A Guide to

Pneumatic Pipe Bursting

with the

GRUNDOCRACK® SYSTEM

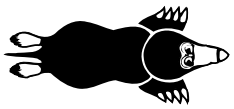
PIPE BURSTING SUCCESS
STARTS HERE

TT TECHNOLOGIES

PIPE RENEWAL

TT TECHNOLOGIES

Table of Contents



1) Foreword.....4

2) Company Background.....5

3) Pipe Bursting History.....6

4) GRUNDOCRACK Concept.....7

5) Project Considerations 8-13

6) GRUNDOCRACK Equipment Specifications..... 14-15

7) Special Applications 16-19

8) Bentonite Specifications..... 20-21

9) GRUNDOWINCH Specifications.....22

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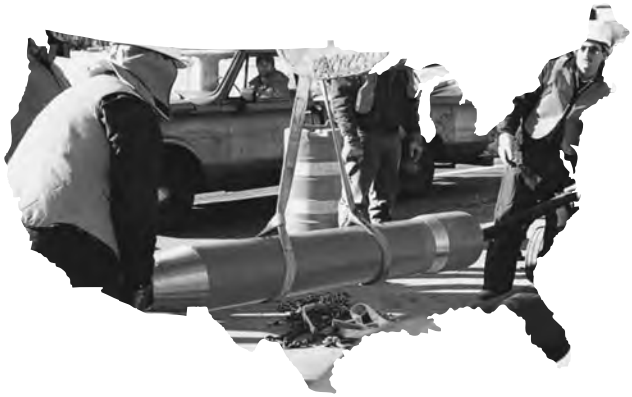
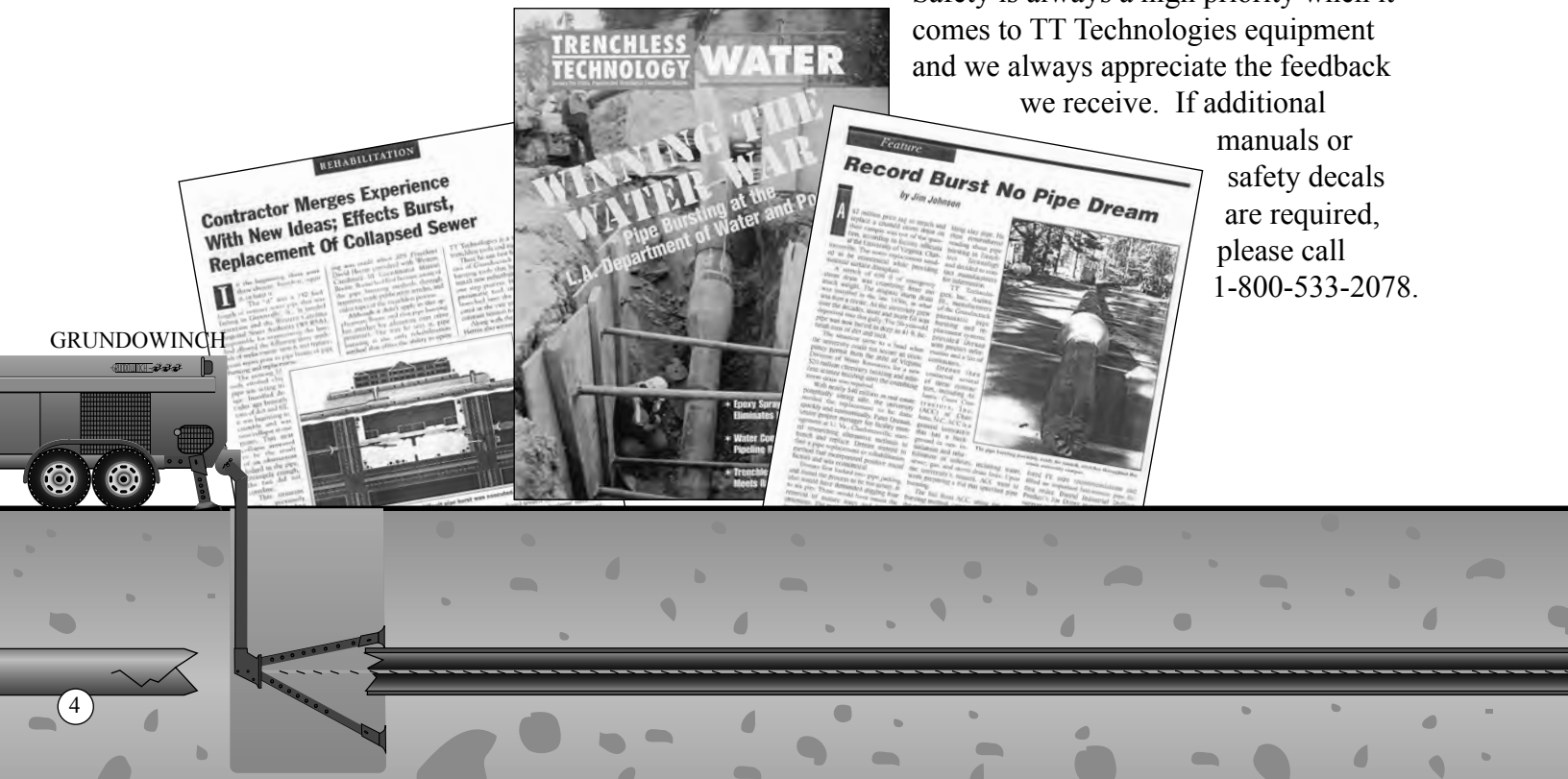


For over 45 years TT Technologies has lead the way for trenchless replacement systems beginning with pneumatic piercing tools. Today, after over 200 patents worldwide, TT's pneumatic tools are used in trenchless applications ranging from pipe pulling, pipe ramming, sliplining, directional drilling, and 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.



