	0.191	520	260	0.569	0.624
1½ (38.1)	1.900	0.200	470	240	0.690	0.760
2 (50.8)	2.375	0.218	400	200	0.957	1.050
2½ (63.5)	2.875	0.276	420	210	1.460	1.602
3 (76.2)	3.500	0.300	370	190	1.950	2.146
4 (101.6)	4.500	0.337	320	160	2.844	3.126
5 (127)	5.563	0.375	290	"Threading Pipe Above 4" Is Not Recommended"	3.953	—
6 (152.4)	6.625	0.432	280		5.433	6.077
8 (203.2)	8.625	0.500	250		8.251	9.263
10 (254)	10.750	0.593	230		12.243	13.886
12 (304.8)	12.750	0.687	230		16.831	—
14 (355.6)	14.000	0.750	220		19.960	—
16 (406.4)	16.000	0.843	220		25.550	—

PVC AND CPVC SCHEDULE 40 AND SDR PRESSURE PIPE

Nominal Pipe Size in. (mm)	Outside Diameter in.	PVC And CPVC Schedule 40			SDR 26/PR 160 160 PSI @ 73°F		SDR 21/PR 200 200 PSI @ 73°F		SDR 13.5/PR 315 315 PSI @ 73°F	
		Min. Wall Thickness in.	Max W.P. PSI @ 73°F	Approx. Weight lbs./ft.*	Min. Wall Thickness in.	Approx. Weight lbs./ft.	Min. Wall Thickness in.	Approx. Weight lbs./ft.	Min. Wall Thickness in.	Approx. Weight lbs./ft.
½ (12.7)	0.840	0.109	600	0.162					0.062	0.101
¾ (19.05)	1.050	0.113	480	0.219			0.060	0.122		
1 (25.4)	1.315	0.133	450	0.320			0.063	0.162		
1¼ (31.75)	1.660	0.140	370	0.431	0.064	0.210	0.079	0.260		
1½ (38.1)	1.900	0.145	330	0.519	0.073	0.270	0.090	0.330		
2 (50.8)	2.375	0.154	280	0.693	0.091	0.421	0.113	0.521		
2½ (63.5)	2.875	0.203	300	1.133	0.110	0.633	0.137	0.761		
3 (76.2)	3.500	0.216	260	1.455	0.135	0.923	0.167	1.131		
4 (101.6)	4.500	0.237	220	2.050	0.173	1.520	0.214	1.870		
5 (127)	5.563	0.258	190	2.780	0.214	2.330	0.265	2.854		
6 (152.4)	6.625	0.280	180	3.615	0.255	3.300	0.316	4.052		
8 (203.2)	8.625	0.322	160	5.436	0.332	5.600	0.410	6.851		
10 (254)	10.750	0.365	140	7.713	0.413	8.686	0.511	10.640		
12 (304.8)	12.750	0.406	130	10.195	0.490	12.214	0.606	14.949		
14 (355.6)	14.000	0.438	130	11.81						
16 (406.4)	16.000	0.500	130	15.14						

- Standard pipe length = 20 feet.
- Working pressures based on water at 73°F (23°C). See page 52.
- If operating temperature is above 73°F, working pressure must be de-rated. See page 52.
- **Warning:** PVC and CPVC products are not recommended for use in compressed air or gas systems.

*CPVC Schedule 40 pipe will be slightly heavier than PVC Schedule 40. Consult factory for exact weights.

Pressure Conversion Factors

To Obtain	Multiply
Kgf/cm ²	PSI × 14.223
BAR	PSI × 14.5
1 Inch of Hg	PSI × 0.4912
1 Ft of Head	PSI × 2.309
1 PSI	Ft of Head × 0.433

CONTROL VALVE SPECIFICATIONS

Manufacturer: Asahi/America
425 Riverside Avenue
Medford, Maryland 02155
(617) 391-2353

Model: Type 75 Butterfly Valve

Size: Varies

Operator: Gear

Body: PVC

Discs: PP

Seats: Nitrile

Seals: Same as seating material

Actuators: None

Options

- Wafer Style
- Carbon Steel Stem Extension

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

BUTTERFLY VALVES

INTRODUCTION

Introduction

Discussion

Warranty

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size, range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials insure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Butterfly Valves: Discussion

The name of this valve comes from the wing-like action of the flow-controlling disc which operates at right angles to the flow. The disc has about the same diameter as the connecting pipe and the flow is straight-through with a low pressure drop. Maintenance is easy because of the minimum number of moving parts. The butterfly valve can be used either as an "ON/OFF" type of valve, wherein the seating of the disc against an elastomeric seal is important, or it can be used as a control valve, wherein seating materials are unnecessary.

Asahi/America butterfly valves with seats are self-gasketing, eliminating the need for flange gaskets. These valves can be operated manually, electrically or pneumatically.

Asahi/America thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250° F, pressures to 150 PSI and flows up to 18,500 gpm.

When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electrochemical one. There is ionization or corrosion at the surface due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitability of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

WARRANTY—THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

Warranty and Liabilities

BUTTERFLY VALVES continued

Thermoplastic Materials

Elastomeric Materials

Note

Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalis, as well as gasoline, kerosine, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalis and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF-KYNAR® (POLYVINYLIDENE FLUORIDE) PVDF is a high molecular weight fluoro-carbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temperature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters.

FRP (FIBERGLASS WRAPPED POLYESTER) Unsaturated polyester thermoset resins are manufactured from glycols, dibasic acids and monomers. Inhibitors are used to control gel and curing during the cross linking process. An initiator is added at the final fabrication process to achieve cure. Working temperature range is 210° F. Chemical and corrosion resistance is excellent for acids, bases and some organics.

Elastomeric Materials

NITRILE (BUNA N) Nitrile rubber is a copolymer of butadiene and acrylonitrile. In addition to its good elastomeric properties, it is resistant to aliphatic hydrocarbons and aromatic solvents.

BUTYL Butyl rubber is a copolymer of isobutylene and isoprene, vulcanized in the same manner as natural rubber. Butyl has good resistance to most acids.

HYPALON® Hypalon® is DuPont's name for its elastomer of chlorosulfonated polyethylene used for diaphragms and valve seals.

EPDM (ETHYLENE PROPYLENE TERPOLYMER) This elastomer is particularly suited for diaphragms, valve seals, and "O"-rings. It can stand up to a variety of acids, bases, alcohols, and oxidizing chemicals.

NEOPRENE Neoprene is a chlorinated synthetic rubber which is used primarily as a diaphragm or sealing material in Asahi/America valves. Its use should be limited to lower temperature applications.

NATURAL RUBBER Natural rubber is a high molecular weight polymer of isoprene derived from the Hevea tree. It is used as a diaphragm and sealing material because of its excellent elastomeric properties and resistance to abrasion.

Note

Caution: Asahi/America Butterfly Valves are not recommended for use in compressed gas services. When testing, only hydrostatic pressure testing is recommended, with a gradual increase in pressure.

Teflon®, Viton® and Hypalon® are registered trademarks of DuPont.
Kynar® is a registered trademark of Pennwalt.

TYPE 75 BUTTERFLY VALVES LEVER AND GEAR

Features, Options

Sample Specification

Pressure Vs. Temperature

Vacuum Service

Cv Values

SPECIFICATIONS

SIZES: 1½"-24"

Lever: 1½"-8" Gear: 8"-24"

MODELS: Wafer style (for ANSI flanges)

OPERATORS: Lever, Gear

BODIES: PVC, PVDF

DISCS: PP, PVDF, PVC (optional)

SEATS: EPDM, VITON®, Nitrile (Buna N)
Butyl, Hypalon, Natural Rubber,
Neoprene, Chlorinated
Polyethylene (CPE)

SEALS: Same as seating material

ACTUATORS: Electric, Pneumatic

FEATURES

- Standard model has PVC body and polypropylene disc for better chemical and abrasion resistance at temperatures higher than can be achieved with PVC.
- Can be fitted with a variety of elastomeric seat materials to provide bubble-tight seating for a wide range of chemicals.
- Stainless steel shaft has full engagement with disc and is a non-wetted part isolated from the media by double "O" ring seals on top and bottom trunnions of disc.
- EPDM and Viton® are standard seat materials. Others are available as options.
- Only disc and liner are wetted parts.

OPTIONS

- Stem Extensions
- Other seat materials available on special order.
- Gear operators for all sizes.
- Sprocket and chain wheel: all sizes.
- Teflon® or PVDF stem coatings.
- Handle locking devices.
- 2" square operating nut.
- Stem of any commercially available metal.
- Lug style butterfly valves.
- Lever handle on 8".
- Tandem arrangements (patented).
- Disc and/or body in PVDF for better temperature range or chemical resistance.

SAMPLE SPECIFICATION

All solid thermoplastic butterfly valves shall be of the lined body design and seal bubble tight with only the liner and disc as wetted parts. The disc shall have double "O" ring seals on top and bottom trunnions, of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of valve. Stem shall be of stainless steel and have engagement over the full length of the disc. Butterfly valves shall be wafer style, as manufactured by Asahi/America, 425 Riverside Avenue, Medford, MA 02155.

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

Size (Inches)	PVC Body With PP Disc and appropriate elastomer*				PVDF Body With PVDF Disc and appropriate elastomer*			
	30° F 70° F	120° F	140° F	180° F	-5° F 140° F	141° F 175° F	176° F 210° F	211° F 250° F
1 1/2-3	150	100	70	30	150	100	85	70
4-6	150	100	45	30	150	100	85	70
8	150	100	40	20	150	85	70	60
10	150	100	30	15	150	85	70	60
12	100	60	30	15	100	60	40	20
14	100	60	30	7	100	40	30	15
16	85	60	30	7	85	40	30	15
18	70	30	20	7	70	40	30	15
20-24	50	30	20	7	50	30	20	15

* Maximum allowable temperature of Viton is 250° F. All other elastomers have a limit of 210° F.

VACUUM SERVICE

(UNIT: INCHES OF MERCURY)

Size	Size
1½" -29.92	10" -27.56
2" -29.92	12" -23.62
2½" -29.92	14" -23.62
3" -29.92	16" -23.62
4" -29.92	18" -19.69
5" -29.92	20" -19.69
6" -27.56	24" -19.69
8" -27.56	

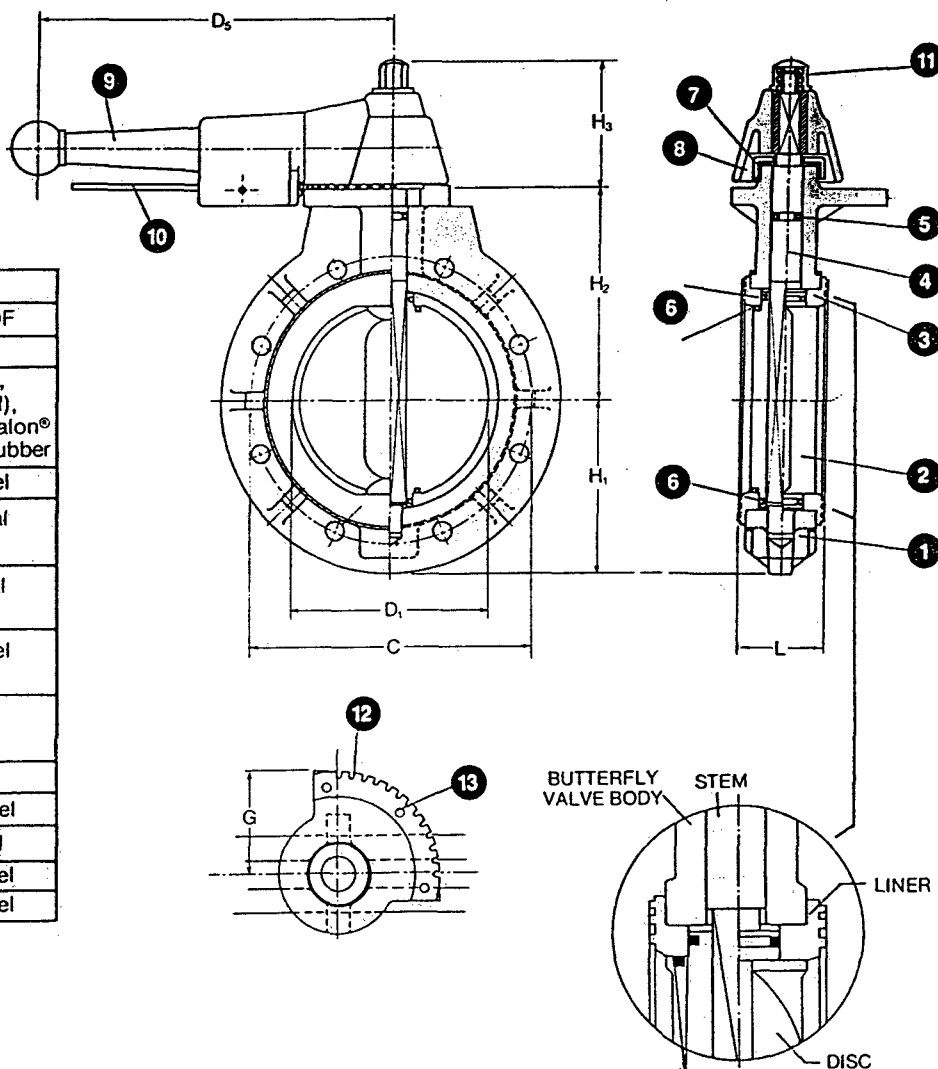
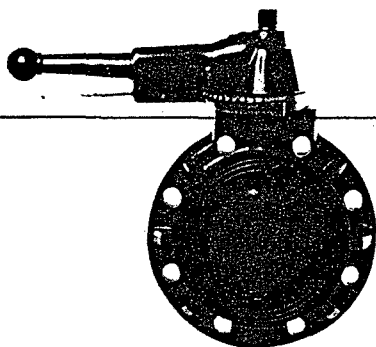
Cv VALUES

Size	10°	20°	30°	40°	50°	60°	70°	80°	90°
1½"	0	0.8	2.6	5.4	11.0	22.0	38.0	58.0	75.0
2"	0	1.9	5.2	9.5	25.0	46.8	79.0	91.0	102.0
2½"	0	4.0	9.0	18.2	35.7	59.7	166.0	239.0	260.0
3"	0	7.5	17.7	31.6	58.0	101.0	251.0	356.0	387.0
4"	0.7	10.5	25.3	45.3	85.8	156.2	328.0	465.0	504.0
5"	2.7	21.6	46.3	82.0	140.0	271.0	501.0	710.0	772.0
6"	15.3	42.6	80.5	142.0	220.0	462.0	794.0	1085.0	1183.0
8"	33.0	82.0	147.0	300.0	387.0	816.0	1390.0	1880.0	2040.0
10"	61.0	151.0	270.0	540.0	720.0	1476.0	2490.0	3320.0	3600.0
12"	88.0	233.0	408.0	776.0	1070.0	2140.0	3650.0	4760.0	5160.0
14"	129.0	328.0	535.0	1030.0	1609.0	2770.0	4580.0	5890.0	6440.0
16"	175.0	458.0	750.0	1416.0	2170.0	3760.0	6000.0	7660.0	8340.0
18"	252.0	622.0	1100.0	1960.0	2940.0	5020.0	7960.0	10020.0	10890.0
20"	337.0	845.0	1448.0	2673.0	3940.0	6620.0	10400.0	12920.0	14060.0
24"	463.0	1148.0	2130.0	3700.0	5550.0	9180.0	13900.0	17000.0	18500.0

TYPE 75 BUTTERFLY VALVES LEVER

Parts, Lever

Dimensions, Lever



PARTS—LEVER 1 1/2"-8"

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
2	Disc	1	PP, PVDF
3	Seat	1	EPDM, Viton®, Nitrile (Buna N), Neoprene®, Hypalon® Butyl, Natural Rubber
4	Stem	1	Stainless Steel
5	Stem Seal "O" Ring	1	Same material as seat
6	Disc Seal "O" Ring	4	Same material as seat
7	Stem Retainer	1	Stainless Steel
8	Retaining Nut	1	PVC
9	Handle	1	PP
10	Trigger	1	Stainless Steel
11	Cap Nut	1	PVC covered
12	Gauge Plate	1	Stainless Steel
13	Machine Screw	3	Stainless Steel

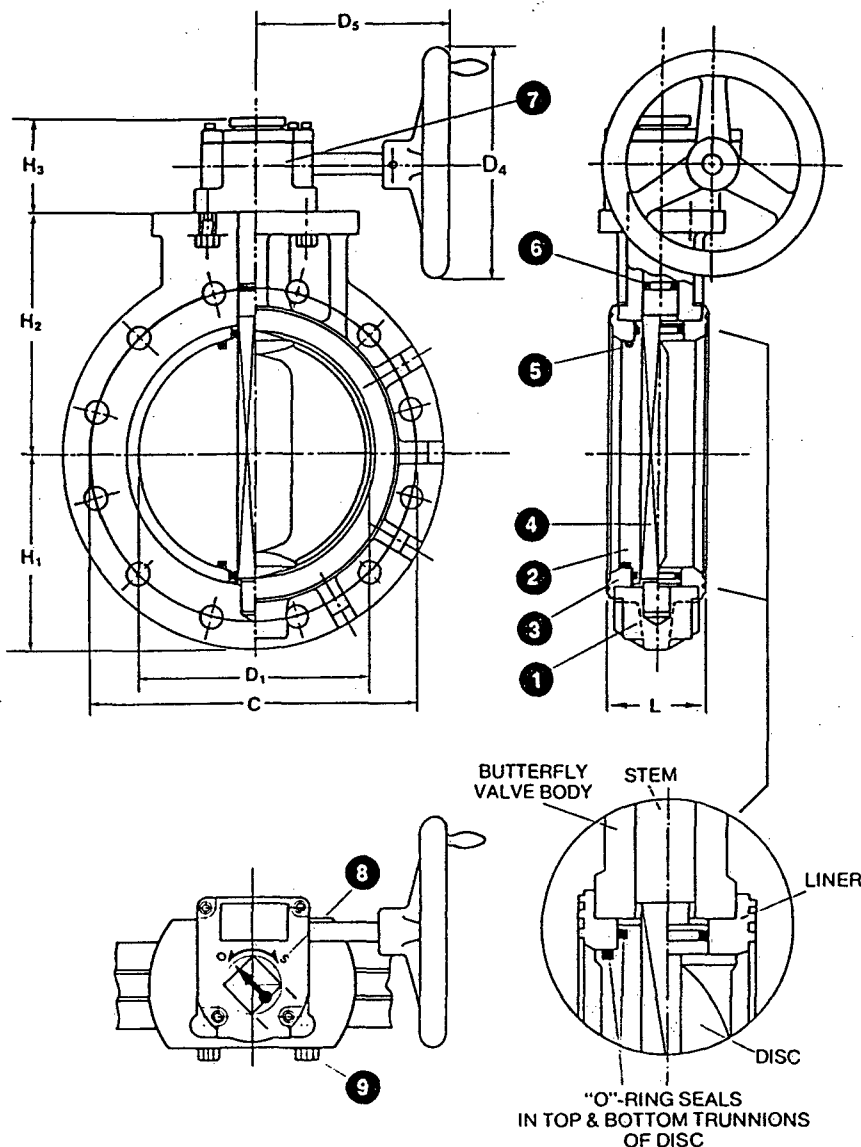
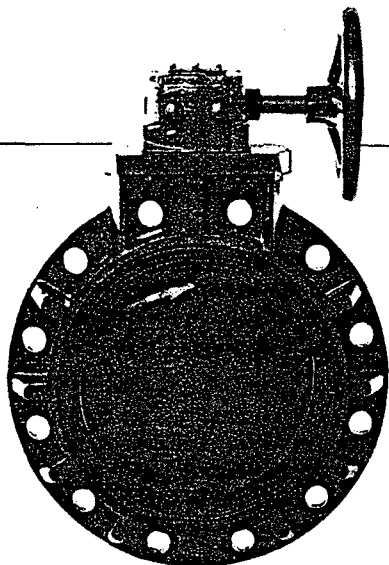
DIMENSIONS—LEVER (IN INCHES—BODY BOLT HOLES ANSI)

Size	Weight (lbs.)	D ₁	C	L	H ₁	H ₂	H ₃	D ₅
1 1/2	2.00	1.99	3.88	1.54	2.95	3.74	2.76	7.87
2	2.65	2.22	4.75	1.65	3.25	3.82	2.76	7.87
2 1/2	3.32	2.76	5.50	1.81	3.66	4.33	2.76	7.87
3	3.76	3.11	6.00	1.81	3.94	4.53	2.76	7.87
4	5.08	4.06	7.50	2.20	4.53	5.31	2.76	9.06
5	10.39	5.12	8.50	2.60	5.00	6.30	4.02	11.81
6	12.16	5.94	9.50	2.80	5.63	7.01	4.02	11.81
8	22.00	7.99	11.75	3.43	6.70	8.27	4.02	15.75

TYPE 75 BUTTERFLY VALVES GEAR

Parts, Gear

Dimensions, Gear



PARTS—GEAR 8"-24"

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
2	Disc	1	PP, PVDF
3	Seat	1	EPDM, Viton®, Nitrile (Buna N), Neoprene®, Hypalon®, Butyl, Natural Rubber
4	Stem	1	Stainless Steel
5	Disc Seal "O" Ring	4	Same material as seat
6	Stem Seal "O" Ring	1	Same material as seat
7	Gearbox	1	Aluminum cast iron coated with epoxy
8	Position Indicator	1	
9	Travel Stops	2	

1. 16"-24" body material is PP

DIMENSIONS—GEAR (IN INCHES—BODY BOLT HOLES ANSI)

Size	Weight (lbs.)	D ₁	C	L	H ₁	H ₂	H ₃	D ₄	D ₅
8	33.60	7.99	11.75	3.43	6.69	8.27	3.23	7.87	6.89
10	41.10	10.04	14.25	4.33	7.99	9.45	3.23	7.87	6.89
12	77.40	12.24	17.00	5.20	9.53	11.69	4.02	9.84	8.74
14	85.80	14.09	18.75	5.20	10.24	11.81	4.02	9.84	8.74
16	112.70	15.69	21.25	6.73	11.81	13.78	4.02	9.84	8.74
18	151.60	17.74	22.75	7.13	12.40	14.57	4.13	12.40	12.99
20	172.40	19.70	25.00	7.60	13.78	15.75	4.13	12.40	12.99
24	258.00	23.66	29.50	8.39	16.02	18.31	4.13	12.40	12.99

ASAHI/AMERICA

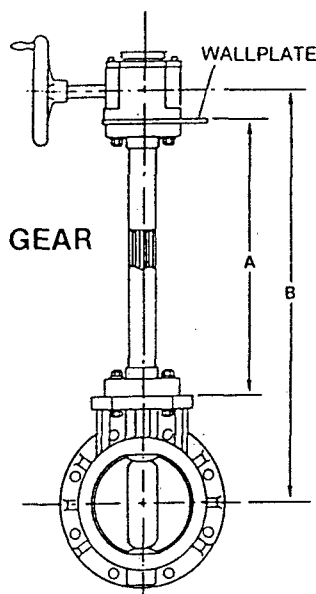
OPTIONS FOR BUTTERFLY VALVES continued

Stem Extensions

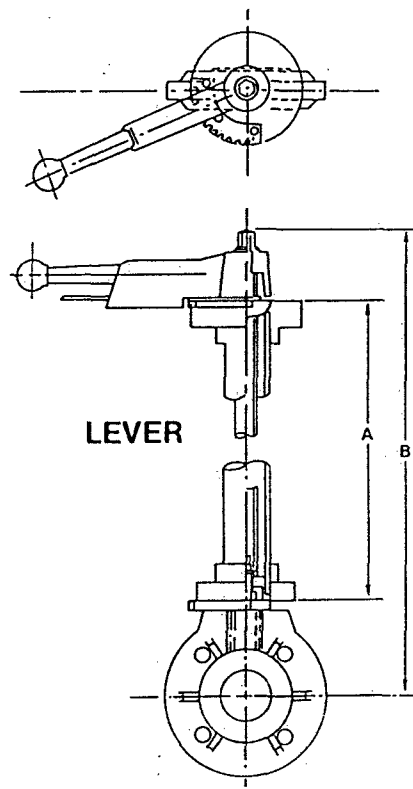
STEM EXTENSIONS

TWO PIECE STEM AND HOUSING

For submerged or buried applications. PVC housing protects stem extensions from aggressive environments, or functions as valve box.



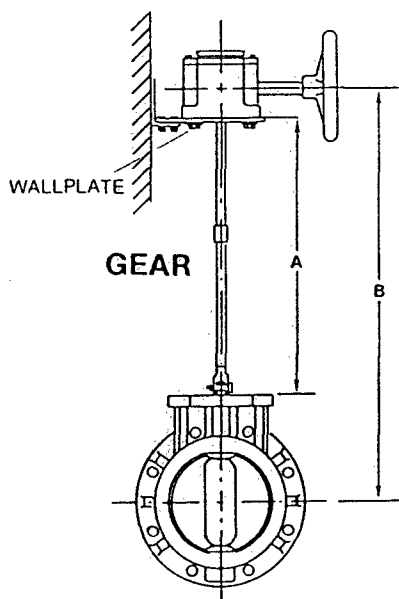
STYLE A
(TWO PIECE STEM & HOUSING)



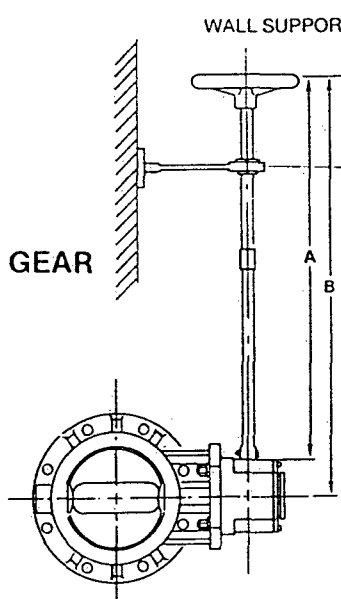
STYLE A
(TWO PIECE, STEM & HOUSING)

SINGLE STEM EXTENSIONS

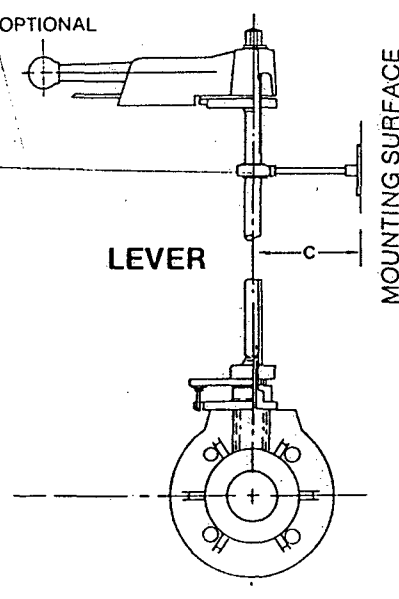
Valve handle can be extended away from the valve for out-of-reach locations.



STYLE B
(ONE PIECE, NON-SUPPORTED)



STYLE C
(ONE PIECE, NON-SUPPORTED)



STYLE B
(ONE PIECE, NON-SUPPORTED)

OPTIONS FOR BUTTERFLY VALVES continued

Lug Style Valves

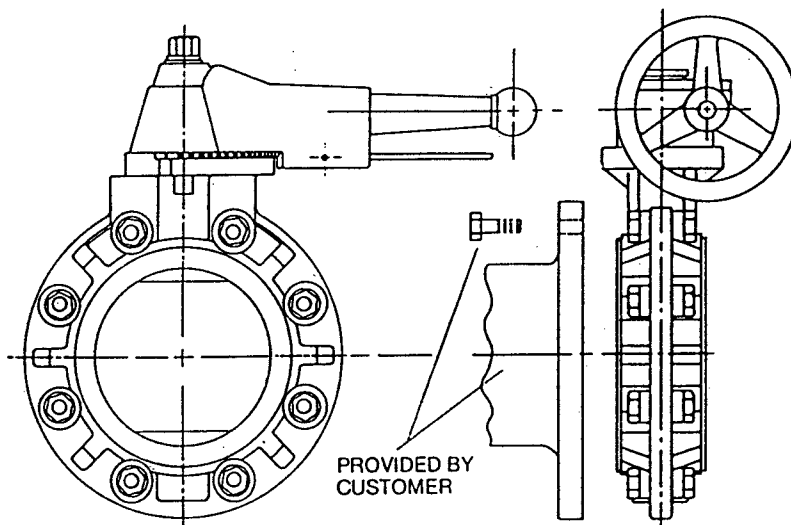
Gear Operators

Limit Switches

LUG STYLE

LUG STYLE VALVES

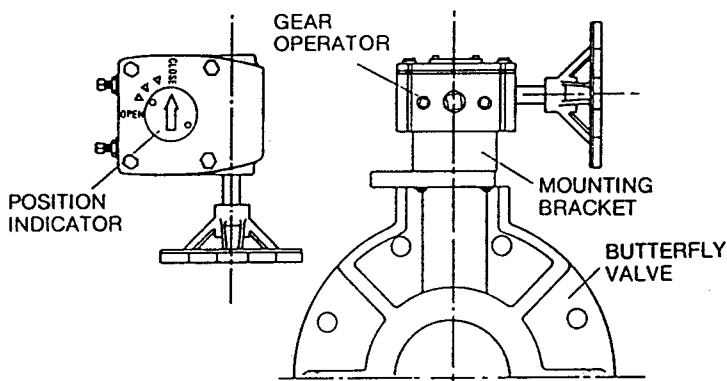
For valves used at the end of line applications, mounted with a single flange. Also used as a blocking valve where either side of the valve can be un-bolted, while still maintaining system pressure on the opposite side of the valve.



GEAR OPERATORS

GEAR OPERATORS

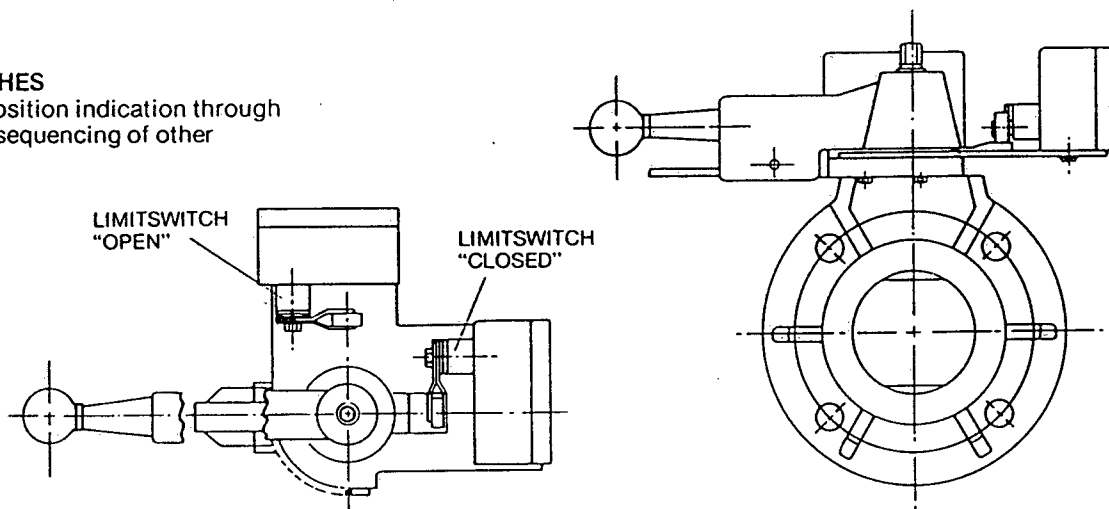
1½"-6". For applications where a gear operator is required to replace the standard lever handle.



LIMIT SWITCHES

LIMIT SWITCHES

For remote position indication through lights, or for sequencing of other equipment.



BALL VALVE SPECIFICATIONS

Manufacturer: Asahi/America
425 Riverside Avenue
Medford, Maryland 02155
(617) 391-2353

Model: True Union Ball Valve

Size: 2"

Body: PVC

Seats: Teflon backed with EPDM

Seals: EPDM

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

BALL VALVES

INTRODUCTION

Introduction

Discussion

Warranty

Liabilities

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials ensure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Ball Valves: Discussion

This valve performs an on/off function and its name is derived from the flow-controlling ball located within the body of the valve. A hole through the center of the ball along one axis connects the inlet and outlet ports of the body. The ball itself is held in place by, and rotates 90° within, Teflon® seats which provide permanent lubrication and keep the valve "bubble tight". Elastomer "O" rings are used for stem and carrier seals to prevent leakage to the atmosphere. In the open position the flow is straight-through and there is no pressure drop when the porting through the ball is the same size as the inside diameter of the pipe. Asahi/America ball valves are quick opening and closing, a quarter turn is all that is necessary. They are easy to maintain, and they give tight sealing with low torque. Asahi/America offers three major types of ball valves: (1) True Union Ball Valves; (2) Omni® Ball Valves; and (3) Multiport Ball Valves. True Union Ball Valves can be lifted from the line—without having to move the piping—simply by loosening the two union nuts; the valve can be disassembled, and parts may be replaced. Asahi/America's Omni® series are economical, one-piece valves which cannot be taken apart. Multiport Ball Valves are three-way ball valves with True Union design on the left and right ports and fixed molded bottom port.

