TRIC™

User Guide

PULLER MODELS

M50 / M100

LEGAL NOTICE

This document was prepared to assist users of trenchless pipe replacement systems manufactured by TRIC Tools Incorporated (TRIC). Information in this document is subject to change without notice and therefore does not represent any commitment on the part of the manufacturer. The material contained herein is supplied without warranty of any kind. TRIC assumes no responsibility and shall have no liability of any kind arising from the supply or use of this document or the material contained herein. No part of this document may be copied, reproduced, translated, or reduced to any electronic medium or machine-readable form without prior written consent from TRIC Tools Inc.

TRIC trenchless pipe bursting systems are protected by US Patent No. 6,305,880, issued on October 23, 2001, and US Patent No. 6,524,031, issued on February 25, 2003.

All other trademarks are the property of their respective owners.

Congratulations and thank you for purchasing a TRIC pipebursting system. This visual guide provides basic yet comprehensive instructions for safe, effective operation and care of your TRIC equipment. We want to familiarize you with the critical working elements of your TRIC pulling unit and bursting head assembly, and to illustrate the essential best practices with your system. Our goal is not to describe every possible bursting scenario, but rather to create a convenient reference to facilitate more trouble-free operation, and above all to encourage safety on the job.

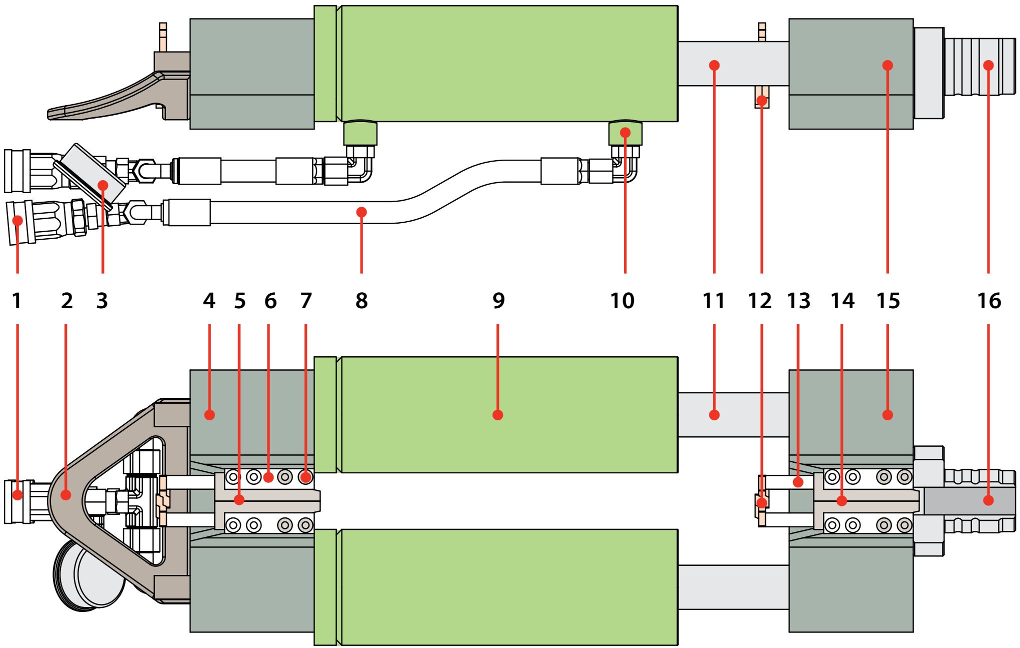

To that intent, please note the warning symbols in this user guide, which indicate two levels of concern. The yellow symbol warns against mechanical failure or undue stress on equipment. The red warning indicates danger of physical injury or death. In some cases both warning symbols will be displayed at once. In any case, please pay close attention to all safety topics covered in this manual. SAFETY FIRST!

We are continually improving our products and actively testing them in the field. We also maintain working relationships with many of our customers, thus their experience is ours. We are happy to share this information, along with the latest updates and tips, at www.trictools.com. Or feel free to call us at 888-883-8742. Welcome to the TRIC Team!

