CHANGE ORDER NO. 1

Date: February 22, 2024
Project: 2023 Sanitary Sewer Rehabilitation
Engineer: Ward, Getz & Associates, PLLC
Project No.: 00574-011-00
Owner: City of Montgomery
Contractor: Cruz Tec, Inc.

CHANGE ORDER DETAILS

You are directed to make the following changes in the Contract Documents:			PREVIOUS		REVISED		
Item No.	Description	Unit	Quantity	Amount	Quantity	Amount	Net Change
4	8-inch (8") sanitary sewer rehabilitation by CURED-IN-PLACE process, all depths, including pre- and post-construction cleaning and televising; removal of roots and other pipe obstructions by regular pipe cleaning methods; sewer flow control (including by-pass pumping, if required); materials testing; removal and replacement of sprinkler systems, and other above ground obstructions per Attachment A of the Contract; removal and replacement of cleanouts as necessary to complete the work; providing the Engineer copies of the curing logs; and site restoration to existing or better condition (includes removal and replacement of fencing, sod, etc.);	LF	4,914.0	$38.00	2,870.0	$38.00	-$77,672.00
5	12-inch (12") sanitary sewer rehabilitation by CURED-IN-PLACE process, all depths, including pre- and post-construction cleaning and televising; removal of roots and other pipe obstructions by regular pipe cleaning methods; sewer flow control (including by-pass pumping, if required); coordination with testing laboratory for materials testing; removal and replacement of sprinkler systems, and other above ground obstructions per Attachment A of the Contract; removal and replacement of cleanouts as necessary to complete the work; providing the Engineer copies of the curing logs; and site restoration to existing or better condition (includes removal	LF	868.0	$49.00	0.0	$0.00	-$42,532.00
16	REMOVE AND REPLACE concrete pavement to match existing as per TxDOT specifications.	SY	800.0	$120.00	10.0	$120.00	-$94,800.00
17	REMOVE AND REPLACE asphalt pavement to match existing as per City standard specifications.	SY	700.0	$75.00	10.0	$75.00	-$51,750.00
32	Existing 10-inch (10") sanitary sewer pipe upsize to 12-inch (12") IPS SDR-19 sanitary sewer pipe via Pipe Bursting. Contractor will pipe burst with new HDPE SDR 19 and make all	LF	0.0	$0.00	3,050.0	$55.00	$167,750.00
33	Existing 8-inch (8") sanitary sewer pipe upsize to 12-inch (12") IPS SDR-19 sanitary sewer pipe via Pipe Bursting. Contractor will pipe burst with new HDPE SDR 19 and make all	LF	0.0	$0.00	381.0	$75.00	$28,575.00
34	Service reconnection via excavation (after pipe bursting	EA	0.0	$0.00	5.0	$850.00	$4,250.00
35	10-inch (10") sanitary sewer rehabilitation by CURED-IN-PLACE process, all depths, including pre- and post-construction cleaning and televising; removal of roots and other pipe obstructions by regular pipe cleaning methods; sewer flow control (including by-pass pumping, if required); materials testing; removal and replacement of sprinkler systems, and other above ground obstructions per Attachment A of the Contract; removal and replacement of cleanouts as necessary to complete the work; providing the Engineer copies of the curing logs; and site restoration to existing or better condition (includes removal and replacement of fencing, sod, etc.);	LF	0.0	$0.00	2,044.0	$45.00	$91,980.00
						NET INCREASE IN CONTRACT PRICE	**$25,801.00**

4526 Research Forest Dr. Suite 360 | The Woodlands, TX 77381 | 713.789.1900 | wga-llp.com

CHANGE ORDER NO. 1

Date: February 22, 2024
Project: 2023 Sanitary Sewer Rehabilitation
Engineer: Ward, Getz & Associates, PLLC — Project No.: 00574-011-00
Owner: City of Montgomery — Contractor: Cruz Tec, Inc.

CHANGE ORDER DESCRIPTION AND REASON

Description of changes: In lieu of repairing and lining the existing sanitary trunkline between SMH-199A and Lift Station No. 2, the entire line will be upsized and replaced from 10" to 12" via pipe bursting construction methods. Existing sanitary line between SMH-166 and SMH-167 to be upsized and replaced from 8" to 12" via pipe bursting construction methods (this scope removed from future phase and added to current phase). Added item for 10" Cured-In-Place sanitary sewer rehabilitation.

Reason for change: Upsizing the existing sanitary sewer line in lieu of repairing and lining to accommodate for potential growth to the west and improve overall service in the area.

CHANGE IN CONTRACT PRICE		CHANGE IN CONTRACT TIMES	
Original Contract Price		Original Contract Times	
		Final Completion:	150 calendar days
$ 837,528.00		Ready for Final Payment:	
Net Increase (Decrease) from previous Change Orders		Net Change from previous Change Orders	
	Percent Change from Original Contract	Final Completion:	0 calendar days
$ -	0.00%		
Contract Price prior to this Change Order		Contract Times Prior to this Change Order	
		Final Completion:	150 calendar days
$ 837,528.00		Ready for Final Payment:	
Net Increase of this Change Order		Net Increase (Decrease) of this Change Order	
	Percent Change from Previous Contract Price	Final Completion:	0 calendar days
$ 25,801.00	3.08%	Ready for Final Payment:	
Contract Price with all approved Change Orders		Contract Time with all approved Change Orders	
	Percent Change from Original Contract Price	Final Completion:	150 calendar days
$ 863,329.00	3.08%	Ready for Final Payment:	

CERTIFICATION AND APPROVAL OF CHANGE ORDER NO. 2

The undersigned certify that work and cost proposed by this Change Order is in accordance with the Contract's Specifications terms and conditions, is fair and just and is now part of the Contract.

CONTRACTOR: Wade Gibson — Date: 2/22/24
Cruz Tec, Inc.

ENGINEER: — Date: 02/22/2024
Ward, Getz & Associates, PLLC

OWNER: — Date:
City of Montgomery

Z:\00574 (City of Montgomery)\011 2023 Sanitary Sewer Rehabilitation\Docs\CA\6. Pay Estimates & Change Orders\Change Order No. 1 Review\Change Order No. 1\Change Order - CoM.xlsx

4526 Research Forest Dr. Suite 360 | The Woodlands, TX 77381 | 713.789.1900 | wga-llp.com

CRUZ TEC INC.
TRENCHLESS UTILITY CONTRACTORS

City of Montgomery

wgibson@cruztec.com

12210 Ann Lane
Houston, TX 77064

C: 281.979.6797
O: 281.469.2888
F: 281.469.2885

Date	Quote
1/17/2024	COM-003

Estimator	Project	Engineer	Rep.
Wade Gibson	City of Montgomery 8"-12" Pipe Burst	City of Montgomery	Sean D.

Bid Item No.	Unit	Description	Qty	Unit Price	Total
CO3	LF	8" Upsize to 12" IPS SDR 19 Pipe Burst	381	$ 75.00	$ 28,575.00
C03	EA	Service Reconnection by Excavation	1	$ 850.00	$ 850.00
				Total	$ 29,425.00
				Sales Tax	
				Total	$ 29,425.00

NOTES

1. Quote is estimated based on field measurements of from MH 166 to MH 167
2. Services are an estimation only.
3. Cruz Tec will Pipe Burst with HDPE SDR 19 and make all reconnections to the existing manholes.

ACCEPTANCE OF PROPOSAL

Owner Name: _____

Owner Contact: _____

Date: _____

Authorized Agent Signature: _____

Printed Name: _____

Project Payment Bond: _____

Surety/Bonding Company: _____

CRUZ TEC INC.

CRUZ TEC INC.
TRENCHLESS UTILITY CONTRACTORS

City of Montgomery

wgibson@cruztec.com

12210 Ann Lane
Houston, TX 77064

C: 281.979.6797
O: 281.469.2888
F: 281.469.2885

Date	Quote
12/28/2023	COM-002

Estimator	Project	Engineer	Rep.
Wade Gibson	City of Montgomery 10"-12" Pipe Burst	City of Monroe	TBD

Bid Item No.	Unit	Description	Qty	Unit Price	Total
CO2	LF	10" Upsize to 12" IPS SDR 19 Pipe Burst	3,000	$ 55.00	$ 165,000.00
C02	EA	Service Reconnection by Excavation	5	$ 850.00	$ 4,250.00
				Total	$ 169,250.00
				Sales Tax	
				Total	$ 169,250.00

NOTES

1. Quote is estimated based on field measurements of the trunk line starting at MH 167 and ending at LS #2
2. Services are an estimation only.
3. Cruz Tec will Pipe Burst with new HDPE SDR 19 and make all reconnections to the existing manholes.

ACCEPTANCE OF PROPOSAL

Owner Name: _____

Owner Contact: _____

Date: _____

Authorized Agent Signature: _____

Printed Name: _____

Project Payment Bond: _____

Surety/Bonding Company: _____

CRUZ TEC INC.

TRANSMITTAL OF SHOP DRAWINGS, PRODUCT DATA, SAMPLES, & VIDEO INSPECTIONS

DATE: 12/28/2023

JOB NAME: Mongomery SS Rehab

TO: WGA
4526 Research Firest Suite 360
The Woodlands, TX 77381

FROM: Cruz Tec Inc.
12210 Ann Lane
Houston, TX 77064

JOB NO.: 362

SUBMITTAL NO.: TBD

ITEM NO.	DESCRIPTION OF ITEM SUBMITTED (mfg. type, size, model number, etc.)	MFG. or CONTRACTOR DRAWING NO. or BROCHURE NO.	NO. COPIES	CONTRACT DOCUMENT REFERENCE		SPECIFICATION VARIANCE REQUESTED (YES OR NO)	LAN APPROVAL CODE
				Specification Section	Sheet No.		
1	HDPE	JM Eagle	1			No	
		George Fischer					
		Performance Pipe					
	Pipe Burst Methods	TT Technologies	1			No	

REMARKS:

I certify that the above submitted Items have been reviewed in detail and are correct and in accordance with the Contract drawings and specifications except as noted by variance column.

Wade Gibson

(CONTRACTOR SIGNATURE)

+GF+ DESIGN-FLOW® | IPS HDPE PIPE

IRON PIPE SIZE PE4710 | HIGH DENSITY POLYETHYLENE PIPE

GEORG FISCHER CENTRAL PLASTICS AVAILABLE STANDARDS:

DESIGN-FLOW® M & I PE4710 HDPE ASTM F714/D3035 AWWAC901/C906 NSF-61

DESIGN-FLOW® OIL & GAS PE4710/PE3408 HDPE ASTM D2513 CFR-192

DESIGN-FLOW® FM Approved PE4710 HDPE FM1631

DESIGN-FLOW® Gray SL PE4710 HDPE ASTM F714/D3035

Issued November 2012

Size		DR 32.5 CLASS 65 WPR @ 65psi			DR 26 CLASS 80 WPR @ 80psi			DR 21 CLASS 100 WPR @ 100psi			DR 19 CLASS 110 WPR @ 110psi			DR 17 CLASS 130 WPR @ 130psi			DR 13.5 CLASS 160 WPR @ 160psi			DR 11 CLASS 200 WPR @ 200psi			DR 9 CLASS 250 WPR @ 250psi			DR 7 CLASS 335 WPR @ 335psi		
IPS Pipe Size	Pipe OD (in)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)	Avg ID (in)	Min Wall (in)	Weight (lbs/ft)
2"	2.375	-	-	-	-	-	-	-	-	-	-	-	-	2.078	0.140	0.43	2.002	0.176	0.53	**1.917**	**0.216**	**0.64**	**1.815**	**0.264**	**0.77**	1.656	0.339	0.95
3"	3.500	-	-	-	-	-	-	-	-	-	-	-	-	3.063	0.206	0.94	2.951	0.259	1.16	**2.826**	**0.318**	**1.39**	**2.675**	**0.389**	**1.66**	2.440	0.500	2.06
4"	4.500	-	-	-	-	-	-	4.046	0.214	1.27	-	-	-	3.938	0.265	1.55	3.794	0.333	1.92	**3.633**	**0.409**	**2.31**	**3.440**	**0.500**	**2.75**	3.137	0.643	3.40
5"	5.563	-	-	-	5.109	0.214	1.58	5.001	0.265	1.94	4.942	0.293	2.13	4.870	0.327	2.37	4.690	0.412	2.93	**4.490**	**0.506**	**3.52**	4.253	0.618	4.20	3.877	0.795	5.20
6"	6.625	-	-	-	6.084	0.255	2.24	5.957	0.315	2.75	5.886	0.349	3.02	**5.798**	**0.390**	**3.36**	5.584	0.491	4.15	**5.349**	**0.602**	**5.00**	**5.065**	**0.736**	**5.96**	4.619	0.946	7.37
8"	8.625	-	-	-	7.921	0.332	3.80	7.754	0.411	4.66	7.663	0.454	5.12	**7.550**	**0.507**	**5.69**	7.270	0.639	7.04	**6.963**	**0.784**	**8.47**	**6.594**	**0.958**	**10.11**	6.013	1.232	12.50
10"	10.750	-	-	-	9.874	0.413	5.91	9.665	0.512	7.24	9.551	0.556	7.96	**9.410**	**0.632**	**8.83**	9.062	0.796	10.93	**8.679**	**0.977**	**13.16**	**8.219**	**1.194**	**15.70**	7.494	1.536	19.42
12"	12.750	-	-	-	11.711	0.490	8.31	11.463	0.607	10.19	11.327	0.671	11.20	**11.160**	**0.750**	**12.43**	10.749	0.944	15.38	**10.293**	**1.159**	**18.51**	**9.746**	**1.417**	**22.08**	8.889	1.821	27.31
14"	14.000	-	-	-	12.859	0.538	10.02	12.586	0.667	12.28	12.438	0.737	13.50	**12.253**	**0.824**	**14.98**	11.802	1.037	18.54	**11.301**	**1.273**	**22.32**	**10.701**	**1.556**	**26.63**	9.760	2.000	32.93
16"	16.000	-	-	-	14.696	0.615	13.09	14.385	0.762	16.04	14.215	0.842	17.63	**14.005**	**0.941**	**19.57**	13.488	1.185	24.22	**12.915**	**1.455**	**29.15**	**12.231**	**1.778**	**34.78**	11.154	2.286	43.01
18"	18.000	-	-	-	16.533	0.692	16.57	16.183	0.857	20.30	15.992	0.947	22.32	**15.755**	**1.059**	**24.77**	15.174	1.333	30.65	**14.532**	**1.636**	**36.89**	**13.760**	**2.000**	**44.02**	12.549	2.571	54.43
20"	20.000	18.695	0.615	16.50	18.370	0.769	20.45	17.982	0.952	25.07	17.768	1.053	27.55	**17.507**	**1.176**	**30.58**	16.860	1.481	37.84	**16.146**	**1.818**	**45.54**	**15.289**	**2.222**	**54.34**	13.943	2.857	67.20
22"	22.000	20.565	0.677	19.97	20.206	0.846	24.75	19.778	1.048	30.33	19.545	1.158	33.34	19.257	1.294	37.00	18.544	1.630	45.79	**17.760**	**2.000**	**55.10**	**16.819**	**2.444**	**65.75**	15.337	3.143	81.32
24"	24.000	22.434	0.738	23.76	22.043	0.923	29.45	21.577	1.143	36.10	21.322	1.263	39.67	**21.007**	**1.412**	**44.03**	20.231	1.778	54.49	**19.374**	**2.182**	**65.58**	**18.346**	**2.667**	**78.25**	16.731	3.429	96.77
26"	26.000	24.304	0.800	27.89	23.880	1.000	34.57	23.375	1.238	42.36	23.099	1.368	46.56	22.758	1.529	51.67	21.917	1.926	63.95	20.989	2.364	76.96	19.876	2.889	91.84	-	-	-
28"	28.000	26.174	0.862	32.34	25.717	1.077	40.09	25.173	1.333	49.13	24.876	1.474	54.00	24.508	1.647	59.93	23.603	2.074	74.17	22.604	2.545	89.26	21.404	3.111	106.51	-	-	-
30"	30.000	28.043	0.923	37.13	27.554	1.154	46.02	26.971	1.429	56.40	26.653	1.579	61.99	26.259	1.765	68.80	25.289	2.222	85.14	24.218	2.727	102.47	22.933	3.333	122.27	-	-	-
32"	32.000	29.913	0.985	42.24	29.391	1.231	52.36	28.770	1.524	64.17	28.429	1.684	70.53	28.009	1.882	78.28	26.975	2.370	96.87	25.833	2.909	116.58	24.462	3.556	139.12	-	-	-
36"	36.000	33.652	1.108	53.46	33.065	1.385	66.27	32.366	1.714	81.21	31.983	1.895	89.26	31.511	2.118	99.07	30.347	2.667	122.60	29.062	3.273	147.55	-	-	-	-	-	-
42"	42.000	39.260	1.292	72.77	38.575	1.615	90.20	37.760	2.000	110.54	-	-	-	36.762	2.471	134.84	35.404	3.111	166.88	-	-	-	-	-	-	-	-	-
48"	48.000	44.869	1.477	95.05	44.086	1.846	117.81	43.154	2.286	144.38	-	-	-	42.014	2.824	176.12	-	-	-	-	-	-	-	-	-	-	-	-
54"	54.000	50.478	1.662	120.29	49.597	2.077	149.10	48.549	2.571	182.73	-	-	-	47.266	3.176	222.90	-	-	-	-	-	-	-			-	-	-
63"	63.000	58.890	1.938	163.73	57.863	2.423	202.94	56.640	3.000	248.72	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-
65"	65.000	60.760	2.000	174.29	59.700	2.500	216.03	58.438	3.095	264.76	-	-	-	-	-	-	-	-	-	-	-	-				-	-	-