The use of Multiporting Ball Valves simplifies piping and eliminates the need for an additional valve and Tee fitting because an "L" ported ball permits flow from the bottom entry to either the left or right ports or to an OFF position. An optional Tee ported ball allows simultaneous left and right flow. Asahi/America's True Union Ball Valves and Multiport Ball Valves may be electrically or pneumatically operated. The Electromni® is an electrically actuated Omni® Ball Valve. The Omnimatic® is a pneumatically actuated Omni® Ball Valve.

Asahi/America's thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250°F, pressures to 150 PSI and flows up to 18,500 gpm. When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electro-chemical one. There is ionization or corrosion at the surfaces due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

Warranty and Liabilities

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitability of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

ASAHI/AMERICA

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

WARRANTY

THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has an excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalis, as well as gasoline, kerosene, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

CPVC (CHLORINATED POLYVINYL CHLORIDE) TYPE 4, GRADE 1 The properties of CPVC and its advantages are very similar to those of PVC; however, its working temperature range is higher (200° F.) than that of PVC. It should be specified in some instances where hot corrosive liquids are being handled and an extra margin of safety is required.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalies and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF (POLYVINYLIDENE FLUORIDE) PVDF is a high modular weight fluorocarbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temperature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters. Asahi/America's PVDF resin conforms with FDA No. 177.2510 requirements for contact with food.

Elastomeric Materials

TEFLON® (TFE FLUOROCARBONS) This fluorocarbon is almost totally insoluble and chemically inert. Teflon® in application on bearing surfaces exhibits a natural lubricity that makes lubrication completely unnecessary. It has a very high thermal stability, is nonflammable, and exhibits a very low dielectric constant.

VITON® Viton® is a fluoroelastomer which is used as an "O" ring material in many Asahi/America valves. It resists a wide range of chemicals, including mineral acids, salts, and chlorinated hydrocarbons. The maximum temperature is 250° F.

EPDM (ETHYLENE) PROPYLENE TERPOLYMER) This elastomer is particularly suited to diaphragms, valve seats, and "O" rings. It can stand up to a wide variety of acids, bases, alcohols, and oxidizing chemicals. The maximum temperature is 212° F.

Note

Caution: Asahi/America valves are not recommended for use in compressed air service. When testing, only hydrostatic pressure testing is recommended with a gradual increase in pressure.

DUO BLOC[®] TRUE UNION BALL VALVES

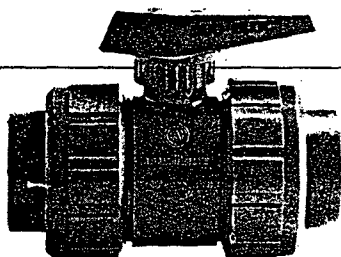
Features, Options

Sample Specifications

Parts

Pressure vs. Temperature

Dimensions



SPECIFICATIONS

SIZES: 1/2" - 6" *

MODELS: Socket, Threaded, Flanged (ANSI),
Butt

BODIES: PVC, CPVC, PP, PVDF (KYNAR[®])

SEATS: Teflon[®] backed with EPDM or VITON[®]

SEALS: EPDM or VITON[®]

FEATURES

- True Union design eliminates the need for flanges and permits installation or repair without expanding the pipeline.
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve.
- One-piece, capsule feature (PVC and CPVC models, 1/2" - 2") prevents over-tightening of seating components.
- Teflon seats with elastomeric backing cushions ensure bubble tight shut off and a low fixed torque, while at the same time compensating for wear.

- Available with EPDM or Viton[®] "O" rings.
- All sizes rated for vacuum service.
- Threaded-in carriers on all sizes of PVDF and PP models and on 2 1/2" - 4" size of CPVC and PVC models prevents over-tightening of seating components.
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC models in 1/2" - 2" sizes. This reduces by up to 50% ball valve inventories.
- Valve capsule guaranteed for 2 years when used as recommended.

OPTIONS (See options under Multiport valves)

SAMPLE SPECIFICATIONS

All thermoplastic ball valves in sizes 1/2" through 4" shall be of a true union design with two-way blocking capability. PVC and CPVC True Union Ball Valves (sizes 1/2" through 2") shall be of a one piece capsule. All PVC and CPVC True Union Ball Valves (sizes 1/2" through 2") shall include both socket and threaded end connectors. All True Union Ball Valves shall have Teflon[®] seats with elastomeric backing cushions of the same material as the valve seals. True Union Ball Valves must carry a 2 year guarantee, as manufactured by Asahi/America, Inc., 425 Riverside Avenue, Medford, MA.

PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	2	PVC, CPVC, PP, PVDF
4	Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Ball Seat	2	Teflon [®]
7	Handle	1	ABS
8	Stem	1	PVC, CPVC, PP, PVDF
9	Face "O" Ring	2	Viton [®] EPDM
10	Stem "O" Ring	1	Viton [®] EPDM
11	Seat Cushion	2	Viton [®] EPDM
12	Screw	1	Stainless Steel
13	Flange	2	PVC, CPVC, PP, PVDF

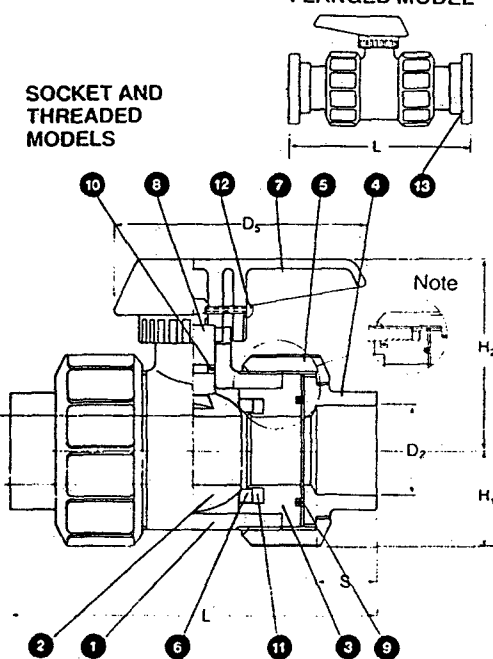
Note: PVC and CPVC models, size 2 1/2", 3" and 4", and all PP and PVDF models feature threaded-in carriers.

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

Size	PVC		CPVC			PP			PVDF			
	30°F 120°F	30°F 120°F	140°F	175°F	195°F	-5°F 85°F	140°F	175°F	-5°F 140°F	175°F	195°F	210°F
1/2"-2"	150	150	120	85	55	150	85	60	150	120	110	85
2 1/2"-6"	150	150	20	85	55	150	70	40	150	120	110	85

SOCKET AND THREADED MODELS

FLANGED MODEL *



DIMENSIONS (IN INCHES UNLESS OTHERWISE NOTED)

Size	Weight Socket/ Threaded (lbs.)	Weight Flanged (lbs.)	D ₁	D ₂ Socket	D ₃ Threaded	S Socket	L Butt Fusion	L Socket	L Threaded	L Flanged PVC/ CPVC/ PP/PVDF	D ₁	H ₂	H ₁	C, Values Gal./Min. @ 1 PSI Pressure Drop
1/2"	0.38	2.00	0.59	0.85	NPT 1/2	0.69	4.57	3.86	3.82	5.63	2.76	1.97	.95	11.9
3/4"	0.67	2.25	0.79	1.06	NPT 3/4	0.72	5.00	4.53	4.65	6.77	3.54	2.24	1.19	30.0
1"	1.00	2.50	0.98	1.33	NPT 1	0.87	5.35	5.28	5.35	7.36	3.94	2.64	1.38	46.8
1 1/4"	1.39	3.25	1.22	1.67	NPT 1 1/4	0.94	6.00	5.83	5.87	7.48	4.13	3.07	1.57	80.0
1 1/2"	2.18	4.00	1.50	1.91	NPT 1 1/2	1.09	6.29	6.65	6.69	8.35	4.53	3.35	1.87	140.0
2"	2.93	4.75	1.77	2.39	NPT 2	1.16	7.04	7.56	7.76	9.21	5.12	3.74	2.09	185.0
2 1/2"	4.86	8.50	2.28	2.89	NPT 2 1/2	1.75	9.70	9.45	8.46	10.20	5.91	4.45	2.62	320.0
3"	8.07	13.00	2.76	3.52	NPT 3	1.87	11.63	11.10	10.39	11.97	8.66	5.12	2.99	430.0
4"	21.00	33.00	3.54	4.52	NPT 4	2.00	14.85	13.90	14.17	14.65	11.02	6.54	4.13	720.0

* 6" Ball Valve is venturied up from 4"

* See Page 10 for details.

ASAHI/AMERICA

WELLHEAD FLEXHOSE SPECIFICATIONS

Manufacturer: Industrial Tube Corporation
3091 Indian Avenue
Perris, California 92571
(714) 657-2611

Model: IT-6000 Flexible Coupling

Size: 4" Wellheads: 4" x 36"

Body: Silicone Rubber/Polyester Fabric

Wire: SS (Type 302)

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713



**INDUSTRIAL TUBE
CORPORATION**
3091 INDIAN AVENUE
PERRIS, CALIFORNIA 92571
PX: 714/657-2611
FAX: 714/943-0191

IT-6000 FLEXIBLE COUPLING

Coupling is chemically compatible with landfill gases.

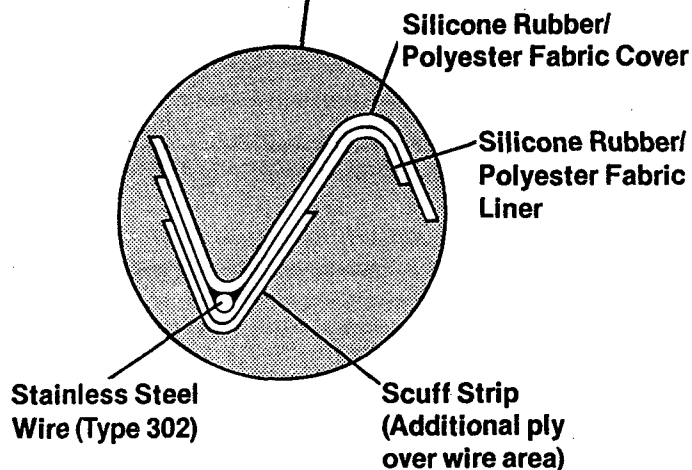
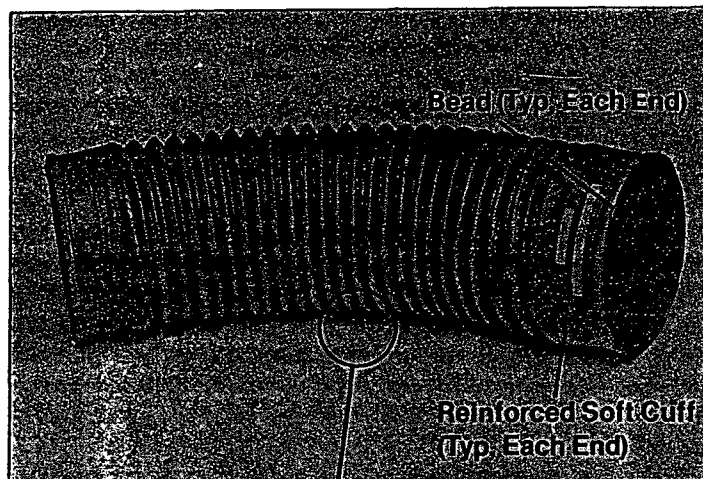
Construction—High strength silicone rubber with polyester fabric reinforcement. Stainless steel type 302 wire is encapsulated within the inner and outer plys and therefore is not exposed to the landfill gases. Scuff strips of silicone rubber are added on the outside of the coupling over the wire areas. There are 2½" soft cuffs at each end that are flexible enough for installation over the IT-6003 PVC collars and capable of holding up under the clamp forces. A bead of silicone rubber has been added at the end of each cuff to prevent, PULL-OFF, under severe pipe movements.

DESIGN CRITERIA	MEDIA: LANDFILL GASES
Operating Temperature Range	– 65°F thru + 325°F
Pressure	– 5 PSIG/10 hg Neg
Extension/Flexibility	50% Contraction 20% Extension
Bend Radius	1.5 × Diameter

Part Number Code IT - 6000 - 4 - 18
Basic Part Number _____
Nom. Pipe Size (Inches) _____
Length In Inches (Standard OAL) _____

NOTES

1. 24" Length Recommended For Extreme Movement
2. 18" & 24" Lengths Standard with 2½" Soft Cuff at Each End
3. Available In All Plastic Pipe Sizes

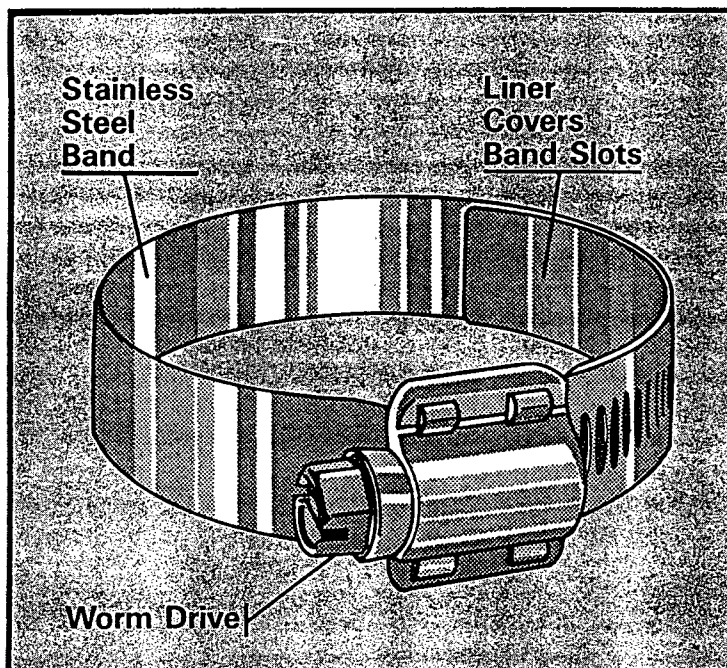


IT-6000 FLEXIBLE COUPLING



**INDUSTRIAL TUBE
CORPORATION**
3091 INDIAN AVENUE
PERRIS, CALIFORNIA 92571
PX: 714/657-2611
FAX: 714/943-0191

IT-406 CLAMP



NOTES:

1. Recommended For Use With IT-6000, IT-6001 & IT-6006 Flexible Couplings To Prevent Damage Caused By Extrusion or Shearing Through The Band Slots.
2. Available In All Standard Plastic Pipe Sizes.

Dash number sizes are applicable to the nominal pipe size. i.e. IT-406-4 clamp recommended for use over IT-6000; IT-6001 or IT-6003 coupling as installed on a 4 inch nominal pipe (4.625 O.D.)

IT-406 CLAMP

INDUSTRIAL TUBE CORPORATION
3091 Indian Avenue, Perris, CA 92571
Ph: (909) 657-2611 Fax: (909) 943-0191
Mfr Code: 26831 S.B.A. Small Business

ISCO Industries
Customer

002103-00
Purchase Order No.

SHIPPER#: 1Z 9277640301303955, 3964[illegible]

The undersigned hereby Certifies the materials used in the items shipped under the subject Purchase Order are in conformance with all contractually applicable Government and Company specifications and the physical and/or chemical test reports of the materials used in said items are on file and will be made available to customer upon request. Seller hereby certifies that all products in this shipment conform to the requirements of the listed purchase order. Inspection and/or test results are on file and will be made available to the customer upon request. Seller certifies the Quality system meets requirements of ISO 9002. Seller certifies items were manufactured in the United States of America. Returns without prior authorization will not be accepted.

Kristen Van Hula
Authorized Q.A. Representative



CERTIFICATE OF CONFORMANCE

INDUSTRIAL TUBE CORPORATION
3091 Indian Avenue, Perris, CA 92571
Ph: (909) 657-2611 Fax: (909) 943-0191
Mfr Code: 26831 S.B.A. Small Business

SEP 25 1998

DATE:

ISCO Industries

Customer

INVOICE: 54031

002103-00

Purchase Order No.

ITC SO#: 38157

SHIPPER#: 179277640301303740, 3759

[illegible]

The undersigned hereby Certifies the materials used in the items shipped under the subject Purchase Order are in conformance with all contractually applicable Government and Company specifications and the physical and/or chemical test reports of the materials used in said items are on file and will be made available to customer upon request. Seller hereby certifies that all products in this shipment conform to the requirements of the listed purchase order. Inspection and/or test results are on file and will be made available to the customer upon request. Seller certifies the Quality system meets requirements of ISO 9002. Seller certifies items were manufactured in the United States of America. Returns without prior authorization will not be accepted.

Kristin Van Halse
Authorized Q.A. Representative



QUICK CONNECT SPECIFICATIONS

Manufacturer: Bee Valve Inc.
1150 Taylor Street
Elyria, OH 44035
(440) 366-0220

Model: 150-F AND 150-DC

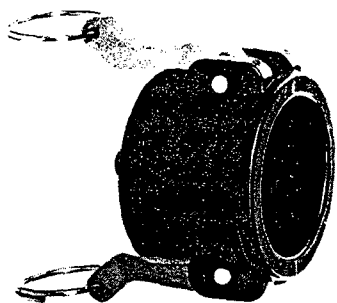
Size: 1 1/2"

Body: Polypropylene

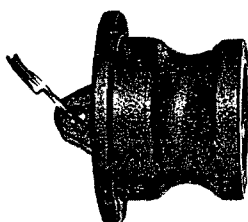
Seals: Viton

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

CAM COUPLERS & ADAPTORS



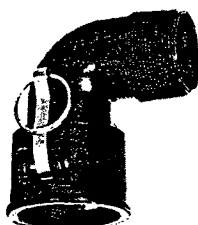
Dust Cap
DC



Dust Plug
DP



Adaptor
A



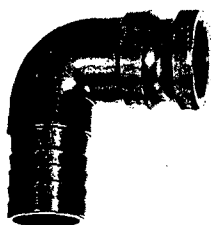
Coupler
B



Coupler
C



Coupler
D



Adaptor
E



Adaptor
F

POLY CAM DUST CAPS & PLUGS

Part No.	Size Description	Carton Qty. Wt.Lbs.		Price Each
050-DC	1/2" Dust Cap	6	1	\$ 7.45
075-DC	3/4" Dust Cap	6	1	7.45
100-DC	1" Dust Cap	6	2	8.45
125-DC	1-1/4" Dust Cap	6	3	8.85
150-DC	1-1/2" Dust Cap	12	6	9.70
200-DC	2" Dust Cap	12	7	12.10
300-DC	3" Dust Cap	6	6	21.10
050-DP	1/2" Dust Plug	6	1	3.10
075-DP	3/4" Dust Plug	6	1	3.10
100-DP	1" Dust Plug	6	1	3.25
125-DP	1-1/4" Dust Plug	6	1	3.60
150-DP	1-1/2" Dust Plug	12	3	3.70
200-DP	2" Dust Plug	12	4	4.50
300-DP	3" Dust Plug	6	4	11.40

90° CAM COUPLERS & ADAPTORS

Part No.	Size Description	Carton Qty. Wt.Lbs.		Price Each
200A-90	2" Adaptor	10	4	\$ 7.35
200B-90	2" Coupler	10	8	15.40
200C-90	2" Coupler	10	8	15.15
200D-90	2" Coupler	10	8	15.40
200E-90	2" Adaptor	10	5	7.45
200F-90	2" Adaptor	10	6	7.45

Features

- Manufactured from glass-reinforced polypropylene
- Rust-proof cam lever pins, arms and rings made from 304 stainless steel
- Standard with EPDM gaskets, Buna N and Viton are available
- Standard NPT threads, BSP are available

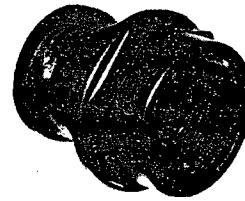


CAM COUPLERS & ADAPTORS

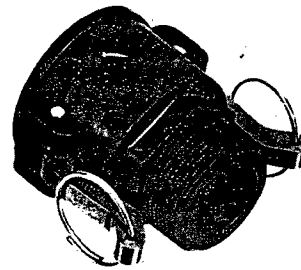
Pressure rating: 1/2" thru 2" – 125 psi,
3" – 100 psi

POLY CAM COUPLERS & ADAPTORS

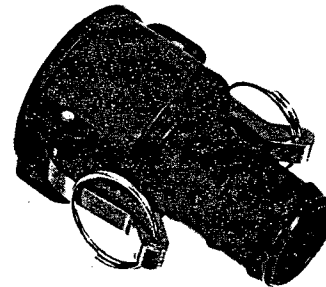
Part No.	Size Description	Carton Qty.	Wt.Lbs.	Price Each
050-A	1/2" Female Thd. Adp.	6	1	\$ 3.10
075-A	3/4" Female Thd. Adp.	6	1	3.10
100-A	1" Female Thd. Adp.	6	1	3.25
125-A	1-1/4" Female Thd. Adp.	6	1	3.50
150-A	1-1/2" Female Thd. Adp.	12	4	3.80
200-A	2" Female Thd. Adp.	12	4	4.50
300-A	3" Female Thd. Adp.	6	5	11.40
050-B	1/2" Male Thd. Coup.	6	1	7.45
075-B	3/4" Male Thd. Coup.	6	1	7.45
100-B	1" Male Thd. Coup.	6	2	8.45
125-B	1-1/4" Male Thd. Coup.	6	3	8.85
150-B	1-1/2" Male Thd. Coup.	12	7	9.70
200-B	2" Male Thd. Coup.	12	7	12.10
300-B	3" Male Thd. Coup.	6	7	21.10
050-C	1/2" Hose Shank Coup.	6	1	7.45
075-C	3/4" Hose Shank Coup.	6	1	7.45
100-C	1" Hose Shank Coup.	6	1	8.45
125-C	1-1/4" Hose Shank Coup.	6	3	8.85
150-C	1-1/2" Hose Shank Coup.	12	8	9.70
200-C	2" Hose Shank Coup.	12	8	12.10
300-C	3" Hose Shank Coup.	6	8	21.10



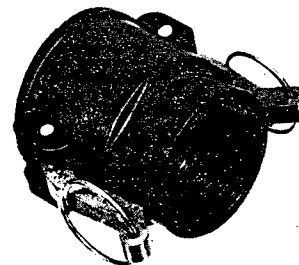
Part A
Male Adaptor-
Female Thread



Part B
Female Coupler-
Male Thread



Part C
Female
Coupler-Hose
Shank



Part D
Female Coupler-
Female Thread



Part E
Male Adaptor-
Hose Shank



Part F
Male Adaptor-
Male Thread

Part No.	Size Description	Carton Qty.	Wt.Lbs.	Price Each
050-D	1/2" Female Thd. Coup.	6	1	\$ 7.45
075-D	3/4" Female Thd. Coup.	6	1	7.45
100-D	1" Female Thd. Coup.	6	1	8.45
125-D	1-1/4" Female Thd. Coup.	6	3	8.85
150-D	1-1/2" Female Thd. Coup.	12	8	9.70
200-D	2" Female Thd. Coup.	12	7	12.10
300-D	3" Female Thd. Coup.	6	8	21.10
050-E	1/2" Hose Shank Adp.	6	1	3.45
075-E	3/4" Hose Shank Adp.	6	1	3.45
100-E	1" Hose Shank Adp.	6	1	4.05
125-E	1-1/4" Hose Shank Adp.	6	1	4.10
150-E	1-1/2" Hose Shank Adp.	12	3	4.20
200-E	2" Hose Shank Adp.	12	4	5.15
300-E	3" Hose Shank Adp.	6	5	14.30
050-F	1/2" Male Thd. Adp.	6	1	3.45
075-F	3/4" Male Thd. Adp.	6	1	3.45
100-F	1" Male Thd. Adp.	6	1	4.05
125-F	1-1/4" Male Thd. Adp.	6	1	4.10
150-F	1-1/2" Male Thd. Adp.	12	3	4.20
200-F	2" Male Thd. Adp.	12	4	5.55
300-F	3" Male Thd. Adp.	6	5	14.30



SAMPLE PORT SPECIFICATIONS

Manufacturer: Colder Products Company
2459 University Avenue
St. Paul, Minnesota 55114
(612) 645-0091

Model: LCD 240-04

Size: 1/4"

Body: Chrome Plated Brass

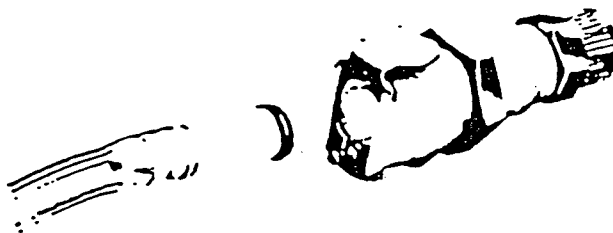
Seals: Buna-N-Seals

Supplying Vendor: Wilson Company
2317 East Loop 820 North
Fort Worth, Texas 76118
(817) 595-2244

PLASTIC QUICK DISCONNECT COUPLINGS (Continued)

PLC 220

1/4" FLOW
PLASTIC SERIES



PMC 110 and PLC 220 ADVANTAGES

- Chemical resistance — can be used where brass is not desirable
- Cost saving — chemical resistance without the high cost of stainless steel
- Attractive appearance — Natural acetal color (white)
- Lightweight — applicable where small tubing and light materials are a must.

PMC 110 and PLC 220 SPECIFICATIONS

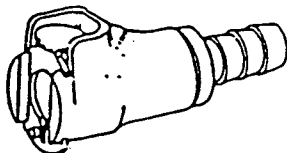
Materials: Bodies and valves; acetal plastic (Delrin[®] or Celcon[®]) stainless steel springs and latch. Buna-N-seals (special seal materials on request)

Color: Natural (White)

Maximum Operating Temperature: 180°F [82°C]

Working Pressure: 120 PSI

COUPLING BODIES

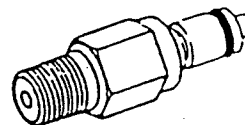
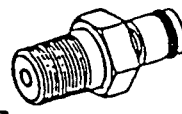


IN LINE

STRAIGHT THRU	TUBING	LENGTH	WITH SHUT-OFF
PLC 130-06	1/4" O.D. Poly	1.95	PLCD 130-06
PLC 170-04**	1/4" I.D.	1.95	PLCD 170-04*
PLC 170-06*	1/4" I.D.	1.95	PLCD 170-06*

*Hose Barb

COUPLING INSERTS



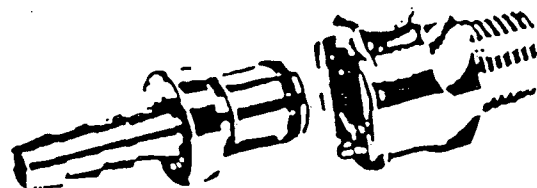
PIPE THREAD

STRAIGHT THRU	THREAD	WITH SHUT-OFF
PLC 240-04	1/4" NPT	PLCD 240-04
PLC 240-06	1/4" NPT	PLCD 240-06

CHROME PLATED BRASS QUICK DISCONNECT COUPLINGS (Continued)

LC 220

1/4" FLOW
BRASS SERIES



LC 220 QUICK COUPLINGS

LC 220 FEATURES — High flow small size couplings. Designed specifically for flexible tubing applications where higher flow rates and minimum coupling size are required. Available in 1/4" and 3/8" sizes. Wide variety of flexible tube connections offered. Chrome plated brass, single and double end shut-off.

SPECIFICATIONS:

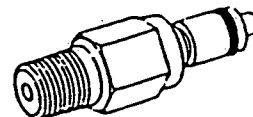
Materials: Chrome plated brass bodies, stainless steel springs and latch, Delrin[®] plastic valve poppet, Buna-N-Seals.

Maximum Operating Temperature: 180°F.

Maximum Working Pressure: 250 psi.

Pipe Thread

SHUT-OFF	THREAD
LCD 240-04	1/4" MPT
LCD 240-06	1/4" MPT



CPC

COLDER PRODUCTS COMPANY

2459 University Avenue, St. Paul, MN 55114
Phone 612/645-0091

GRADED BENTONITE SPECIFICATIONS

Manufacturer: Baroid Industrial Drilling Products
P. O. Box 1675
Houston, Texas 77251
(713) 987-4547

Grade: 3/8" Holeplug

Weight: 50 lbs./bag

Supplying Vendor: Gilbert Pump and Mechanical, Inc.
227 Green Acres Road
Fort Walton Beach, Florida 32547
(850) 864-4000

Baroid Industrial Drilling Products

HOLEPLUG® Graded Bentonite

Baroid's HOLEPLUG® size-graded bentonite is a naturally-occurring clay which is used to seal and plug earthen boreholes. HOLEPLUG is mined from specially-selected ore bodies which exhibit a high swell capability, but at a slower rate than drilling mud grade bentonite. HOLEPLUG will fall through a column of water standing in the hole and reach the bottom of the hole with minimum hydration or water swelling. Complete fill of the annular space can be achieved, and bridging of the particles in the upper hole is minimized. Complete fill of the annular space is necessary to form an effective, long-term plug in compliance with environmental regulatory requirements.

HOLEPLUG is available in two particle size grades:

- HOLEPLUG 3/4" (100% of particles pass through 3/4" screen; all particles retained on 3/8" screen)
- HOLEPLUG 3/8" (100% of particles pass through 3/8" screen; all particles retained on 1/4" screen).

The size of the open annular space will determine which size should be used. When the annular space is 3/4" or more, HOLEPLUG 3/8" should be used. When the annular space is 1-1/2" or more, HOLEPLUG 3/4" should be used.

Major Advantages:

- Prevents entry of surface water into boreholes
- Prevents vertical movement of fluids in the hole between porous zones
- Forms a permanent, flexible downhole seal
- Facilitates pipe recovery
- Allows hole reentry
- Superior alternative to pelletized bentonite due to easier application
- Simple to apply and no mixing expense
- Weatherproof, easy-to-open packaging
- More cost-effective compared to pelletized bentonite

Recommended Uses:

- Highly recommended for environmental monitoring well applications
- Sealing outside casing annulus
- Sealing above gravel packs
- Plugging decommissioned bore holes
- Sealing around conductor pipe
- Sealing lost circulation zones
- Shutting off artesian wells

NOTE

This product has been certified by the National Sanitation Foundation (NSF) to contribute no adverse health problems to ground water when used as the manufacturer recommends for the construction of potable water wells.

Recommended Application Procedures:

Plugging and Stemming Drill Holes

Due to bag shipping, handling and possible slight dehydration, a small amount of fine bentonite particles may be present. For optimum results, HOLEPLUG should be poured over a mesh or screen with 1/4" openings to "sift out" the smaller particles. The screen should be large enough (approx. 1 sq. yd.) to be folded into a "V" shape to allow sifting while the product is being poured into the hole. Also, HOLEPLUG should be poured *slowly* (allow approximately two minutes to pour a 50 lb bag).

1. Open top of HOLEPLUG bag.
2. Hold the screen with one end slightly higher. The lower end should be placed over the bore hole.
3. Slowly pour HOLEPLUG diagonally down the "V" so that any fine particulate falls through the screen before the larger particles fall into the bore hole.

4. Fill hole as required (above static water level or to ground level).
5. Observe all regulatory specifications.

Stopping Loss of Circulation and Stabilizing Unconsolidated Formations

1. Pull drill pipe out of hole.
2. Pour HOLEPLUG graded bentonite into hole to fill above problem zone.
3. Drill ahead slowly with reduced pump pressure.

Plugging Artesian Water Flows

1. Pour HOLEPLUG graded bentonite into hole until water flow subsides or hole is filled to surface.
2. In case of severe flows, add BAROID® barite weighting material along with HOLEPLUG.