CONTENTS

ILLUSTRATIONS

M50 ASSEMBLY



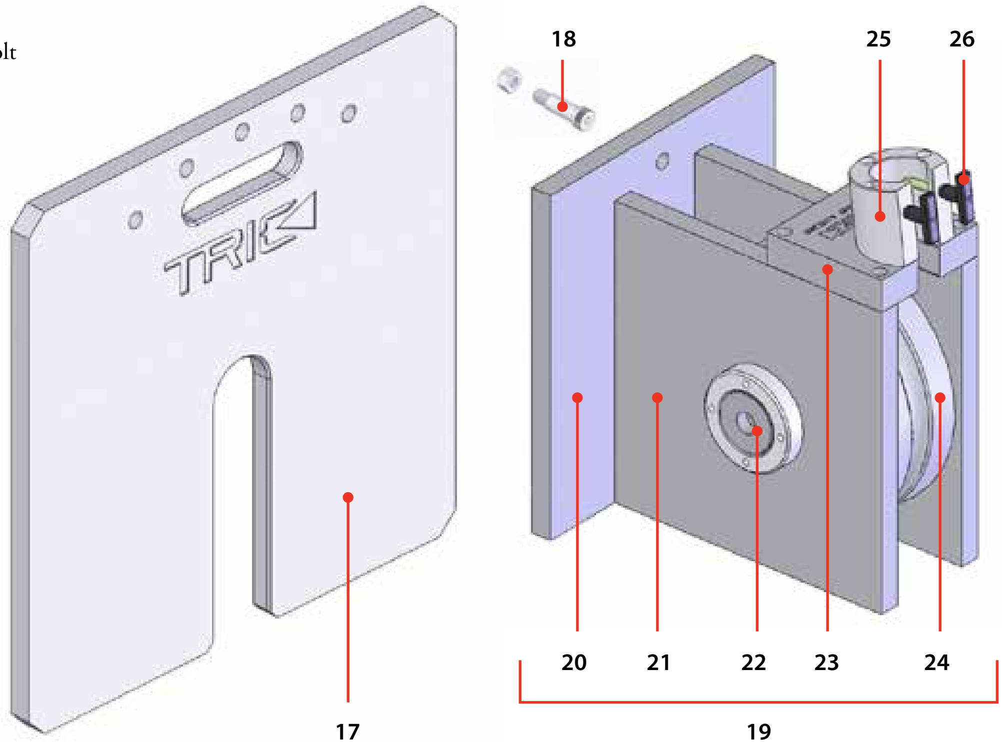
1 Hydraulic Fittings
2 Handle
3 Pressure Gauge
4 Pulling Bridge
5 Grippers (Pulling)
6 Cover Plates
7 Cover Plate Screws
8 Hydraulic Hose
9 Cylinder
10 Cylinder Port
11 Piston Shaft
12 Yokes
13 Yoke Towers
14 Grippers (Retaining)
15 Retaining Bridge
16 Nose