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPITR-4 for PE 4710 materials. Temperature, chemical and environmental use considerations may require use of additional design factors. Pipe weights are calculated in accordance with PPI-7 TR-7. Average inside diameter is calculated with nominal OD and minimum wall thickness plus 6%. Actual ID's will vary and are controlled by the dimensions and tolerances listed in the applicable pipe specifications. PER AWWA C906 the working pressure rating equals the pressure class, with an allowance included in the WPR for pressure surge. The pressure and surge design basis for ployethylene pipe is different from the PVC and Dippe design basis.

Other sizes and DR's are available, contact your customer service representative at **1.800.499.6927** **www.gfcp.com**

STANDARD SIZES AND DR'S SHOWN IN BOLD PRINT.

$$DR = \frac{\text{Pipe OD (in)}}{\text{Min. Wall Thickness (in)}}$$

The Long-Term Hydrostatic Strength of PE4710 Polyethylene Pipe is 1600 psi at 73.4 F. All pipe sizes with the same DR and Long-Term Hydrostatic Strength will have equal operating pressure capability.

+GF+
Georg Fischer Central Plastics, LLC
4949 Joseph Hardin Dallas, TX 75236

GEORG FISCHER
PIPING SYSTEMS
(formerly Independent Pipe Products, Inc.)
Ph: 972-641-2080 Fx: 972-641-2066

Print Line Data Sheet for GFCP Design-Flow®
HDPE Pipe for Municipal & Industrial Use

Current Print Line for Design-Flow® HDPE Pipe for M & I use:

12 DIPS DR-7----DESIGN-FLOW®----PE3408----C3----275PSI----73F----ASTM F714 AWWA C906----NSF61----1----342----061508

New Dual Marking Print Line for Design-Flow® HDPE Pipe for M & I use:

12 DIPS DR-7----DESIGN-FLOW®----PE3408/PE3608/PE4710----73F----ASTM F714 AWWA C906----NSF61----A1----347----061508

[size & sdr --- trademark --- material astm --- wpr temp --- requirements --- plant* --- ppi des** --- prod date]

Changes are as follows:

Omitting the pressure rating designation. Please contact the GFCP Engineering Department for additional WPR details.
Adding PE3608 & PE4710 to the existing PE3408 to insure all material requirements (old and new) are referenced.
Omitting the material code as specified in previous versions of ASTM F714. (*Code shown above as "C3".)

Notes:

Also see available information outlining the PPI Dependent Listing of material designation codes for GFCP.

(*The 3 digit material code that is shown above is for example only. The appropriate material code will be used in place of the code shown here.)

*Plant specific markings shown above as "D1" are for as follows: D = Dallas Plant, A = Abbeville Plant, 1 thru 9 = Ext. Line Nunber

Standard print line color is blue (white print used on colored pipe). Standard pipe color is black, solid color is available upon request, see "Pipe & Stripe Color Information". Striping in standard colors is available upon request.

+GF+
Georg Fischer Central Plastics, LLC
4949 Joseph Hardin Dallas, TX 75236

GEORG FISCHER
PIPING SYSTEMS
(formerly Independent Pipe Products, Inc.)
Ph: 972-641-2080 Fx: 972-641-2066

Print Line Data Sheet for GFCP Design-Flow® HDPE D2513 Pipe for Oil & Gas Gathering

Current Print Line for Design-Flow® HDPE D2513 Pipe for Oil & Gas use:

10 IPS DR-13.5----DESIGN-FLOW®----GAS----PE3408----CEE----ASTM D2513----1----342----061508

New Print Line for PE3608 Design-Flow® HDPE D2513 Pipe for Oil & Gas use:

10 IPS DR-13.5----DESIGN-FLOW®-----GAS----PE3408/PE3608----CEE----ASTM D2513----1----342----061508

New Print Line for PE4710 Design-Flow® HDPE D2513 Pipe for Oil & Gas use:

10 IPS DR-13.5----DESIGN-FLOW®-----GAS----PE3408/PE4710----CEE----ASTM D2513----1----347----061508

Notes:

Also see available information outlining the PPI Dependent Listing of material designation codes for GFCP.
***The 3 digit material code that is shown above is for example only. The appropriate material code will be used in place of the code shown here.**

***Plant specific markings shown above as "D1" are for as follows: D = Dallas Plant, A = Abbeville Plant, 1 thru 9 = Ext. Line Nunber**

Standard print line color is yellow. Standard pipe color is black. Yellow striping is available upon request.

Related Documents: Also see GFCP Design-Flow® HDPE Pipe Dual Marking Designations, PPI Dependent Listing

Issued 05/15/2013

+GF+
Georg Fischer Central Plastics, LLC
4949 Joseph Hardin Dallas, TX 75236

GEORG FISCHER
PIPING SYSTEMS
(formerly Independent Pipe Products, Inc.)
Ph: 972-641-2080 Fx: 972-641-2066

Print Line Data Sheet for GFCP Design-Flow®
HDPE Gray Slip Liner Pipe for Sewer Rehabilitation

Previous Print Line for Design-Flow® Gray Slip Liner HDPE Pipe

12 IPS DR-17----DESIGN-FLOW®----PE3408----73F----ASTM F714 AWWA C906----1----342----061508

Current Dual Marking Print Line for Design-Flow® Gray Slip Liner HDPE Pipe

12 IPS DR-17----DESIGN-FLOW®---- PE3408/PE3608/PE4710----73F----ASTM F714 AWWA C906----D1----347----061508

[size & sdr --- trademark --- material astm --- wpr temp --- requirements --- plant* --- ppi des** --- prod date]

Notes:

Also see available information outlining the PPI Dependent Listing of material designation codes for GFCP.

**The 3 digit material code that is shown above as "347" is for example only. The appropriate material code will be used in place of the code shown here.

*Plant specific markings shown above as "D1" are for as follows: D = Dallas Plant, A = Abbeville Plant, 1 thru 9 = Ext. Line Nunber

Standard print line color is black. Standard pipe color is gray. Striping in standard colors is available upon request.

Related Documents: Also see GFCP Design-Flow® HDPE Pipe Dual Marking Designations, PPI Dependent Listing

Issued 05/15/2013

+GF+
Georg Fischer Central Plastics, LLC
4949 Joseph Hardin Dallas, TX 75236

GEORG FISCHER
PIPING SYSTEMS
(formerly Independent Pipe Products, Inc.)
Ph: 972-641-2080 Fx: 972-641-2066

Print Line Data Sheet for GFCP

Design-Flow® FM Approved HDPE Pipe

Print Line for Design-Flow® FM Approved HDPE Pipe:

12 IPS DR-7---DESIGN-FLOW®---PE3608/PE4710---73F---<FM> CL267---ASTM F714---AWWA C906---NSF61---D1---347---011509

[size & sdr --- trademark --- material astm --- wpr temp --- requirements --- plant* --- ppi des --- prod date]**

Notes:

Also see available information outlining the PPI Dependent Listing of material designation codes for GFCP.

****The 3 digit material code that is shown above as "347" is for example only. The appropriate material code will be used in place of the code shown here.**

***Plant specific markings shown above as "D1" are for as follows: D = Dallas Plant, A = Abbeville Plant, 1 thru 9 = Ext. Line Nunber**

Standard print line color is red. Standard pipe color is black. Striping in standard colors is available upon request.

+GF+
Georg Fischer Central Plastics, LLC
4949 Joseph Hardin Dallas, TX 75236

GEORG FISCHER
PIPING SYSTEMS
(formerly Independent Pipe Products, Inc.)
Ph: 972-641-2080 Fx: 972-641-2066

Pipe & Striping Color Information for GFCP Design-Flow® HDPE Pipe

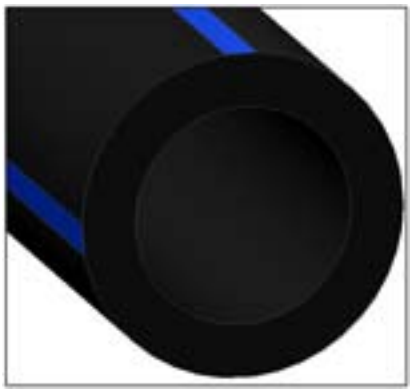
Orientation of Colored Striping:

Four narrow co-axial colored surface stripes are un-equally spaced about the 360 degree surface circumference of the pipe, the centers of the colored surface stripes are positioned at 0° - 81° - 182° - 261° radial.

Size of Stripes:

The width of each narrow colored surface stripe is in the range of 3% to 10 % of the pipe diameter, depending upon pipe diameter.

Striped Pipe Example:



Available Pipe or Striping Colors:

- Red
- Blue
- Green
- Brown
- Yellow
- Orange
- Lavender

Related Documents: Also see GFCP Design-Flow® HDPE Pipe Dual Marking Designations, PPI Dependent Listing

Issued 05/15/2013

DESIGN-FLOW® High Density Polyethylene Gray Slip Liner Pipe

PE4710 Nominal Physical Properties*

Typical Specification	ASTM Test Method	Nominal Values
Density	ASTM D 1505	.959 gm / cm^3
Melt Index[1]	ASTM D 1238	7.0 gm / 10 min.
Tensile Strength		
@ Yield (2 in/min)	ASTM D 638	3600 psi
@ Break (2 in/min)	ASTM D 638	4500 psi
Hydrostatic Design Basis (HDB)		
@ 23° C (73.4° F)	ASTM D 2837	1600 psi
@ 60° C (140° F)	ASTM D 2837	1000 psi
HDB Design Factor (DF)	PPI TR-4	0.63
Elongation @ Break (2 in/min)	ASTM D 638	>740%
Flexural Modulus[2]	ASTM D 790	150,000 psi
Notched Izod Impact Strength	ASTM D 256	9.0 ft-lbf / in
Hardness (Shore D)	ASTM D 2240	68
Brittleness Temperature	ASTM D 746	< -103 ° F
Slow Crack Growth PENT, hours	ASTM D1473	>10,000 hrs
Cell Classification	ASTM D 3350	445574E
Vicat Softening Point	ASTM D 1525	257 ° F
Oxidative Induction Time	ASTM D 3895	OIT > 40 minutes

Design-Flow® High Density Polyethylene Slip Liner Pipe is manufactured in a standard color of light gray. Black slip liner can be produced by special request. Product is available in all standard sizes and SDR's as listed on the **Design-Flow®** HDPE Pipe Size Charts.

Notes: [1] 190° C / 21,600 g; [2] 2% Secant - Method 1

*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 4703 and may differ from specimens taken from pipe.