Amounts of HOLEPLUG Required for Plugging Applications

Hole Diameter (inches)	Hole Volume (cu. ft/ft)	Pounds HOLEPLUG Needed To Fill One Foot	Feet Filled By One Bag HOLEPLUG	Bags HOLEPLUG Needed To Fill 100 ft
2	0.022	1.6	31.3	3.2
2-1/2	0.034	2.5	20.0	5.0
3	0.049	3.5	14.3	7.0
3-1/2	0.067	4.8	10.4	9.6
4	0.087	6.3	7.9	12.6
4-1/2	0.110	7.9	6.3	15.8
5	0.136	9.8	5.1	19.6
5-1/2	0.165	11.9	4.2	23.8
6	0.196	14.1	3.5	28.2
6-1/2	0.230	16.6	3.0	33.2
7	0.267	19.2	2.6	38.4
7-1/2	0.307	22.1	2.3	44.2
8	0.349	25.1	2.0	50.2
8-1/2	0.394	28.4	1.8	56.8
9	0.442	31.8	1.6	63.6
9-1/2	0.492	35.4	1.4	70.8
10	0.545	39.2	1.3	78.4
11	0.660	47.5	1.1	95.0
12	0.785	56.5	0.89	113.0
15	1.227	88.3	0.57	176.6
18	1.767	127.2	0.39	254.4
20	2.182	157.1	0.32	314.2
25	3.409	245.4	0.20	490.8
30	4.909	353.4	0.14	706.8

Physical Characteristics:

Bulk Density, uncompacted	
HOLEPLUG 3/4"	71.8 lb/ft ³
→ HOLEPLUG 3/8"	68.8 lb/ft ³
Moisture	17%
Permeability of resulting plug	
	$K = 1.5 \times 10^{-9}$ cm/sec.
Appearance	beige to tan powder
Specific Gravity	2.5 to 2.6

Mineralogical Analysis (x-ray diffraction) – (typical Wyoming bentonite)

85%	Montmorillonite
5%	Quartz
5%	Feldspars
2%	Cristobalite
2%	Illite
1%	Calcium and Gypsum

Chemical Analysis (typical)

SiO ₂	55.44%
Al ₂ O ₃	20.14%
Fe ₂ O ₃	3.67%
CaO	0.49%
MgO	2.49%
Na ₂ O	2.76%
K ₂ O	0.60%
Bound water	5.50%
Moisture (@ 220°F)	8.00%
TOTAL	99.09%

Environmental Information:

HOLEPLUG graded bentonite is a natural, unaltered mineral with no added chemicals or contaminants. HOLEPLUG does not spoil or ferment.

HOLEPLUG graded bentonite is environmentally safe and complies with the EPA's protocol for TCLP (toxicity characterization leaching procedure). Lab report available on request.

HOLEPLUG graded bentonite is non-toxic (96-hour LC₅₀ on *Mysidopsis bahia* is greater than 100,000 ppm).

Packaging:

HOLEPLUG graded bentonite is packaged in multiwall paper bags containing 50 pounds (22.7 kg).

Availability:

HOLEPLUG may be purchased through Baroid Service Centers or from QUIK-GEL® Distributors.

Because the conditions of use of this product are beyond seller's control, the product is sold without warranty either express or implied and upon condition that purchaser make its own tests to determine the suitability for purchaser's application. Purchaser assumes all risk of use and handling of this product. This product will be replaced if defective in manufacture or packaging or if damaged. Except for such replacement, seller is not liable for any damages caused by this product or its use. The statements and recommendations made herein are believed to be accurate. No guarantee of their accuracy is made, however.

Baroid Drilling Fluids, Inc.
P.O. Box 1675
Houston, Texas 77251
Customer Service: (713) 987-4547

Baroid Drilling Fluids, Inc.
410 17th St., Suite 1870
Denver, Colorado 80202
(303) 825-5712

BENTONITE MAT SPECIFICATIONS

Manufacturer: National Seal Company
1245 Corporate Boulevard, Suite 300
Aurora, Illinois 60504
(708) 898-1161

Type: Bentofix Geosynthetic Clay Liner

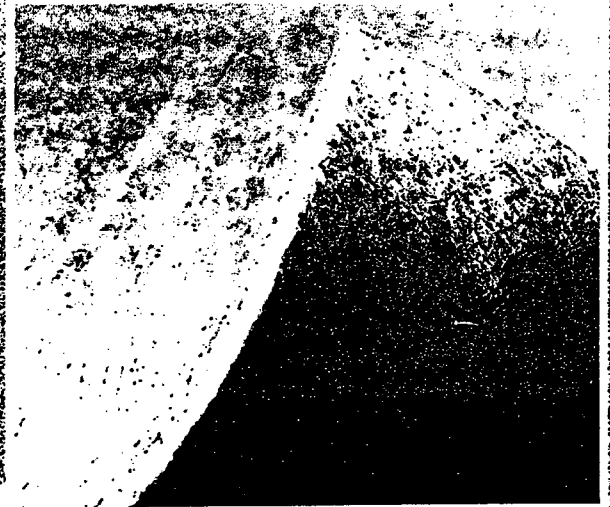
Outer Layer: Geotextile

Inner Layer: Low-Permeability Sodium Bentonite Clay

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

Bentofix®

Thermal Lock
Geosynthetic Clay Liners



NSC

National Seal Company

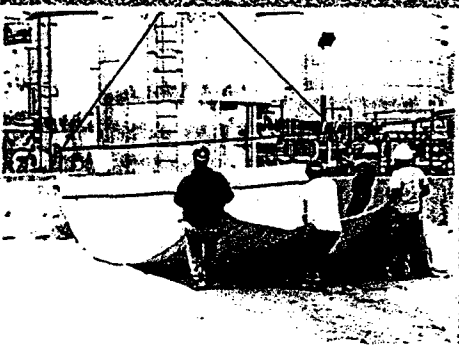
Bentofix® Thermal Lock Geosynthetic Clay Liners

Applications



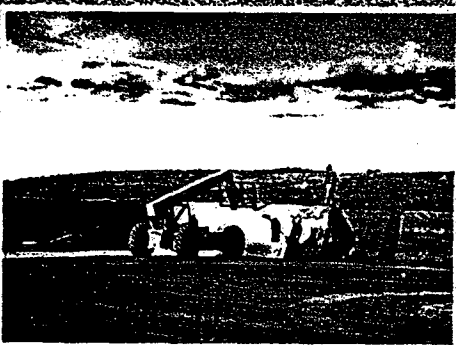
Composite Linings

Bentofix Thermal Lock GCLs can completely or partially replace thick existing compacted clay layers in composite landfill liners and caps due to the efficiency of the high swelling natural sodium bentonite clay.



Secondary Containment

Bentofix Thermal Lock GCLs are excellent for secondary containment barriers in above ground tank farms due to the ease of installation and virtually effortless pipe penetration restoration.



Liquid Containment and Canals

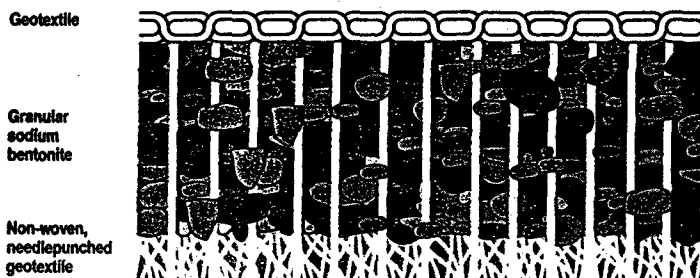
Bentofix Thermal Lock GCLs provide excellent liquid containment in reservoirs and irrigation canals, as well as industrial ponds and lagoons, due to their low permeability and high internal shear strength.

Bentofix Thermal Lock Geosynthetic Clay Liners (GCLs) are needle-punch reinforced composites which combine two durable geotextile outer layers with a uniform core of natural sodium bentonite clay to form a hydraulic barrier.

The sodium bentonite clay utilized in Bentofix Thermal Lock GCL is a naturally occurring clay mineral that swells as water enters between its clay platelets. When hydrated under confinement, the bentonite swells to form a low permeability clay layer with the equivalent hydraulic protection of several feet of compacted clay.

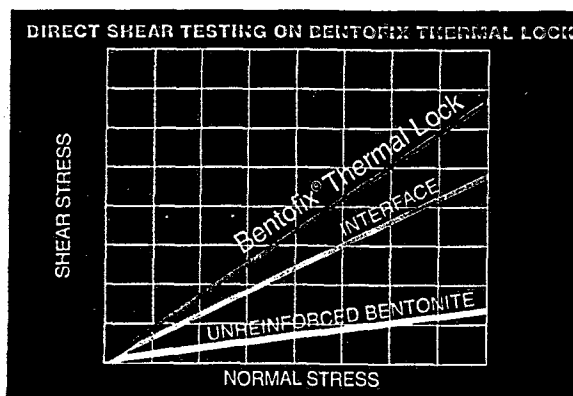
Bentofix Thermal Lock GCLs are produced by distributing a uniform layer of the sodium bentonite between two geotextiles.

CROSS SECTION OF BENTOFIX THERMAL LOCK GEOSYNTHETIC CLAY LINER



Fibers from the non-woven geotextile are then needlepunched through the layer of bentonite and incorporated into the other geotextile (either a woven or a non-woven). This process results in a strong mechanical bond between the fabrics.

A proprietary heat treating process — the Thermal Lock process — is then used to modify and more permanently lock the needle-punched fibers into place. Unique properties, including increased internal shear resistance and long term creep resistance, result from this procedure.



Bentofix Thermal Lock's internal friction angle is higher than those typically found elsewhere in a multi layer lining system.*

*In all applications, design-specific parameters will affect the actual results obtained. Site-specific testing is recommended to determine the shear strengths for each application.

Thermal locking enhances shear strength of needlepunched fibers. High-quality, natural sodium bentonite provides low permeability.

Needlepunching Makes a Difference

By needlepunching fibers through the sodium bentonite clay layer, a completely uniform, reinforced GCL is produced — with shear strength and stability advantages important to any application.

High Shear Resistance

Needlepunching reinforces the otherwise weak layer of sodium bentonite clay. Unreinforced bentonite is susceptible to shear failure, even on gentle slopes.

The Bentofix Thermal Lock GCL needlepunching process consistently reinforces the bentonite layer with thousands of high tenacity fibers that resist and transfer the shearing stresses into the encapsulating geotextiles.

Uniform Bentonite Content

The uniform confinement provided by the fibers from the needlepunching process resist lateral migration of the bentonite clay within the Bentofix Thermal Lock GCL — in either the dry or hydrated state. As a result, a consistent bentonite content is preserved throughout the composite, in turn resulting in a consistently low permeability.

Greater Installation Durability

During installation, the needlepunched fibers hold the bentonite in place and prevent the GCL from separating. Bentofix Thermal Lock GCL is more durable over a wider range of installation conditions, and, because it is needlepunched, it can greatly reduce the adverse effects of premature hydration during installation.

Superior GCL Performance

With Bentofix Thermal Lock GCLs, the clay component is no longer the limiting factor on side slopes. You can use Bentofix Thermal Lock GCLs to replace compacted clay layers on steep side slopes and be assured of low permeability without sacrificing slope stability. The inherent confining stress from the needlepunching also improves the hydraulic properties of Bentofix Thermal Lock GCLs under low confining stress applications.

Assured Quality Control

Because Bentofix Thermal Lock GCLs are factory manufactured liner products, the controlled environment of the production facility allows for greater control over critical performance characteristics. The intensive Bentofix Thermal Lock GCL quality control program ensures consistent hydraulic and physical properties through the latest ASTM procedures.

The thorough manufacturing quality control minimizes the expensive and time consuming on-site quality assurance testing required for compacted clay liners.

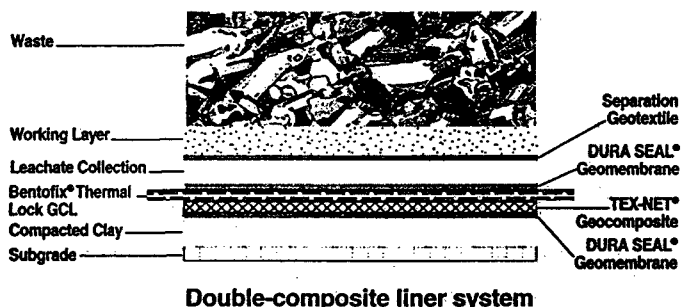
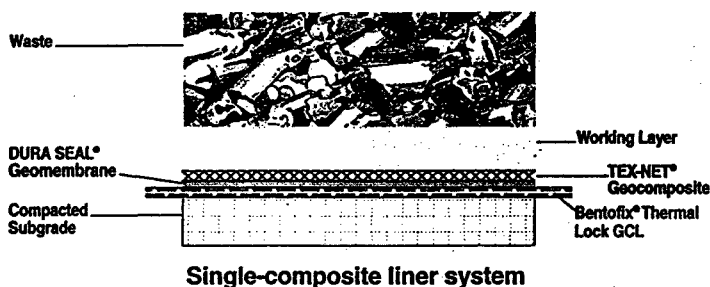
Bentofix Thermal Lock GCL provides consistent high quality performance.

Bentofix Thermal Lock Is More Versatile Than Compacted Clay

Bentofix Thermal Lock GCLs are part of an important trend toward the combined use of geosynthetics and clay materials in containment applications. In a typical composite liner system, GCLs work synergistically with polyethylene and other geomembrane materials to maximize liner system efficiency.

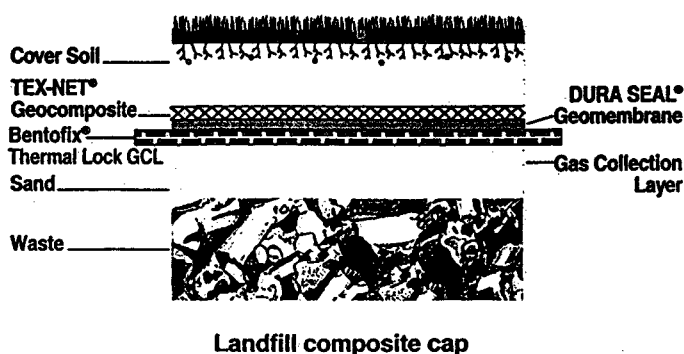
Increased Airspace and Liner Efficiency

In a composite landfill liner system, Bentofix Thermal Lock GCLs can in many cases completely replace, or significantly reduce, the required thickness of the compacted clay layer. This results in less excavation and recompaction, as well as increased containment volume. And, in a landfill, increased airspace means increased revenues.



Caps and Closures

Bentofix Thermal Lock GCLs are ideally suited for use in landfill caps and closures. Used alone, or in conjunction with a geomembrane, Bentofix Thermal Lock GCLs are resistant to the deleterious effects of differential settlement and seasonal temperature fluctuations.



Combining low permeability and high internal shear strength, Bentofix Thermal Lock is an exceptionally easy to use hydraulic barrier. Bentofix Thermal Lock GCLs are the widest geotextile based GCLs in the industry. The widest width, coupled with available custom lengths, makes Bentofix Thermal Lock the most versatile GCL available.

Simple, cost-effective installation techniques make Bentofix Thermal Lock GCL a practical alternative to a compacted clay liner for a wide range of applications, including composite landfill liners, landfill caps, secondary containment, storm water and waste water impoundments, as well as canals, dams and reservoirs.

NSC

Construction Group
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 Marketing / Italian
 Relo. / Italy / France
 European Division
 Switzerland / The Netherlands
 Germany
 Asian Division
 China / Japan / Korea

FLANGE GASKET SPECIFICATIONS

Manufacturer: Boston Industrial Products
P. O. Box 1000
Paragould, Arkansas 72451
(800) 643-0134

Style No.: 1051

Material: Neoprene

Thickness: 1/8 inch

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

These products are blends of SBR, neoprene and nitrile rubbers. They are moder-

ately oil and ozone-resistant, for use as bumpers, pads, sealing and general gasket applications. This is commercial grade material, not recommended for severe oil and ozone-resistance applications.

Style #244 is a soft, good-quality, Blended SBR/CR/NBR sheet, Black.

Style #254 is a medium-soft, good-quality, Blended SBR/CR/NBR sheet, Black.

Style #264 is a medium-hard, good-quality, Blended SBR/CR/NBR sheet, Black.

Style #274 is a hard, good-quality, Blended SBR/CR/NBR sheet, Black.

Style #284 is a hard, good-quality Blended SBR/CR/NBR sheet, Black.

For applications needing greater oil resistance:

Style #361 is a good-quality nitrile sheet. Smooth finish. Black.

Style #1051 is a good-quality neoprene sheet (51% neoprene base). Black.

CAUTION

Exposure to chemicals and heat can affect the performance of sheet rubber and should be considered when selecting a material. Since each application is unique consult Customer Service at 1(800) 643-0134 for further information.

Product	Elastomer	Color	Durometer	Minimum Tensile (PSI)	Finish	Ultimate Elongation (% Min.)	Approx. Weight (Lbs./Sq. Yd. 1/16" Thick)	Width* (Inches)	Gauge** (Inches)
Style #244	Blended SBR/CR/NBR	Black	35-45	800	Smooth	350	3.7	36	1/16, 3/32, 1/8, 3/16, 1/4, 3/8, 1/2
Style #254	Blended SBR/CR/NBR	Black	45-55	800	Smooth	300	4.0	36 & 48	1/16, 3/32, 1/8, 3/16, 1/4, 3/8, 1/2, 3/4, 1
Style #264	Blended SBR/CR/NBR	Black	55-65	800	Smooth	300	3.9	36, 48 & 72	3/32, 1/16, 3/32, 1/8, 3/16, 1/4, 3/8, 1/2, 3/4, 1, 1 1/2, 2
Style #274	Blended SBR/CR/NBR	Black	65-75	800	Smooth	200	4.0	36 & 48	1/16, 3/32, 1/8, 1/4, 3/8, 1/2, 3/4, 1
Style #284	Blended SBR/CR/NBR	Black	75-85	800	Smooth	200	4.1	36	1/16, 1/8, 3/16, 1/4, 3/8, 1/2
Style #361	Nitrile	Black	55-65	1,800	Smooth	400	3.6	36	1/16, 1/8, 1/4
Style #1051	Neoprene	Black	45-55	1,000	Smooth	300	4.3	36	1/16, 3/32, 1/8, 3/16, 1/4
			55-65			250	4.6		
			65-75			200	4.4		

al packings • gaskets • sealing specialists

*Width tolerance is ± one inch

**Thickness tolerance varies with gauge. Refer to "Sheet Rubber Tolerances" Page 15.

Numbers appearing in light face are made-to-stock. Please call customer service at 1(800) 643-0134.

125-150 LB. PIPE FLANGE GASKET

PIPE SIZE OLD STD. I.D.	NEW STD. ASA I.D. & O.D.	LIST PRICE	PIPE SIZE OLD STD. I.D.	NEW STD. ASA I.D. & O.D.	NO. HOLES	DIA. HOLES	BOLT CIRCLE
1/2	27/32 x 1-7/8		1/2	27/32 x 3-1/2	4	5/8	2-3/8
3/4	1-1/16 x 2-1/4		3/4	1-1/16 x 3-7/8	4	5/8	2-3/4
1	1-5/16 x 2-5/8		1	1-5/16 x 4-1/4	4	5/8	3-1/8
1-1/4	1-21/32 x 3		1-1/4	1-21/32 x 4-5/8	4	5/8	3-1/2
1-1/2	1-29/32 x 3-3/8		1-1/2	1-29/32 x 5	4	5/8	3-7/8
2	2-3/8 x 4-1/8		2	2-3/8 x 6	4	3/4	4-3/4
2-1/2	2-7/8 x 4-7/8		2-1/2	2-7/8 x 7	4	3/4	5-1/2
3	3-1/2 x 5-3/8		3	3-1/2 x 7-1/2	4	3/4	6
3-1/2	4 x 6-3/8		3-1/2	4 x 8-1/2	8	3/4	7
4	4-1/2 x 6-7/8		4	4-1/2 x 9	8	3/4	7-1/2
4-1/2	5 x 7		4-1/2	5 x 9-1/4	8	3/4	7-3/4
5	5-9/16 x 7-3/4		5	5-9/16 x 10	8	7/8	8-1/2
6	6-5/8 x 8-3/4		6	6-5/8 x 11	8	7/8	9-1/2
7	7-5/8 x 10		7	7-5/8 x 12-1/2	8	7/8	10-3/4
8	8-5/8 x 11		8	8-5/8 x 13-1/2	8	7/8	11-3/4
9	9-5/8 x 12-1/2		9	9-5/8 x 15	12	7/8	13-1/4
10	10-3/4 x 13-3/8		10	10-3/4 x 18	12	1	14-1/4
12	12-3/4 x 16-1/8		12	12-3/4 x 19	12	1	17
14	14 x 17-3/4		14	14 x 21	12	1-1/8	18-3/4
15	15 x 19		15	15 x 22-1/4	16	1-1/8	20
16	16 x 20-1/4		16	16 x 23-1/2	16	1-1/8	21-1/4
18	18 x 21-5/8		18	18 x 25	16	1-1/4	22-3/4
20	20 x 23-7/8		20	20 x 27-1/2	20	1-1/4	25
22	22 x 26		22	22 x 29-1/2	20	1-1/4	27-1/4
24	24 x 28-1/4		24	24 x 32	20	1-3/8	29-1/2
26	26 x 30-1/2		26	26 x 34-1/4	24	1-3/8	31-3/4
28	28 x 32-3/4		28	28 x 36-1/2	28	1-3/4	35
30	30 x 34-3/4		30	30 x 38-3/4	28	1-3/8	36
32	32 x 38		32	32 x 41-3/4	28	1-5/8	38-1/2
34	34 x 39		34	34 x 43-3/4	32	1-5/8	40-1/2
36	36 x 41-1/4		36	36 x 46	32	1-5/8	42-3/4
38	38 x 43-5/8		38	38 x 48-3/4	36	1-5/8	45-1/4
40	40 x 45-5/8		40	40 x 50-3/4	36	1-5/8	47-1/4
42	42 x 48		42	42 x 53	36	1-5/8	49-1/2
44	44 x 50-1/8		44	44 x 55-1/4	40	1-5/8	51-3/4
46	46 x 52-1/8		46	46 x 57-1/4	40	1-5/8	53-3/4
48	48 x 54-1/2		48	48 x 59-1/2	44	1-5/8	56

FLANGE BOLT SPECIFICATIONS

Manufacturer: Various

Model: Grade 8 Steel, Zinc Plated

Size: Varies

Supplying Vendor: Bowman Distributors
1625 Oakbrook Drive
Norcross, Georgia 30093
(800) 927-3555

ELECTRODEPOSITED COATINGS OF ZINC ON IRON AND STEEL

Abstract of
ASTM B633
1985

IFI Notes:

1. ASTM B633 is a specification developed through the procedures of ASTM. B633 is under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and is the direct responsibility of its Subcommittee B08.04 on Zinc and Cadmium Coatings.

2. B633 covers electrodeposited coatings of zinc on all forms of iron and steel products, including fasteners. This abstract omits those requirements dealing with quality assurance and inspection, and a listing of applicable documents. For the omitted information, refer to the complete B633.

Values in B633 are given in metric units. As a convenience, where appropriate, soft converted inch-pound equivalents have been added.

The paragraph numbers throughout this abstract are those of ASTM B633-85.

3. ASTM B633-85 is abstracted, with permission, from the Annual Book of ASTM Standards, copyright American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103 U.S.A.

1. Scope.

1.1 This specification covers requirements for electrodeposited zinc coatings applied to iron or steel articles to protect them from corrosion. It does not cover electrodeposited zinc-coated steel wire or sheets (see ASTM A591 for sheets).

1.2 The coatings are provided in four standard thickness classes (4.1), in the as-plated condition or with one of three types of supplementary finish (4.2).

1.3 This standard may involve hazardous

standard does not purport to address all or the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Applicable Documents.

(Refer to complete specification, see page M-28.)

3. Definitions.

3.1 Definitions of the terms used in this specification are in accordance with ASTM B374.

4. Classification.

4.1. Thickness — The coating shall be provided in the four thickness classes defined in Table 1.

4.2 Finish — The coating shall have one of the finish types defined as follows:

Type	Description
I	As-plated without supplementary treatment
II	With colored chromate conversion coatings
III	With colorless chromate conversion coatings
IV	With phosphate conversion coatings

5.1 When ordering the electroplating of articles, the purchaser shall state the designation number, the date of issue, the class or service condition number, and the type. (See 4.1, 4.2, and 7.1.)

5.2 If necessary, the purchaser shall include on his part drawings or purchase order the following:

5.2.1 Electroplating application to high strength steel, if specified (6.4),

5.2.2 Thickness, if other than specified (4.1, 7.1),

ELECTRODEPOSITED COATINGS OF ZINC ON IRON AND STEEL

Table 1 Thickness Classes for Coatings

Classification ^a Number and Conversion Coating Suffix	Service Condition ^{a,c}	Thickness, min μm
Fe/Zn 25	SC 4 (very severe)	25
Fe/Zn 13	SC 3 (severe)	13
Fe/Zn 8	SC 2 (moderate)	8
Fe/Zn 5	SC 1 (mild)	5

^aIron or steel with zinc electroplate. Numeral indicates thickness in micrometres.

^bSee Appendix X2.

^cWhere service conditions are valid only for coatings with chromate conversion coating. Type II for SC 4 and SC 3, and Type III for SC 2 and SC 1.

5.2.3 Location of significant surface (7.1.1, 7.1.2),

5.2.4 Luster (7.3),

5.2.5 Corrosion resistance test, if specified (9.3, 10.3),

5.2.6 Hydrogen embrittlement test, if required (9.4, 10.4),

5.2.7 Sample size for inspection, if other than specified, and

5.2.8 Supplementary requirements, if applicable (Supplementary Requirement).

6. Materials and Manufacture.

6.1 The coatings shall be essentially pure zinc produced by electrodeposition.

6.2 Defects in the surface of the basis metal, such as scratches, porosity, pits, inclusions, cracks, roll marks, and die marks, may adversely affect the appearance and performance of coatings applied thereto despite the observance of the best electroplating practices. Accordingly, the electroplater's responsibility for defects in the coating resulting from such conditions shall be waived, except when he is the prime contractor supplying electroplated parts. In this event, the basis metal shall be subjected to such polishing or buffing operations as are necessary to yield deposits with the desired final luster and appearance. To minimize problems of this sort, the specifications covering the basis material on the item to be electroplated shall contain appropriate limitations to such basis metal conditions.

6.3 Cleaning of Basis Metal — Proper preparatory procedures and thorough cleaning of the basis metal are essential to ensure satisfactory adhesion and corrosion resistance performance of the coating. It is recommended that the following appropriate ASTM Recommended Practices be used: B183, B242, B254, B320, and B322.

6.4 High-Tensile Strength Metals — Unless otherwise specified, high strength steels having a tensile strength greater than 1,700 MPa (245 ksi) shall not be electroplated.

6.5 Stress Relief — All steel parts having an ultimate tensile strength of 1,000 MPa (145 ksi) and above, and that have been machined, ground, cold formed or cold straightened, shall be heat treated at a minimum of 190° C for 3 h or more for stress relief before cleaning and electroplating.

6.6 Hydrogen Embrittlement Relief — All electroplated parts having a tensile strength of 1,200 MPa (174 ksi) or higher shall be baked at a minimum of 190° C for 3 h or more within 4 h after electroplating to provide hydrogen embrittlement relief. Electroplated springs and other parts subject to flexure shall not be flexed before the hydrogen embrittlement relief treatment. The baking treatment shall be done before the application of the supplementary treatments. Baked parts shall not crack or fail by fracture when tested in accordance with 10.4.

6.7 Reactivation treatment — Electroplated surfaces passivated as a result of the baking operation shall be reactivated before receiving a supplementary treatment. Surfaces in-

ELECTRODEPOSITED COATINGS OF ZINC ON IRON AND STEEL

Abstract of
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1985

tended for supplementary treatments (Types II and III) may be reactivated by immersion in a dilute acid solution. Surfaces should be activated as soon as possible following baking and should be handled carefully to avoid contamination.

6.8 Supplementary Treatments — The supplementary film treatment for Types II and III shall be in accordance with ASTM B201. The treatment required for conversion to Type IV shall be in accordance with ASTM D2092.

NOTE — The zinc surface is attacked by supplementary treatments, thereby diminishing the amount of metallic zinc present. With Classes Fe/Zn25 and Fe/Zn13, this reduction is insignificant; but it is significant with Fe/Zn8 and Fe/Zn5. Therefore, it is recommended that supplementary treatments not be applied to zinc coatings having a nominal thickness less than 5 μm (0.0002 in.).

7. Coating Requirements.

7.1 Thickness — The thickness shall be specified in accordance with 4.1 and 5.1.

7.2 Significant Surfaces — Significant surfaces are areas where minimum thicknesses to be met shall be designated on the applicable drawing or by the provision of a suitably marked sample. Significant surfaces may be defined as those normally visible, directly or by reflection, which are essential to the appearance or serviceability of the article when assembled in normal position; or which can be the source of corrosion products that deface visible surfaces on the assembled article.

7.1.2 Surfaces on which the specified thickness of deposit cannot readily be controlled, such as threads, holes, deep recesses, bases of angles, and similar areas, are normally exempt from minimum thickness requirements, unless they are specially designated as not exempt. When such areas are designated, and thus made subject to minimum thickness requirements, the purchaser and the manufacturer shall recognize the necessity for either thicker deposits on other areas or for special racking.

NOTE 2 — The dimensional tolerance of most threaded articles, such as nuts, bolts, screws, and similar fasteners with complementary threads, normally does not permit the application of a coating thickness much greater than 8.0 μm (0.0003 in.). If heavier coatings are required, allowance for the deposit build-up must be made during the manufacture of the threaded articles.

7.2 Adhesion — The adhesion of the coating shall be such that when examined in accordance with 10.2, the coating shall not show separation from the basis metal at the interface.

7.3 Luster — Unless otherwise specified by the purchaser, a bright, semi-bright, or dull luster shall be acceptable.

7.4 Corrosion Resistance — Zinc coatings with Types II and III treatments shall show neither corrosion products of zinc nor basis metal corrosion products at the end of the test period, as shown below, when tested by continuous exposure to salt spray in accordance with 10.3. The appearance of corrosion products visible to the unaided eye at normal reading distance shall be cause for rejection except that white corrosion products at the edges of specimens shall not constitute failure.

Corrosion Resistance Requirements	
Types	Test Period, hours
II	96
III	12

7.5 Workmanship — The surface of the electroplated article shall be uniform in appearance, free of visible coating defects, such as blisters, pits, roughness, nodules, burning, cracks, or unplated areas, and other defects that will affect the function of the coating. The coating shall not be stained or discolored. However, superficial staining that results from rinsing or slight discoloration resulting from any drying or baking operation to relieve hydrogen embrittlement, shall not be cause for rejection. On articles where a visible contact mark is unavoidable, its position shall be that chosen by the purchaser. The electroplated article shall be clean and free of damage.

8. Sampling.

(Refer to complete specification.)

9. Specimen Preparation.

9.1 Electroplated Parts or Separate Specimens — When the electroplated parts are of such form, shape, size, and value as to prohibit use thereof, or are not readily adaptable

ELECTRODEPOSITED COATINGS OF ZINC ON IRON AND STEEL

to a test specified herein, or when destructive tests of small lot sizes are required, the test shall be made by the use of separate specimens plated concurrently with the articles represented. The separate specimens shall be of a basis metal equivalent to that of the articles represented. "Equivalent" basis metal includes chemical composition, grade, condition, and finish of surface prior to electroplating. For example, a cold-rolled steel surface should not be used to represent a hot-rolled steel surface. Due to the impracticality of forging or casting separate test specimens, hot-rolled steel specimens may be used to represent forged and cast steel articles. The separate specimens may also be cut from scrap castings when ferrous alloy castings are being electroplated. These separate specimens shall be introduced into a lot at regular intervals before the cleaning operations, preliminary to electroplating, and shall not be separated therefrom until after completion of electroplating. Conditions affecting the electroplating of specimens, including the spacing, plating media, bath agitation, temperature, etc., in respect to other objects being electroplated, shall correspond as nearly as possible to those affecting the significant surfaces of the articles represented. Unless a need can be demonstrated, separately prepared specimens shall not be used in place of production items for nondestructive and visual examinations.

9.2 Thickness and Adhesion Specimens — If separate specimens for thickness and adhesion tests are required, they shall be panels not less than 25 mm wide, 100 mm long, and 1 mm thick (1 in. x 4 in. x 0.040 in.).

9.3 Corrosion Resistance Specimens — If separate specimens for corrosion resistance tests are required, they shall be panels not less than 150 mm long, 100 mm wide, and approximately 1 mm thick (6 in. x 4 in. x 0.040 in.).

9.4 Hydrogen Embrittlement Specimens — If specimens are required the configuration shall be that specified by the purchaser.

10. Test Methods.

10.1 Thickness:

10.1.1 The thickness of the coating may be determined by ASTM Methods B487, B499, B504, or B568, as applicable.

10.1.2 MIL-STD-1312, Test 12, may be used for thickness measurements of electroplated fastener hardware.

10.1.3 Other methods may be used if it can be demonstrated that the uncertainty of the measurement with these methods is less than 10 percent.

10.1.4 Make thickness measurements of zinc electroplating, Types II, III, and IV, after application of the supplementary treatments. When ASTM Methods B504 or B568 are used, remove the supplementary treatment prior to testing. The chromate film may be removed from Type II and Type III coatings by using a very mild abrasive (a paste of levigated alumina rubbed on with the finger). The phosphate coating may be removed from Type IV coating by a concentrated (28%) ammonia solution that quickly dissolves the phosphate coating but does not attack the underlying zinc.