17 Resistance Plate

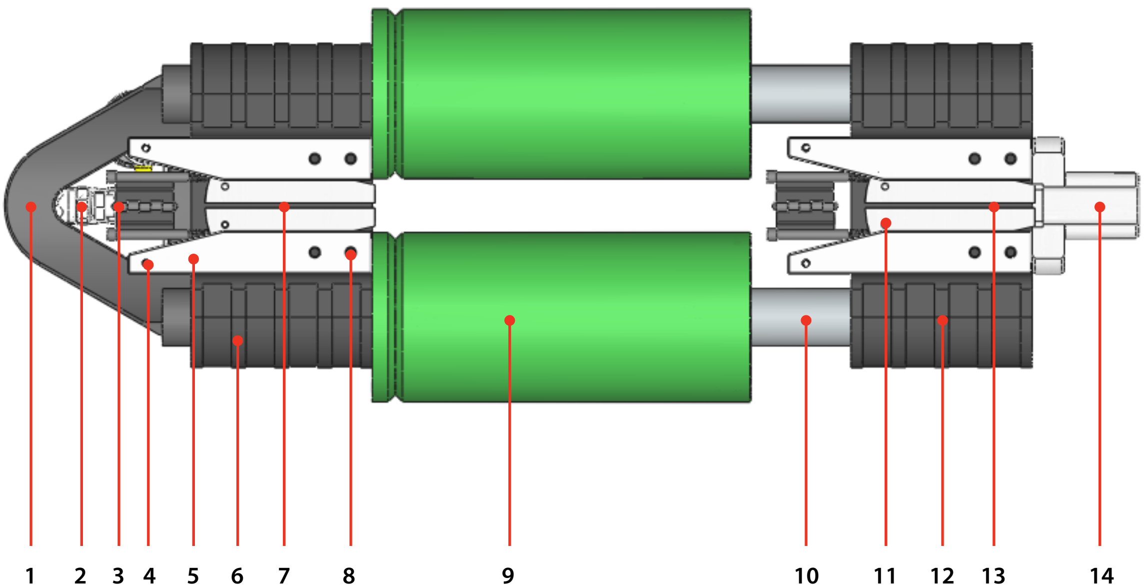
- **18** resistance plate bolt

19 Pulley Base

- **20** front plate
- **21** side plate
- **22** axle
- **23** top plate
- **24** wheel (12")
- **25** annulus
- **26** locking pins



M100 ASSEMBLY



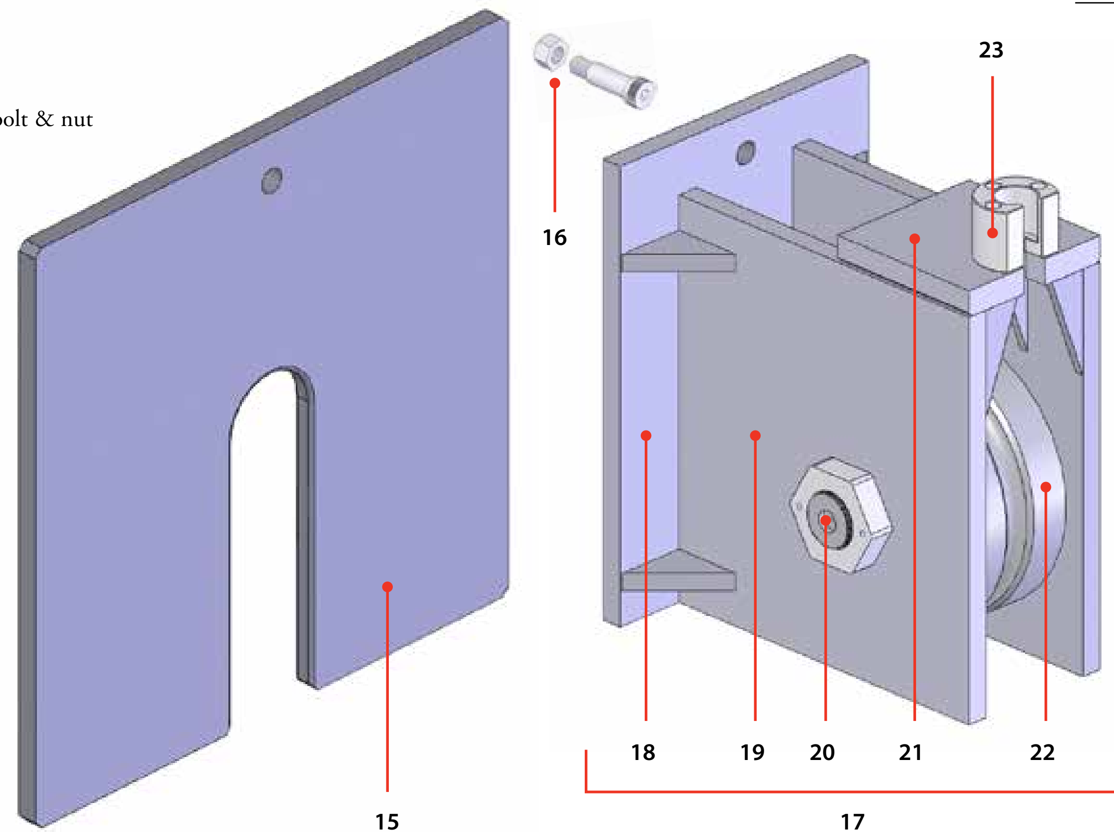
1 Handle
2 Hydraulic Fittings
3 Yoke Assembly
4 Gripper Stop Screws
5 Cover Plates
6 Pulling Bridge
7 Grippers (Pulling)
8 Cover Plate Bolts
9 Cylinder
10 Piston Shaft
11 Gripper O-Ring Screws
12 Retaining Bridge
13 Grippers (Retaining)
14 Nose