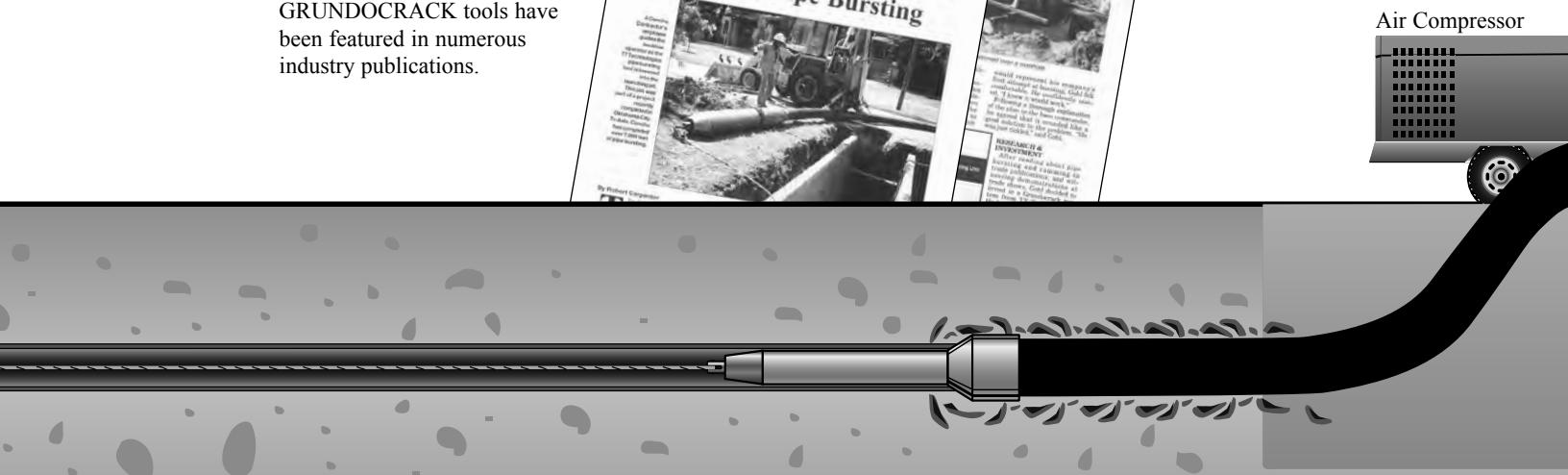
Company Background

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.

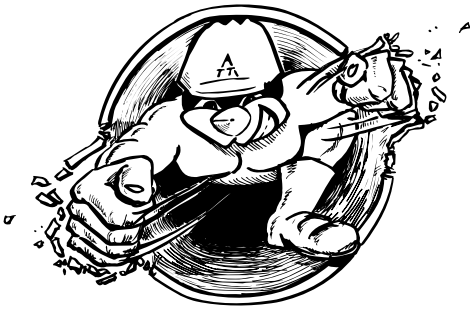
Real job situations involving TT Technologies' GRUNDOCRACK tools have been featured in numerous industry publications.

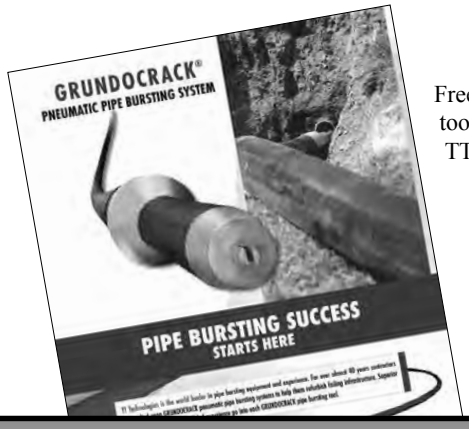


Pipe Bursting History

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.

GRUNDOWINCH

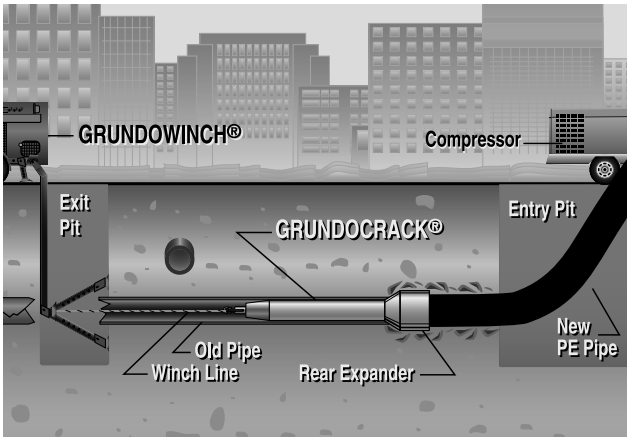
Grundocrack Concept

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.

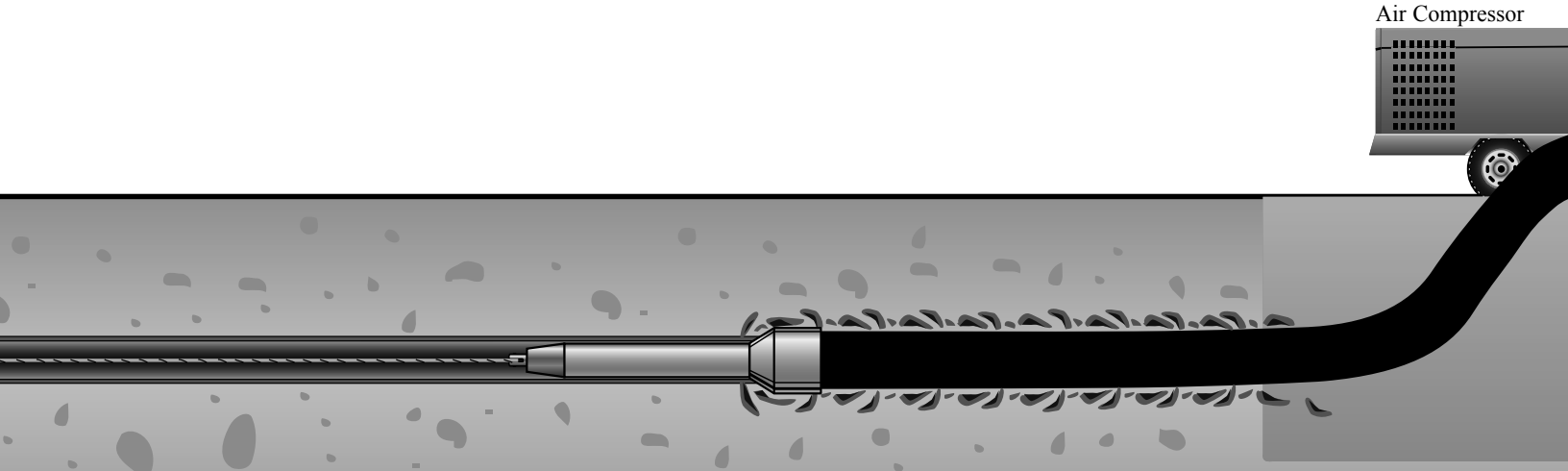
The twin capstan, dual speed, constant tension GRUNDOWINCH is essential to the bursting process as it provides friction for the pneumatic tool, and guides the tool through the host pipe. The winch is not used to "force" the tool, as a minimal pull is needed to allow the percussive action of the hammer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