10.2 Adhesion — Determine adhesion by any suitable procedure in accordance with ASTM B571.

10.3 Corrosion Resistance — When specified in the contract or purchase order, determine the corrosion resistance in accordance with ASTM B117. Subject the selected samples to the salt spray test; the length of time to be applicable for the type of supplementary coating shall be in accordance with the requirements of 7.4. To secure uniformity of results, age Types II and III supplementary coatings at room temperature for 24 h before subjection to the salt spray.

10.4 Hydrogen Embrittlement Relief — When specified in the contract or purchase order, prepare and test the satisfactory behavior of parts to indicate freedom from hydrogen embrittlement.

10.5 Visual Examination — Examine material for compliance with the requirements of luster (7.3) and workmanship (7.5) after electroplating.

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11. Rejection.

12. Certification.

(Refer to complete specification for paragraphs 11 and 12.)

13. Packaging and Packing.

13.1 Preservation, packaging, and packing methods for zinc-electroplated parts or articles employed by a supplier shall be such as to preclude damaging during shipment and handling.

SUPPLEMENTARY REQUIREMENT

The following supplementary requirement shall apply only when specified by the purchaser as part of the purchaser's order or contract and for all agencies of the United States Government.

S1. Responsibility for Inspection.

(Refer to complete specification.)

APPENDIXES

X1. SERVICE LIFE OF ZINC

X1.1 The service life of zinc coating is a function of its thickness and the type of environment to which it is exposed. While the conditions of exposure and uses of electroplated metal are so varied that it is not definitely possible to predict the exact life of articles protected by a coating of a given thickness, those using zinc coatings can draw on the wealth of practical experience at hand, supplemented by results of corrosion tests carried out over the years. As a result of large scale and long range tests conducted by ASTM and other organizations, there is excellent information on the corrosion behavior of zinc and zinc coatings. The following data, based on world-wide testing, may be used to

compare the behavior of electrodeposited coatings of zinc in various atmospheres. The values are only relative, since individual studies in various parts of the world have resulted in figures which vary widely from these averages.

Atmosphere	Mean Corrosion Rate
Industrial	5.6 $\mu\text{m}/\text{year}$
Urban non-industrial or marine	1.5 $\mu\text{m}/\text{year}$
Suburban	1.3 $\mu\text{m}/\text{year}$
Rural	0.8 $\mu\text{m}/\text{year}$
Indoors	Considerably less than 0.5 $\mu\text{m}/\text{year}$

Note X1.1 — The mean corrosion rate given pertains to zinc only and does not include a corrosion rate when zinc is passivated or in contact with other materials.

X2. EXAMPLES OF APPROPRIATE SERVICE CONDITIONS AND DESCRIPTION OF SERVICE CONDITIONS

X2.1 SC 4 — Very Severe — Exposure to harsh conditions, or subject to frequent exposure to moisture, cleaners, and saline solutions, plus likely damage by denting, scratching, or abrasive wear. Examples are: plumbing fixtures, pole line hardware.

X2.2 SC 3 — Severe — Exposure to condensation, perspiration, infrequent wetting by rain, and cleaners. Examples are: tubular furniture, insect screens, window fittings, builder's hardware, military hardware, wash-

ing machine parts, bicycle parts.

X2.3 SC 2 — Moderate — Exposure mostly to dry indoor atmospheres but subject to occasional condensation, wear, or abrasion. Examples are: tools, zippers, pull shelves, machine parts.

X2.4 SC 1 — Mild — Exposure to indoor atmospheres with rare condensation and subject to minimum wear or abrasion. Examples are: buttons, wire goods, fasteners.

ORIFICE PLATE SPECIFICATIONS

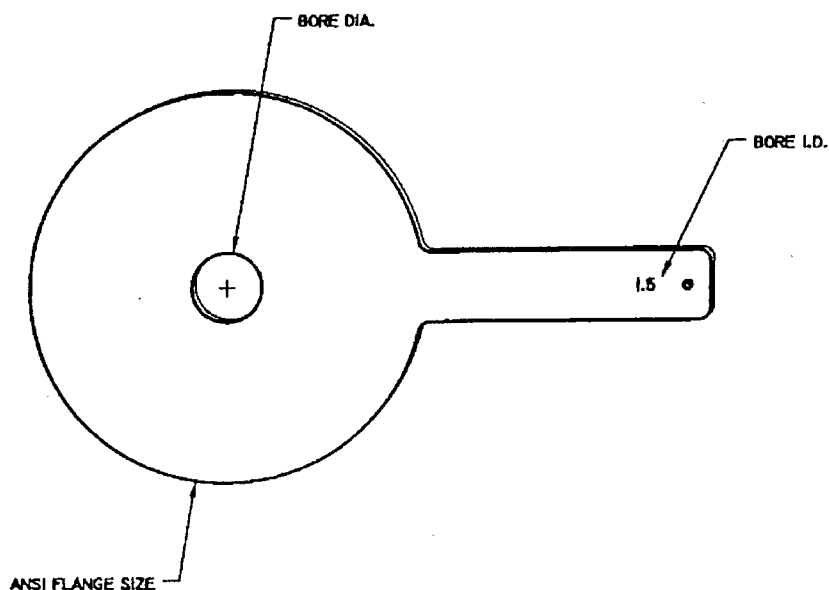
Manufacturer: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

Model: Poly Orifice - 6" x 2", 6" x 1.5", 8" x 2", 14" x 7"

Material: Polypropelene - 1/4" thick

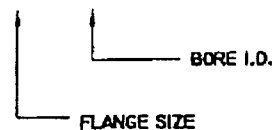
Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

POLYPROPELENE ORIFICE PLATE



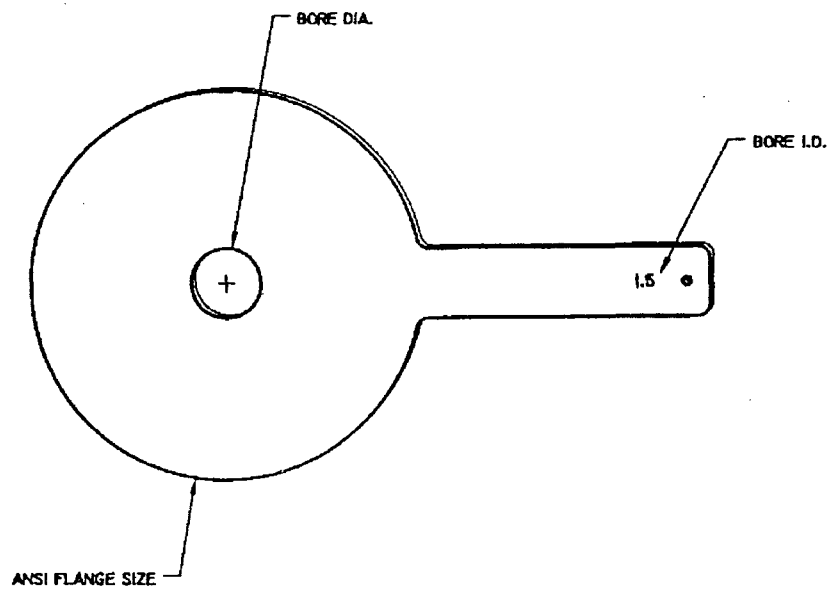
MODEL NUMBER SPECIFICATION: POLY ORIFICE - 6" X 2"

CAN BE ORDERED FOR ANY SIZE ANSI FLANGE,
AND BORE I.D. IN 0.25 INCH INCREMENTS



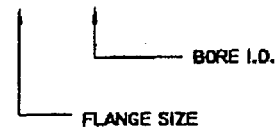
MATERIALS: POLYPROPELENE, 1/4" THICK

POLYPROPELENE ORIFICE PLATE



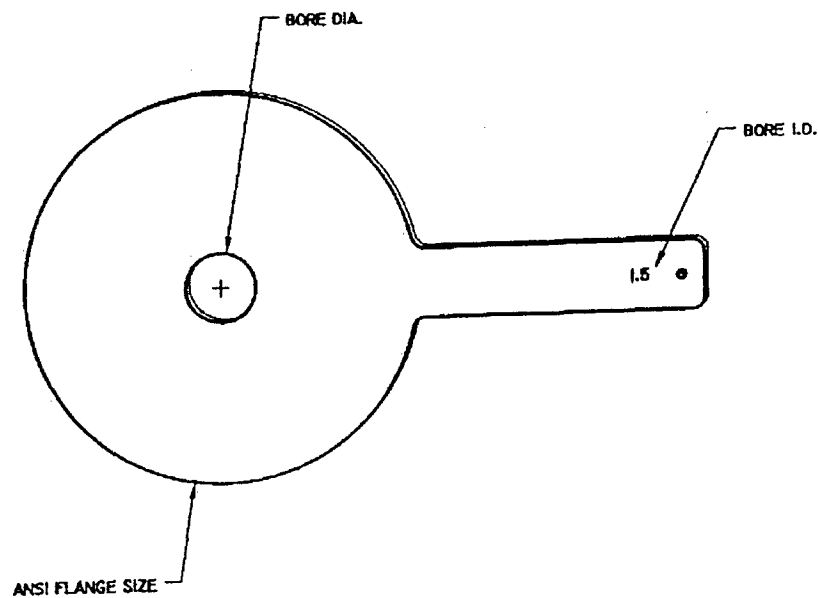
MODEL NUMBER SPECIFICATION: POLY ORIFICE - 6" X 1.5"

CAN BE ORDERED FOR ANY SIZE ANSI FLANGE,
AND BORE I.D. IN 0.25 INCH INCREMENTS



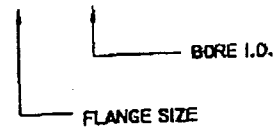
MATERIALS: POLYPROPELENE, 1/4" THICK

POLYPROPELENE ORIFICE PLATE



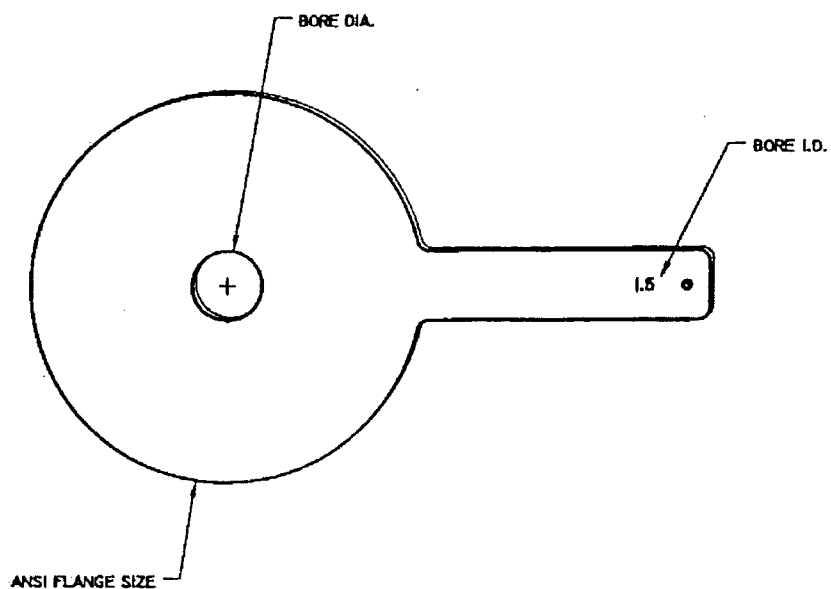
MODEL NUMBER SPECIFICATION: POLY ORIFICE - 8" X 2"

CAN BE ORDERED FOR ANY SIZE ANSI FLANGE,
AND BORE I.D. IN 0.25 INCH INCREMENTS



MATERIALS: POLYPROPELENE, 1/4" THICK

POLYPROPELENE ORIFICE PLATE



MODEL NUMBER SPECIFICATION: POLY ORIFICE-14" X 7"

CAN BE ORDERED FOR ANY SIZE ANSI FLANGE,
AND BORE I.D. IN 0.25 INCH INCREMENTS



MATERIALS: POLYPROPELENE, 1/4" THICK

STEEL PIPE CASING SPECIFICATIONS

Manufacturer: Van Leeuwen Pipe and Tube
2721 North 36th Street
Tampa, Florida 33605
(813) 248-6588

Supplying Vendor: Hughes Supply
5311 Doolittle Road
Jacksonville, Florida 32254
(904) 354-5621

VAN LEEUWEN PIPE AND TUBE

Sold To: HUGHES SUPPLY

5311 DOOLITTLE ROAD
JACKSONVILLE, FL 32254

Ship Point:

Van Leeuwen Tampa Shipping Point
2721 North 36th Street
Tampa, FL 33605

V Item	Material #	Customer Mat #	Weight
C Item	Description/Special Handling		

000001	52		3,400.320 LB
000000	10 .365 I A53A WLD PIPE BPE 21'		
	10.750 OD x .365 (10in STD) 273.1 X 9.27 MM		
000002	54		8,326.080 LB
000000	12 .375 I A53A WLD PIPE BPE 21'		
	12.750 OD x .375 (12in STD) 323.9 X 9.53 MM		
000003	1123		9,167.760 LB
000000	14 .375 I API5L/A53B ERW PIPE BE DR		
	14 OD x .375 (14in STD) 355.6 X 9.53 MM		
000004	1128		5,256.720 LB
000000	16 .375 I API5L/A53B ERW PIPE BE DR		
	16 OD x .375 (16in STD) 406.4 X 9.53 MM		

***** Shipping Instructions *****

CORRUGATED STEEL PIPE SPECIFICATIONS

Manufacturer: Contech Construction Products, Inc.
PO Box 800
Middletown, Ohio 45042
(312) 573-1110

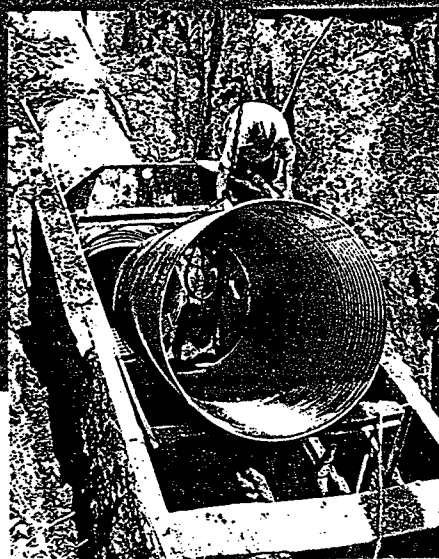
Material: Galvanized

Supplying Vendor: Southern Culvert
PO Box 460
Pinellas Park, FL 33780-0460
(800) 881-1100

CONTECH

CONSTRUCTION PRODUCTS INC.

Corrugated Steel Pipe and Pipe-Arch



Materials

Pipe and pipe-arch are fabricated from three materials: galvanized steel for normal applications, Armco ALUMINIZED STEEL Type 2 and FIBER-BONDED Steel for increased durability.

Galvanized structures are produced from ZINCGRIP Steel. The continuous hot-dip zinc coating is applied under rigorous quality control standards.

Armco ALUMINIZED STEEL Type 2 is available as corrugated steel pipe and pipe-arch. This coating significantly enhances the pipe's durability while retaining the inherent benefits of corrugated steel pipe for use in municipal storm sewers or other drainage projects.

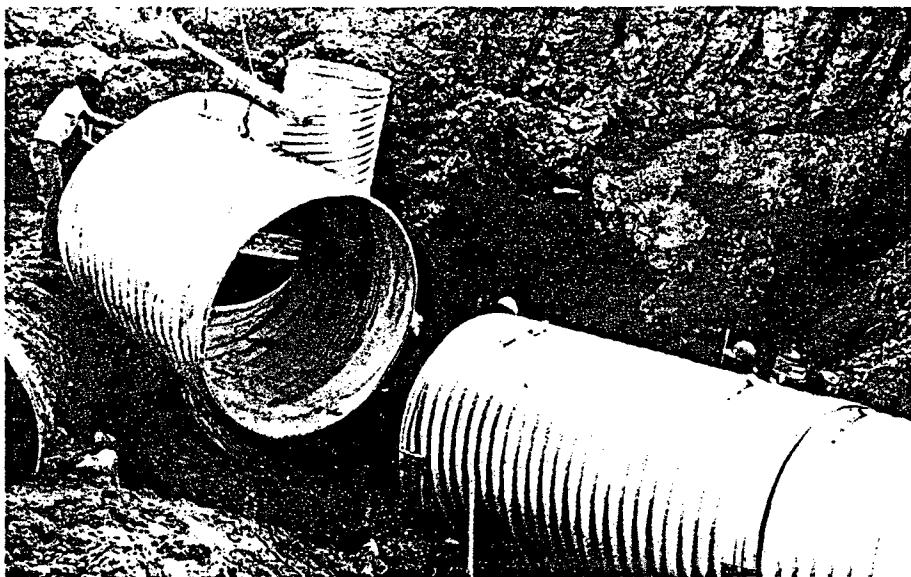
The pipe is fabricated from steel coils which have been hot-dip coated in commercially pure aluminum. More than 30 years of field testing have proven that ALUMINIZED STEEL Type 2 corrugated steel pipe will provide at least two times the service life when compared with galvanized material and used in the recommended environmental range.

For maximum durability under corrosive conditions, such as acid mine runoff or salt water installations, FIBER-BONDED Corrugated Steel Pipe has performed successfully since 1936.

FIBER-BONDED is made from a black steel sheet which passes through a hot-dip galvanizing process. As the sheet emerges, a layer of fibers is pressed into the molten zinc on both surfaces bonding the fibers into the coated-steel substrate. The sheets are corrugated and fabricated into a durable, long-lasting corrugated steel pipe. Then the pipe is asphalt-coated. Adhesion of the bituminous coating is the key to pipe durability.

Coatings and pavements

The variety of protective coatings available on Contech corrugated metal pipe and pipe-arch can provide the degree of corrosion protection dictated by the site. Each system—galvanized, galvanized and coated, ALUMINIZED STEEL Type 2, and FIBER-BONDED—provides a degree of protection for increasingly corrosive installations.



HEL-COR CL (concrete-lined) elbow with manhole is lowered into place.

The asphalt coating can be added to corrugated steel pipe for additional protection. This coating is of greatest benefit when soil side corrosion is the concern.

PAVED-INVERT, for erosion protection, is a shop-applied asphaltic paving along the invert of the pipe, where most pipe wear takes place.

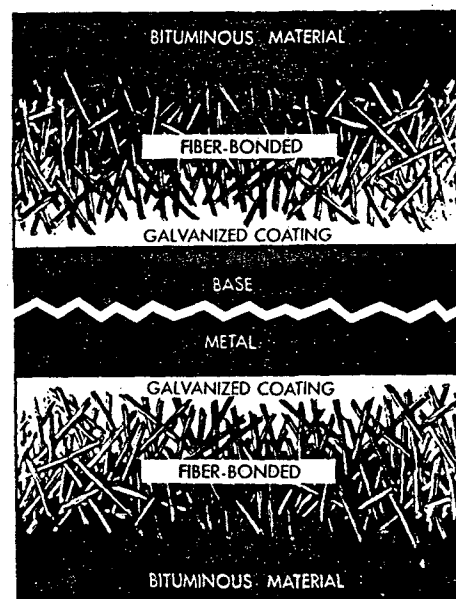
Linings

SMOOTH-FLO is a smooth, fully circumferential asphalt lining for added hydraulic efficiency. All interior corrugations are filled with asphalt as the pipe is spun at high speeds, producing the smooth lining.

HEL-COR CL incorporates a concrete lining that increases the hydraulic capacity of the pipe while retaining all the benefits inherent in corrugated steel pipe. The lining is applied to cover the corrugations of the pipe to a depth of not less than $\frac{1}{8}$ ". The lining is applied by a method that provides a surface with excellent hydraulic efficiency. See hydraulic tables, Page 10.

(A Manning's "n" factor of 0.012 is applicable to SMOOTH-FLO Pipe and HEL-COR CL.)

For more information on these materials, coatings, pavements and linings, call your local Contech Sales Engineer.



With FIBER-BONDED steel pipe, fibers are embedded in the molten zinc. This improved surface results in greater adhesion of asphalt coatings and increases long-term durability.

2²/₃" x 1¹/₂" Sewer Gage Table for Corrugated Steel Pipe

H 20 Live Load

Diameter of Pipe, in.	Depth of Trench to Top of Pipe, ft.					
	1-15	16-20	21-25	26-30	31-35	36-40
12 to 48	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
54	0.079"	0.079"	0.079"	0.079"	0.079"	0.079"
60	0.079"	0.079"	0.079"	0.079"	0.079"	0.079"
66	0.079"	0.079"	0.079"	0.079"	0.079"	0.079"
72	0.079"	0.079"	0.079"	0.079"	0.079"	0.079"
78	0.109"	0.109"	0.109"	0.109"	0.109"	0.109"
84	0.109"	0.109"	0.109"	0.109"	0.109"	0.109"
90	0.109"	0.109"	0.109"	0.138"	0.168"	0.168"
96	0.109"	0.109"	0.138"	0.138"	0.168"	0.168"

3" x 1" or 5" x 1" Sewer Gage Table for Corrugated Steel Pipe

H 20 Live Load

Diameter of Pipe, in.	Maximum Height of Trench Above Top of Pipe, ft.					
	15	16-20	21-25	26-30	31-35	36-40
54	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
60	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
66	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
72	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
78	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
84	0.064"	0.064"	0.064"	0.064"	0.064"	0.064"
90	0.064"	0.064"	0.064"	0.064"	0.064"	0.079"
96	0.064"	0.064"	0.064"	0.064"	0.064"	0.079"
102	0.064"	0.064"	0.064"	0.064"	0.079"	0.079"
108	0.064"	0.064"	0.064"	0.064"	0.079"	0.079"
114	0.064"	0.064"	0.064"	0.079"	0.079"	0.109"
120	0.064"	0.064"	0.064"	0.079"	0.109"	0.109"
126	0.079"	0.079"	0.079"	0.079"	0.109"	0.109"
132	0.079"	0.079"	0.079"	0.109"	0.109"	0.109"
138	0.079"	0.079"	0.079"	0.109"	0.109"	0.109"
144	0.109"	0.109"	0.109"	0.109"	0.109"	0.109"

Sewer table based on trench conditions

The structural design of corrugated steel pipe installations has advanced significantly in the last 25 years. As a result, efficient pipe designs for culverts have been available for many years. However, sewers are not installed in the same manner as culverts (which are normally installed in an above ground projection condition).

Because trench conditions result in significantly less load on the pipe and eliminate the use of very large mechanized equipment next to the pipe, seam strength or wall strength and minimum practical pipe stiffness requirements are less for the trenched sewer than the culvert.

This Sewer Table presents recommended gages for trench depths of 1 to 40 feet. Thicknesses shown are practical for trench installation with

reasonable care in handling. Wall stresses are within the allowable buckling limits established in the AISI Handbook of Steel Drainage and Highway Construction Products, based on 90 percent relative compaction of backfill around the pipe, and a soil weight of 120 pounds per cubic foot.

An Answer to Your Drainage and Construction Problems

Contech is the major producer of steel, aluminum and plastic products for the highway, sewage, drainage and other construction markets. You can have confidence in the strength, durability and economy of these products to help solve almost any drainage or construction problem. They have been tested and proven over years of research and practical field experience.

HEL-COR Corrugated Steel Pipe and CORLIX Corrugated Aluminum Pipe . . . These products are designed for use as drainage culverts, sanitary and storm sewers, stream enclosures and underground conduits for highway, railway, industrial and municipal applications. They are supplied in a variety of linings and coatings to meet almost any durability or hydraulic requirement.

End Sections . . . A modern end finish for culverts and sewer outfalls, either pipe or pipe-arch structures in steel or aluminum.

ULTRA FLO Storm Water Pipe . . . For improved hydraulic capacity and light weight for storm sewers.

Slotted Drain . . . An efficient system for highway and parking lot drainage involving only narrow slots on the surface.

Perforated Pipe . . . For subdrainage under airports, highways and railroads where the strength of steel is needed.

HEL-COR Pile Shell . . . For foundations under buildings and bridges.

MULTI-PLATE Pipe, Pipe-Arch and Arch . . . For bridges, stream enclosures and storm sewers.

Box Culverts . . . For maximum water flow under minimum headroom. Aluminum light weight means easier installation.

SUPER-SPAN Structures . . . Economically and aesthetically advantageous for new and replacement bridges.

Bin-Type Retaining Walls . . . For unstable slopes, limited rights-of-way, shore and bank protection.

Liner Plate . . . For constructing new utility tunnels under existing highways and railroads.

Bridge Plank . . . For reflooring bridges and for new bridge construction.

Metric Sheeting . . . For trenches, cofferdams, shore protection and cutoff walls.

Guide Rail . . . A safety device for highways, bridges and parking lots.

A-2000 PVC Pipe . . . Profiled wall construction and smooth interior for small-diameter sanitary sewers. Meets ASTM F 949.

ABS and PVC TRUSS PIPE . . . Combines strength, stiffness, joint integrity, and economy for gravity-flow sanitary sewers. Meets ASTM D 2680.

Geosynthetics . . . TENSAR Geogrids for soil reinforcement, base stabilization, slope reinforcement and retaining walls. TREVIRA Nonwoven Geotextiles and Contech Woven Geotextiles for drainage, separation, filtration and stabilization. STRIPDRAIN for highway edge drains and building foundation drainage. Contech ERO-MAT for erosion control.

Contech Construction Products Inc. • P.O. Box 800 • Middletown, Ohio 45042

Regional Offices are in the following cities:

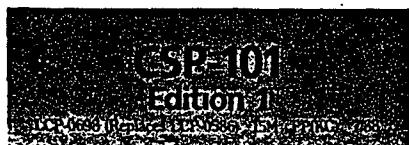
Atlanta, GA 30359	P.O. Box 49526	404/325-0814
Houston, TX 77024	820 Gessner, Suite 855	713/973-9908
Indianapolis, IN 46250	8604 Allisonville Rd., Suite 210	317/842-7766
Memphis, TN 38157	5050 Poplar Avenue, Suite 1028	901/761-3446
Oak Brook, IL 60521	1200 Harger Road, Suite 707	312/573-1110
Palmer, MA 01069	Fenton St.	413/283-7611
Raleigh, NC 27609	4700 Homewood Court, Suite 108	919/781-8540
San Bernardino, CA 92408	1585 South D St., Suite 203	714/885-8800
Topeka, KS 66614	5942 S.W. 29th St.	913/273-5950
Wheat Ridge, CO 80033	4891 Independence St., Suite 195	303/431-8999

Sales Offices are in principal cities.

CONTECH
CONSTRUCTION PRODUCTS INC.

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LINK - SEAL SPECIFICATIONS

Manufacturer: Thunderline Corporation
8707 Samuel Barton Drive
Belleville, Michigan 48111
(313) 397-5000

Model: LS - 475

Pipe O.D.: 4", 8"

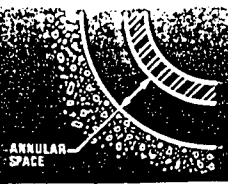
Wall Opening: 4", 8"

Wall Thickness: SDR 11, SDR 17; SDR 17 or heavier fittings

SERVICE DESIGNATION

- S Corrosive Service
- Pressure Plate: Glass Reinforced Nylon Plastic
- Bolt and Nut: 18-8 Stainless Steel (304)
- Sealing Element: EPDM Rubber

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713



*These wall opening figures are approximate. To be absolutely sure that the LINK-SEAL model you have selected will work with your

IZING SMALL PIPES

SIZING LARGE PIPES



LS-200 LS-425
LS-300 LS-475
LS-325 LS-500
LS-400 LS-525

THUNDERLINE
corporation



LINK-SEAL FOR NON-STANDARD DIAMETERS

Step 3) To determine the maximum wall opening I.D., locate your pipe O.D. between column A and column C and add the figure in column F to your actual pipe O.D.

PIPE O.D.			D	LINKS PER SEAL	E	F
A	B	C				
LS-400 SIZING CHART — (6)						
14.00	14.750	15.525	17.625	14	2.875	3.625

Actual pipe O.D. + column F
Maximum wall opening I.D. 18.250"

Step 4) DETERMINE NUMBER OF LINKS PER SEAL

Assuming that your wall opening or sleeve size falls within the minimum and maximum I.D. limits as determined in steps 1, 2, and 3, the required number of links per seal are shown in the fifth column.

PIPE O.D.			D	LINKS PER SEAL	E	F
A	B	C				
LS-400 SIZING CHART — (6)						
12.9375	13.6875	14.4375	16.502	14	2.875	3.625
14.00	14.750	15.525	17.625	14	2.875	3.625
15.250	16.00	16.750	18.875	14	2.875	3.625

Links per seal

PIPE O.D.			D	LINKS PER SEAL	E	F
A	B	C				
LS-200 SIZING CHART—(3)						
.500	.500	.687	1.750	3	1.25	1.25
.687	.937	1.125	1.937	4	1.00	1.25
1.125	1.375	1.500	2.375	5	1.00	1.25
1.625	1.875	1.937	2.875	6	1.00	1.25
2.000	2.125	2.375	3.125	7	1.00	1.25
2.375	2.500	2.812	3.500	8	1.00	1.25
2.687	2.812	3.125	3.812	9	1.00	1.25
3.125	3.375	3.625	4.375	10	1.00	1.25

LS-300 SIZING CHART — (4)						
.625	.687	.875	2.375	3	1.687	1.750
1.125	1.312	1.437	2.875	4	1.562	1.750
1.562	1.875	2.000	3.312	5	1.437	1.750
2.062	2.375	2.687	3.812	6	1.437	1.750
2.562	2.875	3.125	4.312	7	1.437	1.750
3.062	3.375	3.812	4.812	8	1.437	1.750
3.562	3.937	4.125	5.312	9	1.374	1.750
4.000	4.375	4.750	5.750	10	1.374	1.750

LS-325 SIZING CHART — (5)						
1.625	1.875	2.000	4.000	3	2.125	2.375
2.875	2.875	3.125	5.250	4	2.375	2.375
3.625	4.000	4.250	6.000	5	2.000	2.375
4.625	5.000	5.250	7.000	6	2.000	2.375
5.625	6.000	6.500	8.000	7	2.000	2.375
6.625	7.000	7.625	9.000	8	2.000	2.375
7.625	8.000	8.625	10.000	9	2.000	2.375
8.625	9.000	9.625	11.000	10	2.000	2.375

LS-400 SIZING CHART — (6)						
2.875	2.875	3.500	6.500	4	3.625	3.625
3.875	4.250	4.750	7.500	5	3.250	3.625
5.000	5.250	6.125	8.625	6	3.375	3.625
6.125	6.500	7.250	9.750	7	3.250	3.625
7.250	7.875	8.500	10.875	8	3.000	3.625
8.375	9.125	9.750	12.000	9	2.875	3.625
9.500	10.250	11.250	13.125	10	2.875	3.625
10.625	11.370	12.125	14.250	11	2.875	3.625
11.750	12.500	13.375	15.375	12	2.875	3.625
12.937	13.687	14.437	16.562	13	2.875	3.625
14.00	14.750	15.525	17.625	14	2.875	3.625
15.250	16.000	16.750	18.875	15	2.875	3.625

PIPE O.D.			D	LINKS PER SEAL	E	F
A	B	C				
LS-425 SIZING CHART— (7)						
3.000	3.500	3.500	6.000	4	2.500	3.000
4.125	4.500	4.875	7.125	5	2.625	3.000
5.250	5.750	6.250	8.250	6	2.500	3.000
6.500	7.000	7.500	9.500	7	2.500	3.000
7.625	8.250	8.750	10.750	8	2.500	3.000
8.750	9.250	10.000	11.750	9	2.500	3.000
9.875	10.500	11.000	12.875	10	2.375	3.000
10.937	11.562	12.187	13.937	11	2.375	3.000
12.125	12.875	13.500	15.125	12	2.375	3.000
13.375	14.125	14.625	16.375	13	2.250	3.000
14.375	15.125	15.750	17.375	14	2.250	3.000
15.625	16.375	16.875	18.625	15	2.250	3.000

LS-475 SIZING CHART — (8)						
1.375	1.687	2.000	5.375	4	3.688	4.000
2.250	2.562	2.812	6.250	5	3.688	4.000
3.125	3.562	3.875	7.125	6	3.563	4.000
3.875	4.375	4.750	7.875	7	3.500	4.000
4.875	5.375	5.750	8.875	8	3.500	4.000
5.625	6.125	6.500	9.625	9	3.500	4.000
6.375	6.875	7.375	10.375	10	3.500	4.000
7.250	7.750	8.375	11.250	11	3.500	4.000
8.000	8.625	9.250	12.000	12	3.375	4.000
8.750	9.500	10.250	12.750	13	3.250	4.000
9.625	10.375	11.125	13.625	14	3.250	4.000
10.375	11.125	11.875	14.375	15	3.250	4.000

LS-500 SIZING CHART — (9)						
2.375	2.375	2.500	8.000	4	5.625	5.625
3.375	3.625	4.000	9.000	5	5.375	5.625
4.375	4.812	5.375	10.000	6	5.188	5.625
5.625	6.250	7.000	11.250	7	5.000	5.625
6.750	7.500	8.375	12.375	8	4.875	5.625
8.000	8.750	9.500	13.625	9	4.875	5.625
9.125	10.000	10.750	14.750	10	4.750	5.625
10.500	11.375	12.250	16.125	11	4.750	5.625
11.750	12.625	13.500	17.375	12	4.750	5.625
12.937	13.815	14.875	18.565	13	4.750	5.625
14.500	15.375	16.125	20.125	14	4.750	5.625
15.625	16.500	17.250	21.250	15	4.750	5.625

LS-525 SIZING CHART — (10)						
2.750	2.750	2.875	7.750	4	5.000	5.000
3.750	3.750	4.250	8.750	5	5.000	5.000
5.000	5.000	5.625	10.000	6	5.000	5.000
6.000	6.250	7.062	11.000	7	4.750	5.000
7.125	7.625	8.250	12.125	8	4.500	5.000
8.562	9.062	9.750	13.562	9	4.500	5.000
9.750	10.375	10.875	14.750	10	4.375	5.000
10.811	11.437	12.312	15.811	11	4.374	5.000
12.124	12.750	13.625	17.125	12	4.374	5.000
13.436	14.062	14.937	18.436	13	4.374	5.000
14.874	15.500	16.250	19.874	14	4.374	5.000
16.000	16.625	17.375	21.000	15	4.374	5.000

NOTE: The SIZING CHARTS above may show that your wall opening or sleeve is too large or too small for use with the particular LINK-SEAL model you have selected. In this case, you can either go back to SELECTION CHART (2) on pages 16-17 and choose another LINK-SEAL model, or change the I.D. of your wall opening. If either change appears to be a problem, contact factory.