15 Resistance Plate

- **16** resistance plate bolt & nut

17 Pulley Base

- **18** front plate
- **19** side plate
- **20** axle
- **21** top plate
- **22** wheel (15”)
- **23** annulus



The heart of every TRIC pipebursting system is a cable-pulling device. Cable, or wire rope, has been essential to the TRIC method since the company introduced trenchless home sewer lateral replacement in America back in 1996. Residential sewers typically have directional changes between the building foundation exit point and the property line or municipal sewer main connection. A cable is the best way to negotiate these bends. By contrast, larger municipal sewer pipes generally maintain a straight flow path, and each change of direction becomes an accessible service point, or manhole. TRIC equipment leverages the unique qualities of steel cable to replace more pipe with less excavation, especially in difficult easements and other hard-to-access areas. This is also true for other underground utilities such as water and gas.

Steel cable is valued for its flexibility, compactness, resiliency, and high strength-to-weight ratio. The standard TRIC configuration employs a wheel that directs cable and pulling force from horizontal (pipe flow path) to vertical. This configuration allows for great power in a relatively small footprint, and also provides easier access to the puller and grippers.

As with all heavy-duty construction equipment, the TRIC system must be used with caution and good planning. The following pages illustrate the safe and effective use of your TRIC M-Series pipebursting system. Please review this information carefully.

NOTE: Your hydraulic power source (i.e., pump or power-pack, PTO device, or excavation equipment) is not covered in this manual. Please refer to original manufacturers for further information.

BURSTING HEAD	PIPE MATERIAL
Standard	1, 2, 3, 4, 5, 6
Impact	1, 2, 3, 4, 7, 8
Swaged Splitter	2, 6, 8, 9
Link-Blade Splitter	2, 6, 7, 8, 9

1 Vitreous Clay
2 Cast Iron
3 Asbestos Concrete
4 Reinforced Concrete
5 Fiber Conduit
6 Plastic
7 Ductile Iron
8 Steel
9 Copper

Figure 1
Bursting Head Selection Table

TRIC M-Series pipebursting units are designed primarily to serve the municipal utilities market. This includes underground sewer, water, and gas lines in a variety of pipe materials ranging from 2" (50mm) to 20" (500mm) in diameter.

TRIC also manufactures a variety of bursting or splitting heads, each specific to the type and size of pipe to be replaced. Please see Figure 1 on the opposite page for a selection of bursting heads to replace different host pipes.

The first step in any pipebursting job is to locate and expose the existing pipe at each end of the service line to be replaced. Drain lines should be recently inspected and located by video, with all depths, bends, transitions, connections, and service points marked on the ground surface. Entry and exit pits are configured differently from one another, and can have vastly different excavation requirements. Figures 2 and 3 on the following pages illustrate entry (launch) and exit (pulling) pit configurations.