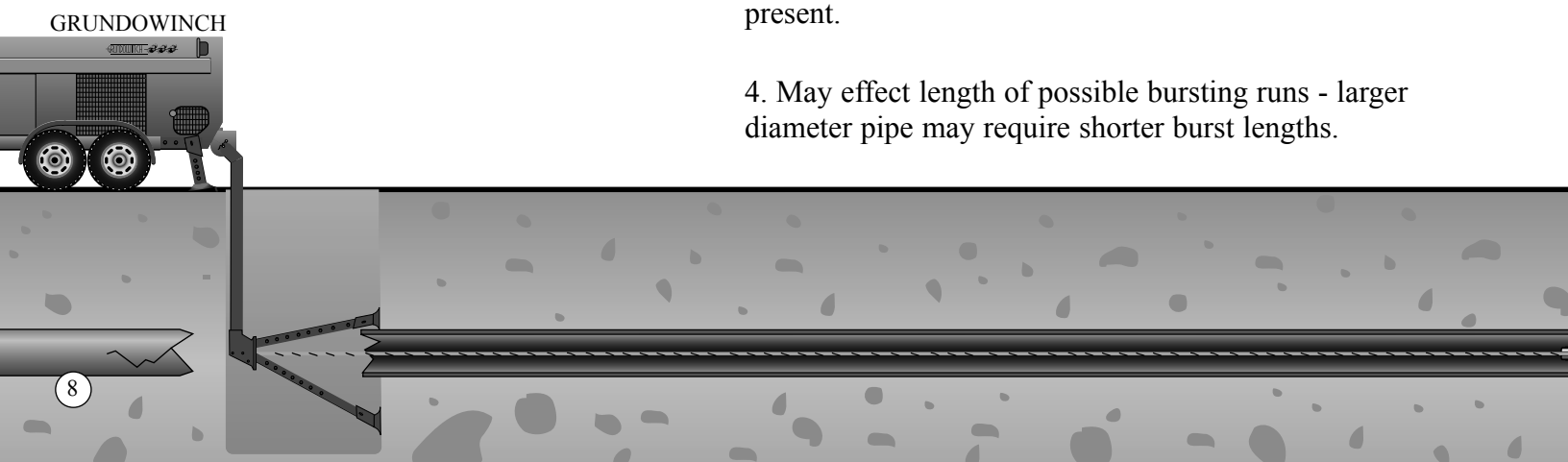
Host Pipe Depth and Profile

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

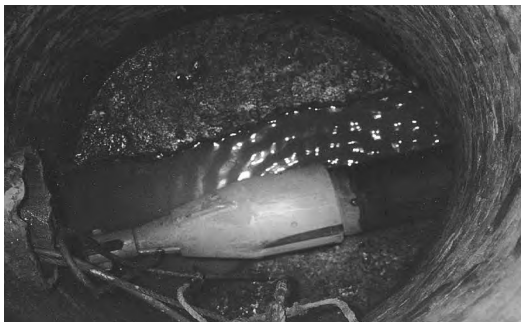
1. Point repairs may contain different materials that will not fracture and may require excavation and removal prior to bursting.

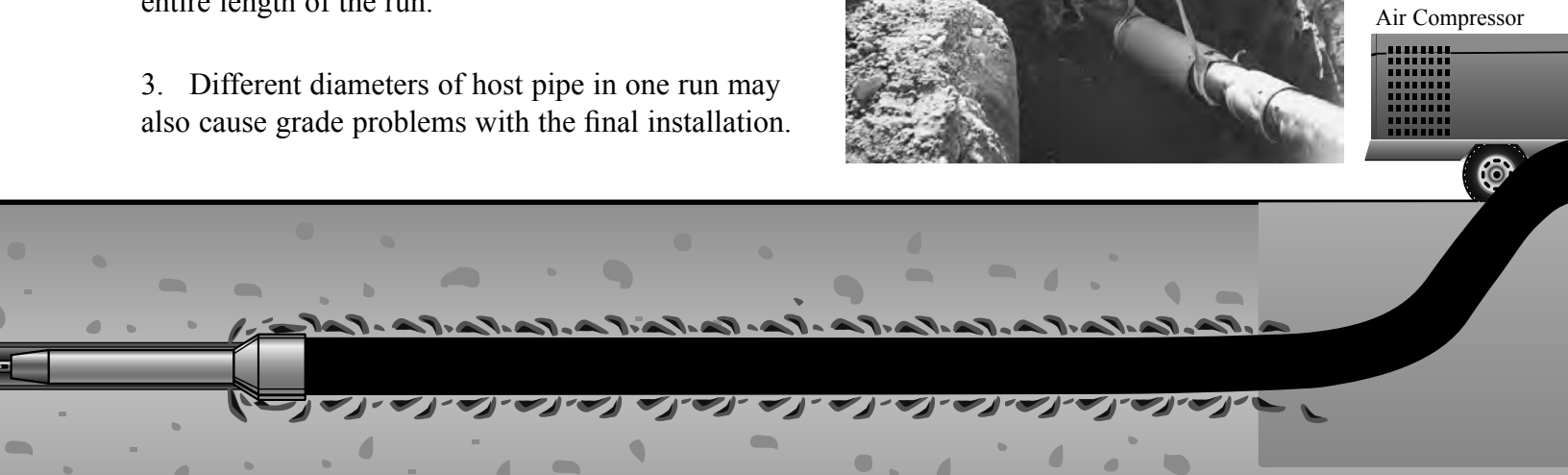
2. Cleaning the host pipe prior to bursting is necessary to prevent the buildup of material in front of the bursting tool. The final grade of the new pipe installed is dependent on a clean, open host pipe the entire length of the run.

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

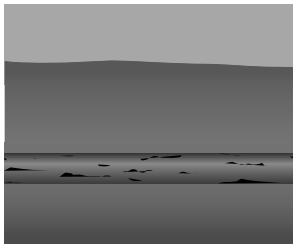
Example:
An existing 8-inch cast iron pipe needs to be replaced with a new 8-inch line with a carrying capacity of an 8-inch pipe. Working pressure is 150 PSI. The pipe is approximately 4 feet deep. Based on the working pressure, SDR 11 (165 PSI) is selected. The inside diameter (ID) of 8-inch pipe is 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.

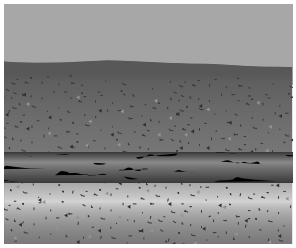
The manufacturer’s tool recommendation for this particular burst is an 8.5-inch diameter pneumatic bursting tool, equipped with a 13.8-inch OD rear expander. With the rear expander, the total upsize becomes 8-inch ID to 13.8-inch OD, an increase of 5.8 inches. Using the guide for minimum depth cover (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.

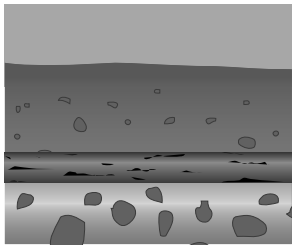


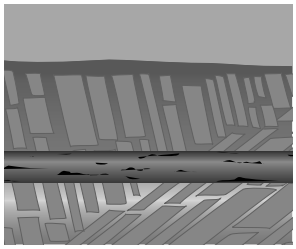


Soil Conditions and Types


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.