LINK - SEAL FEATURES

POSITIVE HYDROSTATIC SEALING

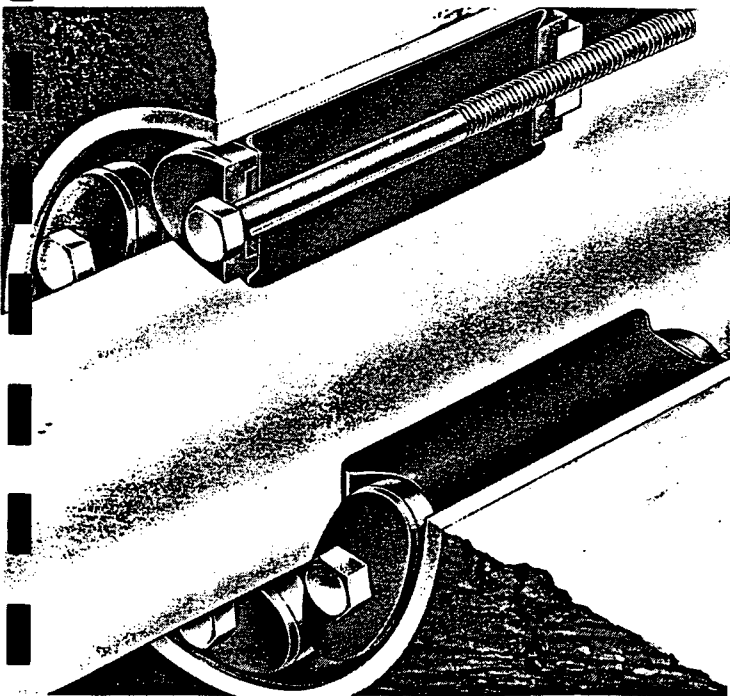
When properly installed, Link-Seal is rated for 40 feet of head or 20 psig . . . pressures much greater than normally encountered in wall and casing seal applications. They effectively withstand radiation levels up to 5×10^8 RADS often encountered in nuclear power plants, and prevent tracking or corona resistance created by high energy underground electrical cables.

EASY INSTALLATION CUTS LABOR COSTS

As shown in the step-by-step photos on the preceding page, Link-Seal can be installed in minutes. Time consuming caulking, leading, flashing, taping and messy mastics are eliminated, and installation time and costs are reduced by as much as 50%.

SEALS ANY TYPE CONDUIT

Link-Seal is ideal for use with API steel pipe, soil pipe, copper and steel tubing, cast iron pipe, concrete pipe, electrical conduit, PVC and other type plastic pipes. Since plastic pipes can't tolerate the heat required for lead-oakum joints, Link-Seal is a natural. On thinwall conduit the expanded links provide excellent sealing with no danger of damaging or rupturing the pipe wall.



6) Cut-away of completed installation. Link-Seal not only helps support the carrier pipe, but absorbs shock and dampens vibration. Metal-to-metal contact is eliminated, thus preventing any damaging cathodic reaction.

CATHODIC PROTECTION

Where insulation against cathodic reaction (electrolysis — is required, Link-Seal is supplied with special high strength, non-creep glass-reinforced nylon pressure plates. Since all metal parts are encased either in solid rubber sealing elements or dielectric plastic pressure plates, metal-to-metal contact is impossible.

FIRE AND HIGH TEMPERATURE PROTECTION

For firewalls or applications where extreme heat may be encountered, Link-Seals can be supplied with metal pressure plates and special high temperature-resistant elastomer sealing elements. See page 9 for details.

EIGHT BASIC LINK SIZES

Link-Seal comes in eight different thicknesses to fit various size annular spaces. They have been used to effectively seal pipes from 1/4" to 121" in diameter, though there is no maximum limit to the diameter that can be handled. Select the exact model you require from the charts on pages 10-19.

SUPPORT FOR CARRIER PIPE

Link-Seal's solid rubber links and sturdy pressure plates resist radial loading which helps the floor or ceiling brackets support the carrier pipe. In cased crossings the Model PL Link-Seal installed at each end (see pages 20 & 21) effectively centers the carrier pipe in the casing and helps the cradles, end supports or insulators resist the loads from back-filling. Although Link-Seal does not anchor the pipe, it does provide the pipe good axial support on vertical floor and ceiling applications.

SHOCK, SOUND AND VIBRATION ABSORPTION

An inherent feature of Link-Seal's flexible rubber body is its ability to absorb shock, sound or vibration created either by changes in internal pipe pressures or ground disturbances such as earthquakes or shock waves at railway crossings. Failures due to fatigue are greatly reduced at welds, flanges and threaded connections.

PROTECTION AGAINST DAMAGE

Unlike exposed pipeline boots, Link-Seal's position inside the casing or sleeve prevents any damage from sharp aggregate, tools or backfilling equipment.

SOUNDING CABLE SPECIFICATIONS

Manufacturer: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

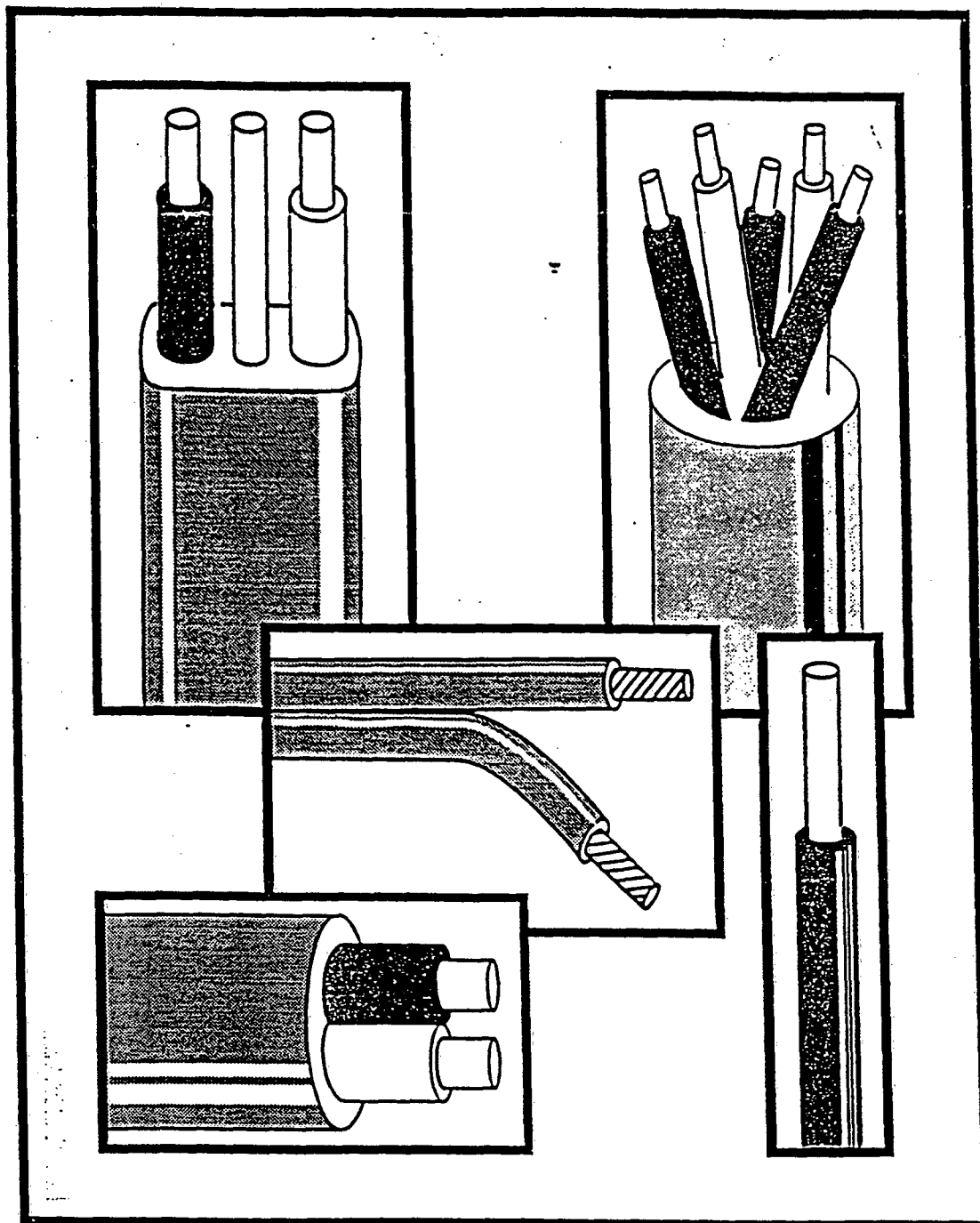
Size: 20 Gauge Wire

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

REGENCY

WIRE & CABLE

"Serving The Irrigation Industry"



P.O. Box 925 • Sikeston, Missouri 63801
314-472-2990 • Fax: 314-471-3134

1-800-876-3020

February 1, 19

REGENCY WIRE & CABLE

REGENCY WIRE & CABLE

P.O. Box 1515 • Sikeston, Missouri 63801
314-472-2990 • Fax: 314-471-1317
800-876-3020

IRRIGATION DISTRIBUTORS

Regency Wire is pleased to announce the availability of UL listed Polyethylene Golf Course

SPRINKLER SYSTEMS WIRE

in sizes 18 AWG through 8 AWG which we sell only to Irrigation Distributors. We respectfully suggest that it is to your economic best interest to support irrigation manufacturers who sell only to Irrigation Distributors.

SPRINKLER SYSTEMS WIRE - POLYETHYLENE, TYPE PE

We manufacture Sprinkler Systems Wire using a state of the art UL approved medium density polyethylene compound. The weight per thousand feet of polyethylene insulated wire shown on the data sheet on page three is considerably less than the weight of type UF insulated wire.

It appears that the use of type PE wire has advantages over using type UF wire.

REGENCY WIRE

We believe it is important for you to better understand the advantages of your purchasing wire from our company. We believe it is important for you to compare our method of producing our own bare copper wire and insulating the wire that we manufacture compared to other wire suppliers.

It is especially important for you to know how bare copper wire is manufactured and more about its being insulated so you will be knowledgeable about evaluating wire suppliers within our industry.

We have been operating our own wire manufacturing company since 1975. Management of our wire manufacturing has been under the direction of a graduate electrical engineer since 1975.

Copper Rod

We manufacture bare copper wire from 99.9% pure copper rod purchased from United States copper producers.

Copper rod is produced by melting copper cathodes in a furnace from which 99.9% pure molten copper is poured into a ten foot diameter casting wheel where the molten copper is cooled in one revolution in a continuous casting process. A ten square inch copper bar comes from the casting wheel. The bar then passes through a series of 13 rolling stands which produces a 5/16" diameter copper rod.

Regency Wire purchases 8000# packages of copper rod from United States copper producers which is drawn into wire and electrically annealed to produce the wire sizes needed for irrigation wire.

Our copper wire scrap is sold to brass mills who use it in making brass products.

Wire Insulation

We insulate wire using the state of the art insulating compound purchased from United States compound producers to meet the specs required by UL and to meet industry standards for non UL listed wire.

We insulate such a large quantity of UL listed copper wire in our plant that it requires a UL inspector to be in our plant almost every week making the tests that UL is routinely required to make.

Quality

WE ARE NOT A WIRE BROKER! A Wire Broker buys from a wire manufacturer and resells.

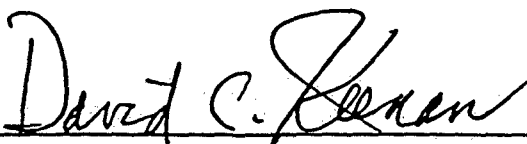
When you purchase from Regency Wire, you will know where the bare wire is manufactured and tested for quality, and you know where the wire is insulated and tested for quality.

Summary

We believe that with our years of experience in manufacturing insulated wire, that we will be able to be of service to you.

We have presented here a brief summary of facts relating to wire manufacturing and quality considerations in the hope that you will find this information helpful to your business.

We at Regency Wire welcome the opportunity to discuss applications of insulated wire for your irrigation needs.



David C. Keenan, *Chairman*



Bill Branum, *Customer Service*

REGENCY WIRE & CABLE

REGENCY WIRE & CABLE

P.O. Box 1515 • Sikeston, Missouri 63801

314-472-2990 • Fax: 314-471-1317

800-876-3020

SPRINKLER SYSTEMS WIRE

POLYETHYLENE (UL) LISTED 600V*

AWG. SIZE	COND. STRAND.	CONDUCTOR INSULATION	WT. MFT.	STANDARD PACKAGING
18*	Solid	3/64	10	500' Spools & 2500' Reels
16*	Solid	3/64	14	
14	Solid	3/64	19	
12	Solid	3/64	27	
10	Solid	3/64	40	
8	Solid	3/64	60	

*SIZES 18 & 16 - 300V

UNDERGROUND FEEDER WIRE

UF (UL) LISTED* 600V

AWG. SIZE	COND. STRAND.	CONDUCTOR INSULATION	WT. MFT.	STANDARD PACKAGING
18*	Solid	3/64	13	500' Spools & 2500' Reels
16*	Solid	3/64	17	
14	Solid	4/64	28	
12	Solid	4/64	37	
10	Solid	4/64	51	
8	Solid	5/64	76	500' & 1000' Reels
6	Stranded	5/64	120	
4	Stranded	5/64	175	
2	Stranded	5/64	280	500' & 1000' Reels
1/0	Stranded	5/64	408	
2/0	Stranded	5/64	501	
3/0	Stranded	5/64	617	
4/0	Stranded	5/64	762	

*SIZES 18 & 16 NOT UF LISTED BY (UL)

MULTI CONDUCTOR CABLE

AWG. SIZE	NO. OF COND.	INSULATION		WT. MFT.
		CONDUCTOR	JACKET	
18	2	1/64	2/64	18
18	3	1/64	2/64	25
18	4	1/64	2/64	35
18	5	1/64	2/64	42
18	6	1/64	2/64	50
18	7	1/64	2/64	59
18	8	1/64	2/64	68
18	10	1/64	2/64	84
18	12	1/64	2/64	97
18	13	1/64	2/64	104

MULTI CONDUCTOR PACKAGING
SPOOLS IN CARTONS AND REELS

LOW VOLTAGE LIGHTING CABLE

AWG. SIZE	COND. STRAND.	CONDUCTOR INSULATION	WT. MFT.	STANDARD PACKAGING
18	2	4/64	27	Inquiry
12	2	4/64	80	
8	2	4/64	161	

BARE COPPER WIRE - ANNEALED

AWG. SIZE	SOLID WT/MFT	STRANDED WT/MFT	STANDARD PACKAGING
14	12.4	12.7	Spools & Reels
12	19.8	20.2	
10	31.4	32.1	
8	50.0	51.0	
6	79.5	81.1	
4	126.3	128.9	
2	200.9	204.9	

MAXI® CABLE

AWG. SIZE	NO. OF COND.	INSULATION		WT. MFT.
		CONDUCTOR	JACKET	
14	2	4/64	3/64	80
12	2	4/64	3/64	103

THERMOMETER SPECIFICATIONS

Manufacturer: Trend Instruments, Inc.
887 South Matlack Street
P. O. Box 2047
West Chester, Pennsylvania 19380
(215) 431-2000

Model: 33040A205G2, with 3" dial, 4" stem, 1/4" MNPT connection

Material: Corrosion Resistant 304 Stainless Steel

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

3" INDUSTRIAL Thermometer

Bi-Metal Thermometer Model 33

This high quality, low cost thermometer is designed for applications where a weather resistant, tamper proof case is required.

Specifications

Case: One Piece case/bezel design in corrosion resistant 304 stainless steel.

Dial: White matte finish with black markings. Dished form with Celsius on lower plane and Fahrenheit on raised plane. Also available with single scale on anti-parallax dial.

Crystal: Heavy duty clear glass, gasketed and sealed to insure weather tight integrity.

Stem/Connection: Type 304 stainless steel, 1/4 inch/6.35 millimeter diameter with standard lengths to 24 inches/609 millimeter. 1/2 inch NPT connection is standard.

Bi-metal Element: An extremely responsive temperature sensing helix which has been carefully sized and tested, heat treated and aged to relieve inherent stresses and insure continued accuracy.

Accuracy: One percent mid-scale is standard.

Options: Special ranges, dial layouts, accuracies, stems, connections and windows.

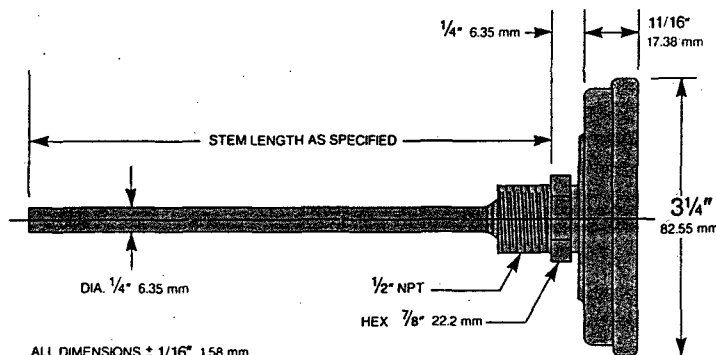
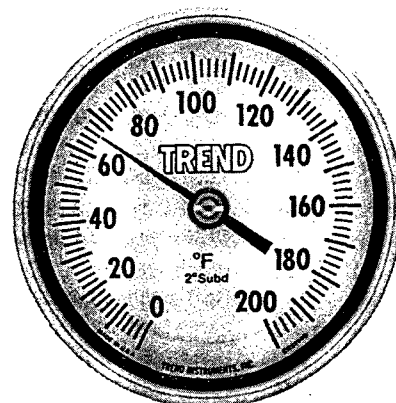
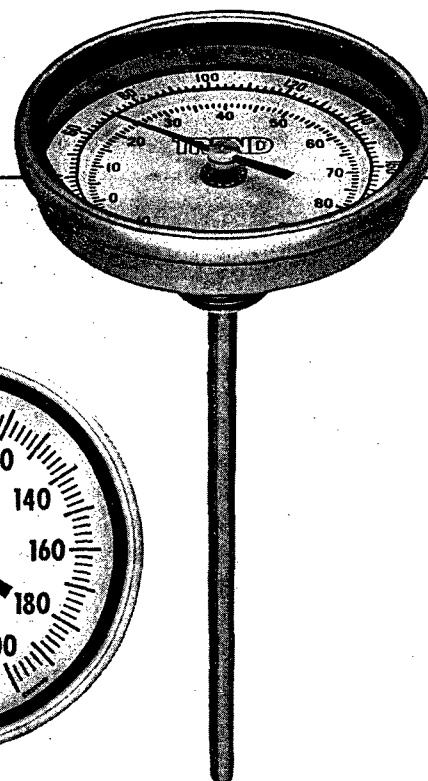
How to Order

The catalog number indicates dial size, stem length and angle form. For standard stem diameter and connection pipe size, refer to the outline drawing. Please specify the catalog number and range required in your purchase order.

Catalog Numbers

MODEL 33

Stem length		MODEL 33
inches	millimeters	
2 1/2	63.5	33025
4	101.6	33040
6	152.4	33060
9	228.6	33090
12	304.8	33120
15	381.0	33150
18	457.2	33180
24	609.6	33240



Standard Ranges — Dual Scale

Fahrenheit Scale		Celsius Scale	
Range	Accuracy	Range	Accuracy
-100 to 100°	20° 2"	-70 to 40°	10° 1"
-40 to 120°	20° 2"	-40 to 50°	10° 1"
-25 to 125°	10° 1"	-5 to 50°	5° 1/2"
0 to 200°	20° 2"	-15 to 90°	10° 1"
0 to 250°	20° 2"	-20 to 120°	10° 1"
20 to 240°	20° 2"	-5 to 115°	10° 1"
50 to 300°	20° 2"	10 to 150°	10° 1"
50 to 400°	50° 5"	10 to 200°	20° 2"
50 to 500°	50° 5"	10 to 260°	20° 2"
150 to 750°	100° 10"	65 to 400°	50° 5"
*200 to 1000°	100° 10"	*100 to 540°	50° 5"

*Not recommended for continuous use over 800°F or 425°C.

**Not available with 2.5"/63.5mm stem.

TREND instruments, inc.

887 South Matlack Street • Post Office Box 2047 • West Chester, PA 19380 • Phone: 215-431-2000 • Telex: 821612

DISTRIBUTED BY:

Model # 33020A205G2 has a non-standard 2" stem length and the optional 1/4" NPT connection. Range code 205 is 0/200F only.

WARNING RIBBON SPECIFICATIONS

Manufacturer: Reef Industries, Inc.
P. O. Box 750245
Houston, Texas 77275
(800) 231-2417

Model: Terra Tape

Supplying Vendor: Reef Industries, Inc.
P. O. Box 750245
Houston, Texas 77275
(800) 231-2417



REEF INDUSTRIES, INC.
TERRA TAPE PRODUCTS
P.O. Box 750245
Houston, Texas 77275-0245

PHONE 1-800-231-2417
PHONE (713) 484-6892
FAX (713) 947-2053
TELEX 077-5154

TERRA TAPE® SPECIFICATION SHEET

Now you have a choice. Twenty plus years have gone into the development of our Terra Tape® products.

Below is a description of our different Terra Tape® products that can be transcribed into your specification package. This will ensure that the tape you direct bury will still be working after many years.

1. Terra Tape® Standard 250: Standard marking tape shall consist of a 2 mil, 4 mil or 6 mil inert plastic film specifically formulated for prolonged use underground. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. 2 mil tape shall have a minimum tensile strength of 10 lbs. per 3" wide strip and a minimum elongation of 300%. 4 mil tape shall have a minimum tensile strength of 30 lbs. per 3" wide strip and a minimum elongation of 400%. 6 mil tape shall have a minimum tensile strength of 38 lbs. per 3" strip and a minimum elongation of 600%. Tape shall bear a continuous printed message normally repeated every 16 to 36 inches warning of the installation buried below.
2. Terra Tape® Extra Stretch™ 540: Extra Stretch™ 540 marking tape shall consist of 6 ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. Extra Stretch™ 540 tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 lbs. per 3" width strip, and a minimum elongation of 800%. Tape shall bear a continuous printed message normally repeated every 16 to 36 inches warning of the installation buried below.
3. Terra Tape® Sentryline™ Detectable:
 - A. Terra Tape® Sentryline™ Detectable 620 marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 4.5 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape shall be imprinted with a continuous warning message normally repeated every 16 to 36 inches. It shall be inductively locatable and conductively traceable using a standard pipe and cable locating device.
 - B. Terra Tape® Sentryline™ Detectable 1350 marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film with a scrim reinforcement. It shall be resistant to alkalis, acids, and other destructive agents commonly found in the soil. The lamination bond should be strong enough that the layers cannot be separated by hand. Tape shall be a minimum of 9 mils thick with a minimum tensile strength of 125 lbs. in the machine direction and 125 lbs. in the transverse direction per 3" wide strip. Tape shall be imprinted with a continuous warning message normally repeated every 16 to 36 inches. It shall be inductively locatable and conductively traceable using a standard pipe and cable locating device.

CONDENSATE MANAGEMENT

CONDENSATE PUMP SPECIFICATIONS

Manufacturer: ITT Flygt Corporation
P. O. Box 1004
Trumbull, Connecticut 96611
(203) 380-4700

Model: BS-3085SSX - 254

Electric Motor: 4.0 Hp, 460 Volt, 3 Phase, 60 Hertz

Supplying Vendor: Jim House and Associates, Inc.
P. O. Box 320129
Birmingham, Alabama 35232
(205) 592-6302

B/C/D-3085(SS)

Performance Specifications

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REQUIREMENTS

Furnish and install ___ submersible non-clog wastewater pump(s). Each pump shall be equipped with a ___ HP, submersible electric motor connected for operation on ___ volts, ___ phase, 60 hertz, ___ wire service, with ___ feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval. The pump shall be supplied with a mating stainless steel ___ inch discharge connection and be capable of delivering ___ GPM at ___ TDH. An additional point on the same curve shall be ___ GPM at ___ feet total head. Shut off head shall be ___ feet (minimum). Each pump shall be fitted with ___ feet of ___ lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

PUMP DESIGN

The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. **Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.** No portion of the pump shall bear directly on the sump floor.

PUMP CONSTRUCTION

Major pump components shall be of AISI type 329 stainless steel construction, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel construction.

Sealing design shall incorporate **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

COOLING SYSTEM

Motors are sufficiently cooled by the surrounding

environment or pumped media. A water cooling jacket is not required.

CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

MOTOR

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and pump shall be designed and assembled by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

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B/C/D-3085(SS)

Performance Specifications

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

BEARINGS

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. **Single row lower bearings are not acceptable.**

MECHANICAL SEAL

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating **silicon carbide** ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating **tungsten carbide** seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor **depend on direction of rotation for sealing**. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. Cartridge type systems will not be acceptable. No system requiring a *pressure differential to offset pressure and to effect sealing* shall be used.

Each pump shall be provided with an lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. **The motor shall be able to operate dry without damage while pumping under load.**

Seal lubricant shall be FDA Approved, nontoxic.

PUMP SHAFT

Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be AISI type 329 stainless steel.

If a shaft material of lower quality than 329 stainless steel is used, a shaft sleeve of 329 stainless steel is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless steel sleeves will not be considered equal to stainless steel shafts.

IMPELLER

The Impeller(s) shall be of AISI type 329 stainless steel, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The Impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, Impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be, retained with an Allen head bolt and shall be capable of passing a minimum ____ inch diameter solid.

B-3085(SS):

The Impellers shall be of AISI 329 stainless steel, dynamically balanced, open multi-vane type.

C-3085(SS):

The Impeller(s) shall be of composite resin (PVFD), dynamically balanced, closed single-vane non-clogging design having a long throughlet without acute turns.

D-3085(SS):

The impeller(s) shall be of AISI 329 stainless steel, dynamically balanced, open vortex type.

All Impellers:

Mass moment of Inertia calculations shall be provided by the pump manufacturer upon request. Impellers shall be retained with an Allen head bolt and shall be capable of passing a minimum ____ in. diameter solid.

WEAR RINGS

A wear ring system shall be used to provide efficient sealing between the volute and suction Inlet of the Impellers. The wear ring shall be stationary and made of type 316 stainless steel, which is drive fitted to the volute inlet.

B/C/D-3085(SS)

Performance Specifications

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VOLUTE

B-3085(SS):

Pump volute(s) shall be single-piece AISI 329 stainless steel non-concentric design with an adjustable suction cover.

C & D-3085(SS):

Pump volute(s) shall be single-piece AISI type 329 stainless steel, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum Inlet and discharge size shall be as specified.

PROTECTION

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote.

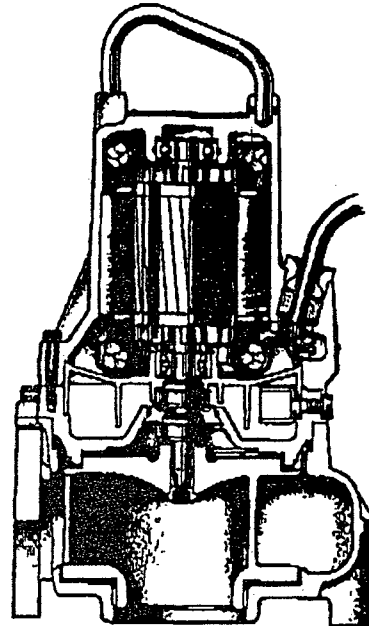
USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.

The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

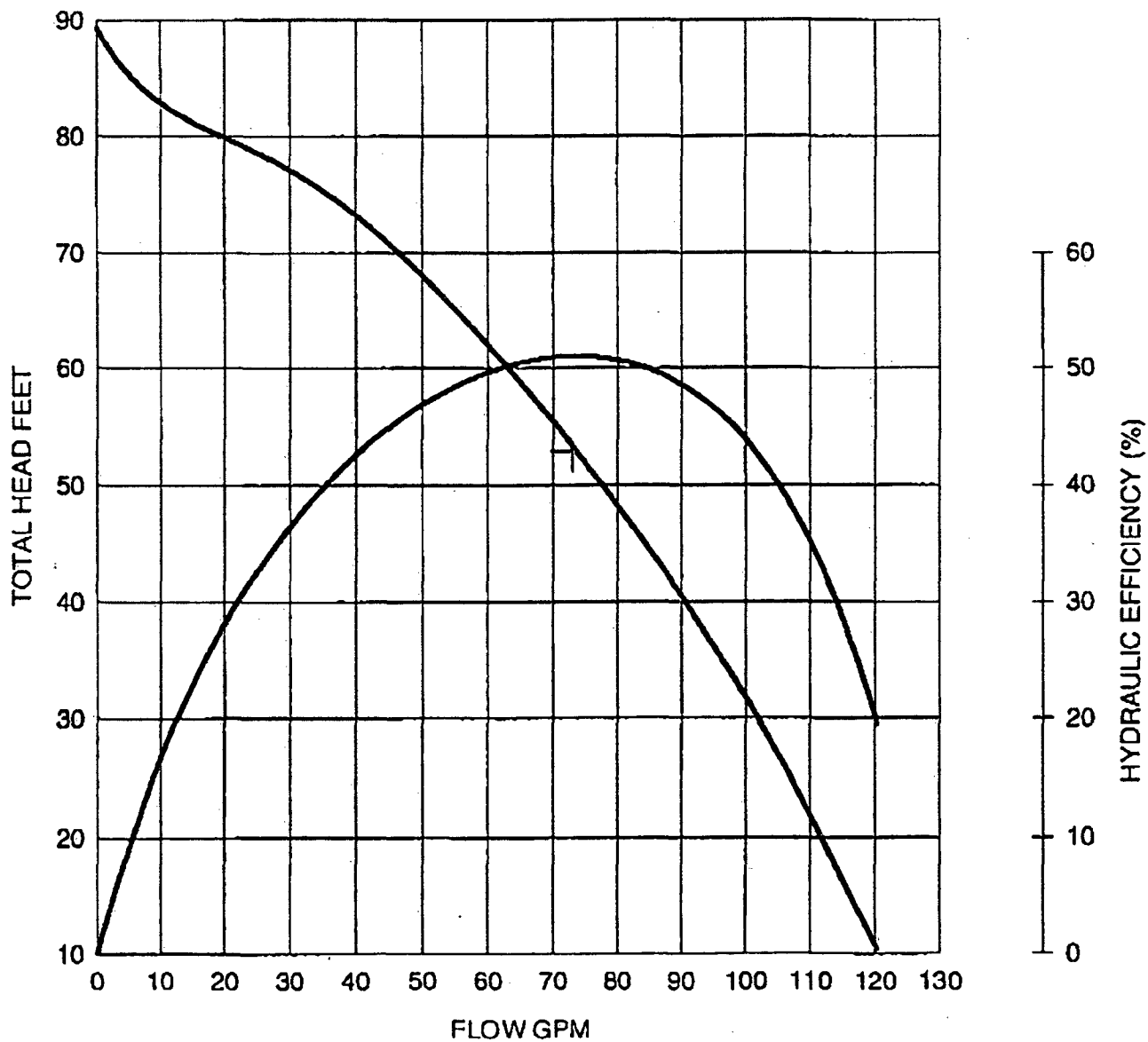
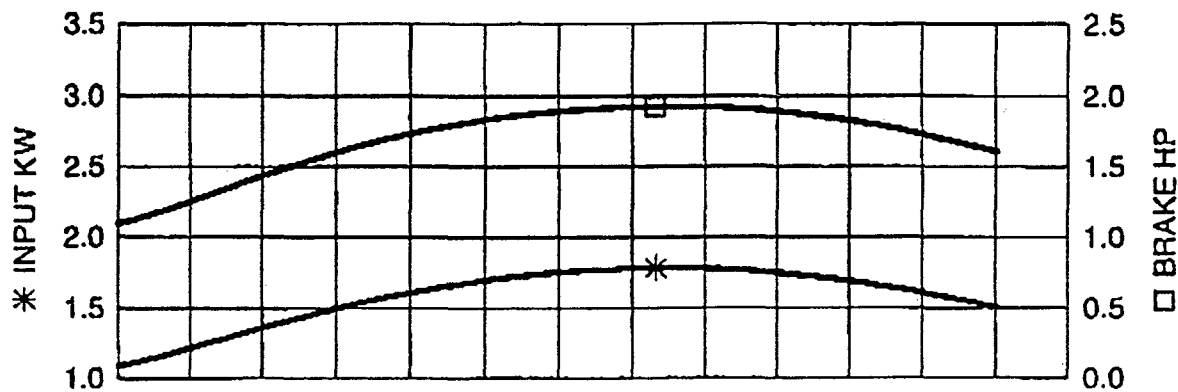
MODIFICATIONS

1. Explosion-proof Pumps (X).
2. Warm Liquid Applications (WL)

Refer to the General Guide Specifications for additional information.