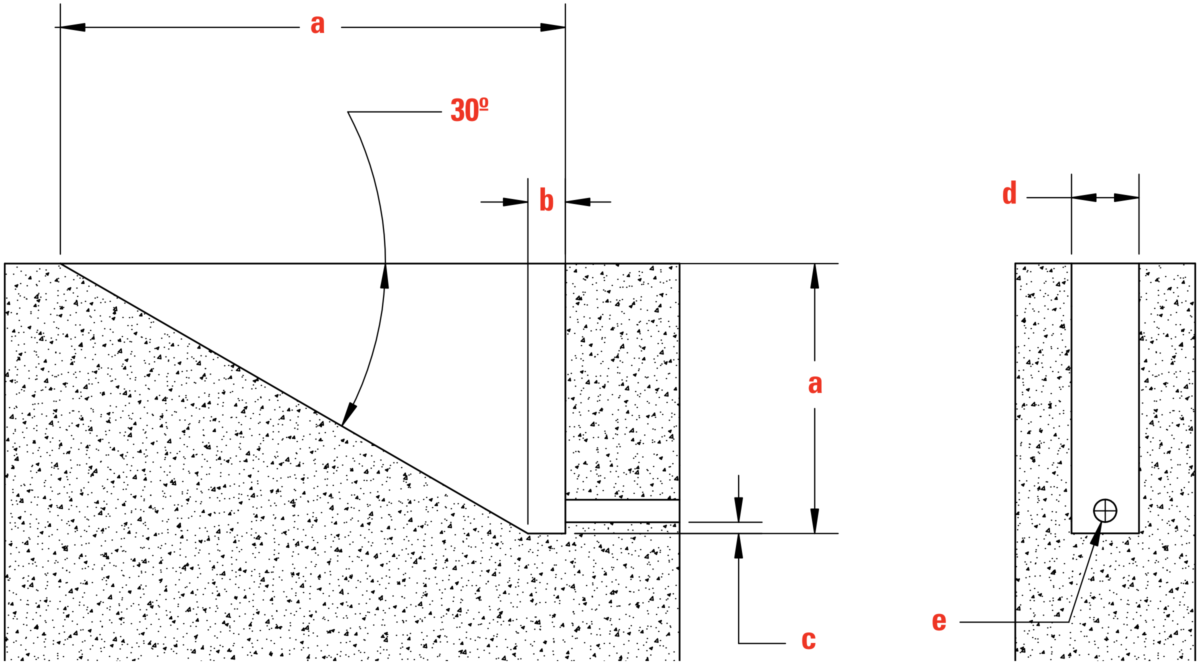


Figure 2
Entry or Launch Pit (Municipal)

a = Variable

b = 2' (60cm)

c = 6"–12" (15–30cm)

d = 36" (90–100cm)

e = 8"–12" pipe (200–300mm)

HDPE pipe is flexible, which is indispensable for pipebursting applications. The combination of pipe diameter and wall thickness (known as SDR or Standard Dimensional Ratio) determines the level of flexibility for each pipe size. A safe formula for the excavation of entry pits for municipal sizes of HDPE pipe is a 30º access angle or ramp down to pipe level. This translates to a surface cut that is roughly twice as long as the pipe is deep. Smaller pipe sizes (150mm and under) have smaller bending radii. Figure 2 on the facing page illustrates a typical municipal entry scenario.