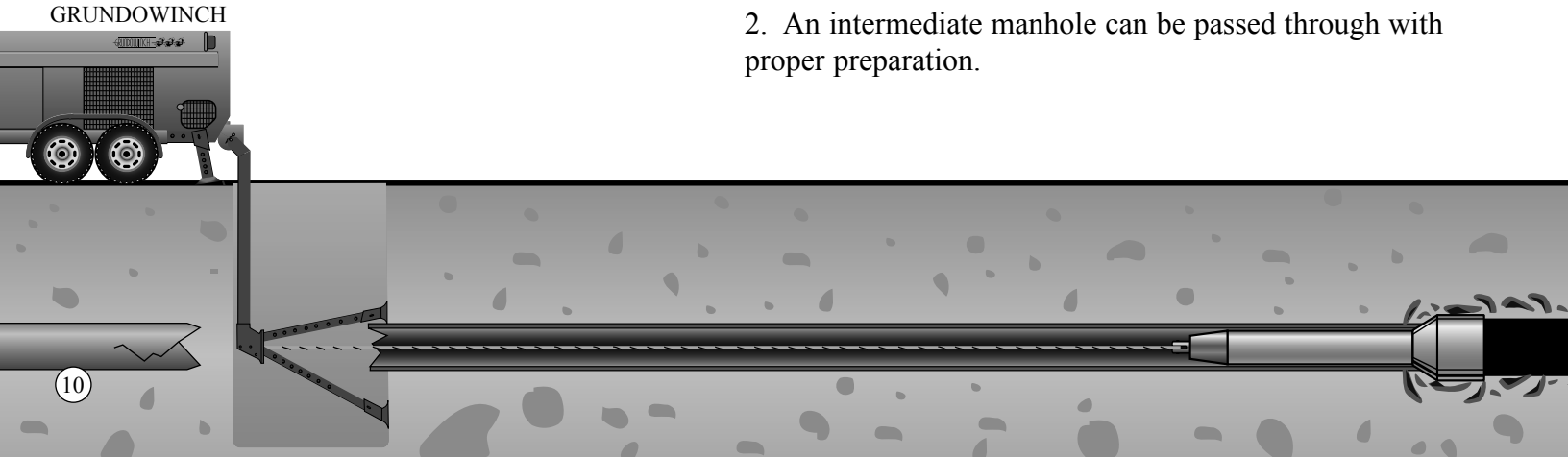
4. Soil conditions may dictate the use of a lubricant, such as Bentonite or polymers, to help reach the burst length desired. Grundocrack rear expander design allows for efficient lubricant flow at the immediate rear of the expander.

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.

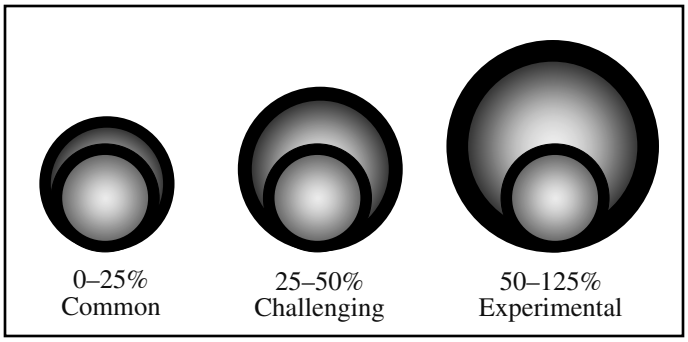
2. Tool and expander selection is dictated by new pipe size, as well as host pipe specs.

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.

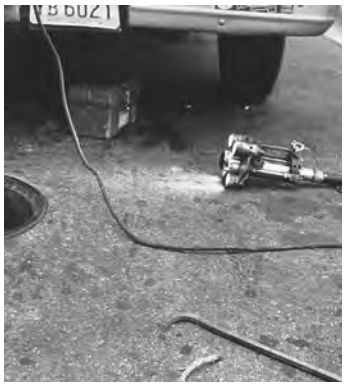
Pipe Sizes



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



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.

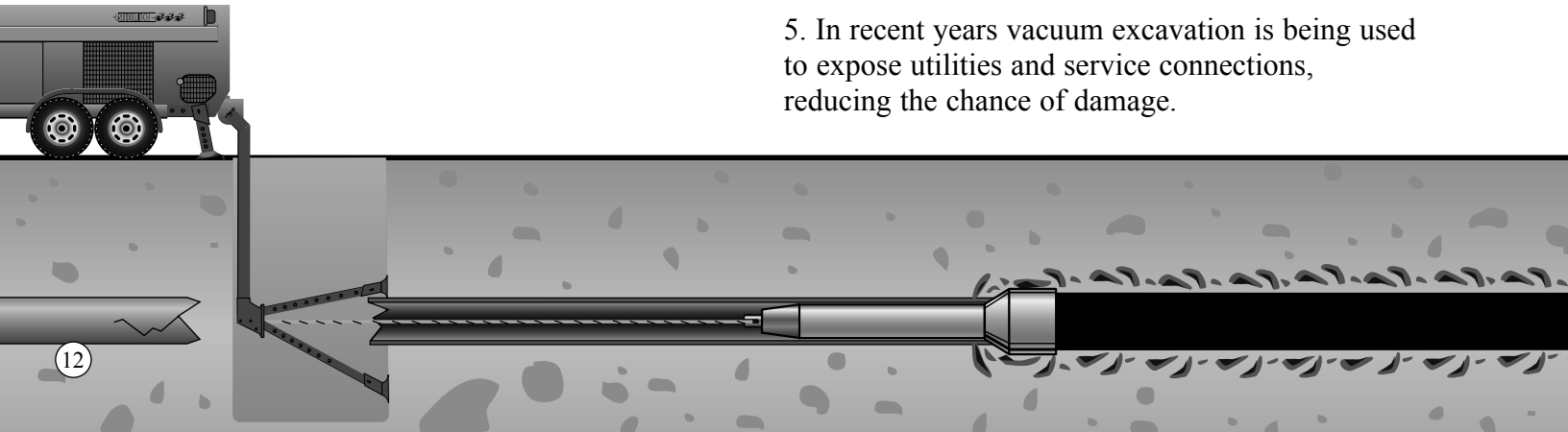
2. Gas services are normally excavated prior to bursting, usually to provide temporary service.