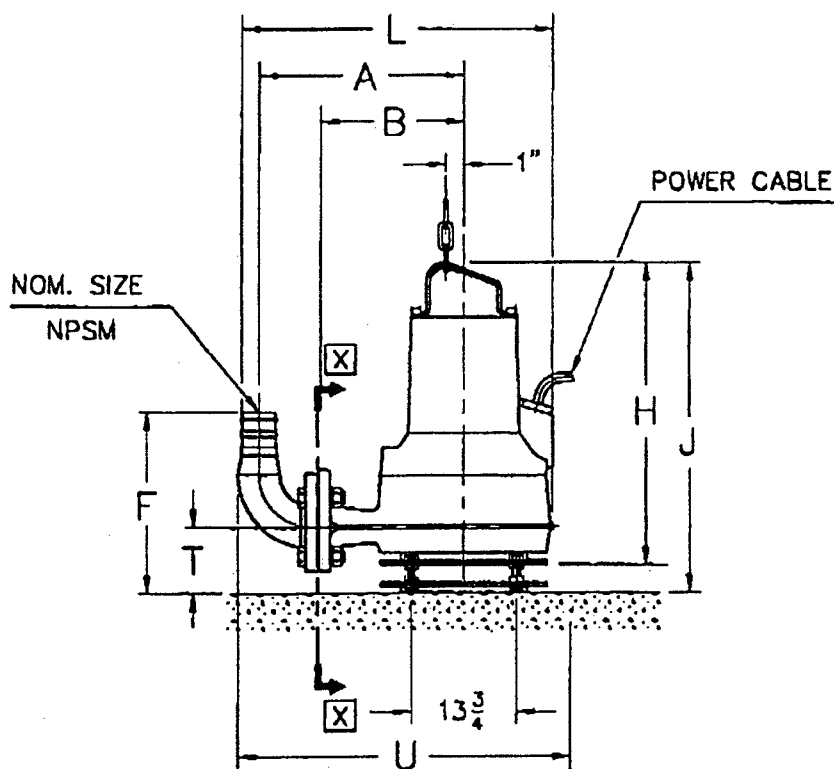
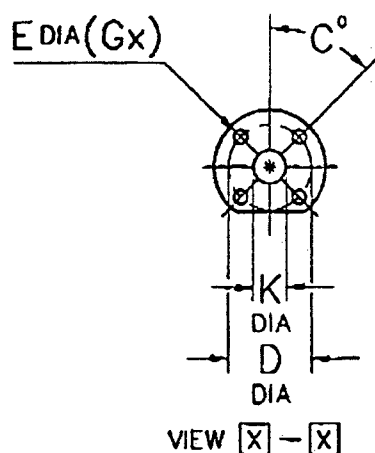
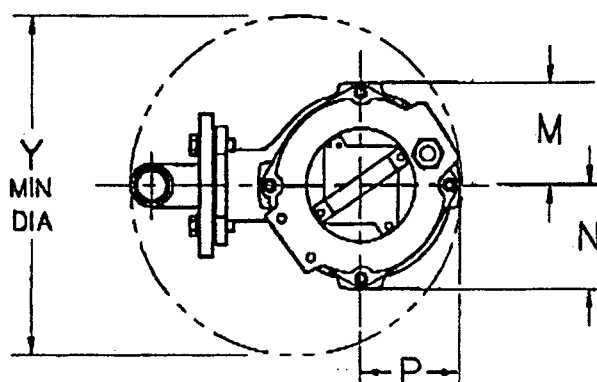


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PHASE	VANES		SUPERSEDES	ISSUED
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SUED	SUPERSEDES
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BS-3085(SS) Outline Dimensions



NOM. SIZE	VERSION	WEIGHT (LBS)
2"	HT	130

ALL DIMENSIONS IN INCHES

NOM. SIZE	VERSION	DIMENSIONAL CHART																
2"	HT	A	B	C	D	E	F	G	H	J	K	L	M	N	P	T	U	Y
2"	HT	11 1/2	8 1/2	45°	6 1/2	7/8	9	4	17	18 1/2	2	17 1/2	5 1/2	6 1/2	6 1/2	2 1/2	15 3/4	18

PAGE	SECTION
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C/D-3085(SS)

Electrical Data

Motor Data

RATED OUTPUT POWER HP (KW)	Ø	VOLTS NOM.	FULL LOAD AMPS	LOCKED ROTOR AMPS	LOCKED ROTOR KVA	LOCKED ROTOR CODE LETTER KVA/HP	RATED INPUT POWER kW	POLES/RPM
3.0 (2.4)	3	200	10.0	55	19.1	H	2.9	4/1700
		230	9.0	48				
		460	4.5	24				
		575	3.6	19				
4.0 (3.0)	3	200	11.0	69	24.0	G	3.8	2/3430
		230	10.0	60				
		460	5.0	30				
		575	4.0	24				

PUMP MOTOR HP	EFFICIENCY			POWER FACTOR		
	100% LOAD	75% LOAD	50% LOAD	100% LOAD	75% LOAD	50% LOAD
3.0	77.5	78.5	78.5	0.82	0.75	0.64
4.0	81.5	82.5	81.5	0.92	0.89	0.83

Cable Data

HP	VOLTS	MAX. LENGTH FT.	CABLE SIZE/ NOMINAL DIA.	CONDUCTORS (IN ONE CABLE)	PART NUMBER
3.0	200	130	14/7 19.0mm (0.75")	(3) 14AWG (PWR) (2) 14AWG (CTRL) (1) 14AWG (GND) (1) 14AWG (GC)	00094 21 02
	230	165			
	460	655			
	575	1025			
4.0	200	105	14/7 19.0mm (0.75")	(3) 14AWG (PWR) (2) 14AWG (CTRL) (1) 14AWG (GND) (1) 14AWG (GC)	00094 21 02
	230	135			
	460	530			
	575	825			

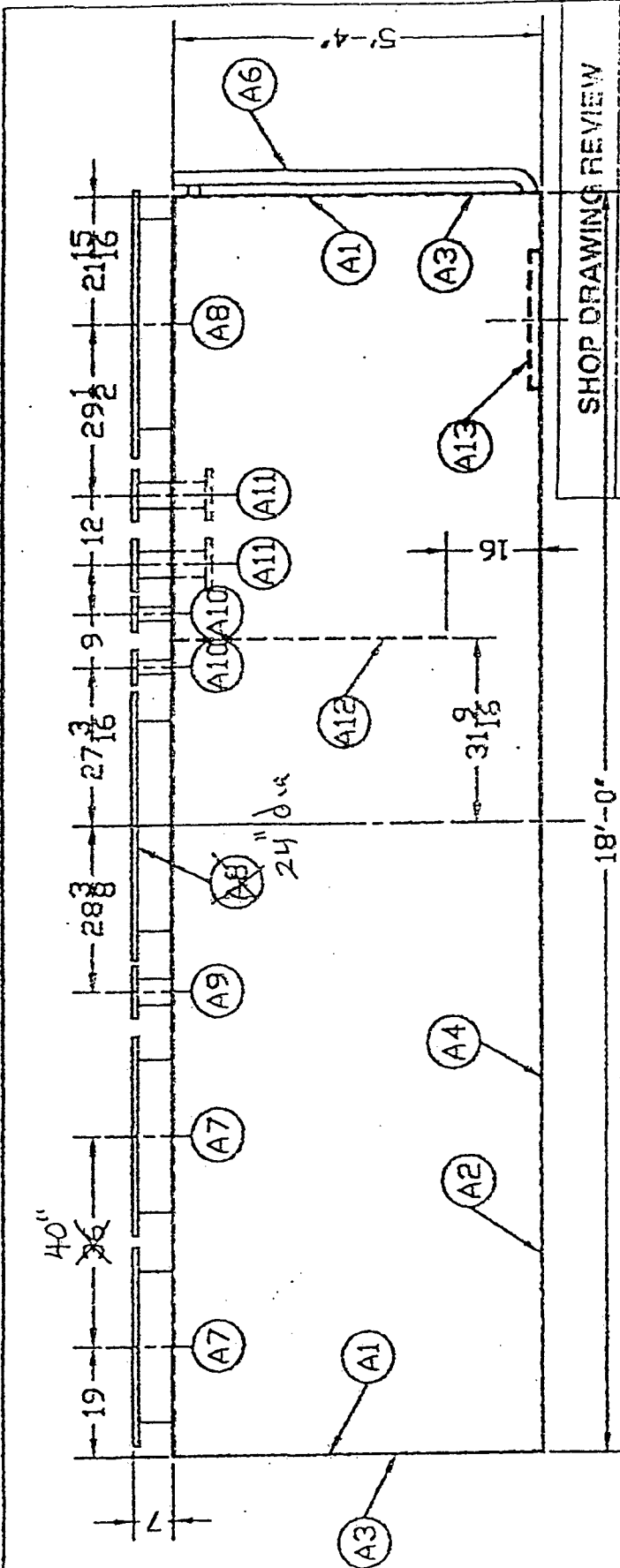
UNDERGROUND STORAGE TANK SPECIFICATIONS

Manufacturer: Lannon Tank Corporation
P. O. Box 516
Lannon, Wisconsin 53046
(414) 251-7890

Size: 3000 Gallon

Material: Double Wall Dura-glass

Supplying Vendor: Lannon Tank Corporation
P. O. Box 516
Lannon, Wisconsin 53046
(414) 251-7890



SHOP DRAWING REVIEW

☒ APPROVED ☐ REUSE AND RESUBMIT

☐ AS NOTED ☐ NOT APPROVED

 WASTE ENERGY TECHNOLOGY, INC.
 SIGNED *Tony Oliver* DATE 8/25/98

NOTES:

1. BUILT IN ACCORDANCE WITH UL-58 SPECIFICATIONS
2. INNER SHELL AND HEADS LAP WELDED, OUTER SHELL AND HEADS LAP WELDED.
3. ALL WELDS MUST BE LOW, BACK GRIND SIDE SEAMS BEFORE WELDING.
4. ALL WELD SCARS AND "B'S" ARE TO BE REMOVE.
5. COAT EXTERIOR WITH DURAGLASS.

BILL OF MATERIALS

ITEM	QTY	DESCRIPTION
A1	1	7 GA. THK. SHELL (0.167" MIN)
A2	2	7 GA. THK. X 8'-4" FLANGED HEAD (0.167" MIN)
A3	1	7 GA. THK. OUTER SHELL (0.167" MIN)
A4	2	7 GA. THK. X 8'-4" FLANGED HEAD (0.167" MIN)
A5	2	LIFTING LUGS (SEE DETAIL DWG P-1861)
A6	1	2" LEAK MONITOR PIPE
A7	2	26" 150# FLANGED NOZZLE X 11" LG
A8	2	36" 150# FLANGED NOZZLE X 14"
A9	1	4" 150# FLANGE NOZZLE X 8"
A10	2	2" 150# FLANGE NOZZLE X 8"
A11	2	4" 150# DOUBLE FLANGE NOZZLE X 15"
A12	1	1/4" SEPARATION BATTLE
A13	1	PUMP BASE - 24' X 24"

Lannon Tank
CORPORATION

REV	DESCRIPTION	DATE	INIT
1	ISSUED FOR CONSTRUCTION	8/25/98	TOE
2	ISSUED FOR CONSTRUCTION	8/25/98	TOE
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3-WAY BALL VALVE SPECIFICATIONS

Manufacturer: Asahi/America
425 Riverside Avenue
Medford, Maryland 02155
(617) 391-2353

Model: 3-Way Ball Valve

Size: 2"

Body: PVC

Seats: Teflon backed with EPDM

Seals: EPDM

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

BALL VALVES

INTRODUCTION

Introduction

Discussion

Warranty

Liabilities

Introduction

For over 15 years Asahi/America has been at the forefront of thermoplastic valve technology. The Asahi/America line is now the broadest in the industry in terms of size range, valve types, materials, features, and options. Advanced molding techniques, rigid engineering standards, and a wide choice of corrosion resistant thermoplastic and elastomeric materials ensure the highest level of reliability for all Asahi/America valves, even in the most severe corrosive applications.

The valves in this catalog represent one segment of the Asahi/America line. Other valves are grouped according to type or special function in separate catalogs. On the back cover of this brochure you will find a brief representation of the complete product line as an aid to requesting additional information.

If, however, you have a requirement for a valve with features not contained in any of our literature, please contact our engineering department to discuss our custom fabrication capability. Chances are we have already encountered a similar request and can accommodate your special needs with a minimum of effort.

Ball Valves: Discussion

This valve performs an on/off function and its name is derived from the flow-controlling ball located within the body of the valve. A hole through the center of the ball along one axis connects the inlet and outlet ports of the body. The ball itself is held in place by, and rotates 90° within, Teflon® seats which provide permanent lubrication and keep the valve "bubble tight". Elastomer "O" rings are used for stem and carrier seals to prevent leakage to the atmosphere. In the open position the flow is straight-through and there is no pressure drop when the porting through the ball is the same size as the inside diameter of the pipe. Asahi/America ball valves are quick opening and closing, a quarter turn is all that is necessary. They are easy to maintain, and they give tight sealing with low torque. Asahi/America offers three major types of ball valves: (1) True Union Ball Valves; (2) Omni® Ball Valves; and (3) Multiport Ball Valves. True Union Ball Valves can be lifted from the line—without having to move the piping—simply by loosening the two union nuts; the valve can be disassembled, and parts may be replaced. Asahi/America's Omni® series are economical, one-piece valves which cannot be taken apart. Multiport Ball Valves are three-way ball valves with True Union design on the left and right ports and fixed molded bottom port.

The use of Multiporting Ball Valves simplifies piping and eliminates the need for an additional valve and Tee fitting because an "L" ported ball permits flow from the bottom entry to either the left or right ports or to an OFF position. An optional Tee ported ball allows simultaneous left and right flow. Asahi/America's True Union Ball Valves and Multiport Ball Valves may be electrically or pneumatically operated. The Electromni® is an electrically actuated Omni® Ball Valve. The Omnimatic® is a pneumatically actuated Omni® Ball Valve.

Asahi/America's thermoplastic valves provide a dependable and economical way to handle corrosive chemicals like sulfuric and hydrofluoric acid, nitric acid, and other oxidizing chemicals, as well as caustics, solvents, halogens and other problem materials, at temperatures to 250° F, pressures to 150 PSI and flows up to 18,500 gpm. When we speak of corrosion resistance, we refer to the ability of a material to withstand physical and chemical deterioration when it reacts with its environment, and particularly with oxygen. Corrosion, itself, has become a term which applies mostly to metals because the process is primarily an electrochemical one. There is ionization or corrosion at the surfaces due to electrical potentials that are created between positive and negative poles formed when unlike metals are joined in the same electrically conductive medium or when fluids that surround the metals have different ionic concentrations. Because thermoplastics are dielectric, meaning that they cannot easily support a charge, they are practically immune from corrosion in the conventional sense. There are some chemicals that can cause thermoplastics to deteriorate. For this reason, we have a thermoplastic chemical resistance chart, which we will be happy to send you upon request.

Warranty and Liabilities

To the best of our knowledge the information contained herein is accurate. However, neither Asahi/America, Inc. nor any of its affiliates assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of the suitability of any information or material for the use contemplated, or the manner of use, is the sole responsibility of the user.

ASAHI/AMERICA

BALL VALVES continued

Warranty

Liabilities

Thermoplastic Materials

Elastomeric Materials

Note

Due to our policy of continuous product improvement, we reserve the right to change or modify design without incurring any obligation to furnish or install such changes or modifications on products previously or subsequently sold.

WARRANTY

THE SALE BY ASAHI/AMERICA, INC. OF ITS PRODUCTS IS EXPRESSLY CONDITIONED UPON AND SUBJECT TO ALL TERMS AND CONDITIONS SET FORTH ON THE BACK COVER OF THIS CATALOG.

Thermoplastic Materials

PVC (POLYVINYL CHLORIDE) TYPE 1, GRADE 1 Asahi/America uses an unplasticized PVC polymer in all of its PVC valves. This material has an excellent chemical resistance, strength, rigidity, and modulus of elasticity. It resists attack by most acids and strong alkalis, as well as gasoline, kerosene, aliphatic alcohols and hydrocarbons, and salt solutions. Aromatics, chlorinated organic compounds, and lacquer solvents do have effect upon PVC's chemical properties. Its temperature range is 140° F. PVC's low cost and overall balance of properties make it the material best suited to the widest number of corrosive applications.

CPVC (CHLORINATED POLYVINYL CHLORIDE) TYPE 4, GRADE 1 The properties of CPVC and its advantages are very similar to those of PVC; however, its working temperature range is higher (200° F.) than that of PVC. It should be specified in some instances where hot corrosive liquids are being handled and an extra margin of safety is required.

PP (POLYPROPYLENE) TYPE 1 Polypropylene, a member of the polyolefin family, is one of the lightest plastics known. It is highly crystalline, thus is strong and hard. It possesses excellent chemical resistance to many acids, alkalis and organic solvents. PP is not recommended for use with chlorinated hydrocarbons and aromatics. Its upper temperature limit is slightly lower than that of CPVC.

PVDF (POLYVINYLIDENE FLUORIDE) PVDF is a high modular weight fluorocarbon that has superior abrasion resistance, chemical resistance, dielectric properties, and mechanical strength. The remarkable fact is that it maintains these characteristics over a temperature range of -40° F. to 250° F. PVDF is highly resistant to wet or dry chlorine, bromine and other halogens, most strong acids and bases, aliphatics, aromatics, alcohols, and chlorinated solvents. It is not, however, recommended for ketones or esters. Asahi/America's PVDF resin conforms with FDA No. 177.2510 requirements for contact with food.

Elastomeric Materials

TEFLON® (TFE FLUOROCARBONS) This fluorocarbon is almost totally insoluble and chemically inert. Teflon® in application on bearing surfaces exhibits a natural lubricity that makes lubrication completely unnecessary. It has a very high thermal stability, is nonflammable, and exhibits a very low dielectric constant.

VITON® Viton® is a fluoroelastomer which is used as an "O" ring material in many Asahi/America valves. It resists a wide range of chemicals, including mineral acids, salts, and chlorinated hydrocarbons. The maximum temperature is 250° F.

EPDM (ETHYLENE) PROPYLENE TERPOLYMER) This elastomer is particularly suited to diaphragms, valve seats, and "O" rings. It can stand up to a wide variety of acids, bases, alcohols, and oxidizing chemicals. The maximum temperature is 212° F.

Note

Caution: Asahi/America valves are not recommended for use in compressed air service. When testing, only hydrostatic pressure testing is recommended with a gradual increase in pressure.

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ASAHI/AMERICA

MULTIPORT® BALL VALVES

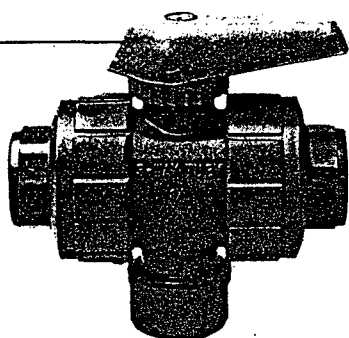
Features, Options

Sample Specifications

Parts

Pressure vs. Temperature

Dimensions



FEATURES

- Blocks from left or right union ports leaving full pressure on the opposite end of valve.
- "L" ported ball permits flow from common port to either left or right port or to OFF position ("Tee" port optional).
- Eliminates need for additional valve and Tee.
- True Union design on left and right ports.
- Blow-out proof bottom entry stem.
- Replaceable Teflon® seats.
- Available with either Viton or EPDM "O" rings.
- All sizes rated for vacuum service.

OPTIONS (See Page 10 for details) (For both Duo Bloc and Multiport valves)

- Stem extensions.
- Teflon® encapsulated "O" ring kits.
- 2" square nut.
- "T" nut.
- Locking handle.
- Spring return handle.
- Round handle.
- Mounting pads for actuators.

SPECIFICATIONS

SIZES: 1/2"–6"*

MODELS: Threaded, Socket, Flanged (ANSI),

Butt

BODIES: PVC, CPVC, PP, PVDF (KYNAR®)

SEATS: Teflon® backed with EPDM or VITON®

SEALS: EPDM or VITON®

SAMPLE SPECIFICATIONS

All multiport valves shall be of a molded construction with union ends on the left and right ports. Carriers must thread into the body in order to provide blocking capabilities in off position. Teflon® seats must have elastomeric backing cushions of the same material as the valve seals as manufactured by Asahi/America, Inc., 425 Riverside Avenue, Medford, MA.

PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	2	PVC, CPVC, PP, PVDF
4	End Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Ball Seat	2	Teflon®
7	Handle	1	ABS
8	Stem	1	PVC, CPVC, PP, PVDF
9	Face "O" Ring	2	Viton® EPDM
10	Carrier "O" Ring	2	Viton® EPDM
11	Stem "O" Ring	1	Viton® EPDM
12	Machine Screw	1	Stainless Steel
13	Seat Cushion	2	Viton® EPDM

PRESSURE VS. TEMPERATURE (PSI, WATER, NON-SHOCK)

Size	PVC				PP				CPVC				PVDF			
	30°F	~5°F	120°F	85°F	140°F	175°F	30°F	~5°F	120°F	140°F	175°F	195°F	140°F	175°F	195°F	210°F
1/2–2"	150	150	85	60	150	120	85	55	150	120	110	85	150	120	110	85
2 1/2–6"	150	150	70	40	150	20	85	55	150	120	110	85	150	120	110	85

DIMENSIONS (IN INCHES UNLESS OTHERWISE NOTED)

Size	Weight (lbs.)	S Threaded/Socket	L Threaded/Socket	L Butt Fusion	L Flanged PVC/CPVC/PP/PVDF	H ₂	H ₁ Threaded/Socket	H ₁ Flanged PVC/CPVC	H ₁ Flanged PP/PVDF	D ₂ NPT	D ₂ Socket	D ₃	D ₁	C, Values Gal./Min. @ 1 PSI Pressure Drop
1/2"	0.41	0.69	3.82	4.57	5.63	1.97	1.77	2.77	2.65	1/2"	.85	.59	.59	9
3/4"	0.72	0.72	4.65	5.00	6.77	2.24	2.17	3.28	3.29	3/4"	1.06	.79	.79	21
1"	1.13	0.88	5.35	5.35	7.36	2.64	2.60	4.09	3.64	1"	1.33	.98	.98	33
1 1/2"	2.43	1.09	6.69	6.29	8.35	3.35	3.86	5.54	4.71	1 1/2"	1.91	1.26	1.49	71
2"	3.32	1.16	7.76	7.04	9.21	3.74	4.45	6.30	5.28	2"	2.39	1.50	1.77	97
3"	9.06	1.87	10.39	11.63	11.97*	5.12	6.14	8.15	•	3"	3.52	2.28	2.76	211

*Consult factory for dimensions of PVDF valves 3" and larger, and PVC, CPVC, PP valves 4" and larger. Consult factory for H, Flanged, PP and PVDF dimensions.

Consult factory for valves with butt weld end connectors.

SWING CHECK VALVE SPECIFICATIONS

Manufacturer: Asahi/America
425 Riverside Avenue
Medford, Maryland 02155
(617) 391-2353

Model: Swing Check Valve

Size: 2"

Body: PVC

Seats: EPDM

Seals: EPDM

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

SWING CHECK

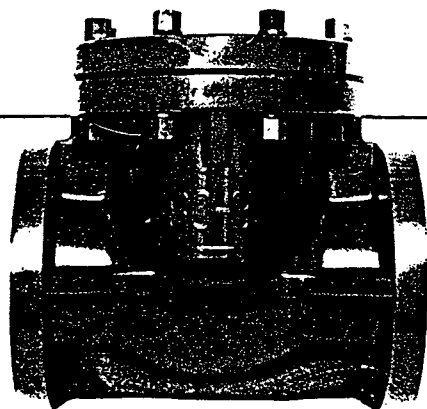
Features

Options

Sample Specifications

Cv Values

Pressure Tables



FEATURES

- Minimum resistance to flow.
- May be installed in horizontal or in vertical lines.
- Disc seats tightly with minimum back pressure.

- Top entry valve facilitates cleaning without removing from line.
- EPDM seat and seal.
- All sizes rated for full vacuum service.

OPTIONS

- External lever and weight to assist the disc in closing faster.

- External spring to assist disc in closing faster.
- Teflon® or Viton® seat and seals.

SPECIFICATIONS

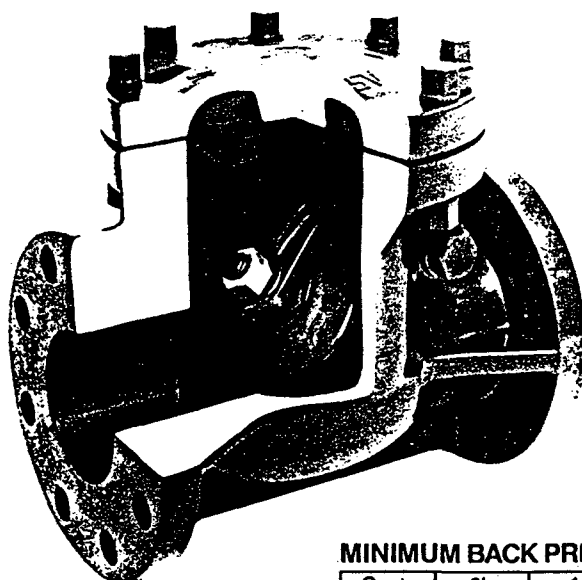
SIZES: 3/4"-8"

MODELS: Flanged

BODIES: PVC, PP, PVDF

SAMPLE SPECIFICATIONS

All swing check valves shall be of a solid thermoplastic construction having no metal to media contact. Valves must incorporate a single disc design suitable for either horizontal or vertical installations as manufactured by Asahi/America.



C_v VALUES

Size	C _v
3/4"	18.0
1"	24.0
1 1/2"	70.0
2"	95.0
2 1/2"	233.0
3"	300.0
4"	480.0
5"	750.0
6"	1100.0
8"	1900.0

MINIMUM BACK PRESSURE REQUIRED TO CLOSE VALVE (PSI)

Seat	3/4"	1"	1 1/2"	2"	2 1/2"	3"	4"	6"	8"
EPDM	2.8	5.0	5.0	5.0	5.0	5.7	5.7	6.4	6.4
Teflon	5.0	8.5	8.5	8.5	8.5	8.5	9.2	10.0	10.0

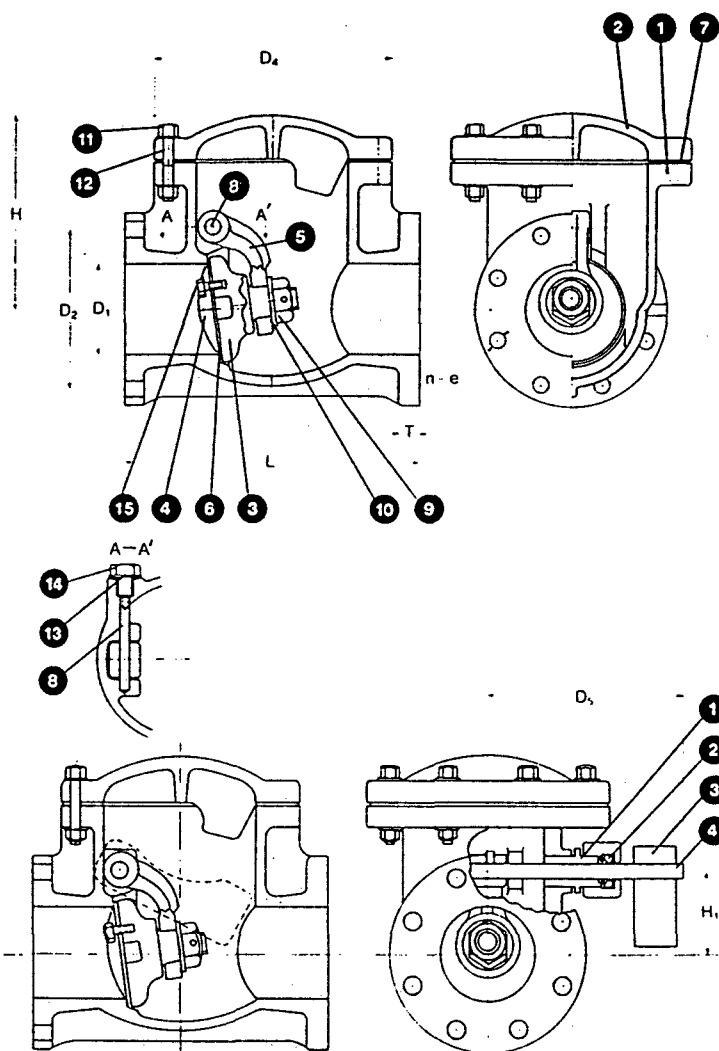
OPERATING PRESSURE VS. TEMPERATURE (PRESSURE IN PSI. WATER NON SHOCK)

PVC					PP				PVDF				
Elastomer				Teflon®	Elastomer			Teflon®	Elastomer				Teflon®
Size	30°F 70°F	105°F	120°F	30° 120°F	-5°F 105°F	140°F	175°F	-5°F 175°F	-5°F 140°F	175°F	190°F	210°F	-5°F 210°F
¾"	150	150	100	85	150	100	90	70	150	120	100	85	85
1"	150	150	100	85	150	100	90	70	150	120	100	85	85
1½"	150	150	100	85	150	100	90	70	150	120	100	70	85
2"	150	150	100	85	150	100	80	70	150	120	90	55	85
2½"	150	100	100	85	150	85	70	70	150	100	80	55	85
3"	150	100	100	70	150	70	60	60	150	100	80	40	70
4"	100	70	70	70	100	65	40	60	100	85	60	40	70
5"	100	70	70	60	100	50	35	40	100	85	60	30	60
6"	100	70	60	40	100	40	30	30	100	70	50	30	40
8"	70	40	40	40	70	40	30	30	70	50	40	30	40

SWING CHECK continued

Parts

Dimensions



LEVER & WEIGHT OPTION

PARTS

No.	Parts	Pcs.	Materials
1	Body	1	PVC, PP, PVDF
2	Bonnet	1	PVC, PP, PVDF
3	Disc	1	PVC, PP, PVDF
4	Seat Holder	1	PVC, PP, PVDF
5	Swing Arm	1	PVC, PP, PVDF
6	Seat	1	EPDM, PTFE VITON®
7	Sheet Gasket Seal	1	EPDM, PTFE VITON®
8	Shaft	1	PVC, PP, PVDF
9	Nut	1	PVC, PP, PVDF
10	Washer	1	PVC, PP, PVDF
11	Bolt and Nut	Set	304 SS*
12	Washer	Set	Stainless Steel
13	Sheet Gasket	1	EPDM, PTFE VITON®
14	Bolt	1	PVC, PP, PVDF
15	Bolt	Set	PVC, PP, PVDF

*PVDF valve has titanium bolt and nuts

PARTS—LEVER AND WEIGHT

No.	Parts	Pcs.	Materials
1	Fitting	1	PP, PVDF
2	"O" Ring	1	EPDM, PTFE VITON®
3	Weight	1	PVC
4	Arm.	1	PVC, PP, PVDF

LEVER & WEIGHT DIMENSIONS

Size	D ₁	H ₁
¾"	4.0	1.18
1"	4.5	1.57
1½"	5.0	1.77
2"	5.5	2.17
2½"	6.0	2.56
3"	6.5	2.76
4"	8.0	3.54
5"	10.0	4.33
6"	10.5	5.31
8"	12.0	6.69

DIMENSIONS (IN INCHES UNLESS OTHERWISE NOTED.)