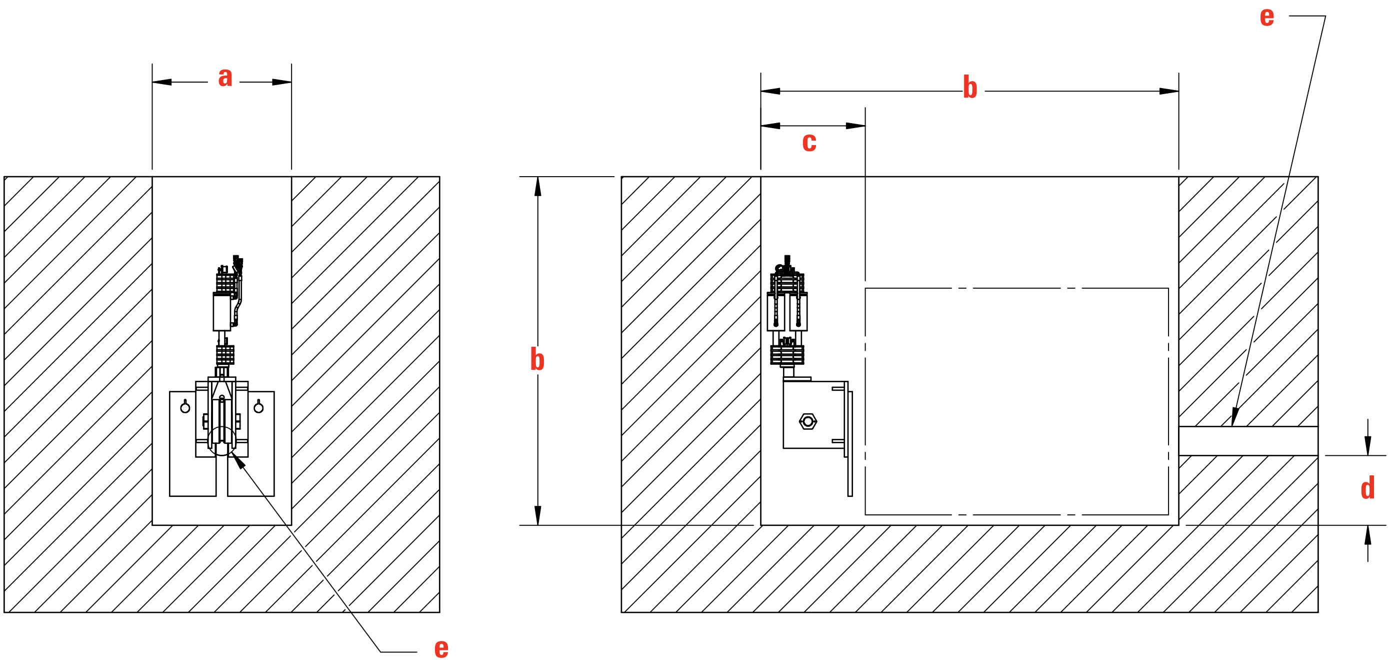


Figure 3
Exit, Receiving, or Pulling Pit (Municipal)

a = 48” minimum (120cm)

b = Variable

c = 36” minimum (90–100cm)

d = 18”–24” (45cm–60cm)

e = 8”–12” pipe (200–300mm)

Municipal pipelines (especially drains and sewers) generally require larger entry and exit pits due to their size and depth. When using the M-Series units (especially the M100), a trench-box is indispensable for stabilizing the pulling assembly, and for extracting the bursting head at the end of the pull. Figure 3 on the opposite page illustrates setup behind a trench box. Figures 7 and 8 on pages 20 and 21 show typical field applications of the M50 and M100 in conjunction with manhole boxes or heavy-duty trench boxes.

Figure 4
Inserting cable to upper grippers

Figure 5
Pulling cable slack to help insert cable to lower grippers

Figure 6
M100 gripper engagement

The M100 (shown here) is typically equipped with either 1-1/8" (28mm) or 1-1/4" (32mm) compact swaged wire rope. These cable sizes are much heavier than those used with TRIC lateral systems. When loading the cable into the M100, it is sometimes helpful to engage the top (pulling) grippers first, and then extend the puller to draw slack out of the cable and bring it into the lower or retaining grippers (Figures 4 and 5 on page 18). Also, the M100 may have gripper stop-screws at the top of the cover plates. In Figure 6 at left, red arrows indicate holes for stop-screws (5/32" or 4mm allen-type), which must be loosened or removed to allow full opening of grippers to insert cable. When the cable is fully engaged, attach gripper O-rings to bolts on cover plates and grippers (yellow arrows), to keep grippers engaged to the cable.