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

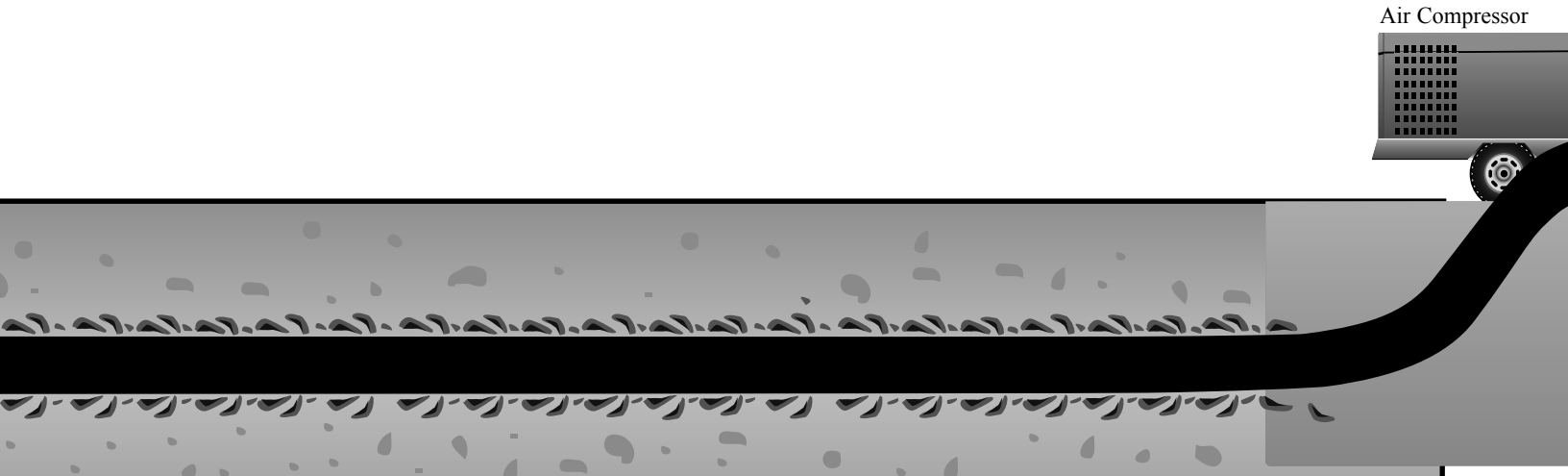
1. All confined space safety procedures apply when entering manholes.

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.



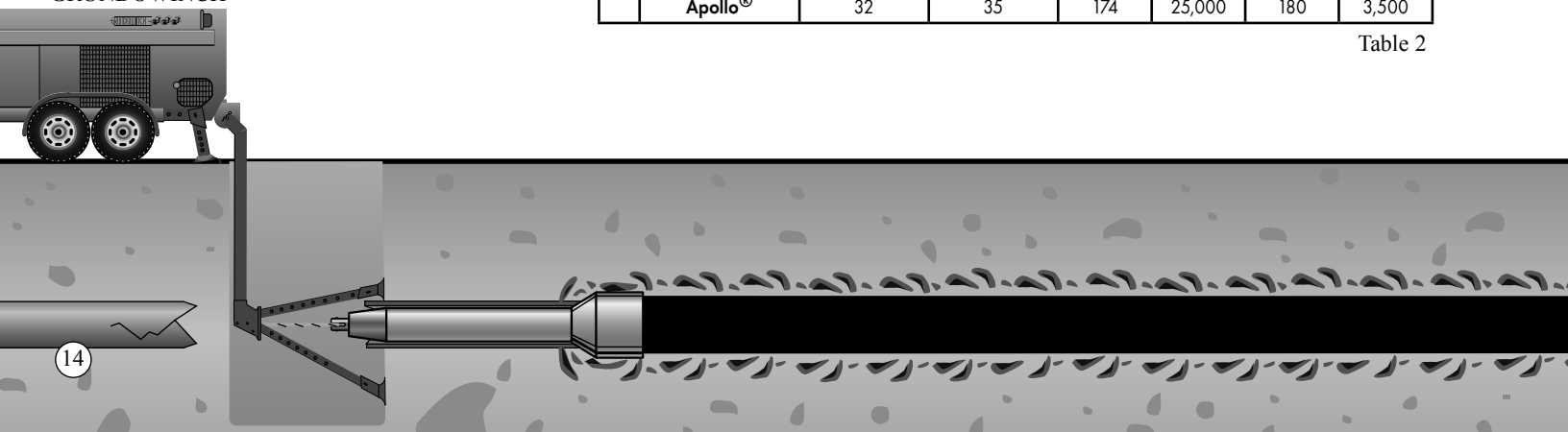
Tool and expander selection is affected by various considerations:

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	Tool Diameter (in.)	Rear Flair Diameter (in.)	Length (in.)	Weight (lbs.)	Strokes/ Minute	Air Cons. (cfm)
REVERSIBLE TOOLS	Taurus®	24	26.3	144	10,580	180	1,766
	Goliath®	18	20	112	5,434	180	1,236
	KV 350	15	N/A	102	3,375	220	706
	PCG 270	11	N/A	84	1,540	310	424
	HV 220	9	N/A	79	945	300	283
	PCG 210	8.28	N/A	89	866	290	229
	PCG 180	7	N/A	66	490	280	176
	PCG 145	5.75	N/A	60	370	330	117
	PCG 130	5	N/A	50.5	237	350	92
	Mini-Atlas®	5	6	36	132	580	60
	PCF 130®	5	6.2	53.5	209	320	95
	Titan®	5.75	6.9	61	302	285	141
	PCF 145®	5.7	6.9	63	302	310	141
	Mini-Olympus®	7	8.5	44.5	385	500	124
	PCF 180®	7	8.3	66.5	507	280	159
	Olympus®	7	8.3	66.5	507	280	159
	PCF 220®	8.4	9.8	77	811	340	282
	Hercules®	8.5	9.8	75	811	340	282
	Mini-Gigant®	10	13	49	1,014	430	353
	Gigant®	10	11.8	79	1,356	310	424
	Koloss®	14	15.7	92	2,601	220	706
	Goliath®	18	20	112	5,434	180	1,236
	Taurus®	24	26.3	144	10,580	180	1,766
	Apollo®	32	35	174	25,000	180	3,500