+GF+ GEORG FISCHER PIPING SYSTEMS

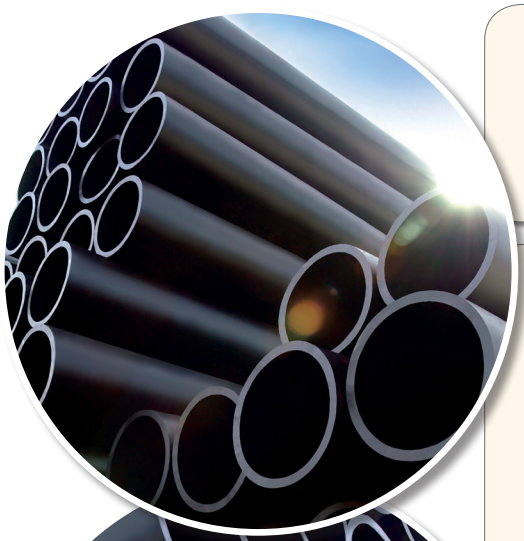
JM Eagle™

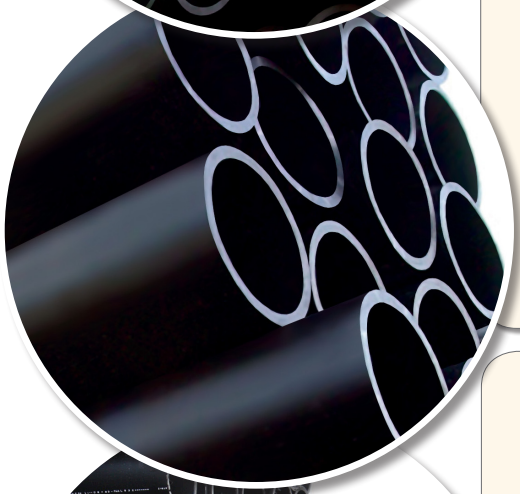
Building essentials for a better tomorrow™

HDPE WATER & SEWER

MEETS AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714, CELL CLASS PER ASTM D3350, PPI LISTED MATERIAL (TR-4) PE 3408/3608/4710, AND ANSI/NSF-14.

QUALITY • PERFORMANCE • LONGEVITY
50-YEAR WARRANTY on JM Eagle Plastic Pipe
GUARANTEED





APPLICATIONS

JM Eagle's high-performance high-density polyethylene water pressure pipes are suitable for municipal and industrial transmission systems for potable water, sewer, drain, mining, irrigation, and reclaimed water.

DESCRIPTION

JM Eagle's high-density polyethylene water and sewer pipe is made from premium, highly engineered PE 3408/3608 or PE 4710 resin material for a maximum pressure rating to service today's water and sewer needs.

Products are available in ½-inch to 63-inch diameters.

The product's physical properties make it applicable to open-trench and slip-lining installations.

It can be manufactured with the color striping to identify application, such as a blue stripe for potable water, a green stripe for sewer applications and a purple stripe for reclaimed water.

PE 4710 resin surpasses PE 3408/3608 in the following high-performance designations:

- Density class 4 (0.947 – 0.955 g/cc) vs. density cell class 3 (>0.940 – 0.947 g/cc).
- SCG (slow crack growth) cell class 7 or PENT value of 500 hours vs. SCG cell class 4 or PENT value of 10 hours.
- 1,000 psi HDS (hydrostatic design stress) vs. 800 psi HDS.

BENEFITS

JM Eagle's HDPE pipe for water and sewer is manufactured for excellent performance and a long life expectancy.

- Its butt-fused joints eliminate potential leak points, common at 10 to 20 feet with ductile iron pipe, for a zero leak rate.
- Highly resistant to corrosion and weather, recent studies conclude it will last at least 100 years.
- Its light weight and flexibility make it easy to install, eliminate the need for fittings required with directional changes, and make it highly suitable for use in earthquake-prone areas.
- Its high-strength walls give it the highest PE pressure rating, outstanding resistance to SCG and increased resistance to rapid crack propagation.
- The increased working stress rating of high-performance PE 4710 resin material makes it a superior choice over steel or ductile iron pipe, especially for the large-diameter pipe sizes.

Revised 3/8/2013. This information may have been updated. Please download the latest version at www.jmeagle.com/onesheets.

JM Eagle™

Building essentials for a better tomorrow™

HDPE WATER & SEWER

SUBMITTAL AND DATA SHEET

HDPE IRON PIPE SIZE (I.P.S.) PRESSURE PIPE

ANSI/NSF-61, 14 LISTED

PE 4710		DR 7 (333 psi)			DR 9 (250 psi)			DR 11 (200 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
1/2	0.840	0.120	0.586	0.12	0.093	0.643	0.10	0.076	0.679	0.08
3/4	1.050	0.150	0.732	0.19	0.117	0.802	0.15	0.095	0.849	0.12
1	1.315	0.188	0.916	0.29	0.146	1.005	0.23	0.120	1.061	0.20
1-1/4	1.660	0.237	1.158	0.46	0.184	1.270	0.37	0.151	1.340	0.31
1-1/2	1.900	0.271	1.325	0.61	0.211	1.453	0.49	0.173	1.533	0.41
2	2.375	0.339	1.656	0.95	0.264	1.815	0.77	0.216	1.917	0.64
3	3.500	0.500	2.440	2.06	0.389	2.675	1.66	0.318	2.826	1.39
4	4.500	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.30
5-3/8	5.375	0.768	3.747	4.85	0.597	4.109	3.92	0.489	4.338	3.29
5	5.563	0.795	3.878	5.20	0.618	4.253	4.20	0.506	4.490	3.52
6	6.625	0.946	4.619	7.36	0.736	5.065	5.96	0.602	5.349	4.99
7	7.125	0.976	5.056	8.52	0.792	5.446	6.89	0.648	5.751	5.78
8	8.625	1.232	6.013	12.48	0.958	6.594	10.09	0.784	6.963	8.46
10	10.750	1.536	7.494	19.40	1.194	8.219	15.68	0.977	8.679	13.14
12	12.750	1.821	8.889	27.28	1.417	9.746	22.07	1.159	10.293	18.49
14	14.000	2.000	9.760	32.90	1.556	10.107	26.61	1.273	11.301	22.30
16	16.000	2.286	11.154	42.97	1.778	12.231	34.75	1.455	12.915	29.12
18	18.000	2.571	12.549	54.37	2.000	13.760	43.97	1.636	14.532	36.84
20	20.000	2.857	13.943	67.13	2.222	15.289	54.28	1.818	16.146	45.49
22	22.000	3.143	15.337	81.23	2.444	16.819	65.68	2.000	17.76	55.05
24	24.000	3.429	16.732	96.67	2.667	18.346	78.18	2.182	19.374	65.52
26	26.000	—	—	—	2.889	19.875	91.75	2.364	20.988	76.90
28	28.000	—	—	—	3.111	21.405	106.40	2.545	22.605	89.15
30	30.000	—	—	—	3.333	22.934	122.13	2.727	24.219	102.35
32	32.000	—	—	—	—	—	—	2.909	25.833	116.46
34	34.000	—	—	—	—	—	—	3.091	27.447	131.48
36	36.000	—	—	—	—	—	—	3.273	29.061	147.41

PE 4710		DR 21 (100 psi)			DR 26 (80 psi)			DR 32.5 (63 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
3	3.500	0.167	3.146	0.77	0.135	3.214	0.63	0.108	3.271	0.51
4	4.500	0.214	4.046	1.27	0.173	4.133	1.03	0.138	4.207	0.83
5-3/8	5.375	0.256	4.832	1.81	0.207	4.936	1.48	0.165	5.025	1.19
5	5.563	0.265	5.001	1.94	0.214	5.109	1.58	0.171	5.200	1.27
6	6.625	0.315	5.957	2.74	0.255	6.084	2.24	0.204	6.193	1.81
7	7.125	0.339	6.406	3.18	0.274	6.544	2.59	0.219	6.661	2.09
8	8.625	0.411	7.754	4.66	0.332	7.921	3.80	0.265	8.063	3.06
10	10.750	0.512	9.665	7.24	0.413	9.874	5.90	0.331	10.048	4.77
12	12.750	0.607	11.463	10.17	0.490	11.711	8.30	0.392	11.919	6.69
14	14.000	0.667	12.586	12.28	0.538	12.859	10.00	0.431	13.086	8.08
16	16.000	0.762	14.385	16.03	0.615	14.696	13.07	0.492	14.957	10.54
18	18.000	0.857	16.183	20.28	0.692	16.533	16.54	0.554	16.826	13.36
20	20.000	0.952	17.982	25.03	0.769	18.370	20.43	0.615	18.696	16.48
22	22.000	1.048	19.778	30.31	0.846	20.206	24.72	0.677	20.565	19.95
24	24.000	1.143	21.577	36.06	0.923	22.043	29.42	0.738	22.435	23.72
26	26.000	1.238	23.375	42.32	1.000	23.880	34.53	0.800	24.304	27.86
28	28.000	1.333	25.174	49.07	1.077	25.717	40.05	0.862	26.173	32.33
30	30.000	1.429	26.971	56.36	1.154	27.554	45.98	0.923	28.043	37.09
32	32.000	1.542	28.730	64.11	1.231	29.390	52.31	0.985	29.912	42.22
34	34.000	1.619	30.568	72.36	1.308	31.227	59.06	1.046	31.782	47.63
36	36.000	1.714	32.366	81.12	1.385	33.064	66.22	1.108	33.651	53.42
42	42.000	2.000	37.760	110.43	1.615	38.576	90.08	1.292	39.261	72.68
48	48.000	2.286	43.154	144.25	1.846	44.086	117.68	1.477	44.869	94.95
54	54.000	2.571	48.549	182.51	2.077	49.597	148.95	1.662	50.477	120.20
63	63.000	3.000	56.640	248.46	2.423	57.863	202.73	1.938	58.891	163.53

PE 4710		DR 13.5 (160 psi)			DR 17 (125 psi)			DR 19 (111 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
1/2	0.840	—	—	—	—	—	—	—	—	—
3/4	1.050	0.078	0.885	0.10	—	—	—	—	—	—
1	1.315	0.097	1.109	0.16	—	—	—	—	—	—
1-1/4	1.660	0.123	1.399	0.26	—	—	—	—	—	—
1-1/2	1.900	0.141	1.601	0.34	—	—	—	—	—	—
2	2.375	0.176	2.002	0.53	0.140	2.078	0.43	—	—	—
3	3.500	0.259	2.951	1.16	0.206	3.063	0.94	0.184	3.110	0.84
4	4.500	0.333	3.794	1.91	0.265	3.938	1.55	0.237	3.998	1.39
5-3/8	5.375	0.398	4.531	2.73	0.316	4.705	2.21	0.283	4.775	1.99
5	5.563	0.412	4.690	2.92	0.327	4.870	2.36	0.293	4.942	2.13
6	6.625	0.491	5.584	4.15	0.390	5.798	3.35	0.349	5.885	3.02
7	7.125	0.528	6.006	4.80	0.419	6.237	3.88	0.375	6.330	3.49
8	8.625	0.639	7.270	7.03	0.507	7.550	5.68	0.454	7.663	5.12
10	10.750	0.796	9.062	10.92	0.632	9.410	8.82	0.566	9.550	7.95
12	12.750	0.944	10.749	15.36	0.750	11.160	12.41	0.671	11.327	11.19
14	14.000	1.037	11.802	18.52	0.824	12.253	14.98	0.737	12.438	13.49
16	16.000	1.185	13.488	24.19	0.941	14.005	19.55	0.842	14.215	17.61
18	18.000	1.333	15.174	30.61	1.059	15.755	24.75	0.947	15.992	22.29
20	20.000	1.481	16.860	37.79	1.176	17.507	30.53	1.053	17.768	27.52
22	22.000	1.630	18.544	45.75	1.294	19.257	36.86	1.158	19.545	33.30
24	24.000	1.778	20.231	54.44	1.412	21.007	43.99	1.263	21.322	39.63
26	26.000	1.926	21.917	63.89	1.529	22.759	51.61	1.368	23.100	46.51
28	28.000	2.074	23.603	74.09	1.647	24.508	59.87	1.474	24.875	53.94
30	30.000	2.222	25.289	85.04	1.765	26.258	68.74	1.579	26.653	61.92
32	32.000	2.370	26.976	96.76	1.882	28.010	78.18	1.684	28.430	70.45
34	34.000	2.519	28.660	109.26	2.000	29.760	88.28	1.790	30.205	79.54
36	36.000	2.667	30.346	122.49	2.118	31.510	98.98	1.895	31.983	89.17
42	42.000	3.111	35.404	166.70	2.471	36.761	134.72	2.211	37.314	121.37
48	48.000	3.556	40.462	217.76	2.824	42.013	175.97	2.526	42.644	158.52
54	54.000	—	—	—	3.177	47.265	222.67	2.842	47.975	200.63

HDPE DUCTILE IRON PIPE SIZE (D.I.P.S.) PRESSURE PIPE

ANSI/NSF-61, 14 LISTED

PE 4710		DR 7 (333 psi)			DR 9 (250 psi)			DR 11 (200 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
4	4.800	0.686	3.346	3.87	0.533	3.670	3.13	0.436	3.876	2.62
6	6.900	0.946	4.894	7.99	0.767	5.274	6.46	0.627	5.571	5.41
8	9.050	1.293	6.309	13.75	1.006	6.917	11.12	0.823	7.305	9.32
10	11.100	1.586	7.738	20.68	1.233	8.486	16.72	1.009	8.961	14.01
12	13.200	1.886	9.202	29.25	1.467	10.090	23.65	1.200	10.656	19.82
14	15.300	2.186	10.666	39.29	1.700	11.696	31.77	1.391	12.351	26.63
16	17.400	2.486	12.130	50.82	1.933	13.302	41.08	1.582	14.046	34.44
18	19.500	2.786	13.594	63.82	2.167	14.906	51.61	1.773	15.741	43.25
20	21.600	3.086	15.058	78.31	2.400	16.512	63.32	1.964	17.436	53.07
24	25.800	—	—	—	2.867	19.722	90.35	2.345	20.829	75.69
30	32.000	—	—	—	—	—	—	2.909	25.833	116.46
36	38.300	—	—	—	—	—	—	3.482	31.33	166.84