Size	Weight (lbs.)	D ₁	D ₂	e	n	D ₃	L	T	H
¾"	1.8	0.79	2.76	0.63	4	3.39	5.51	0.59	3.54
1"	3.6	0.98	3.13	0.63	4	5.12	6.30	0.63	4.72
1½"	6.0	1.57	3.88	0.63	4	5.71	7.09	0.71	5.43
2"	8.9	1.97	4.74	0.75	4	7.09	7.87	0.79	6.46
2½"	11.3	2.56	5.49	0.75	4	7.87	9.45	0.87	6.61
3"	12.2	3.15	6.00	0.75	4	8.07	10.24	0.87	6.73
4"	21.0	3.94	7.50	0.75	8	10.43	11.81	0.94	8.39
5"	36.1	4.92	8.50	0.87	8	12.99	13.78	0.94	9.76
6"	46.0	5.91	9.51	0.87	8	14.57	15.75	0.98	11.14
8"	75.2	7.87	11.75	0.87	8	16.73	19.69	1.18	13.23

QUICK CONNECT SPECIFICATIONS

Manufacturer: Branham Corporation
PO Box 9286
Louisville, Kentucky 40209
(800) 331-6643

Model: DC, F

Size: 4"

Body: Aluminum

Supplying Vendor: Irrigation Supply Company, Inc.
926 Baxter Avenue
P. O. Box 4545
Louisville, Kentucky 40204
(502) 584-9713

Part EMale Adapters -
Hose Shank

Item Code	Size	Metal Selection					
		CB	AL*	SS	MI	PP	BR
5EXX	1/2"	10.05	6.15	43.40	7.85	4.17	33.50
7EXX	3/4"	10.35	6.30	32.85	7.95	4.60	33.80
10EXX	1"	12.85	6.60	34.25	8.10	5.15	36.90
12EXX	1-1/4"	17.10	7.95	40.80	12.80	5.90	22.80
15EXX	1-1/2"	16.85	8.10	41.45	12.80	6.35	22.45
20EXX	2"	22.35	10.10	47.30	15.35	7.95	28.80
25EXX	2-1/2"	37.00	18.95	80.15	22.30	N/A	49.30
30EXX	3"	37.30	19.65	90.40	23.45	17.45	49.60
40EXX	4"	79.15	41.20	175.85	48.05	N/A	105.30
50EXX	5"	140.05	66.10	249.25	82.45	N/A	N/A
60EXX	6"	189.80	80.15	297.30	106.70	N/A	N/A

Available in 8" and 10" sizes. Please call for more information.

3" and 4" aluminum have machined shanks.

Part FMale Adapters -
Male Thread

Item Code	Size	Metal Selection					
		CB	AL*	SS	MI	PP	BR
5FXX	1/2"	7.50	4.35	34.00	8.05	4.17	10.00
7FXX	3/4"	7.95	5.50	35.45	8.20	4.70	10.65
10FXX	1"	9.30	6.30	41.30	9.10	5.25	12.45
12FXX	1-1/4"	13.80	8.45	49.55	11.85	6.05	18.35
15FXX	1-1/2"	15.20	8.50	52.30	13.35	6.65	20.20
20FXX	2"	19.00	10.70	57.85	14.40	9.15	25.35
25FXX	2-1/2"	34.35	20.00	96.75	18.35	N/A	45.80
30FXX	3"	38.95	22.15	114.70	27.80	19.05	51.85
40FXX	4"	70.85	41.65	172.45	51.25	N/A	94.30
50FXX	5"	153.95	73.45	269.85	88.00	N/A	N/A
60FXX	6"	183.30	92.55	307.35	106.70	N/A	N/A

BSP and BST threads available on request.

Available in 8" and 10" sizes. Please call for more information.

Dust PlugFor Use
With Couplers
(Not to be used in pressure
applications.)

Item Code	Size	Metal Selection					
		CB	AL*	SS	MI	PP	BR
5DPXX	1/2"	8.30	5.30	26.70	4.45	3.61	11.05
7DPXX	3/4"	8.95	5.90	28.70	4.80	4.10	11.95
10DPXX	1"	9.05	6.60	28.90	4.90	4.55	12.10
12DPXX	1-1/4"	12.05	8.10	34.00	7.05	5.00	16.05
15DPXX	1-1/2"	12.80	8.35	34.75	8.65	5.80	18.85
20DPXX	2"	14.95	9.05	42.45	14.45	7.45	19.90
25DPXX	2-1/2"	22.60	12.35	59.90	17.90	N/A	30.10
30DPXX	3"	22.95	14.10	68.35	18.35	13.55	30.55
40DPXX	4"	37.40	21.50	99.40	29.80	N/A	49.80
50DPXX	5"	73.05	37.80	132.70	44.10	N/A	N/A
60DPXX	6"	105.95	44.95	183.35	71.60	N/A	N/A

Available in 8" and 10" sizes. Please call for more information.

Dust CapFor Use
With Adapters
(Not to be used in pressure
applications.)

Item Code	Size	Metal Selection					
		CB	AL*	SS	MI	PP	BR
5DCXX	1/2"	12.75	6.70	40.55	10.10	9.06	17.00
7DCXX	3/4"	15.20	10.40	42.05	11.05	9.70	20.20
10DCXX	1"	19.25	12.10	45.50	12.40	10.30	25.70
12DCXX	1-1/4"	21.55	15.35	53.70	14.35	11.45	28.70
15DCXX	1-1/2"	22.80	14.40	55.30	17.85	13.35	30.10
20DCXX	2"	25.40	13.70	69.35	21.70	16.45	33.85
25DCXX	2-1/2"	27.60	20.55	81.80	26.55	N/A	36.80
30DCXX	3"	37.10	21.25	88.30	29.45	25.35	49.35
40DCXX	4"	56.05	31.00	119.10	43.35	N/A	74.80
50DCXX	5"	121.00	62.00	174.75	84.25	N/A	N/A
60DCXX	6"	148.80	77.15	269.60	100.45	N/A	N/A

See page 11 for Dust Caps With Overlock Handles.

Aluminum couplers are standard with stainless steel handles. Brass handles available on request.

Available in 8" and 10" sizes. Please call for more information.

*Also available in hard-coat or anodized aluminum at an additional cost. Please call for pricing.
 XX indicates that a metal selection must be designated when ordering: CB = Cast Brass; AL = Aluminum; SS = 316 Stainless Steel; MI = Malleable Iron; PP = Polypropylene; BR = Forged Brass.
 Also available in Monel, Hastelloy C and Carpenter 20. Call for pricing.

FLAME ARRESTER SPECIFICATIONS

Manufacturer: The Protectoseal Company
225 Foster Avenue
Bensenville, Illinois 60106
(708) 595-0800

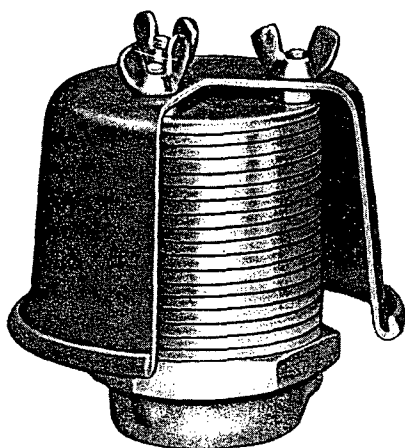
Model: Series No. 670 / 6670

Material: Aluminum / Stainless Steel

Supplying Vendor: LFG Specialties, Inc.
725 Friendship Drive
New Concord, Ohio 43762
(740) 826-7686



FLAME ARRESTER



Series 670

Series 6670

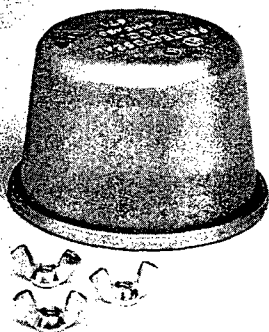
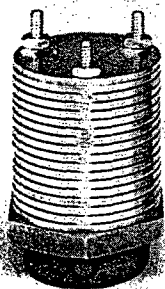
IMPORTANT - Before installation or servicing, make sure line is free of flammable or hazardous vapor.

Installation

1. Remove all protective packing.
2. Install unit, using suitable wrench on body flats to tighten.
3. Unit is ready for service.

Maintenance

1. Remove unit from installation.
2. Remove wing nuts on weatherhood. Remove weatherhood.
3. Inspect grid plates, blow out loose dirt and immerse in suitable solvent to dissolve gums and deposits. **IMPORTANT: DO NOT DISASSEMBLE GRID ASSEMBLY.**
4. Reassemble weatherhood and wing nuts. Tighten wing nuts securely.
5. Reinstall unit, using suitable wrench on body flats to tighten.



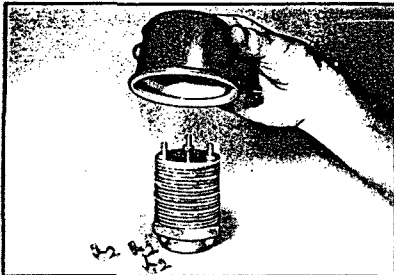


PROTECTOSEAL

SAFETY WITHOUT COMPROMISE

Series 670/ No. 6670

Flame Arrester



Mushroom Vent with Circular Plate-Type Flame Arrester

OBJECTIVE

Protectoseal Series No. 670/6670 Flame Arresters are installed where it is not necessary to conserve vapor losses but where low flash point solvents must be protected against fire and explosion from exterior sources of ignition. In this type of installation, the Protectoseal flame arrester is an integral part of the vent housing. The Series No. 670/6670 Flame Arresters are generally installed under conditions of moderate atmospheric exposures or limitations of space for installation.

TECHNIQUE

The Flame Arrester is mounted on the end of a vent pipe from the tank. Vapors are allowed to escape into the atmosphere and air can be drawn into the tank through the specially designed flame arrester grid assembly. If a possible ignition source outside the tank is encountered, the flame arrester provides protection for the tank contents.

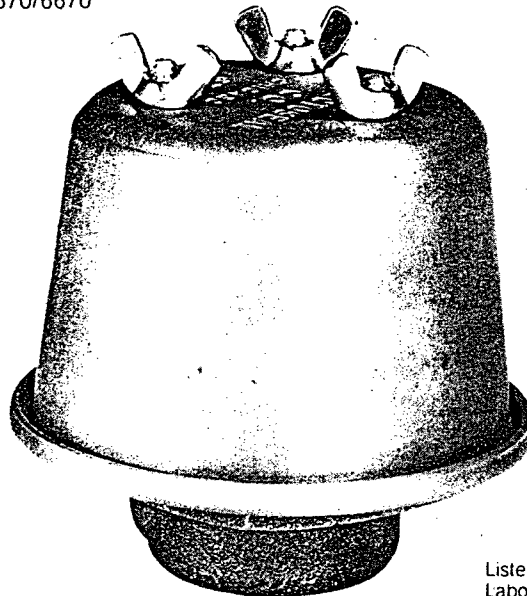
CONSTRUCTION

Construction consists of a series of sturdy, round discs mounted on a durable collar casting:

Standard: Lightweight cast Aluminum collar, weatherhood and flame arrester plates.

Custom: Stainless Steel and other special metals or coatings to withstand the corrosive action of some vapors and atmospheric conditions are available on request.

SERIES NO. 670/6670



Listed by Underwriters Laboratories in 1" size, Catalog No. 671, and 2" size, Catalog No. 6672.

SPECIAL FEATURES

Easy Inspection, Installation and Maintenance. Design and light weight of unit permit easy, convenient handling for inspection, installation and maintenance. The weatherhood is readily removable by loosening just a few extra large wing nuts.

UL Listed. Listed by Underwriters' Laboratories in 1-inch size, Catalog No. 671, and 2-inch size, Catalog No. 6672, in both Aluminum and Stainless Steel.

Positive Flame Arresting. Precision embossings on alternate plates provide correct air-spacing for flame arresting function. Plates are sturdily fabricated

from 1/16" to 3/32" heavy gauge metal depending on material of construction to resist distortion and bending during cleaning, assuring correct reassembly to original factory standards.

Numerous Sizes Available. 1-inch, 2-inch, 3-inch and 4-inch vents have standard N.P.T. threaded connections. Adapter flanges available in these sizes. Select the correct size vent necessary to relieve tank structure from pressure build-ups and provide adequate relief. Use chart on reverse side for ordering.

Quality Assurance. Each unit is factory inspected prior to shipment to meet Protectoseal's high standards.

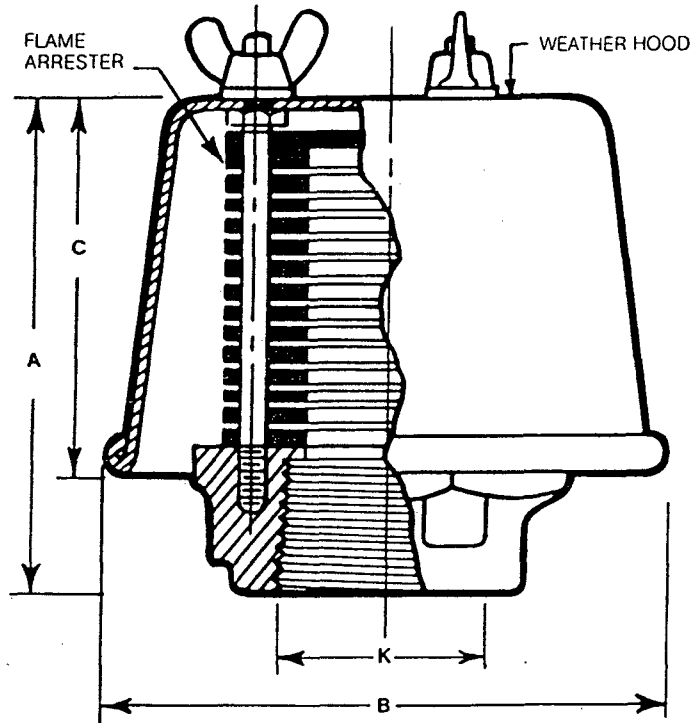
MATERIALS OF CONSTRUCTION

Series	Hood	Flame Arrester Grid Assembly
670	Aluminum	Aluminum 356
6670	Aluminum	Aluminum 356
F670	316 Stainless Steel	316 Stainless Steel
FF6670	316 Stainless Steel	316 Stainless Steel

SPECIFICATIONS

Series No. 670/6670 Flame Arrester

SIDE VIEW



SERIES NO. 670/6670

DIMENSIONS

Cat. No.	K Pipe Size	Standard Construction		
		A Ht.	B Width	C Length
For Aluminum Weatherhood and Flame Arrester				
*671	1"	2 ⁷ / ₈ "	3 ³ / ₈ "	2 ³ / ₁₆ "
**6672	2"	4 ⁵ / ₈ "	6 ¹ / ₈ "	4"
*673B	3"	7 ³ / ₈ "	7 ¹ / ₂ "	6 ⁹ / ₁₆ "
674	4"	6 ³ / ₄ "	8 ¹ / ₂ "	5 ¹ / ₂ "

*Add prefix "F" for all Stainless Steel construction.

**Add prefix "FF" for all Stainless Steel construction.

Check with Sales Department for availability and scheduled delivery.



THE PROTECTOSEAL COMPANY
225 Foster Ave., Bensenville, IL 60106-1690
Fax: 1-708-595-8059 Tlx: 28-2549
Ph: 1-708-595-0800

SAFETY WITHOUT COMPROMISE

FLARE PACKAGE

FLARE PACKAGE SPECIFICATIONS

Manufacturer: LFG Specialties, Inc.
750 Friendship Drive
New Concord, Ohio 43762
(800) 331-7683

Supplying Vendor: LFG Specialties, Inc.
750 Friendship Drive
New Concord, Ohio 43762
(800) 331-7683

See LFG Specialties, Inc. Operation & Maintenance Manual which is supplied under separate cover. Note that the Title Sheet, Table of Contents, Shop Drawing Summary, and Technical Data are included in this Section along with additional blower data not included in the LFG Specialties, Inc. Operation & Maintenance Manual.

UTILITY FLARE MODEL CF1228I12
TECHNICAL DATA

- A. Flare Tip size -- 12 in.
 - B. Overall Height -- 31 ft.
 - C. Maximum landfill gas flow -- 2800 SCFM
 - D. Turndown Ratio -- 10:1
 - E. Destruction efficiency at design flow with gas methane content 40 to 60% -- 98% overall destruction of total hydrocarbons
- Guaranteed to meet E.P.A. emission standards for landfill gas disposal in utility "candle type" flares.

Note: Flare is designed in accordance with the United States Environmental Protection Agency (EPA) established criteria for open flares, 40 CFR 60.18

- F. Minimum flow rate to maintain stable flame and 98% destruction efficiency -- 280 SCFM
- G. Minimum methane content required to maintain stable flame and 98% destruction efficiency -- 30%
- H. Flow/Emissions (expected) at maximum flow, 50% methane content and 1400°F combustion temperature:

N ₂	73.5	% vol.
O ₂	13.6	% vol.
CO ₂	6.0	% vol.
H ₂ O	6.9	% vol.
NO ₂	0.068	lbs./MMBTU *
CO	0.37	lbs./MMBTU *

* Per the US EPA AP-42 Supplement D, Table 11.5-1

- I. Equipment drawing -- typical attached
- J. P&ID -- typical attached

NOTE:

Wind loads: Designed for 100 mph wind loading (per ASCE 7-88, Exp. C)

Approximate weight of stack- 2,500 lbs.

LFG SPECIALTIES

LFG SPECIALTIES

SERIAL NO. 1546

CANDLE FLARE SYSTEM

OPERATION & MAINTENANCE MANUAL

November 1998

INDEX

SECTION I

PROPOSAL NO 69810 CANDLE FLARE

- Utility Flare Model CF1228I12
- Peripheral Equipment
- Flame-Trol I Utility Flare Control System
- Additional Control Equipment
- Technical Data
- Utility Flare System Per Specification
- LFG Terms & Conditions

SECTION II

INSTALLATION AND SERVICE

- Utility Flare Installation
- Flame-Trol I Installation
- Flare Maintenance
- Utility Flare Station Start-up
- Initial Manual Startup
- Initial Automatic Startup
- Operation
- Service Contacts
- Maintenance Schedule
- Spare Parts List
- Lock-Out/Tag-Out Procedures
- System Drawings

SECTION III

PILOT GAS SYSTEM

- Pilot Gas Line Shutoff Valve
- Pilot Gas Line Strainer
- Pilot Gas Pressure Indicator
- Pilot Gas Pressure Regulator
- Pilot Gas Solenoid Valve
- Pilot/Igniter System

SECTION IV

FLARE STACK SYSTEM

- Flare Inlet Temperature Switch
- Igniter Spark Plug
- Igniter Transformer
- Thermocouple Elements
- UV Flame Detector

SECTION V

GAS HANDLING SYSTEM

- Actuator Solenoid Valve
- Butterfly Valve
- Differential Pressure Transmitter
- Flame Arrester
- Landfill Gas Blower
- Orifice Plate
- Valve Actuator

SECTION VI

FLAME-TROL I CONTROL CENTER

- Auto-Dialer
- Blower Ammeter
- Blower Motor Control & Protection
- Circuit Breakers
- Control Panel Heater
- Control Panel Lights & Switches
- Data Recorder/ Transfer Module
- Flame Detector Relay
- Power Transformer
- Purge, Pilot, Igniter, & Down Time Timers
- Surge Protector
- Temperature Controller



2830 Symmes Road
Fairfield, OH 45014
Ph. 513-874-2400
Fax 513-870-8248

Representative Information

513-469-2000

Air Pro, Inc.
7245 Edington Dr.
Cincinnati, OH 45249

Date: 08-20-88

AIR PRO, INC
7245 EDINGTON DRIVE
CINCINNATI, OHIO 45249

Performance Requirements

Actual Volume	2000	Cu Ft / Min
Static Pressure	39.500	Inches W.G.
Max Design Temperature	200	Degree F

Inlet Conditions

Operating Temperature	70	Degree F
Specific Gravity	1.000	
Altitude	0	Feet
Inlet Pressure	-36.000	Inches W.G.
Density at Static Pressure	0.0684	Lb / Cu Ft

Selected Direct Drive Speed

Speed	3515	RPM
-------	------	-----

Selection

Model and Size	VP-8-08-23B	
Impeller Diameter	23.00	Inches
Impeller Material	Steel	

Density	0.0684	Lb / Cu Ft
Volume	1987	Cu Ft / Min
Static Pressure	39.40	Inches W.G.
Power @ Condition	17.25	Horsepower
Power @ 0.075 Lb / Cu Ft	18.01	Horsepower
Fan Speed	3515	RPM

Impeller Tip Speed	21165	ft / Min
Static Efficiency	72	%
Outlet Velocity	5722	ft / Min

% of Max Fan Speed	88	%
Max Fan Speed	3854	RPM
Recommended Motor	20	Horsepower

Sound Data

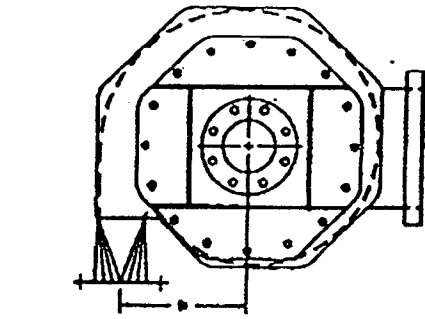
Sound Power Levels @ 10E-12 Watts

Frequency	LW dB
63	83
125	101
250	106
500	110
1000	104
2000	101
4000	95
6000	80

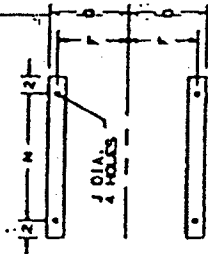
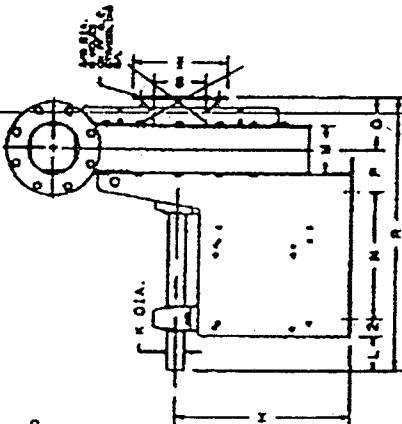
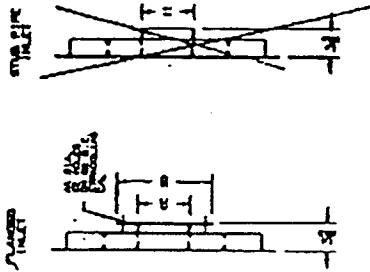
Estimated dBA @ 5 Feet
101

The sound power level ratings are shown in decibels, referred to 10E-12 watts calculated per AMCA Standard 301. Values shown are for inlet line sound power levels for Installation Type B, free inlet, ducted outlet. Ratings do not include the effects of duct and conversion.

dBa value shown was obtained in installation Type B tests conducted in the APO Laboratory. dBa values obtained for your installation may be different. dBa levels shown is for comparison purposes only.



NOTE: UNIT 1 BASE SHIP IS THE BASED TO MATCH UNIT 2 BASE.



ROTATION VIEWED FROM DRIVE SIDE	VIEW	FIG. 1	FIG. 2	FIG. 3	FIG. 4	FIG. 5	FIG. 6	FIG. 7	FIG. 8	FIG. 9	FIG. 10	FIG. 11	FIG. 12	FIG. 13	FIG. 14
VIEW	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH	TH
VIEW	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU	TAU
VIEW	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB
VIEW	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
VIEW	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB
VIEW	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
VIEW	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB
VIEW	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU

* ADD 1/4" FOR FLANGED INLET

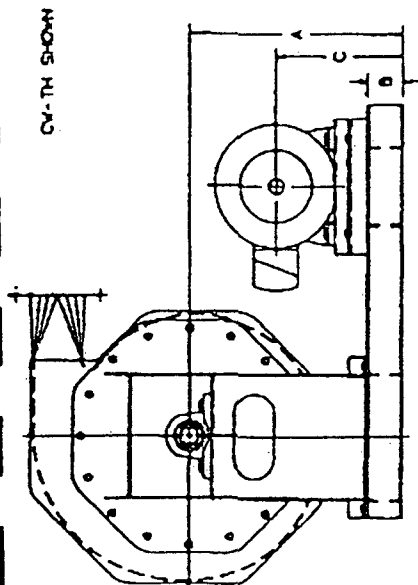
IN	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	APPROX. PRESS. (PSI)
1	12 1/2	11 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	12 1/2	245
2	17 1/2	15 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	300
3	17 1/2	15 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	405
4	17 1/2	15 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	405
5	17 1/2	15 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	405
6	17 1/2	15 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	16 1/2	405

INLET FLANGE	INLET PORT	INLET TYPE
AA	BB	CC
DD	EE	FF
GG	HH	II
JJ	KK	LL
MM	NN	OO
PP	QQ	RR
SS	TT	UU
VV	WW	XX
YY	ZZ	AA

AVP, QVP, BC, AND VP-1 THRU 6
PRESSURE BLOWERS ARR'T 1

VPC979F

2



CV-TM SHOWN

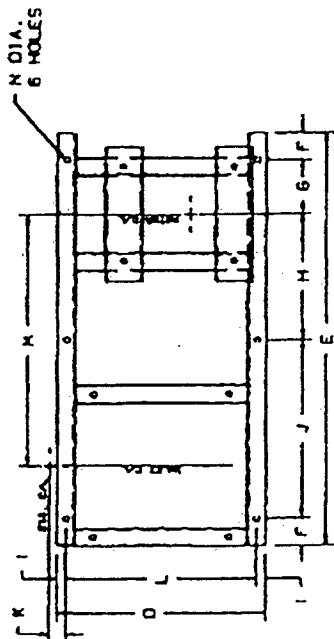
FOR APPROVAL
AS WILL NOT BE
RETURNED UNLESS
NOTED.

DWG. IS CERTIFIED
CORRECT FOR
CONSTR. PURPOSES
AND RELEASED.

DWG. HAS BEEN
REVISED. OBTAIN
ALL PRINTS
SUBMITTED PREVIOUS
TO.

ROTATION VIEWED FROM DRIVE SIDE	CV TH	CV TAU	CV BAU
FIG. 1	FIG. 2	FIG. 3	FIG. 4
FIG. 5	FIG. 6	FIG. 7	FIG. 8
FIG. 9	FIG. 10	FIG. 11	FIG. 12
FIG. 13	FIG. 14	FIG. 15	FIG. 16

* NOT AVAILABLE IN FAN
SIZES IN, 1 AND 2



N DIA.
6 HOLES

FAN SIZE	FRAME SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O
IN, 1 & 2	182T			12		38				11	16			22	23.8
IN, 1 & 2	184T			13		40		5		12	17			23	24.4
IN, 1 & 2	215T	21	4	14		42				13	18			24	24.9
IN, 1 & 2	254T			14		43				12	18			26	28.6
IN, 1 & 2	256T			14		46		3		14	20			28	30.1
IN, 1 & 2	258T			14		49				15	21			29	30.6
IN, 1 & 2	260T			15		51				16	22			30	31.3
IN, 1 & 2	262T			15		50				14	22			30	34.2
IN, 1 & 2	264T			16		52		3		15	23			31	34.5
IN, 1 & 2	266T			17		55				16	24			32	35.1
IN, 1 & 2	268T			19		58				18	28			34	36.4

* DIMENSION ON
ACTUALLY LOCATED
SIDE OF MOUNTING HOLE IS
SHOWN.

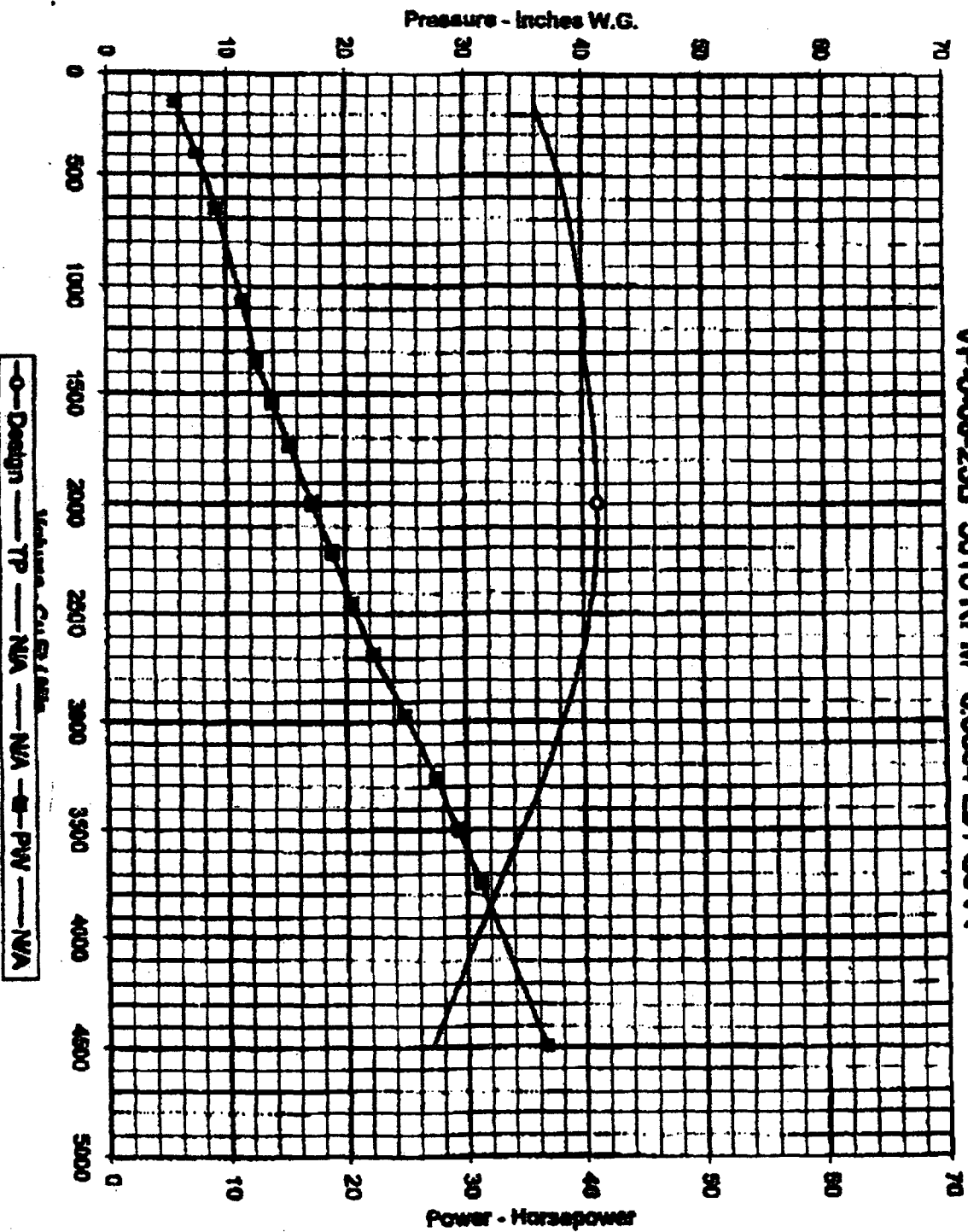
NOTES:
FOR FAN DETAILS
SEE DWG. VPC975F
BELT C/D = "0" DIMENSION
ARR'T IR UNITARY BASE
MOTOR POSITION "W"

CHANNEL SIZES:
FAN SIZES IN THRU 4 = 4 X 2 X .1793
FAN SIZES 5N, 5 AND 6 = 6 X 2.497 X .310

CUSTOMER		MODEL	ROT.	DIS.	ARR'T
					IR
DATE	ATC JOB NO.	QUN	CUSTOMER P.O. NO.	MARK	

VPC994F		AMERICAN FAN COMPANY	
VPC994F		AMERICAN FAN COMPANY	
VPC994F		AMERICAN FAN COMPANY	

VP-6-08-238 3515 RPM 0.0684 Lb / Cu Ft



AIR PRO, INC
7245 EDINGTON DRIVE
CINCINNATI, OHIO 45249

NITROGEN BOTTLE SPECIFICATIONS

Manufacturer: Action Welding Supply
6683 Stuart Avenue
Jacksonville, Florida 32254
(940) 786-2254

Supplying Vendor: Action Welding Supply
6683 Stuart Avenue
Jacksonville, Florida 32254
(940) 786-2254