Table 2

GRUNDOWINCH

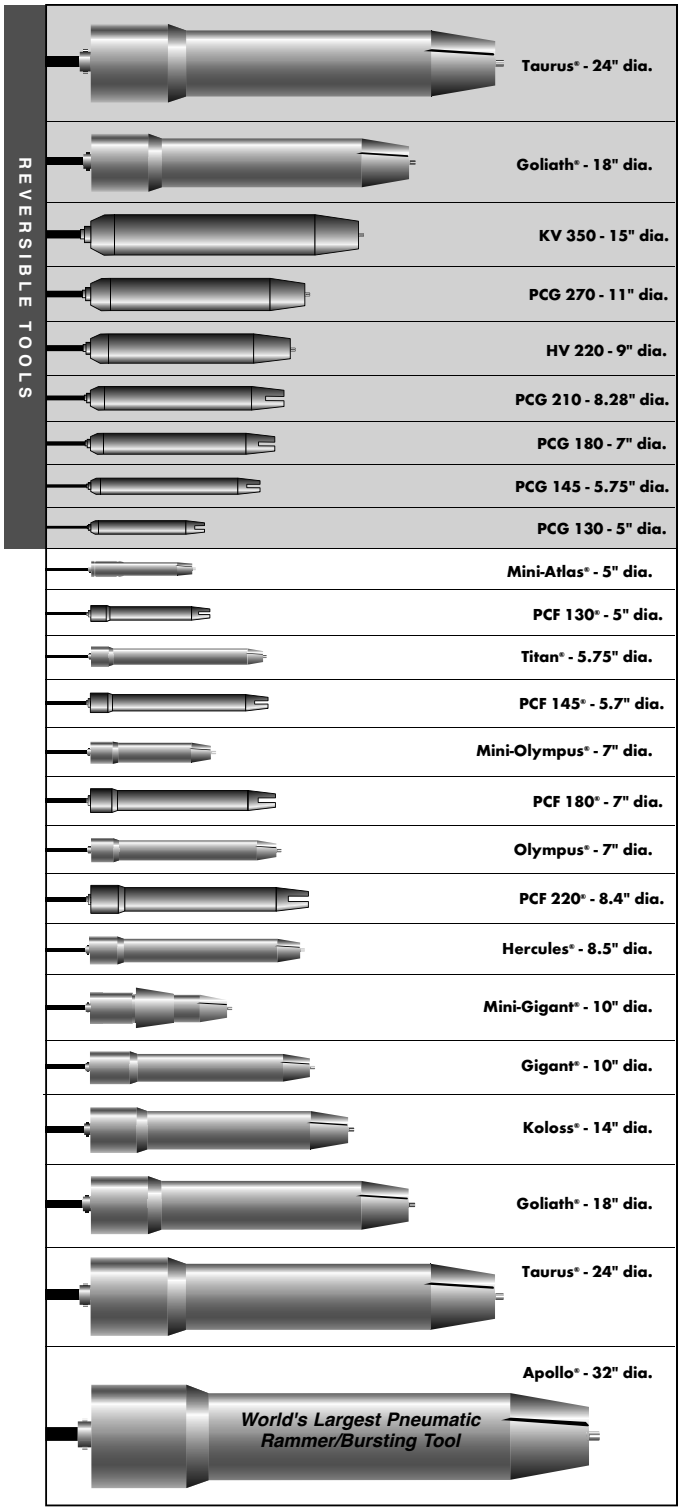


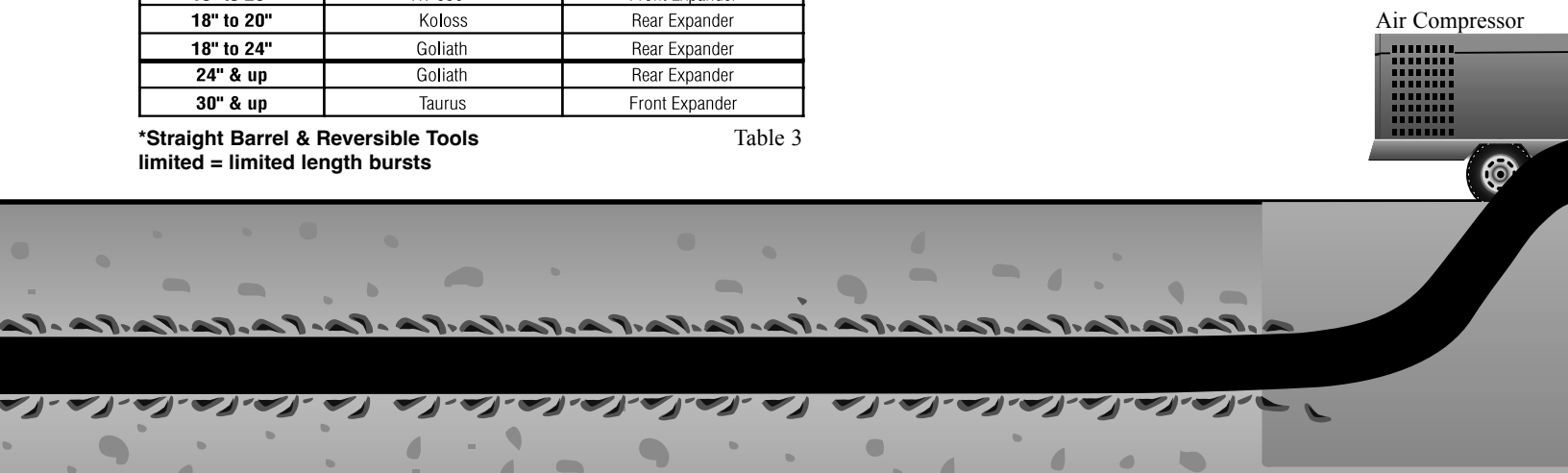
The following lists host pipe, new pipe, and tool/ expander selection as a guideline only.

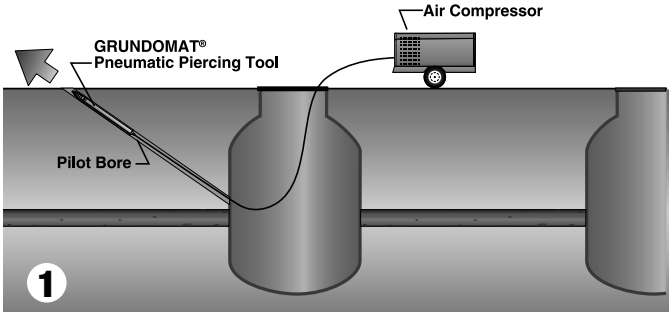
GRUNDOCRACK EXPANDER SELECTION		
Host Size— New Product Size	**Tool Selection**	**Expander Selection**
4" to 4"	G'Mat 85 & 95	Front Expander
4" to 6"	G'Mat 95	Front Expander
4" to 6"	PCG 130*	Front Expander
4" to 4"	Mini-Atlas	Rear Expander
6" to 6"	PCG 130*	Front Expander
6" to 8"	PCG 145*	Front Expander
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

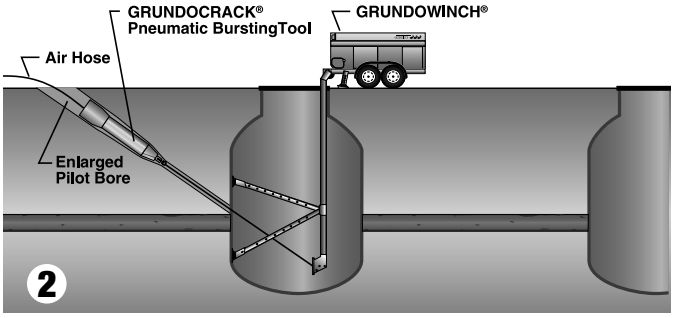
***Straight Barrel & Reversible Tools**
limited = limited length bursts