PE 4710		DR 13.5 (160 psi)			DR 17 (125 psi)			DR 19 (111 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
4	4.800	0.356	4.045	2.18	0.282	4.202	1.76	0.253	4.264	1.59
6	6.900	0.511	5.817	4.50	0.406	6.039	3.64	0.363	6.130	3.27
8	9.050	0.670	7.630	7.74	0.532	7.922	6.25	0.476	8.041	5.63
10	11.100	0.822	9.357	11.64	0.653	9.761	9.41	0.584	9.862	8.47
12	13.200	0.978	11.127	16.47	0.776	11.555	13.30	0.695	11.727	11.99
14	15.300	1.133	12.898	22.12	0.900	13.392	17.88	0.805	13.593	16.10
16	17.400	1.289	14.667	28.61	1.024	15.229	23.13	0.916	15.458	20.84
18	19.500	1.444	16.439	35.92	1.147	17.068	29.04	1.026	17.325	26.15
20	21.600	1.600	18.208	44.09	1.271	18.905	35.64	1.137	19.190	32.10
24	25.800	1.911	21.749	62.90	1.518	22.582	50.84	1.358	22.921	45.80
30	32.000	2.370	26.976	96.76	1.880	28.014	78.18	1.684	28.430	70.45
36	38.300	2.837	32.286	138.62	2.253	33.524	112.02	2.016	34.026	100.94
42	44.500	—	—	—	2.618	38.950	151.24	2.342	39.535	136.24
48	50.800	—	—	—	2.988	44.465	197.05	2.674	45.131	177.57

PE 4710		DR 21 (100 psi)			DR 26 (80 psi)			DR 32.5 (63 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
4	4.800	0.229	4.315	1.44	0.185	4.408	1.18	0.148	4.486	0.95
6	6.900	0.329	6.203	2.98	0.265	6.338	2.43	0.212	6.451	1.96
8	9.050	0.431	8.136	5.13	0.348	8.312	4.18	0.278	8.461	3.37
10	11.100	0.529	9.979	7.72	0.427	10.195	6.29	0.342	10.375	5.08
12	13.200	0.629	11.867	10.91	0.508	12.123	8.91	0.406	12.339	7.18
14	15.300	0.729	13.755	14.66	0.588	14.053	11.95	0.471	14.301	9.65
16	17.400	0.829	15.643	18.96	0.669	15.982	15.46	0.536	16.264	12.49
18	19.500	0.929	17.531	23.81	0.750	17.910	19.95	0.600	18.228	15.67
20	21.600	1.029	19.419	29.22	0.831	19.838	23.84	0.665	20.190	19.24
24	25.800	1.229	23.195	41.68	0.992	23.697	33.99	0.794	24.117	27.44
30	32.000	1.524	28.769	64.11	1.231	29.390	52.31	0.985	29.912	42.22
36	38.300	1.824	34.433	91.84	1.473	35.177	74.92	1.179	35.801	60.43
42	44.500	2.119	40.008	123.96	1.712	40.871	101.17	1.370	41.596	81.59
48	50.800	2.419	45.672	161.55	1.954	46.658	131.83	1.563	47.486	106.34

* For custom DR, perforated pipe, please contact JM Eagle™ PE sales at (800) 621-4404 for availability.
* All dimensions are in inches unless noted otherwise.

I.D. : Inside Diameter
O.D. : Outside Diameter
T. : Wall Thickness

* For data, sizes, or classes not reflected in these charts, please contact JM Eagle™ for assistance.

Pipe is IPS SDR 19 GRAY

Revised 3/8/2013. This information may have been updated. Please download the latest version at www.jmeagle.com/onesheets.

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

DRISCOPLEX® 4600/4700 Series PE Piping

DRISCOPLEX® 4600/4700 Series PE Piping
HDPE Sewer Pipe

DRISCOPLEX® HDPE Piping is available to meet your needs in compliance with ASTM F714 or AWWA C906 product standards.

Produced from only the highest rated HDPE pipe material, DRISCOPLEX® 4600/4700 Series PE Piping is manufactured from PE4710 resin as listed in PPI-TR4.

DRISCOPLEX® HDPE Piping Advantages:

- ✓ Durable
- ✓ Leak Tight
- ✓ Excellent Flow
- ✓ Low Surge
- ✓ Fatigue Free
- ✓ Impact Resistant
- ✓ Trenchless Install
- ✓ Bend Radius
- ✓ Chemical Resistant
- ✓ UV Protection
- ✓ Flexibility
- ✓ Environmental

Optional Color Stripes to Identify the Application	
Color	**Application**
Green	Wastewater

Standard product is solid gray with no stripes.
IPS – 4 Single Stripe / DIPS – 3 Sets of Dual Stripes

Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7329

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

DRISCOPLEX® 4600/4700 Series PE Piping

DriscoPlex® Series PE Piping Material Physical Properties		
Property	**Standard**	**Typical Value†**
Material Designation	ASTM F714	PE4710
Cell Classification	ASTM D3350	445574E (Gray)
Density [4]	ASTM D1505	0.950 g/cc (Gray)
Melt Index [4]	ASTM D1238	0.08 g/10 min
Flexural Modulus [5]	ASTM D790	>120,000 psi
Tensile Strength [5]	ASTM D638 Type IV	>3500 psi
SCG (PENT) [7]	ASTM F1473	>500 hours
HDB at 73°F (23°C) [4]	ASTM D2837	1600 psi
Color; UV stabilizer [E]	ASTM D3350	Black Color with UV Stabilizer

This is not a product specification and does not guarantee or establish specific minimum or maximum values or manufacturing tolerance for material or piping products to be supplied. Values obtained from tests of specimens taken from piping product may vary from these typical values.

Additional Sizes and DR available. Contact Performance Pipe or visit www.performancepipe.com

Selected Dimension Ratios for DriscoPlex® 4700 DIPS Pipe
(Additional Sizes and DR's available. Contact Performance Pipe)

DIPS		DR 19			DR 17		
ASTM F714 PR		PR = 112 psi			PR = 125 psi		
AWWA C906 PC		PC = 88 psi			PC = 100 psi		
Pipe Size, in.	OD, in.	Min Wall in.	Avg. ID in.	Wgt. lbs/ft	Min Wall in.	Avg. ID in.	Wgt. lbs/ft
4	4.80	0.253	4.264	1.59	0.282	4.201	1.76
6	6.90	0.363	6.130	3.28	0.406	6.040	3.64
8	9.05	0.476	8.040	5.64	0.532	7.921	6.26
10	11.10	0.584	9.861	8.49	0.653	9.716	9.42
12	13.20	0.695	11.727	12.00	0.776	11.554	13.32

Selected Dimension Ratios for DriscoPlex® 4600 IPS Pipe
(Additional Sizes and DR's available. Contact Performance Pipe)

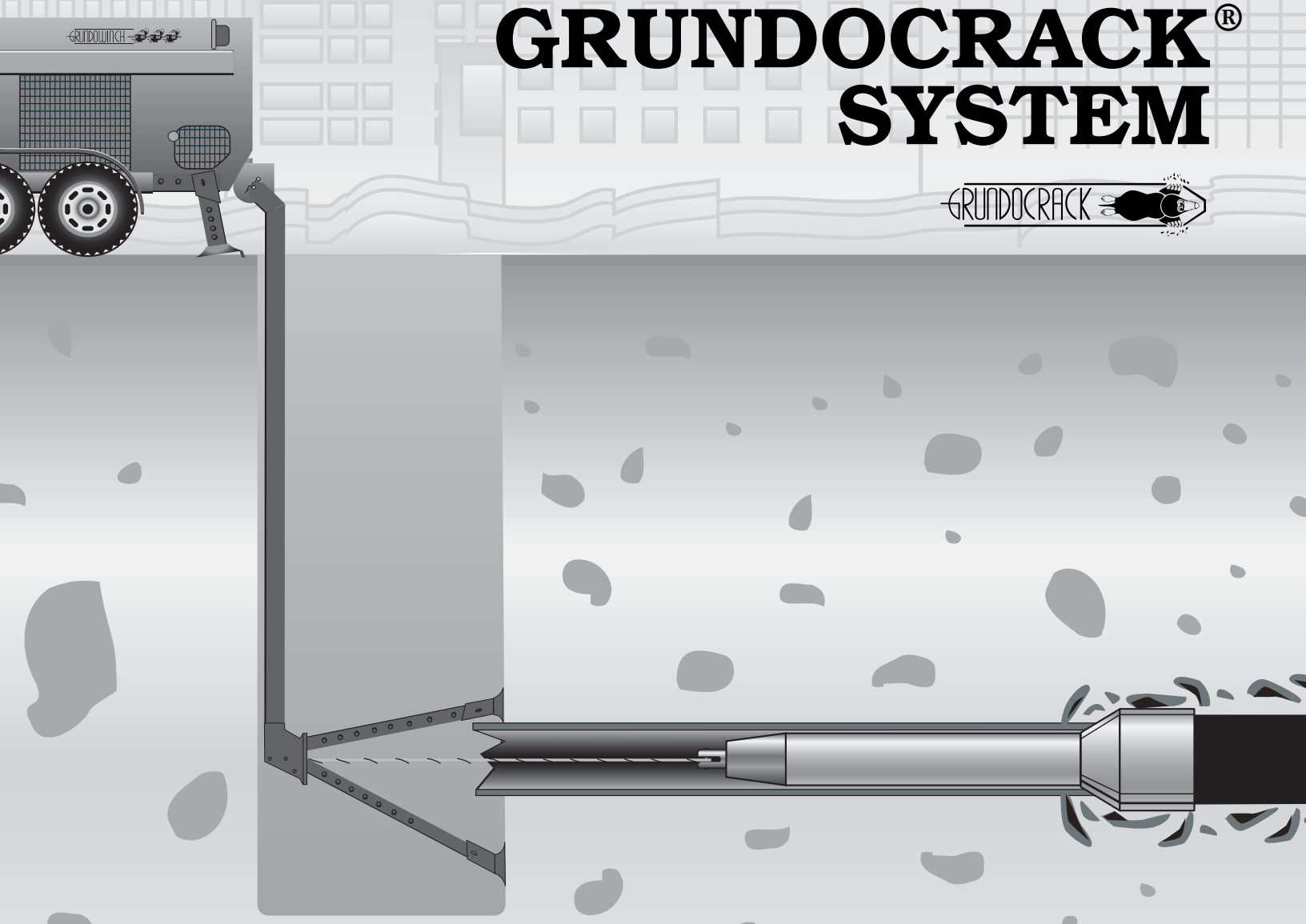
IPS		DR 19			DR 17		
ASTM F714 PR		PR = 112 psi			PR = 125 psi		
AWWA C906 PC		PC = 88 psi			PC = 100 psi		
Pipe Size, in.	OD, in.	Min Wall in.	Avg. ID in.	Wgt. lbs/ft	Min Wall in.	Avg. ID in.	Wgt. lbs/ft
2	2.375	0.125	2.110	0.39	0.265	3.938	1.55
4	4.50	0.237	3.998	1.39	0.265	3.938	1.55
6	6.63	0.349	5.886	3.02	0.390	5.798	3.36
8	8.63	0.454	7.663	5.12	0.507	7.550	5.69
10	10.75	0.566	9.551	7.96	0.632	9.410	8.83
12	12.75	0.671	11.327	11.20	0.750	11.160	12.43

This product flyer is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pressure Ratings and Pressure Class are based on operating temperature up to 80°F. Pressure class is based on a 0.5 Design Factor for water application from AWWA while Pressure Rating is based on a 0.63 Design Factor per PPI TR-41. Average inside diameter is calculated using Nominal OD and Minimum Wall plus 6% for use in estimating fluid flow. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimensions and tolerances in the applicable pipe manufacturing specification. Additional information available at www.performancepipe.com

Pipe is IPS SDR 19

Performance Pipe, a division of Chevron Phillips Chemical Company LP | 5085 W. Park Blvd | Suite 500 | Plano, TX 75093 | Phone: 800-527-0662 | Fax: 972-599-7329

A Guide to Pneumatic Pipe Bursting with the GRUNDOCRACK® SYSTEM



GRUNDOCRACK

TT Technologies, Inc.

TT Technologies, Inc.

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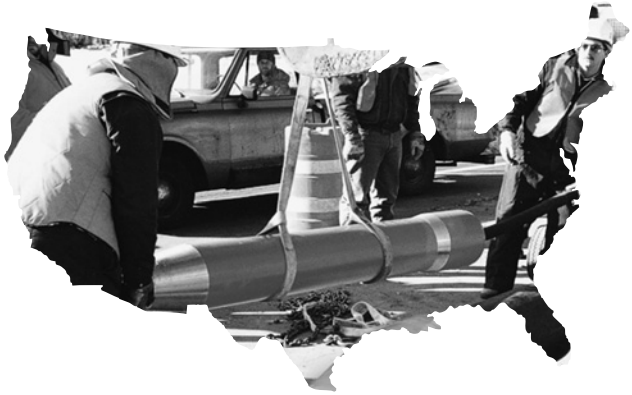
2020 E. New York Street • Aurora, IL 60502
800-533-2078 • 630-851-8200 • FAX 630-851-8299 • Internet http://www.tttechnologies.com



For over 35 years TT Technologies has lead the way for trenchless replacement systems beginning with pneumatic piercing tools. Today, after over 200 patents worldwide, TT's pneumatic tools are used in trenchless applications ranging from pipe pulling, pipe ramming, sliplining, directional drilling, and pipe bursting, both mainline and laterals.

While "pipe bursting" can be a generic term, 90% of the bursts worldwide are accomplished using pneumatic tools, the majority use the TT GRUNDOCRACK® equipment.

TT Technologies, Inc., the proud leader in the trenchless industry, makes safety priority number one each day. For everyone's safety read the operators manual carefully and exercise caution while using the **GRUNDOCRACK** pipe bursting system. Personal injury or death could result from improper use of the system. Have existing buried utilities located prior to digging, **CALL BEFORE YOU DIG (ONE-CALL 1-888-258-0808)**.

Safety is always a high priority when it comes to TT Technologies equipment and we always appreciate the feedback we receive. If additional manuals or safety decals are required, please call 1-800-533-2078.

Company Background

Active from the start of the "trenchless revolution," TT Technologies, Inc., continues to be a leader and innovator in the field of no-dig technology. Beginning in the 1970's with a small staff promoting a limited line of pneumatic piercing tools, TT has since exploded on the market as the source for a variety of trenchless tools and accessories.