PHOTOGRAPHS

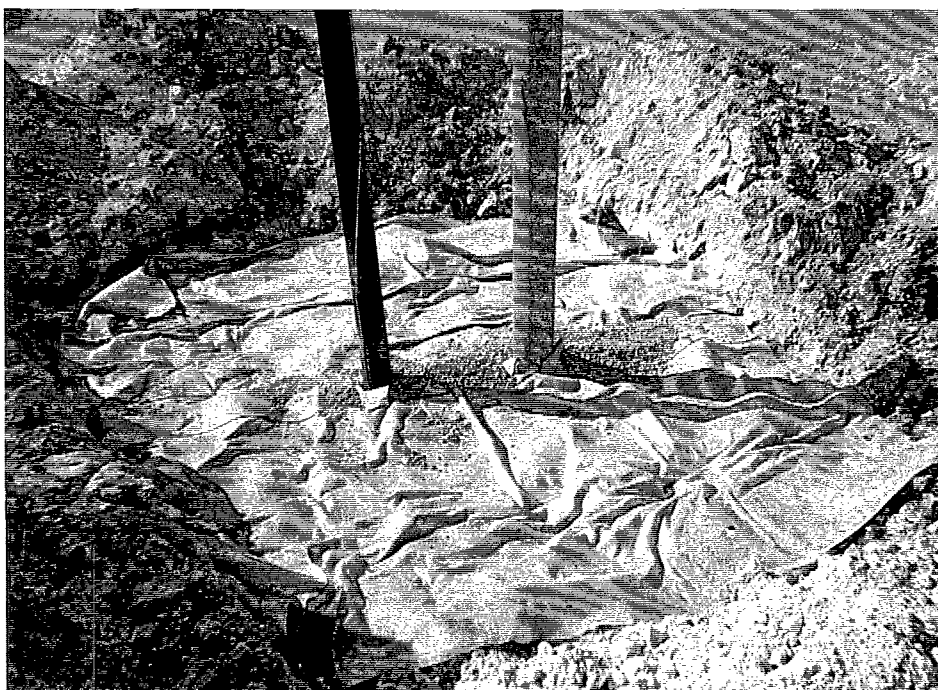
LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of Gas Extraction Well and Lateral (Typical)
- Installation of Bentonite Mat at Gas Extraction Wells (Typical)

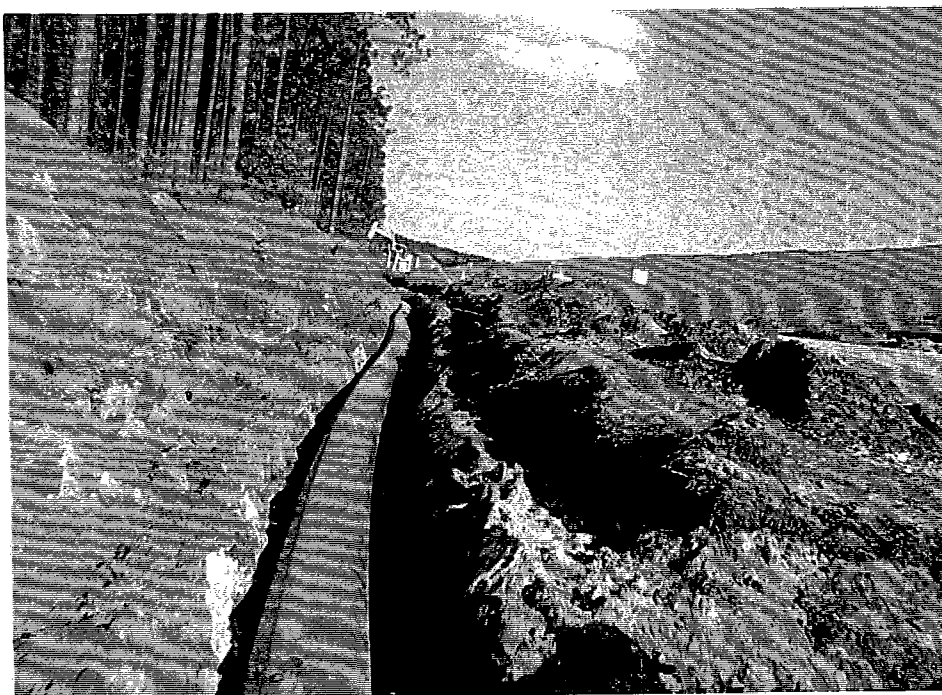
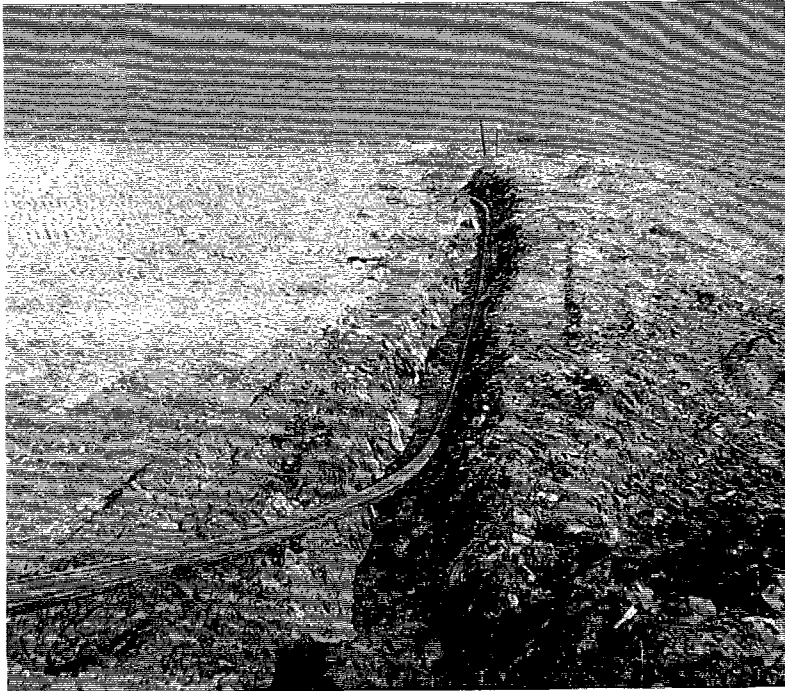


LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM

- Installation of 6" HDPE Header Line (Typical)
- Installation of 20" HDPE Header Line (Typical)

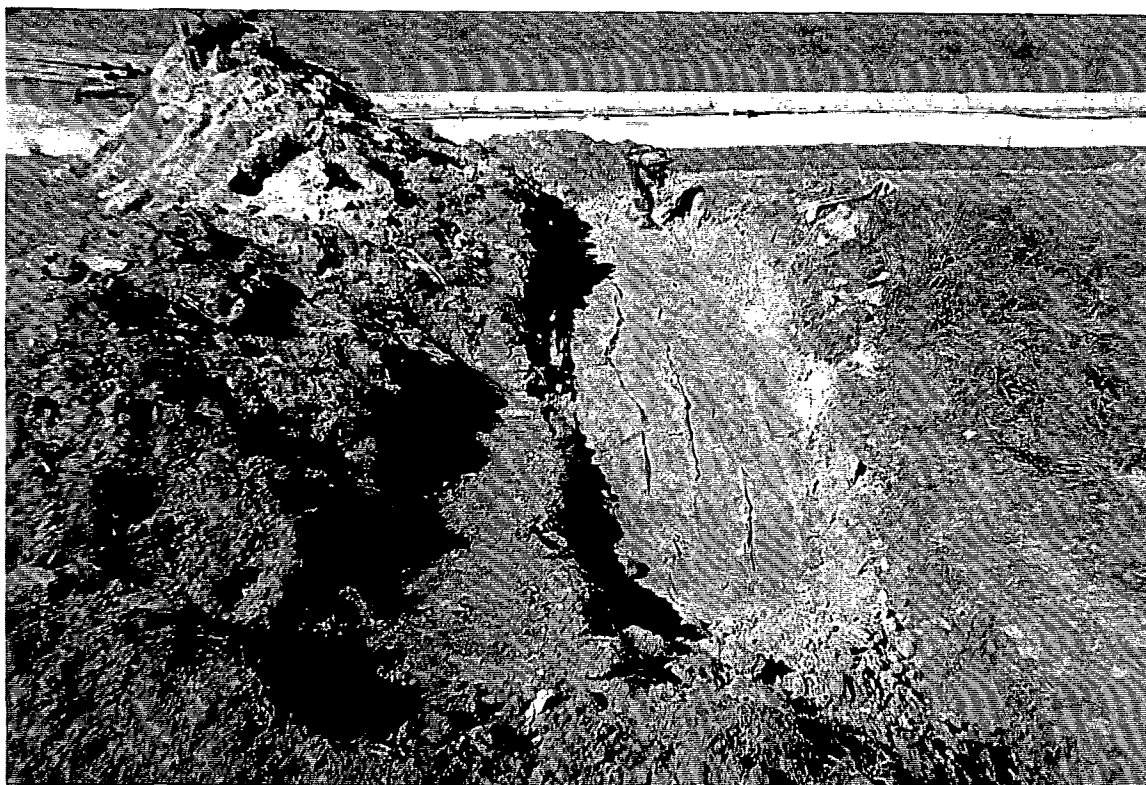
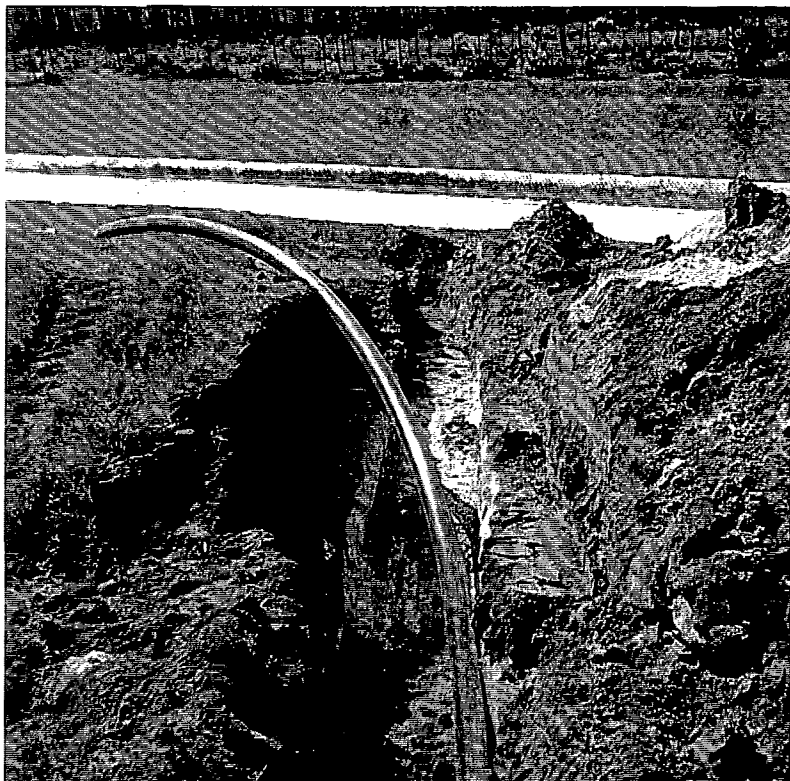


LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

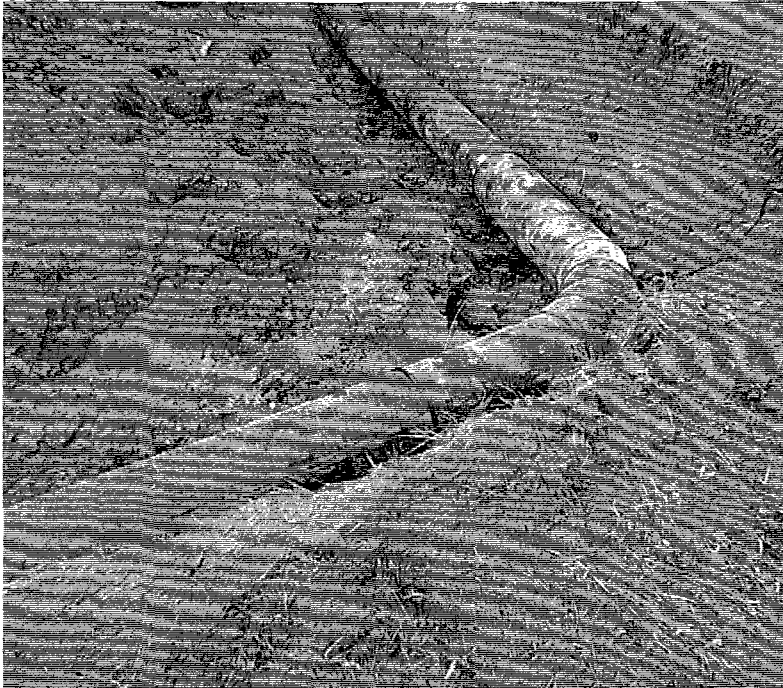
TOP TO BOTTOM

- Excavation through Clay Cap (Typical)
- Repair of Clay Cap (Typical)



LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS



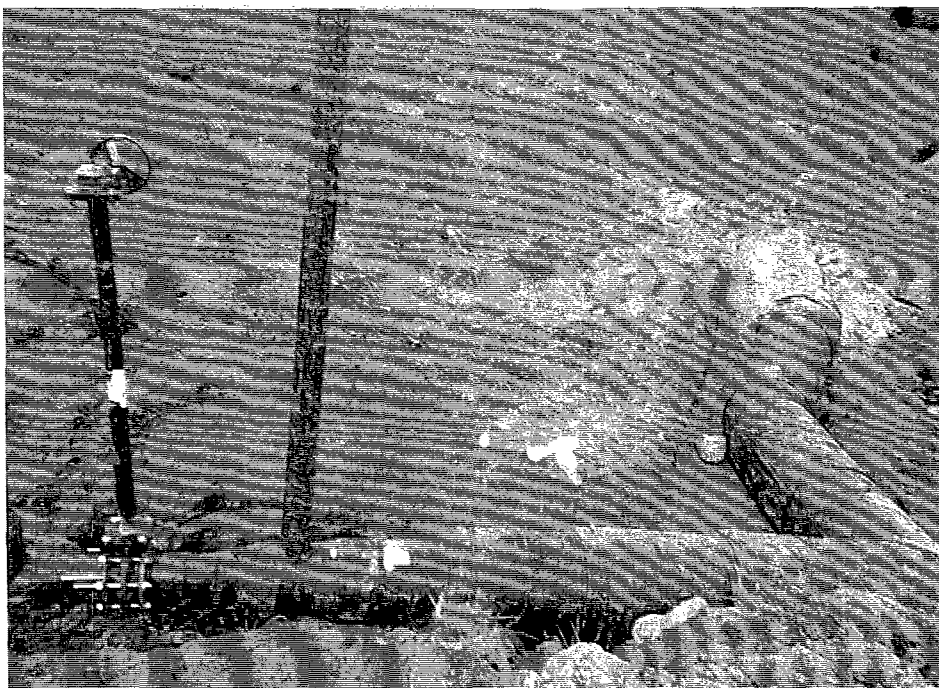
TOP TO BOTTOM

- Installation of 12" 90° Elbow Line B-B'
- Installation of Lateral to Well W-17 Line G-G' STA 7+74

22" Tee Line G-G'
STA 7+74

22" x 6" Reducer Lateral
to Well W-17 STA 0+02

6" Underground Control
Valve Lateral to Well
W-17 STA 0+04



LANDFILL GAS MANAGEMENT SYSTEM
FOR
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BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of 6" Underground Control Valve with 4" Risers (Typical)
- Installation of 6" Underground Control Valve with 4" Risers and Bentonite Mat (Typical)



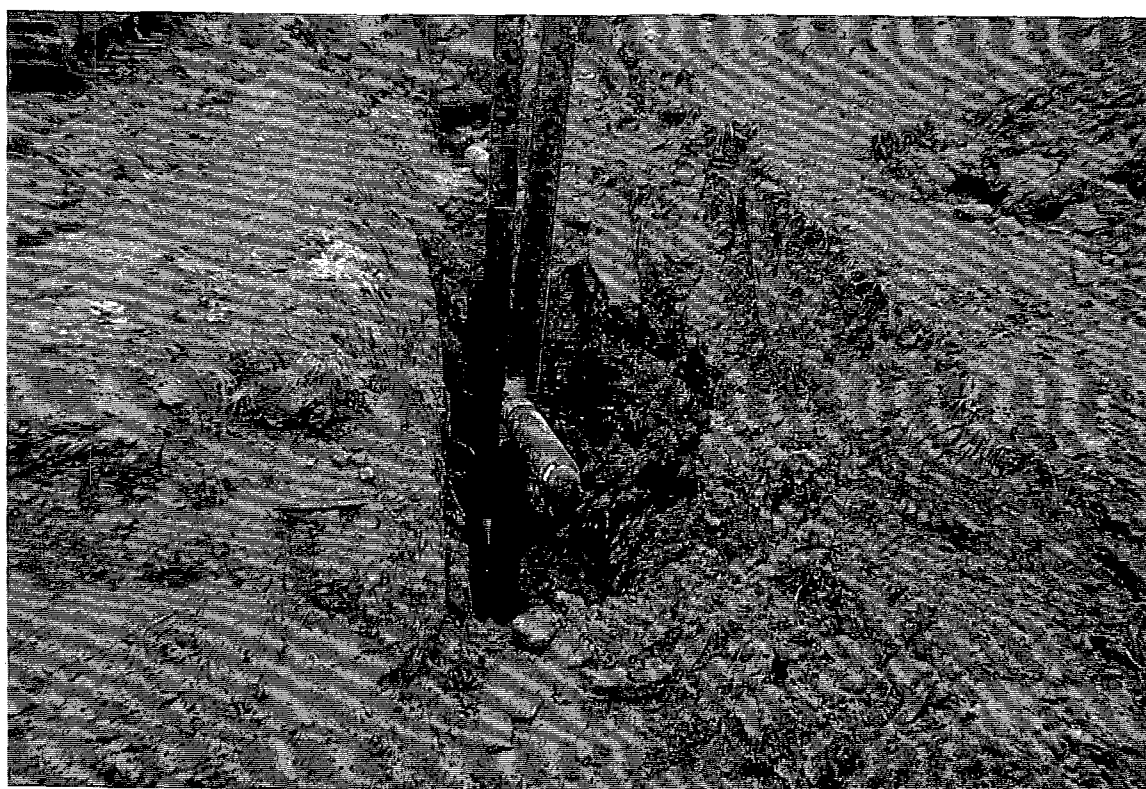
LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of 12" Condensate Knockout CK-5 Line H-H' STA 0+00
- Installation of Condensate Dripleg (Typical)

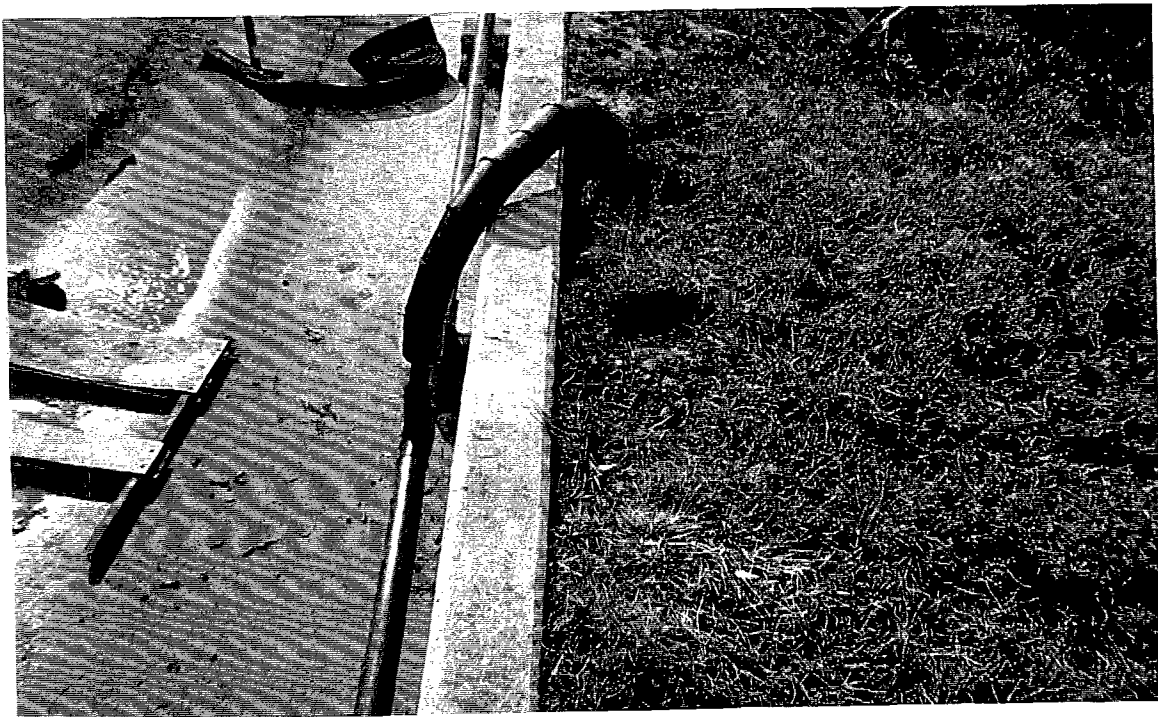
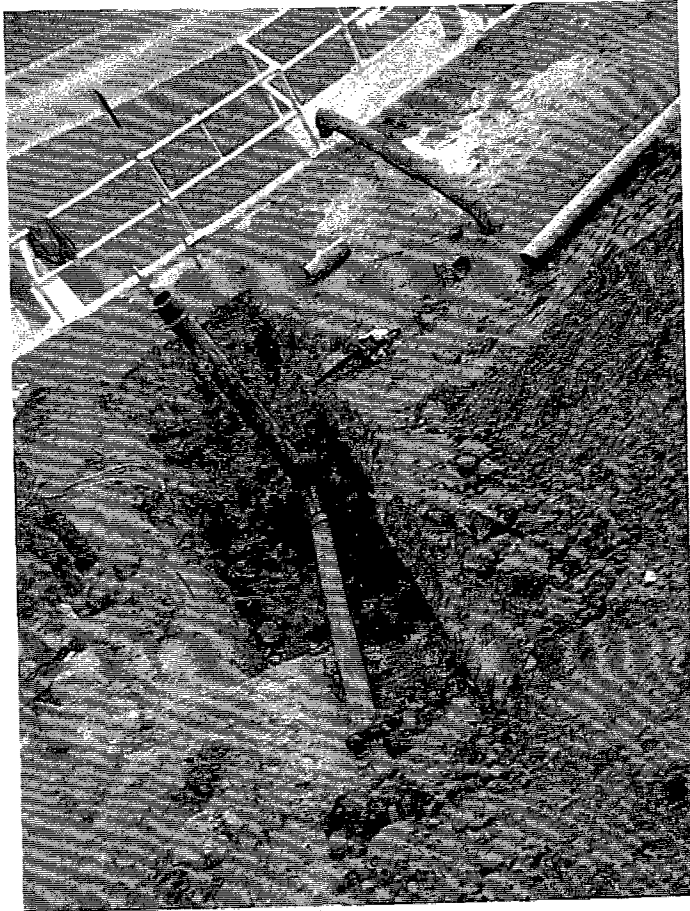


LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM

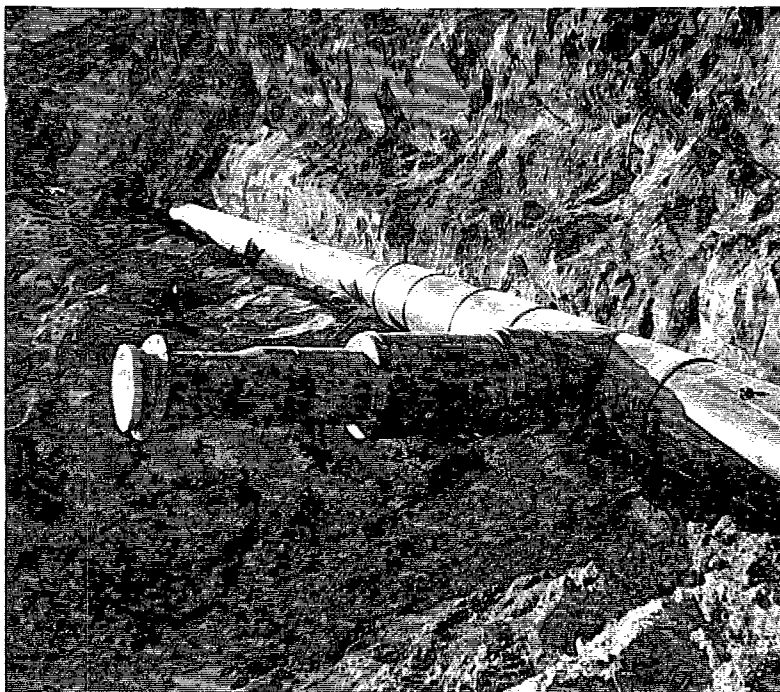
- Tie-in to Leachate Sump Riser (Typical)
- 4" X 2" Dual Containment Tie-in to Existing Leachate Collection System



LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of 20" Tee Reduced down to 6"
- Installation of 10" Steel Casing across Concrete Ditch (Typical)



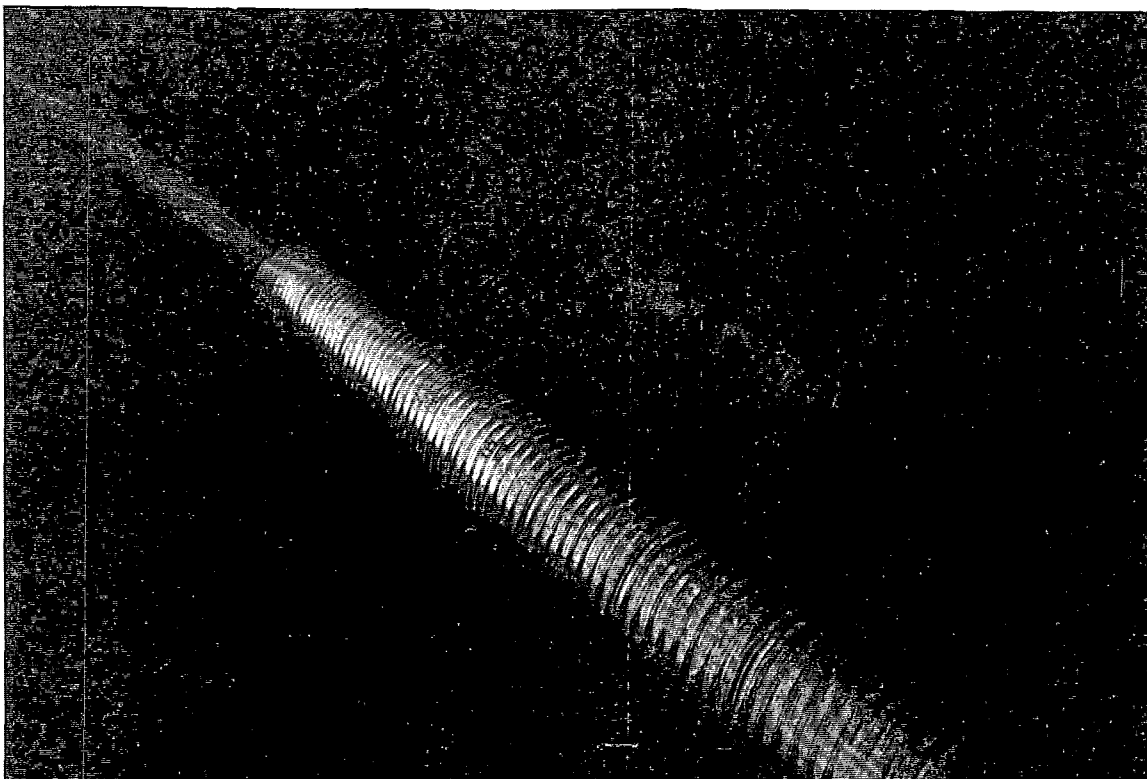
LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of Road Crossing Line G-G' STA 10+82 to STA 11+23
- Installation of Corrugated Metal Road Casing (Typical)



LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



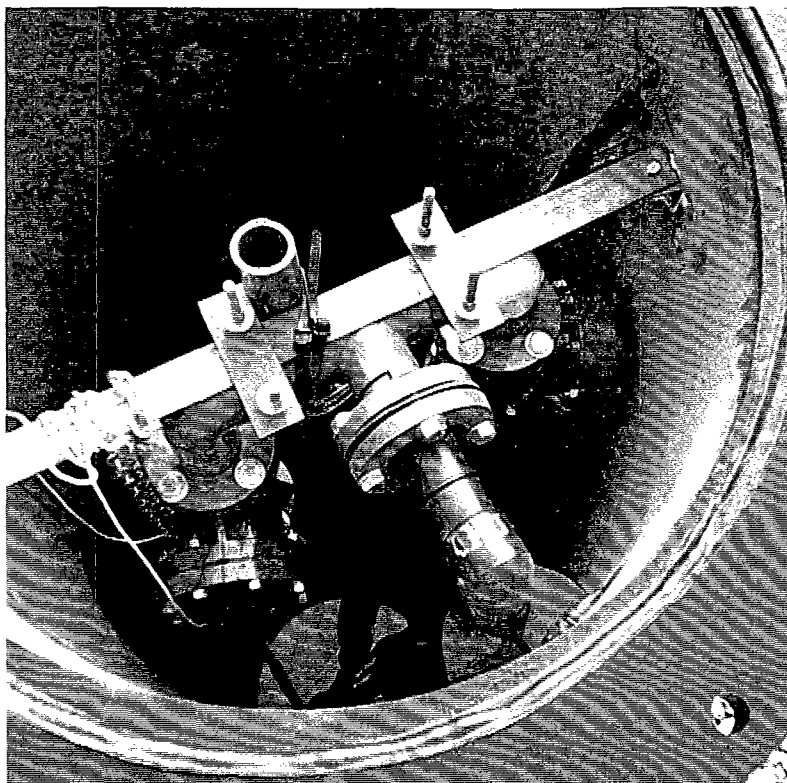
- Excavation for installation of Concrete Pad at Condensate Tank Location
- Installation of 3000 Gallon Below Ground Tank



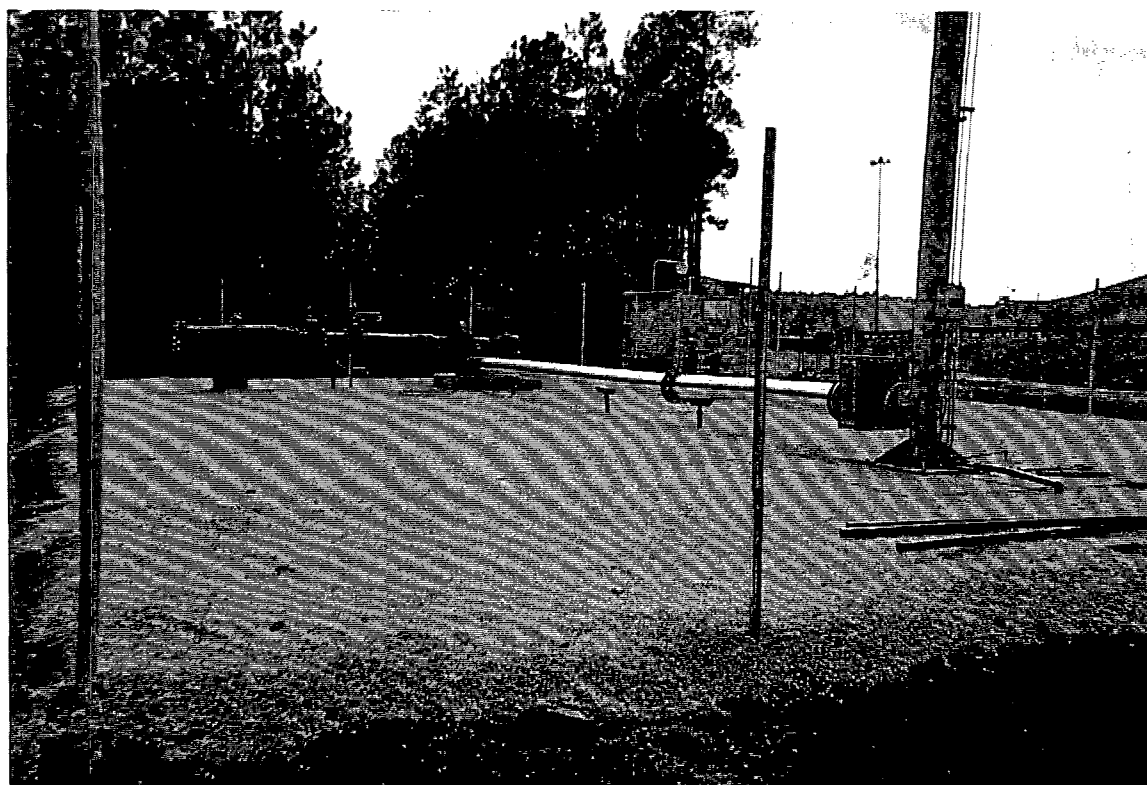
LANDFILL GAS MANAGEMENT SYSTEM
FOR
TRAIL RIDGE LANDFILL
BALDWIN, FLORIDA

PHOTOGRAPHS

TOP TO BOTTOM



- Installation of Flygt Pumps inside 3000 Gallon Below Ground Tank
- Installation of Flare Station



**LARGE NUMBER
OF MAPS
SCANNED
SEPARATELY**