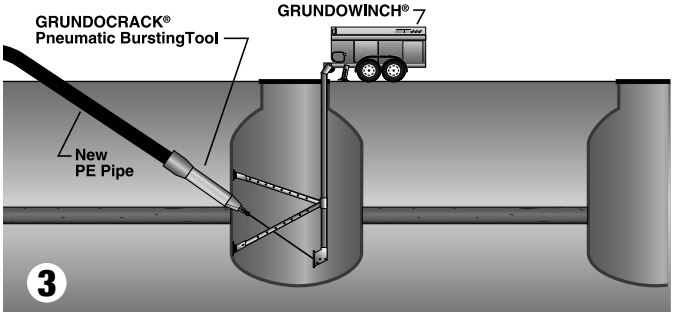
Table 3

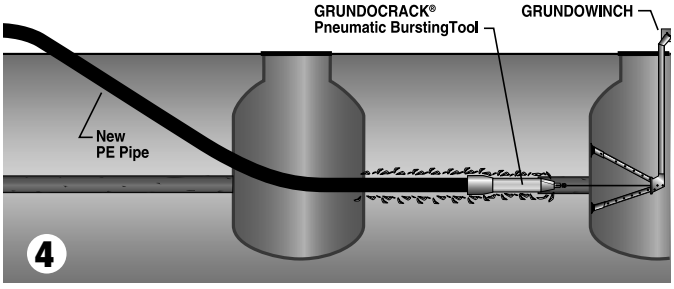


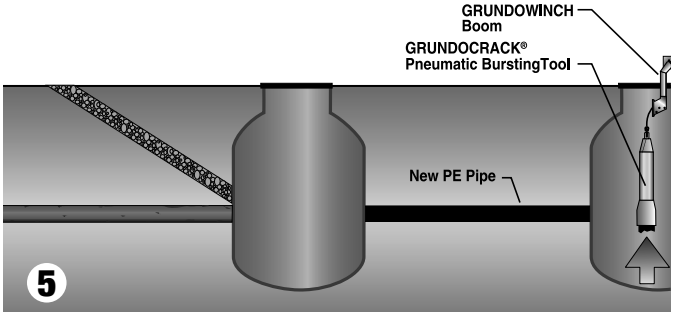












Reduce or Eliminate Launch & Exit Pits

Windowing Method for Tool Launch

Patent # (US 6,443,657 B1)

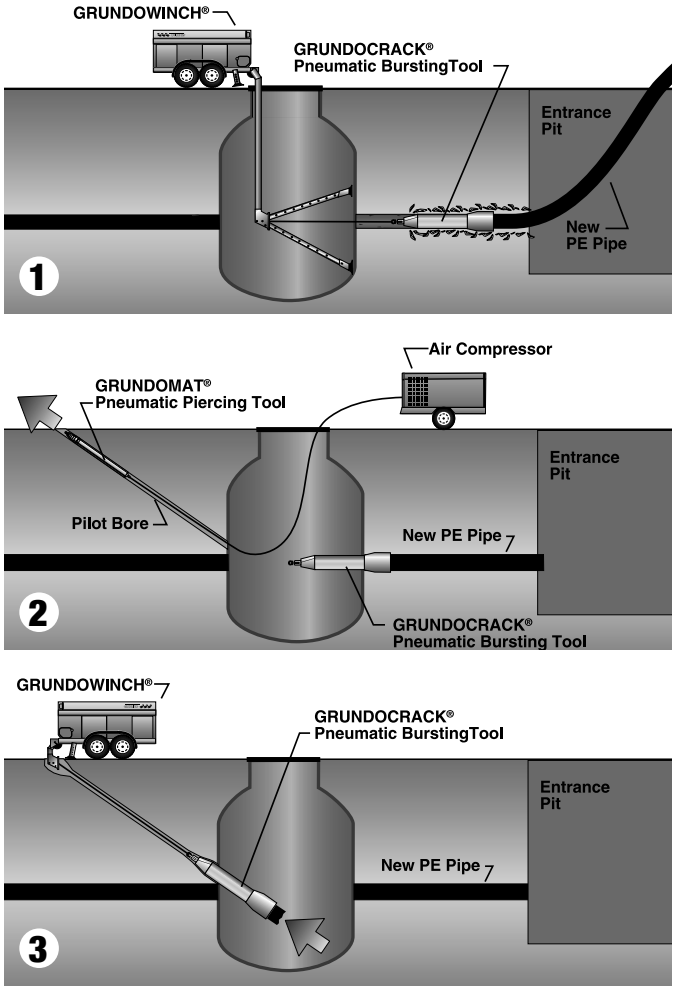
Using a pilot bore created by a GRUNDOMAT piercing tool, a GRUNDOCRACK pipe bursting tool can be launched from street level into a manhole, with an absolute minimal amount of surface disruption limited to a small surface patch rather than a full entry pit. GRUNDOWINCH constant-tension winch aids in this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

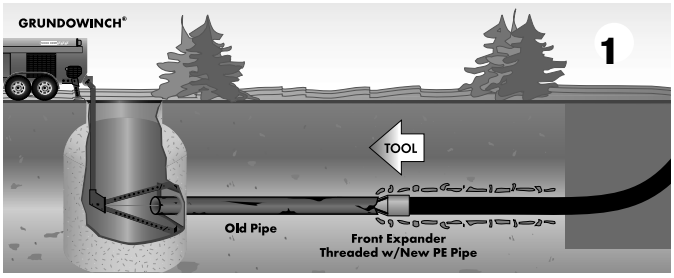
Reduce or Eliminate Launch & Exit Pits

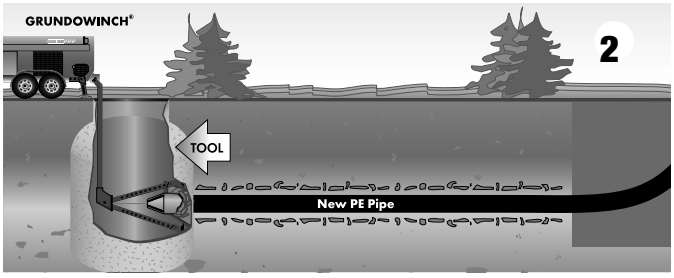
Windowing Method for Tool Exit

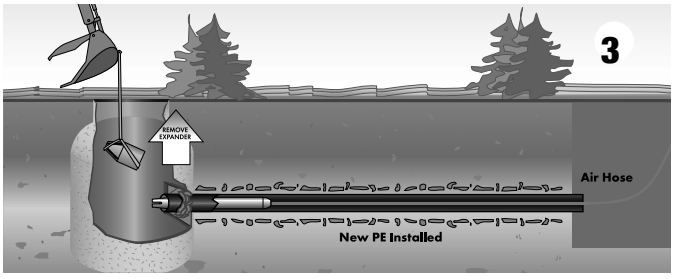
Patent # (US 6,443,657 B1)