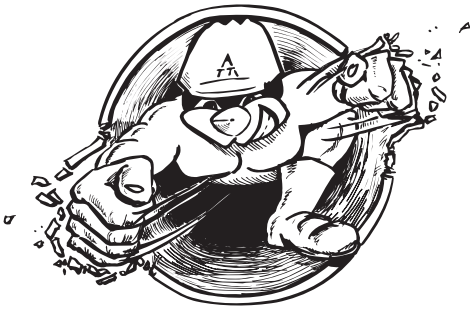
This success is attributed to field proven product, and to the TT people. TT Technologies has assembled a team of highly motivated professionals who are dedicated to customer satisfaction. And this process extends far beyond the sale. TT staff assist with proper product training, as well as lending technical expertise at customer job sites throughout North America.

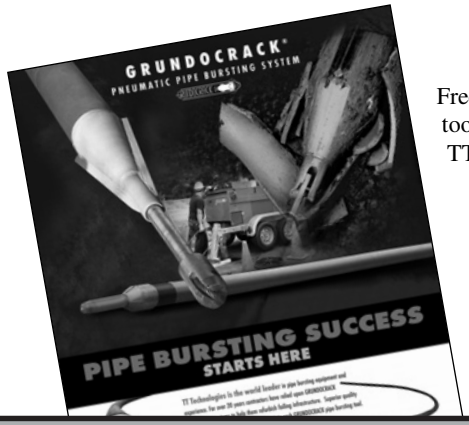
Now headquartered in expanded facilities, TT Technologies is poised to provide the right tools and technologies for trenchless contractors well into the 21st century, and beyond.

Real job situations involving TT Technologies' GRUNDOCRACK tools have been featured in numerous industry publications.

Pipe bursting allows the replacement of cast iron, clay, concrete, and other fracturable pipes with a new line of the same, or larger size with a minimum, and in some cases, no excavation and disturbance to the environment.

Pipe bursting can achieve significant savings over traditional “open cut” excavations.





Free literature on GRUNDOCRACK tools can be obtained by contacting TT Technologies, Inc.

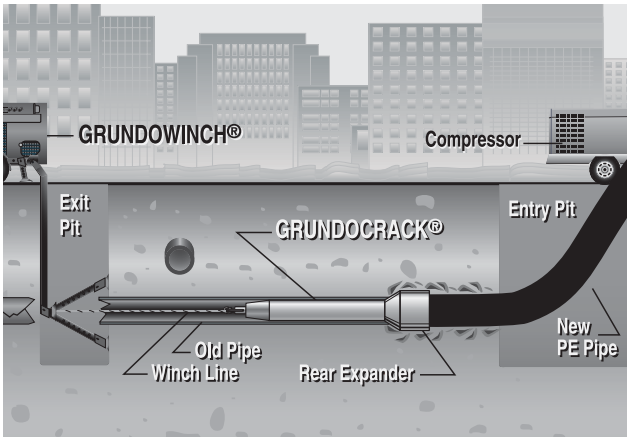
Grundocrack Concept

The GRUNDOCRACK system is effectively used where existing pipes have failed beyond the possibility of point repairs. It is also ideal for use where sliplining or "cured in place" is not an option due to reduction in pipe sizes.

The term "fracturable" applies to host pipe materials such as cast iron, clay, non-reinforced and reinforced concrete, ABS, and some plastics.

The percussive action of the GRUNDOCRACK tool, combined with the expander forcing the fragments out into the surrounding soil provides the space needed for the placement of the new pipe. It is this expansive action that allows for the new pipe upsizing. This soil expansion and the percussive action of the tool also reduces stress on the new product pipe.

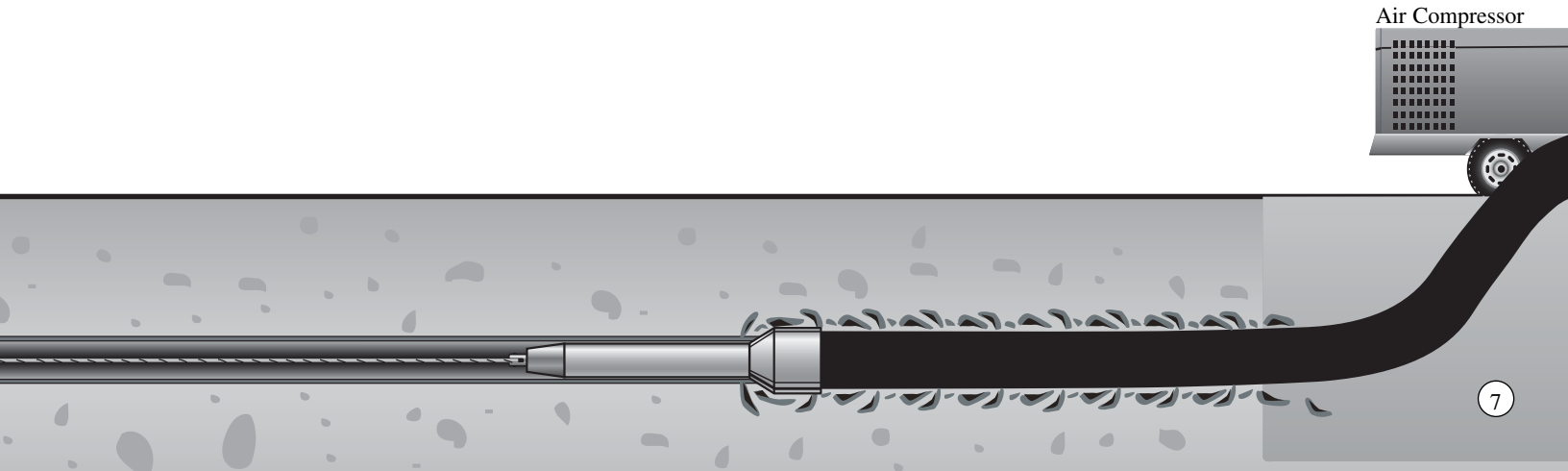
The twin capstan, dual speed, constant tension GRUNDOWINCH is essential to the bursting process as it provides friction for the pneumatic tool, and guides the tool through the host pipe. The winch is not used to "force" the tool, as a minimal pull is needed to allow the percussive action of the hammer to do the bursting. In addition, the winch "pull" is used to provide tension on the product pipe.




Front Expander


Rear Expander


Guide Head



Host Pipe Materials

1. Concrete, Reinforced Concrete—Good bursting potential. Steel welded wire mesh and thickly encased pipes may cause concern and may require special guide head design.

2. Clay—Good bursting potential. Pipes with PVC joints need special applications tools.

3. Cast Iron—Good bursting potential. Special applications tools and protection of the winch cable must be considered.

4. PVC, ABS Plastic—Some bursting potential. Special cutting blades are necessary, length of runs may be reduced.

5. Transite—Good bursting potential.

6. Asbestos - Cement Pipe—Good bursting potential.

7. Truss pipe - a combination of plastic with a concrete honeycomb reinforcement. Good bursting potential.

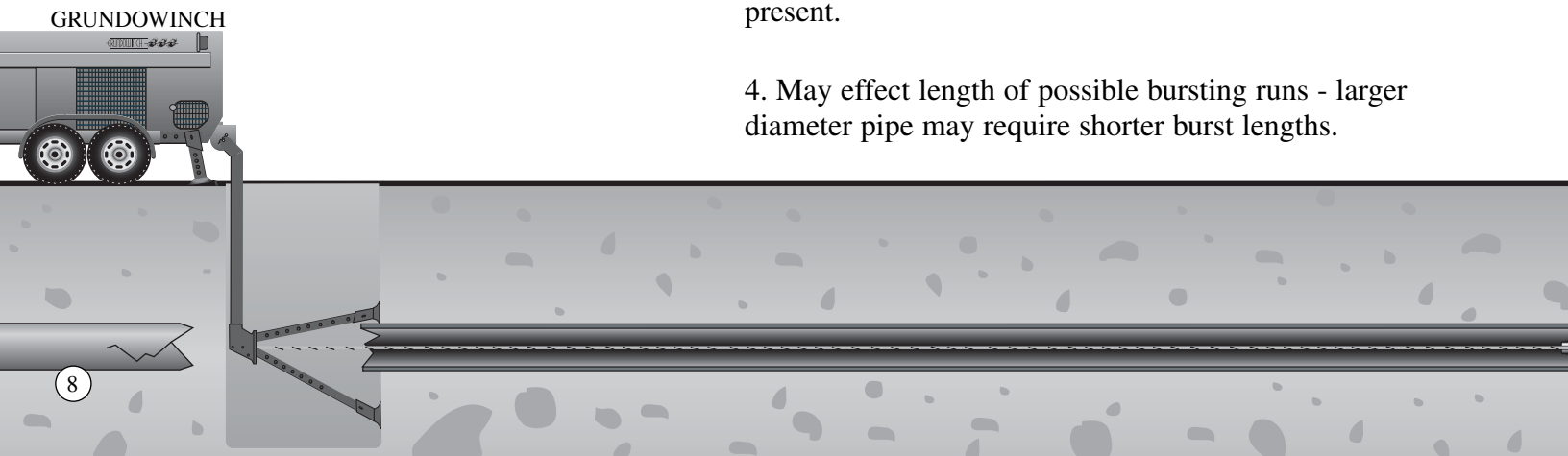
Host Pipe Depth and Profile

1. May effect both winch & pneumatic tool selection.

2. May effect length of entrance & exit pit requirements.

3. Special cutting attachments for repair joints, if present.

4. May effect length of possible bursting runs - larger diameter pipe may require shorter burst lengths.



Host Pipe Depth and Profile

1. Expansion of surrounding soil is affected by depth of host pipe. Using this guide for minimum depth cover (10x the total upsize) (See example on the right).

2. Water table considerations vary with depth - working below the water table may require dewatering procedures such as "well pointing" - and in some cases an alternative burst system such as the Grundoburst static system may be more efficient.

3. Profile of host pipe run will affect performance and final grade. A severally errant profile, due to poor initial installation or deterioration over time, will not be “cured” by pipe bursting.

4. Start and exit pits become larger and more complex as depth increases.

5. Length of burst may be shortened as depth increases.

Host Pipe Repairs

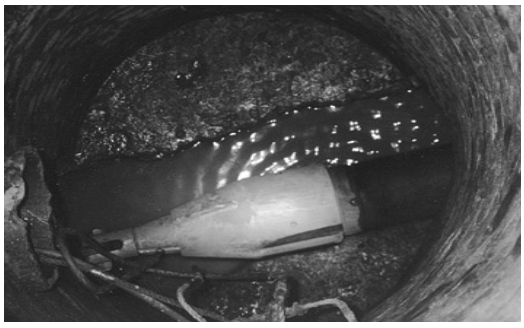
1. Point repairs may contain different materials that will not fracture and may require excavation and removal prior to bursting.

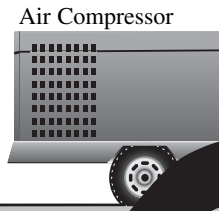
2. Cleaning the host pipe prior to bursting is necessary to prevent the buildup of material in front of the bursting tool. The final grade of the new pipe installed is dependent on a clean, open host pipe the entire length of the run.

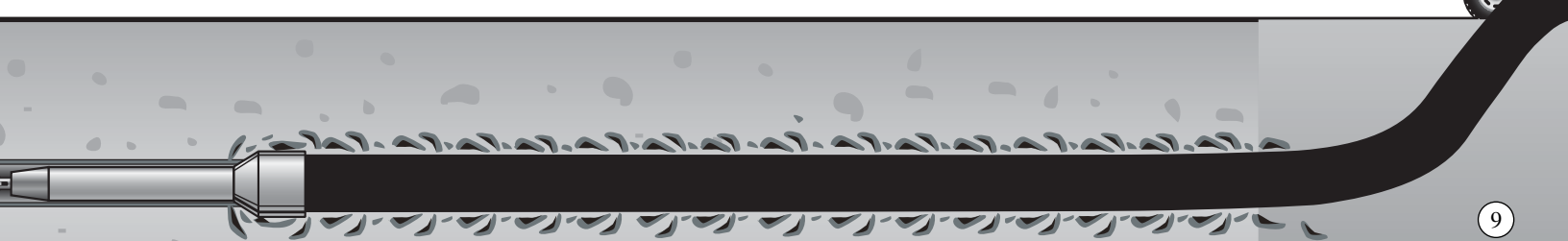
3. Different diameters of host pipe in one run may also cause grade problems with the final installation.

Example:
An existing 8-inch cast iron pipe needs to be replaced with a new 8-inch line with a carrying capacity of an 8-inch pipe. Working pressure is 150 PSI. The pipe is approximately 4 feet deep. Based on the working pressure, SDR 11 (165 PSI) is selected. The inside diameter (ID) of 8-inch pipe is 6.963 inches. A 10-inch SDR 11 pipe with an ID of 8.679 inches is needed to supply the 8-inch carrying capacity. The outside diameter (OD) of the 10-inch pipe is 10.75. Therefore, the upsize is from 8-inch ID Cast Iron to 10.75-inch OD HDPE, an increase 2.75 inches.

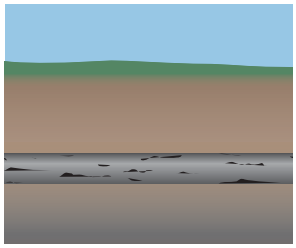
The manufacturer’s tool recommendation for this particular burst is an 8.5-inch diameter pneumatic bursting tool, equipped with a 13.8-inch OD rear expander. With the rear expander, the total upsize becomes 8-inch ID to 13.8-inch OD, an increase of 5.8 inches. Using the guide for minimum depth cover (10x the total upsize), based on 5.8 inches, the minimum pipe depth requirement for bursting in this scenario would be approximately 58-inches (10 x 5.8-inches). This depth will prevent any heaving of the ground and pavement caused by soil displacement. In this situation, the existing pipe, located 48-inches below the surface, may not be deep enough for pipe bursting. Investigate alternative pipe SDRs or use DIPS size pipe. Many times, the pipe is overrated for the application. A 150 PSI system may never actually operate higher than 90-100 PSI. A higher SDR (larger ID), but smaller OD pipe could therefore be used.

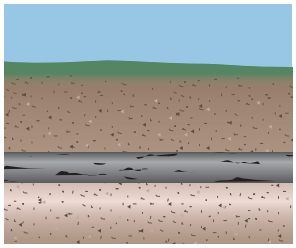


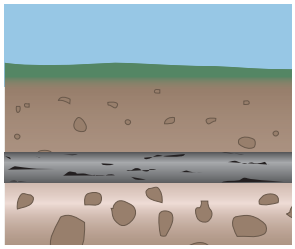


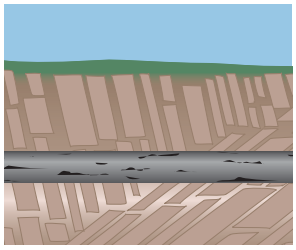


Soil Conditions and Types


Clay


Sand


Cobble


Shale

1. Since most favorable bursting projects were originally installed by “trenching” or open cut, at least the top of the host pipe has fill material.

2. Is the surrounding soil expandable? Beach sand is an example of soil, with certain water conditions, that will not remain in the expanded state long enough for the installation of the new product pipe. A host pipe installed in a rock trench may not have room enough for soil expansion, especially if the new pipe is an upsize.

3. Can the base soil support the weight of the tool, expander and product pipes? A sewer line which has been leaking for years may not support this weight during the bursting process.

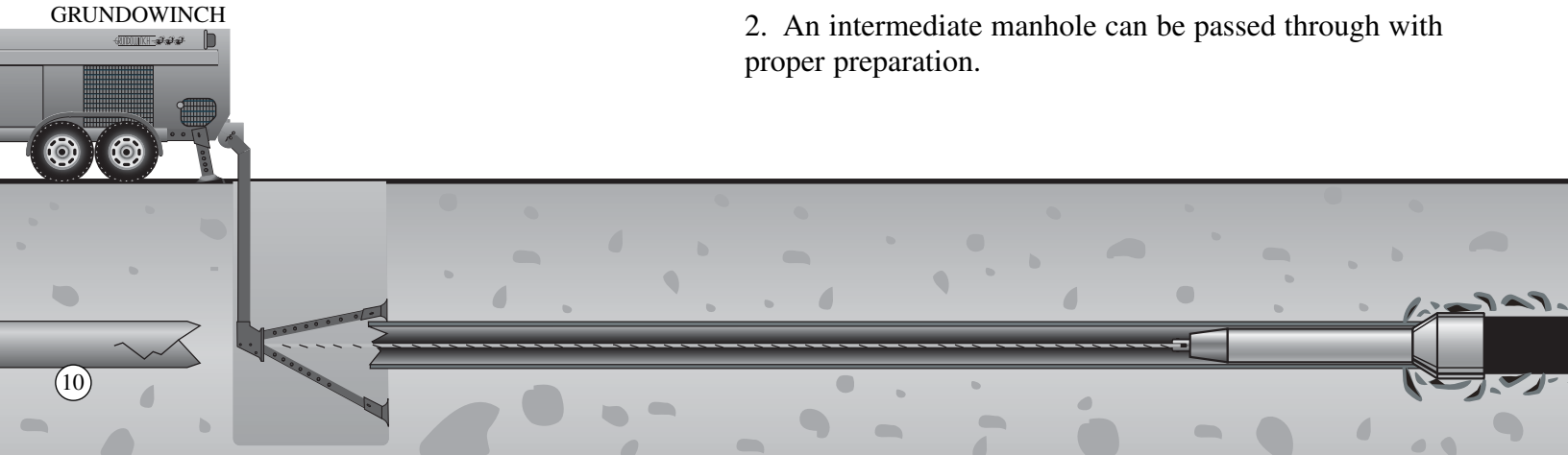
4. Soil conditions may dictate the use of a lubricant, such as Bentonite or polymers, to help reach the burst length desired. Grundocrack rear expander design allows for efficient lubricant flow at the immediate rear of the expander.

5. Some backfill material, such as pea gravel, and very wet conditions will affect the success of a project. The knowledge of such conditions before the project is started is vital.

Burst Length

1. In sewer rehab applications, burst length is usually manhole to manhole.

2. An intermediate manhole can be passed through with proper preparation.



3. Longer than normal bursts may need larger tools and Bentonite.

4. New pipe upsize will have an impact on burst length. Normal upsize is two pipe size increases, example: 8" to 10" or 8" to 12". Overly large increases in specified new pipe can result in project problems. In addition, the use of DIPS over IPS pipe can change the expected results, due to the increase in new pipe o.d.

Product Pipe Sizes and Material

1. HDPE is the most common new pipe material.

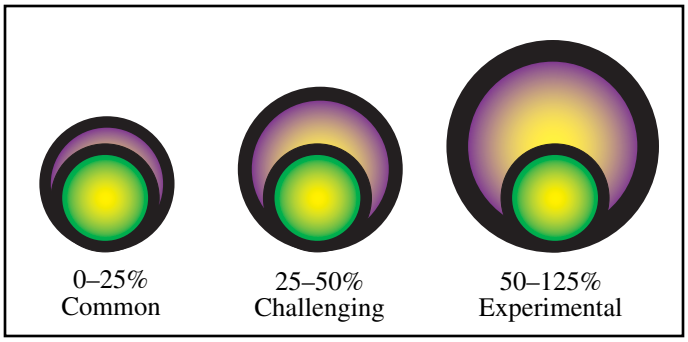
2. Tool and expander selection is dictated by new pipe size, as well as host pipe specs.

3. Due to the weight of larger diameter, thicker wall HDPE, Bentonite is used to reduce friction. Examples of 100' lengths of various HDPE are shown in Table 1.

4. As shown in Table 1, a 600' length of 20" SDR 17 HDPE can approach 20,000 lbs. The GRUNDOCRACK tool and winch combination must overcome this weight, in addition to bursting the host pipe, and expanding the soil.

5. Pipe is available in IPS and DIPS sizes.

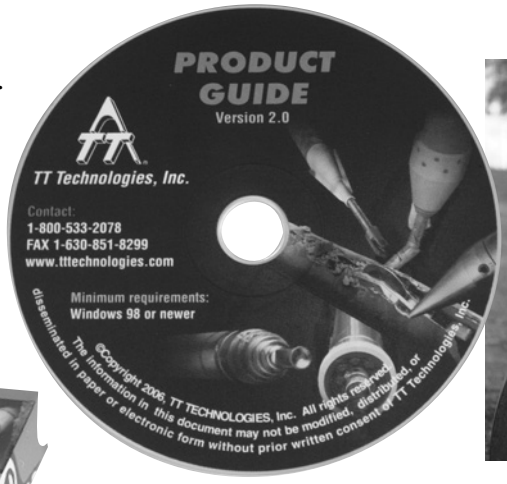
Pipe Sizes



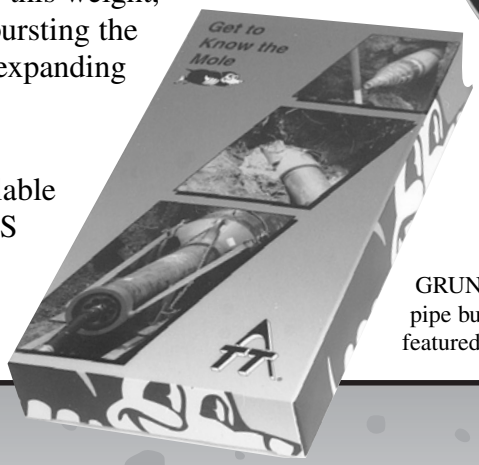
Upsize Examples

PIPE WEIGHT		
Pipe Size	**Weight per Foot (lbs)**	**Weight per 100 Feet (lbs)**
8" SDR 17	5.65	565
10" SDR 17	8.78	878
12" SDR 17	12.36	1236
20" SDR 17	30.42	3042
30" SDR 17	68.45	6845
36" SDR 17	98.56	9856

Table 1

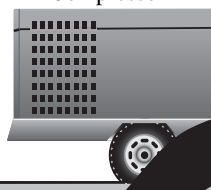


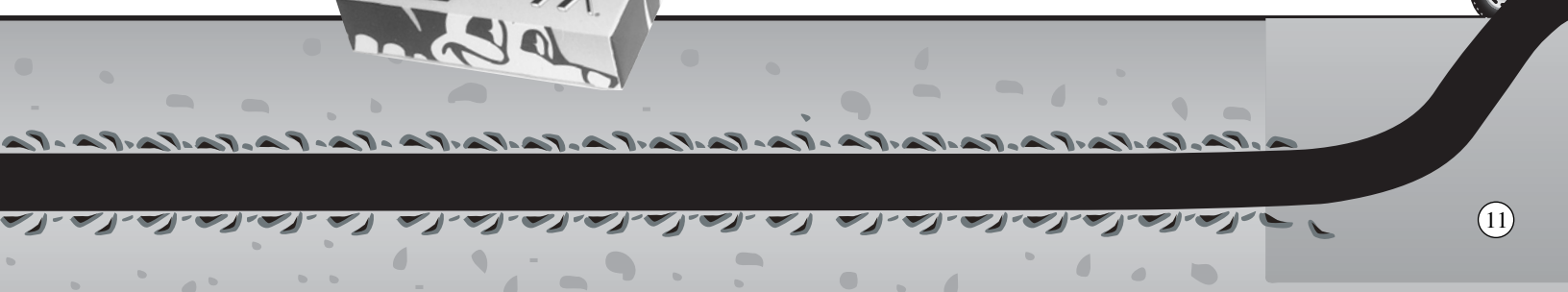
The Product Guide is available on CD.

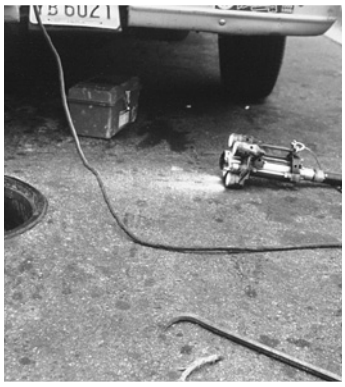


GRUNDOCRACK pneumatic pipe bursting systems are featured on VHS videotape.

Air Compressor







Peripheral Utilities

1. Start and exit pit location can be affected by surrounding utilities.

2. Interfering utilities must be located and exposed prior to burst.

3. Historically, very little damage to surrounding utilities has occurred due to pipe bursting. A Trenchless Technology Center Research Paper completed by Louisiana State University study on these effects is available.

Service Excavations

1. Sewer services are normally located in the pre-construction video operation.

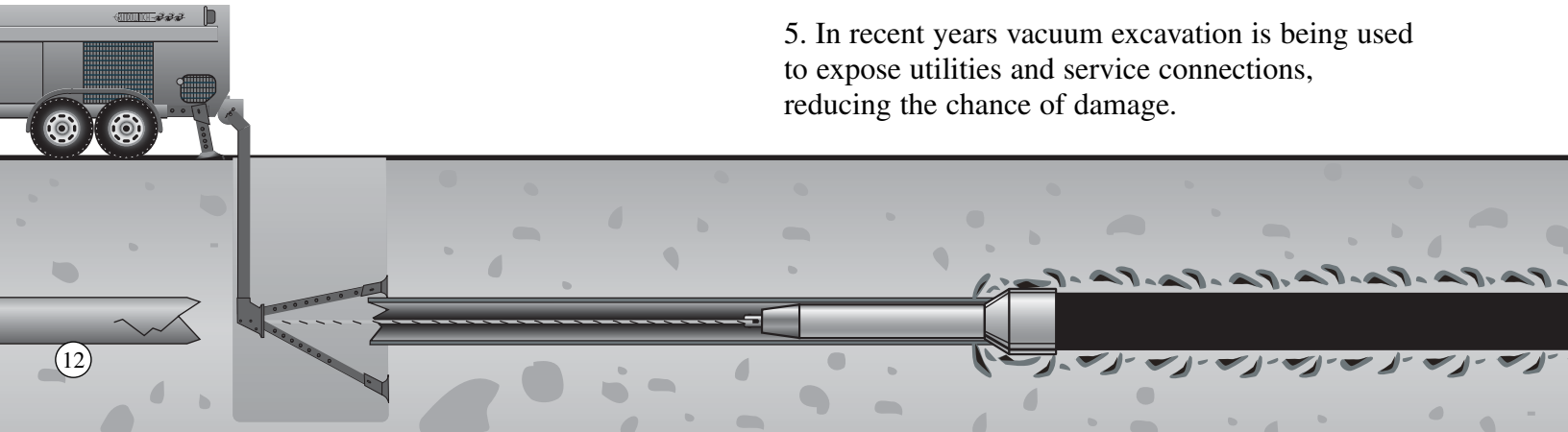
2. Gas services are normally excavated prior to bursting, usually to provide temporary service.

3. Various T-attachments are available for service hookups to the new main.

4. Services may be burst using a GRUNDOCRACK pneumatic pipe bursting machine with various compact winch configurations available. The GRUNDOTUGGER static pipe bursting system is also available, and can be used with pneumatic piercing tools.

5. In recent years vacuum excavation is being used to expose utilities and service connections, reducing the chance of damage.

GRUNDOWINCH



Start and Exit Pits

1. For sewer applications, start and exit pits are usually located in front of manholes.

2. For gas bursts, service pits can be expanded and used for start and exit.

3. All pits should be prepared and shored in an approved manner.

Manhole Preparation

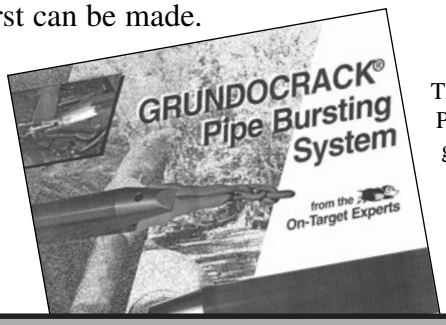
1. All confined space safety procedures apply when entering manholes.

2. Entry and exit holes must be enlarged to accept the new Expander and pipe size.

3. Manhole invert and benches must be removed if a reversible tool is used. The manhole also must be large enough to facilitate removing the expander from the manhole after the burst is complete.

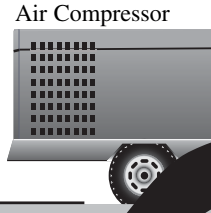
4. Large upsize bursts using reversible tools may make using existing manholes difficult due to invert elevation changes.

5. In some cases, the amount of labor required to repair a manhole after the burst will make replacing the manhole a better choice. A rear expander tool can then be used, and a faster, sometimes longer burst can be made.



The GRUNDOCRACK complete Product & Accessories Catalog gives a full listing of all available equipment and accessories.