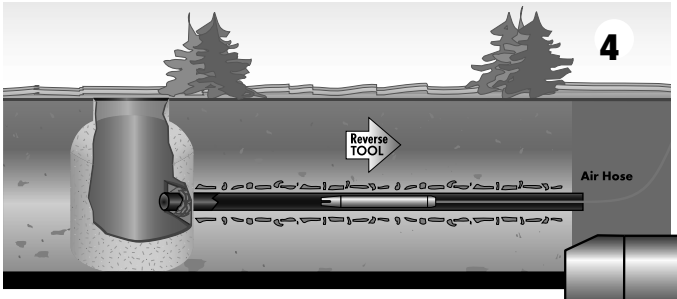
Once a burst is complete, a GRUNDOMAT piercing tool is used to create a pilot bore from the end-point manhole to street level. The GRUNDOCRACK tool is disconnected from the newly installed PE pipe. Using a GRUNDOWINCH constant-tension winch as a guide, the GRUNDOCRACK pipe bursting tool is removed through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

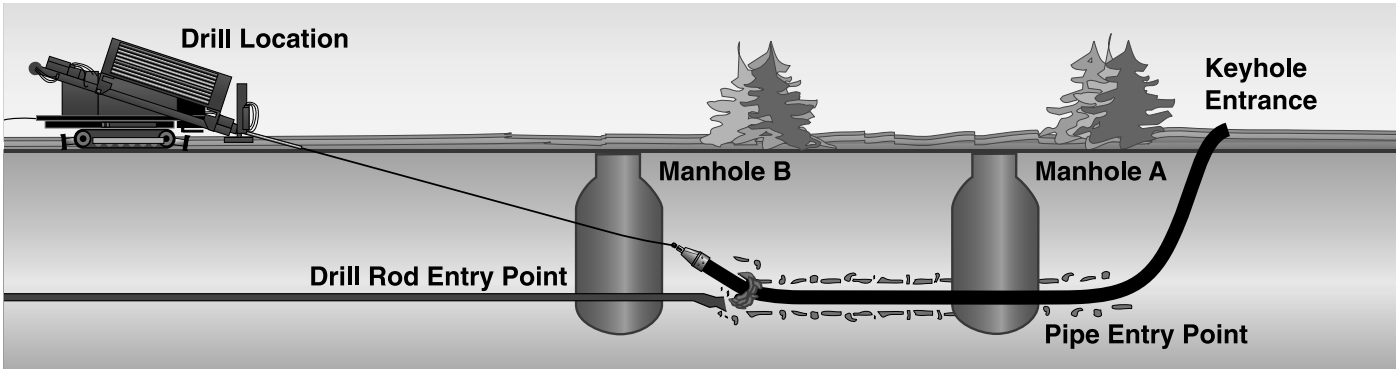
GRUNDOCRACK PCG

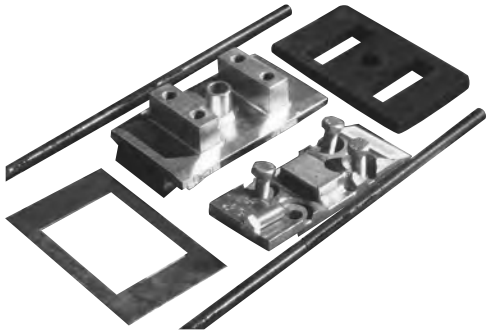
Rammer Assistance

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.



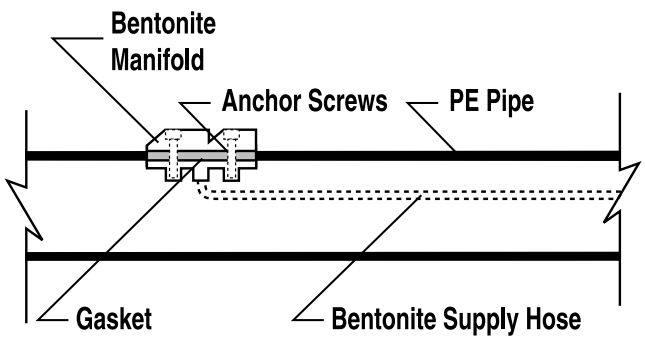


Bentonite Usage and Selection

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 & DELIVERY SYSTEMS SPECIFICATIONS				
Model	**GS225**	**DS225**	**DS500**	**DS225/COMBO**
Length	72"	72"	114"	66"
Width	46"	46"	52"	48"
Height	46"	46"	58"	48"
Weight	850/955 lbs	850/935 lbs	2,150 lbs	1,700 lbs
Bentonite Pump	Hydra Cell	Hydra Cell	FMC	Hydra Cell
Maximum PSI	800	800	1000	800
GPM	3-10	3-10	5-25	0-10
Engine Type	Honda	Hatz	Kubota	Kubota
Engine H.P.	8.0	7.5	23	24.8
Electric Start	Yes	Yes	Yes	Yes
Drive System	V Belt	V Belt	Hydraulic	Hydraulic
Tank Capacity	225 gal.	225 gal.	500 gal.	225 gal.
Number of Tanks	1	1	1	1
Hydraulic Capacity	N/A	N/A	26 gal.	32 gal.
Fuel Capacity	1.4 gal.	1.6 gal.	6 gal.	10 gal.
GPM Display	N/A	N/A	Optional	N/A
Remote Hydraulic	N/A	N/A	N/A	0-10.5 gpm
Hydraulic Pressure				3,625/3770 psi

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.

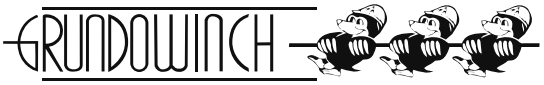
MODEL	RW1500	KW3000	RW5000	RW10	*RW10ATW	*RW20ATW
Engine Type	gas	diesel	diesel	diesel	diesel	diesel
Engine output in Horsepower	5	20	14	35	32	48
Line pull Tonnes Stage 1/2	1.5t	3.3t	5.5t / 2.75t	12t / 6.0t	12t / 6.0t	22.5t / 11.25t
Max. line speed (feet)	16'	160'	92'	95'	95'	56'
Rope diameter (inches)	5/16	10mm	1/2	5/8	5/8	7/8
Useful rope length (feet)	600'	3,280'	2,100'	2,300'	2,300'	2,600'
Single-axle trailer	-	yes	yes	-	-	-
Tandem-axle trailer	-	-	-	yes	-	-
Overrun brake	-	yes	electric	electric	-	-
Parking brake	-	yes	yes	-	-	-
Automatic reversing device	yes	-	yes	yes	yes	-
Towing bar height-adjustable	-	yes	yes	-	-	-
Ball coupling	-	yes	-	-	-	-
Eye coupling	-	-	yes	yes	-	-
Length	40"	135"	158"	181"	107"	132"
Width	34"	63"	65"	82"	67"	76"
Height	31"	49"	51"	58"	63"	84"
Weight	755#	2,645#	3,426#	6,500#	9,000#	15,000#
Line pull pre-select-system	yes	-	yes	yes	yes	yes
Electric start	yes	yes	yes	yes	yes	yes
Light system 12v DC	-	yes	yes	yes	yes	yes

*RW10ATW and the RW20ATW 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



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