Air Compressor



Grundocrack Specifications

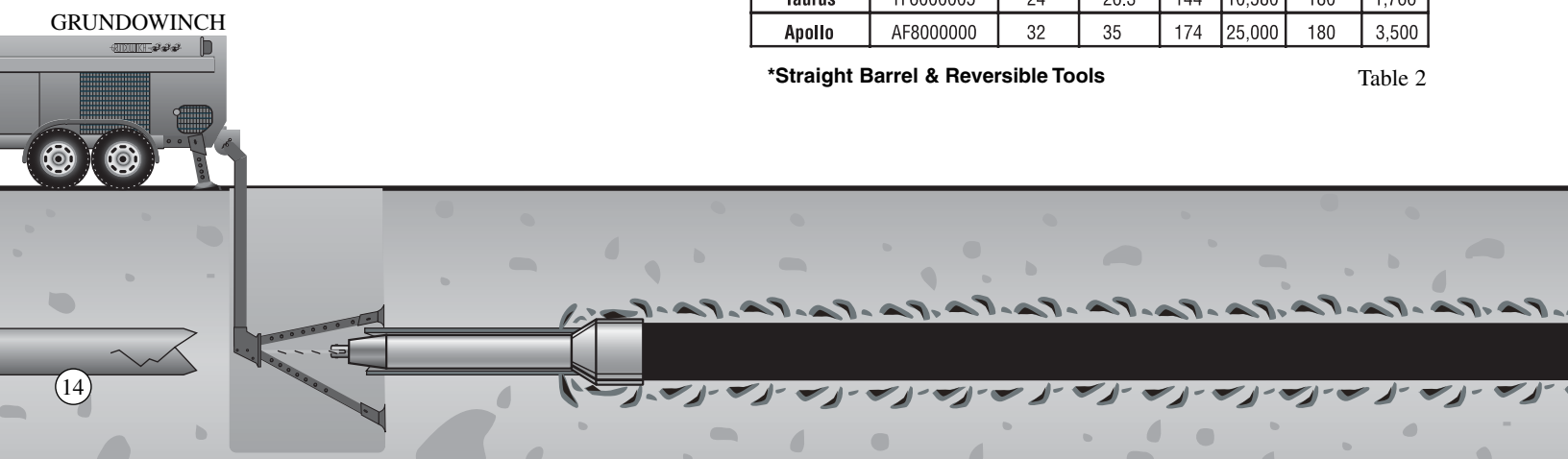
Tool and expander selection is affected by various considerations:

1. Host pipe size
2. Host pipe material
3. Host pipe depth
4. Start and exit pit location
5. Required burst length
6. Terrain
7. Product pipe size
8. Product pipe material

GRUNDOCRACK SPECIFICATIONS							
Model	Part No.	Diameter (In.)	Rear Flair Tool Dia. (In.)	Length (In.)	Weight (Lbs.)	Strokes/ Minute	Air Cons. (cfm)
PCG 130*	PCG1300000	5	—	50.5	237	350	92
PCG 145*	PCG1450000	5.75	—	60	370	330	117
Olympus w/reverse*	PCG1800000A	7	—	66	490	280	159
Hercules w/reverse*	HV2200000	9	—	79	945	300	283
Gigant w/reverse*	PCG2700000	11	—	84	1,540	310	424
Koloss w/reverse*	KV3500000	15	—	102	3,375	220	706
Mini-Atlas	AM1300004	5	6	36	132	580	60
Mini-Olympus	OM1800010	7	8.5	44.5	385	500	124
Olympus	OF1800005	7	8.3	66.5	507	280	159
Hercules	HF2200005	8.5	9.8	75	811	340	282
Gigant	GF2600005	10	11.8	79	1,356	310	424
Koloss	KF3500005	14	15.7	92	2,601	220	706
Goliath	GF4500005	18	20	112	5,434	180	1,236
Taurus	TF6000005	24	26.3	144	10,580	180	1,766
Apollo	AF8000000	32	35	174	25,000	180	3,500

***Straight Barrel & Reversible Tools**

Table 2

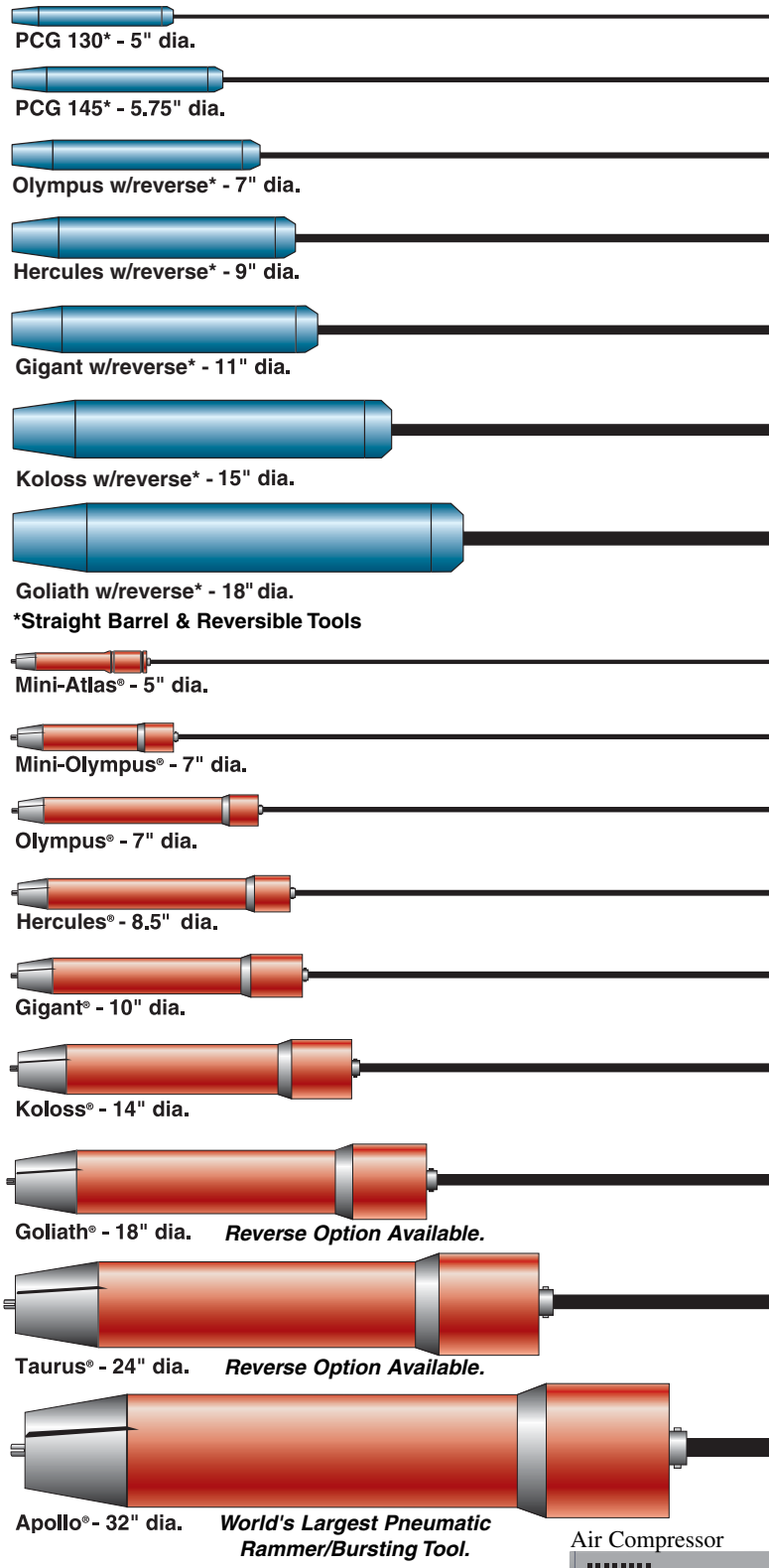


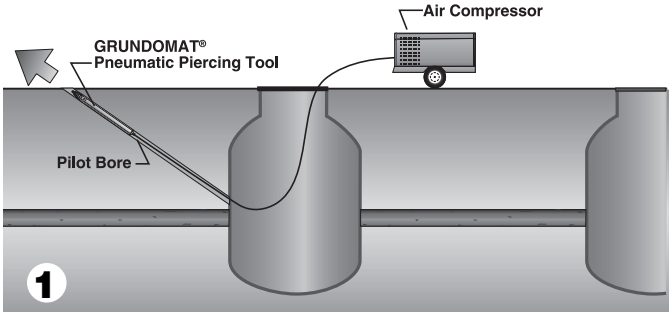
The following lists host pipe, new pipe, and tool/ expander selection as a guideline only.

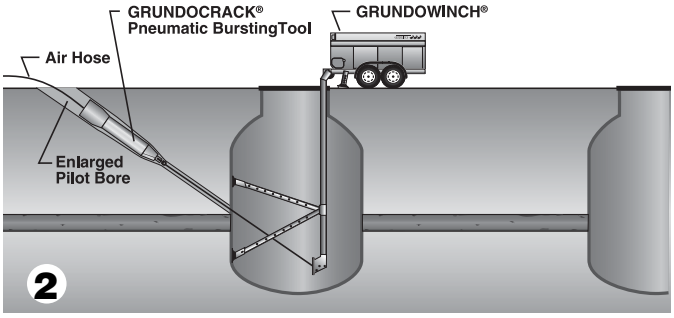
GRUNDOCRACK EXPANDER SELECTION		
Host Size— New Product Size	**Tool Selection**	**Expander Selection**
4" to 4"	G'Mat 85 & 95	Front Expander
4" to 6"	G'Mat 95	Front Expander
4" to 6"	PCG 130*	Front Expander
4" to 4"	Mini-Atlas	Rear Expander
6" to 6"	PCG 130*	Front Expander
6" to 8"	PCG 145*	Front Expander
6" to 8"	PCG 180*	Front Expander
6" to 8"	Hercules	Rear Expander
8" to 8"	PCG 145*	Front Expander
8" to 8"	PCG 180*	Front Expander
8" to 8"	Hercules	Rear Expander
8" to 10"	Hercules	Rear Expander
8" to 10"	PCG 180*	Front Expander
8" to 12"	Hercules, Gigant	Rear Expander
8" to 12"	PCG 220*, limited	Front Expander
10" to 10"	PCG 180*	Front Expander
10" to 10"	Hercules	Rear Expander
10" to 12"	PCG 180*, limited	Front Expander
10" to 12"	PCG 220*	Front Expander
10" to 12"	Hercules, limited	Rear Expander
10" to 12"	Gigant	Rear Expander
10" to 14"	Gigant	Rear Expander
10" to 14"	PCG 270*	Front Expander
12" to 12"	PCG 180*, limited	Front Expander
12" to 12"	Hercules, limited	Rear Expander
12" to 12"	Gigant	Rear Expander
12" to 12"	PCG 220*, limited	Front Expander
12" to 14"	Gigant	Rear Expander
12" to 14"	PCG 270*	Front Expander
12" to 16"	PCG 270*, limited	Front Expander
12" to 16"	Koloss	Rear Expander
14" to 14"	Gigant	Rear Expander
14" to 14"	PCG 270*	Front Expander
14" to 16"	Gigant, limited	Rear Expander
14" to 16"	PCG 270*, limited	Front Expander
14" to 16"	Koloss	Rear Expander
14" to 18"	Koloss	Rear Expander
14" to 20"	Koloss, limited	Rear Expander
16" to 16"	Gigant, limited	Rear Expander
16" to 16"	PCG 270*, limited	Front Expander
16" to 16"	Koloss	Rear Expander
16" to 18"	Koloss	Rear Expander
16" to 18"	KV 350*	Front Expander
16" to 20"	KV 350*, limited	Front Expander
16" to 20"	Koloss	Rear Expander
18" to 18"	Koloss	Rear Expander
18" to 18"	KV 350*	Front Expander
18" to 20"	KV 350*	Front Expander
18" to 20"	Koloss	Rear Expander
18" to 24"	Goliath	Rear Expander
24" & up	Goliath	Rear Expander
30" & up	Taurus	Front Expander

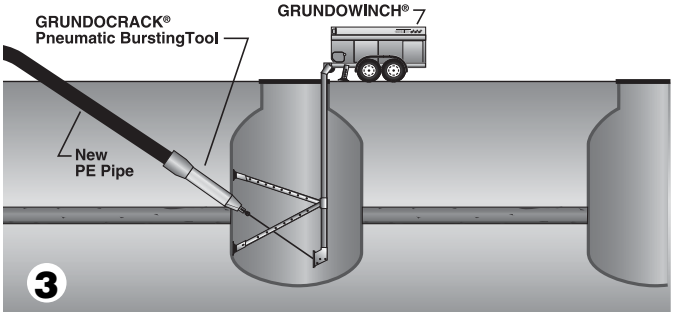
***Straight Barrel & Reversible Tools**
limited = limited length bursts

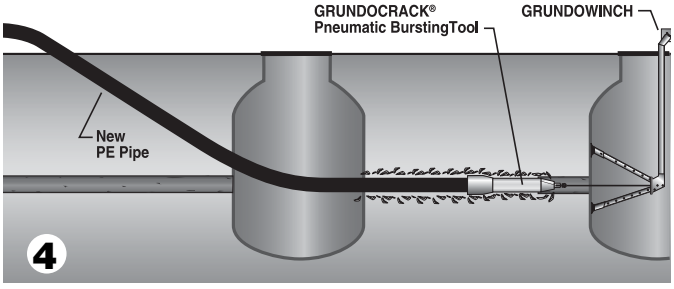
Table 3

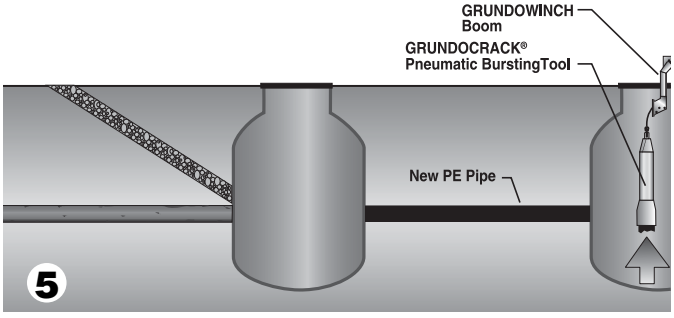












Reduce or Eliminate Launch & Exit Pits

Windowing Method for Tool Launch

Patent # (US 6,443,657 B1)

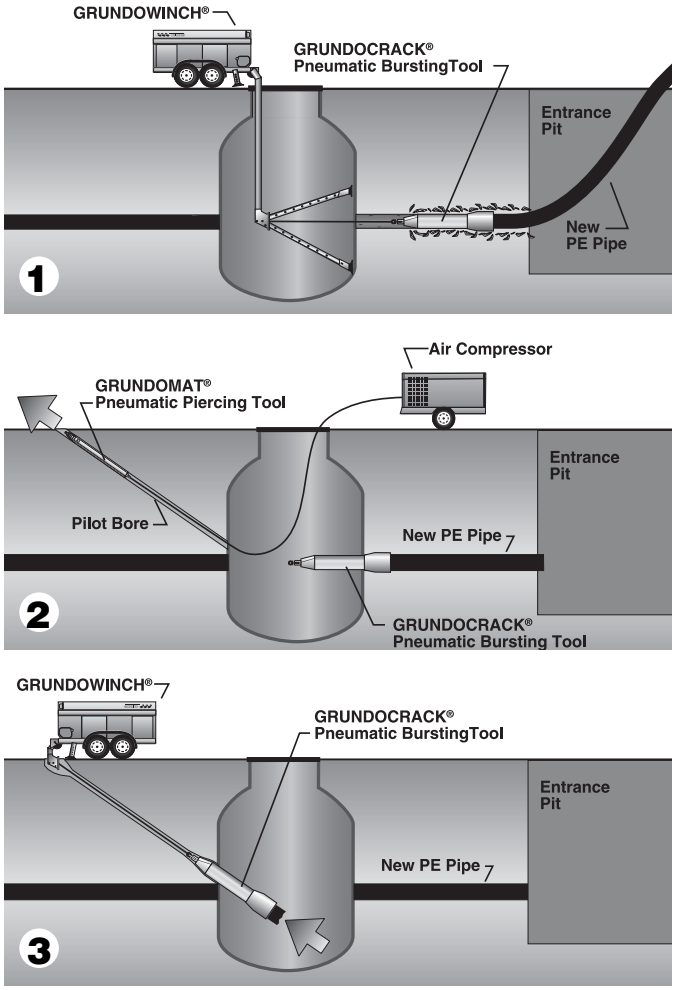
Using a pilot bore created by a GRUNDOMAT piercing tool, a GRUNDOCRACK pipe bursting tool can be launched from street level into a manhole, with an absolute minimal amount of surface disruption limited to a small surface patch rather than a full entry pit. GRUNDOWINCH constant-tension winch aids in this process.

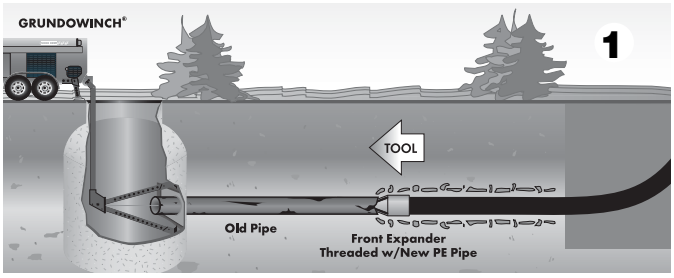
Reduce or Eliminate Launch & Exit Pits

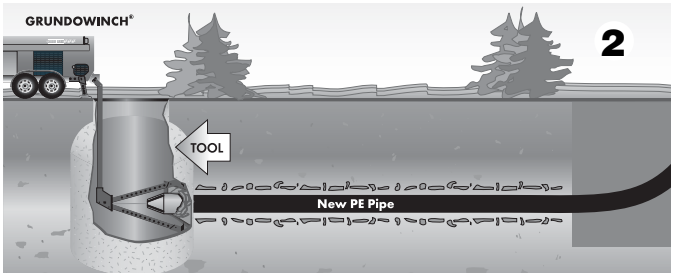
Windowing Method for Tool Exit

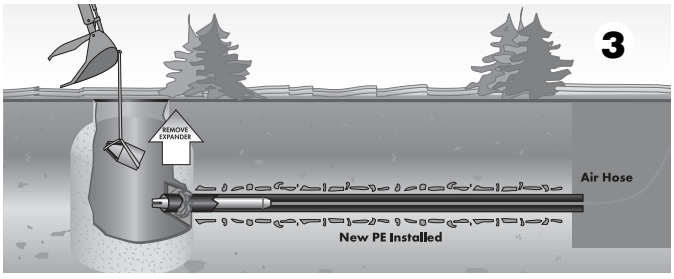
Patent # (US 6,443,657 B1)

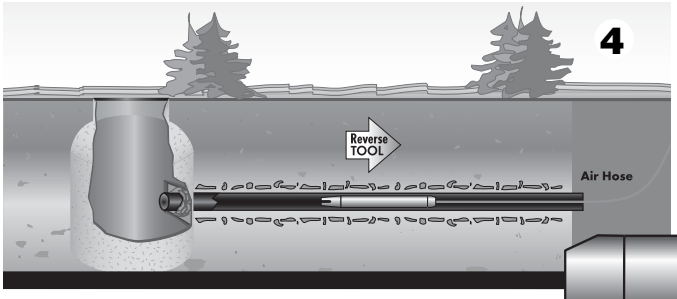
Once a burst is complete, a GRUNDOMAT piercing tool is used to create a pilot bore from the end-point manhole to street level. The GRUNDOCRACK tool is disconnected from the newly installed PE pipe. Using a GRUNDOWINCH constant-tension winch as a guide, the GRUNDOCRACK pipe bursting tool is removed through the pilot bore with a minimum of disruption to the surface.











Reverse Removal with PCG Tools

GRUNDOCRACK "straight barrel tools" (PCG) can be reversed automatically with a quick throw of a lever on the in-line lubricator. Once the expander is disconnected, the tool is reversed and removed back through the newly installed PE pipe.

This method can save time and expense of exit pit removal. Ideal for same-size bursting applications including 6" to 6", 8" to 8" 10" to 10", 12" to 12", or maximum one-size upsize depending on front expander configuration.

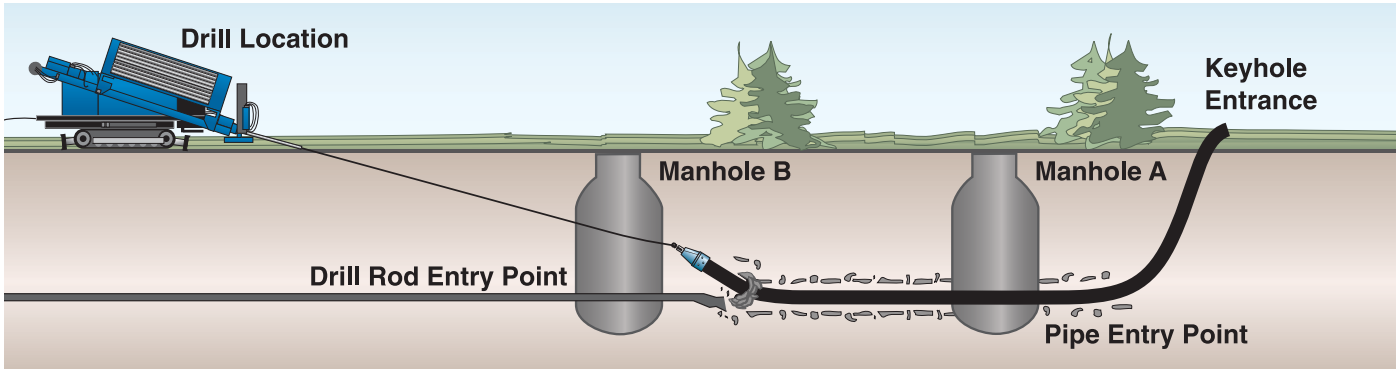
GRUNDOCRACK PCG

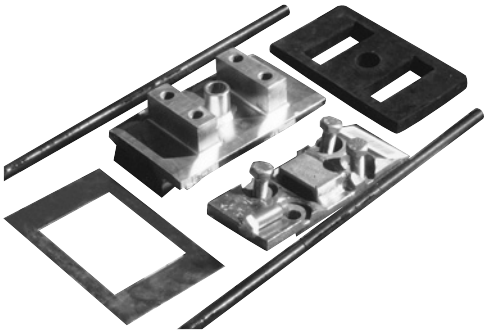
Rammer Assistance

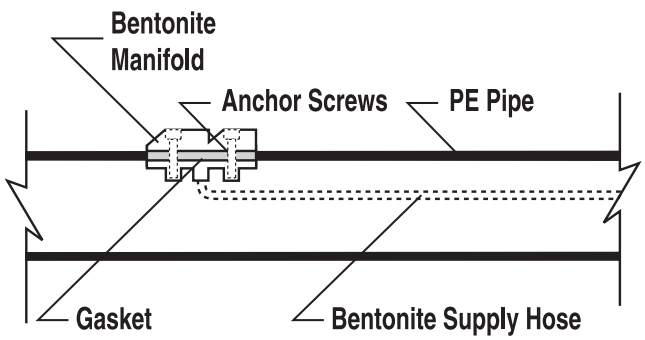
In certain circumstances a pneumatic rammer may be added to the back of a pipe string in order to overcome difficult bursting conditions. Rammer assistance in bursting operations is typically used for large diameter bursting, difficult ground conditions, extreme depths and difficult pipe materials. The added force of the rammer on the back of the pipe string can help overcome pipe drag and difficult soils by increasing bursting speed and achievable distance.

Mechanical HDD Bursting/Backreaming

Combining pipe bursting with HDD was first developed in the late 1980's in an effort to increase the capabilities of directional drilling equipment. During the bursting/backreaming process a bursting tool is attached to the end of the drill string and pulled back through the host pipe. The bursting tools are either pneumatic or powered by the rotational torque of the drill string. Mechanical HDD bursting/backreaming has had minimal success because of the difficulty in maintaining line and grade during bursting and limited capabilities of the method.







Bentonite Usage and Selection

Bentonite mixing and delivery systems are commonly used in pipe bursting applications to reduce friction and provide lubrication in difficult soil conditions. Rear expander tools can accommodate a bentonite manifold for delivery of bentonite during bursting operations.

Various GRUNDOMUDD bentonite mixing and delivery systems are available for pipe bursting applications. GRUNDOMUDD is a portable unit that mixes and pumps bentonite. The unit uses a Venturi mixer/filtration system to mix water and bentonite within minutes. An in-tank re-circulating value prevents the mixture from settling. A diaphragm pump is used for pumping the bentonite mixture on the smaller pump and high volume piston pumps are used on the larger pumps.

The GRUNDOMUDD is available in 225-, and 500-gallon capacity models. Consult a TT Technologies product specialist to determine the appropriate bentonite mixing and delivery unit for a particular project.

GRUNDOMUDD BENTONITE MIXING AND DELIVERY SYSTEMS			
MODEL	**GS225.2**	**DS225.1**	**DS500**
Length	72"	72"	114"
Width	46"	46"	52"
Height	46"	46"	58"
Weight	650 lbs.	650 lbs.	2150 lbs.
Bentonite Pump	Hydra Cell	Hydra Cell	FMC
Maximum PSI	800	800	1000
Engine Type	Honda	Hatz	Kubota
Engine H.P.	9	7	23
Electric Start	Yes	Yes	Yes
Drive System	V Belt	V Belt	Hydraulic
Tank Capacity	225 gal.	225 gal.	500 gal.
Number of Tanks	1	1	1
Hydraulic Capacity	N / A	N / A	26 gal.
Fuel Capacity	1.6 gal.	1.6 gal.	6 gal.
GPM Display	N / A	N / A	Optional
Remote Hydraulic	N / A	N / A	Yes

Table 4

GRUNDOWINCH Usage and Selection

GRUNDOWINCH selection is determined by tool size and product pipe size. In operation, the GRUNDOWINCH provides constant tension/ variable speeds. As the bursting process starts, the tonnage can be varied until optimum tool speed is achieved, and remain at that setting until the burst is complete. Complete GRUNDOWINCH specifications are available upon request.

Note: Do not use mechanical type winches with the GRUNDOCRACK system.

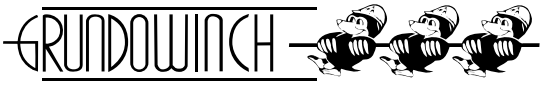
MODEL	RW 1500	RW 4002	RW 5000	RW 10	*RW 10 ATW	RW 22	*RW 22 ATW
Engine Type	gas	gas	diesel	diesel	diesel	diesel	diesel
Engine output in Horsepower	5	18	14	35	35	52	52
Line pull Tons Stage 1/2	1.5t	4.5t / 2.25t	5.5t / 2.75t	11t / 5.5t	11t / 5.5t	22t / 11t	22t / 11t
Max. line speed (feet)	16'	92'	92'	42'	92'	55'	55'
Rope diameter (inches)	5/16	7/16	1/2	5/8	5/8	7/8	7/8
Useful rope length foot	600'	650'	2,100'	2,300'	2,300'	2,300'	2,400'
Single-axle trailer	-	yes	yes	-	-	-	-
Tandem-axle trailer	-	-	-	yes	-	yes	-
Overrun brake	-	yes	yes	yes	-	electric	-
Parking brake	-	yes	yes	yes	yes	yes	yes
Towing bar height-adjustable	-	-	yes	yes	-	yes	-
Eye coupling Pintel Ring	-	yes	yes	yes	-	yes	-
Length	40"	114"	158"	181"	107"	193"	132"
Width	34"	63"	65"	72"	67"	97"	63"
Height	31"	51"	51"	58"	63"	71"	65"
Weight	755#	2,425#	3,426#	6,500#	7,600#	13,400#	13,800#
Line pull pre-select-system	yes	yes	yes	yes	yes	yes	yes
Electric-start	yes	yes	yes	yes	yes	yes	yes
Light system 12v DC	-	yes	yes	yes	yes	yes	yes

*RW 10 ATW and the RW 22 ATW are All-Terrain track mounted Grundowinches.

Table 5

Optional Extras:
Increased rope length. Line Printer giving line speed and forces used. Larger capacity engine—higher line-speed and winching capacity. Painting of winch to customer's colors. Hours in use meter (electric start only). Lighting Board.

Get to Know the Mole



Additional products and training materials are also available, like our Tools & Accessories Catalogs and User Manuals, Contact your TT salesman for details.

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