Figure 7
M50 with manhole box

Figure 8
M100 with trench box

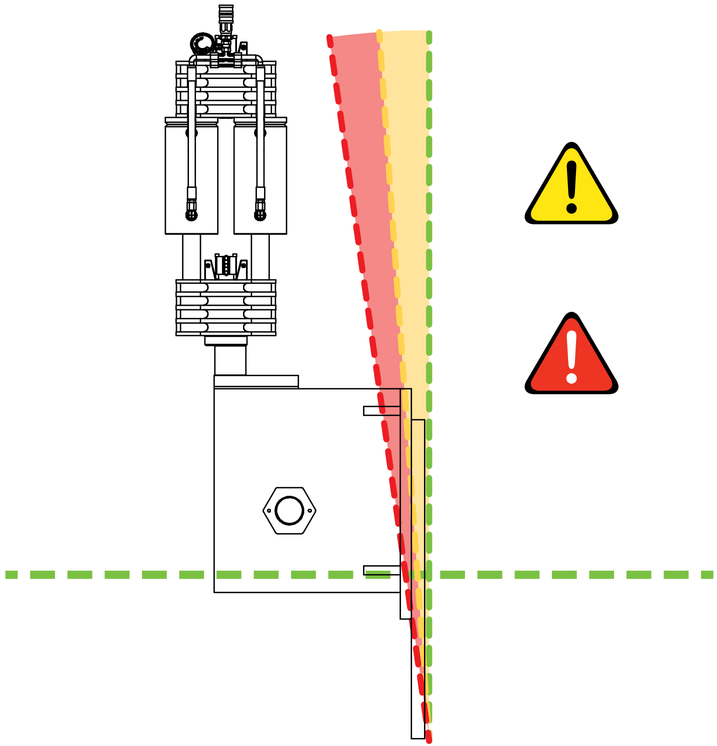


Figure 9: Pulling unit reclining

TRIC M-Series pullers are extremely powerful. Consequently, they must be closely monitored during operation. Keep a working pressure gauge on the puller at all times. Stop if the pulling assembly begins to lean or shift significantly in any direction. Then release cable tension and reset the unit. Figure 9 on the opposite page illustrates the acceptable amount of backward tilt in the pulling unit while under load. Generally, the harder the pull, the more critical it is that the puller remain perpendicular to the pipe line. A safe limit of backward or forward tilt under average conditions (within 50% of pulling capacity) might be 8º. As the pull gets harder, even 3º or 4º of backward tilt approaches the critical danger zone, where both equipment and workers are at risk. Unstable earth or insufficient bracing in the pulling pit can also cause the pulling assembly to shift laterally out of alignment with the pipe path. In this case the cable may cut outside the pipe path or into the resistance plate (see Figure 12 on page 24). In extreme situations the wheelbase can be destroyed, causing a dangerous reaction. In all cases, know your cable strength relative to your puller's capacity and hydraulic power source. See Figures 14 and 15 on pages 26 and 27 to determine safe loads for your particular cables and pulling equipment.

Cable tension achieved during pipe bursting can be deadly. Figure 10 below illustrates the typical zone of reaction in the event of a cable or cribbing failure, or other sudden movement of the pulling assembly. Stay out of the pulling pit when the unit is under load! Completely release cable tension before entering the pulling pit to adjust the pulling assembly.

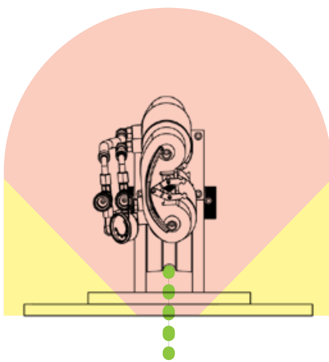


Figure 10
Critical reaction zone

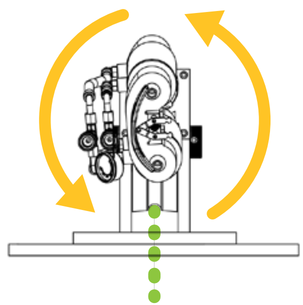


Figure 11
Rotation of puller on wheel base

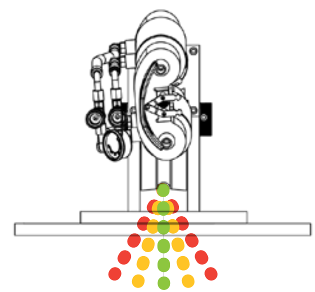


Figure 12
Cable direction / pulling path

TRIC pipebursting units have few moving parts, and all are interdependent. As parts are exchanged or become worn, the cable path may also change, causing erratic operation. The cable path is the line from the center of the pulling grippers to the groove of the pulley wheel. As

Figure 13
Cable out of alignment with retaining (lower) grippers

the unit pulls and the cable is under load, the cable must also be aligned, or centered, with the lower retaining grippers (which should be free, or open, as the unit pulls).

If the puller is not retaining tension—that is, if the retaining grippers fail to engage the cable as the puller retracts—then certain parts may be worn, damaged, or mismatched. These parts include the wheel and/or axle, the nose on the puller, the annulus (wheel socket), or any combination of the above. In Figure 13 at left, the cable is pulling out of line with the retaining grippers. When this happens, release all cable tension and then rotate or spin the puller in the wheel socket to change the cable alignment (see Figure 11 on page 24). This should work in all but the most extreme cases. Check all pulling unit components at your earliest opportunity.

PISTON DIAMETER AND TOTAL SURFACE AREA

Area x PSI	1000	2000	3000	4000	5000	6000	7000	8000
1.625" pair 4.15 sq. in.	2.07	4.15	6.22	8.3	10.37	12.44	14.52	16.6
1.75" pair 4.81 sq. in.	2.4	4.81	7.21	9.62	12.03	14.43	16.84	19.24
2.0" pair 6.28 sq. in.	3.14	6.28	9.42	12.56	15.7	18.84	21.98	25.12
2.5" pair 9.82 sq. in.	4.91	9.82	14.73	19.64	24.55	29.46	34.37	39.28
2.75" pair 11.88 sq. in.	5.94	11.88	17.82	23.76	29.7	35.64	41.58	47.52
3.0" pair 14.14 sq. in.	7.07	14.14	21.21	28.28	35.35	42.42	49.49	56.56
3.5" pair 19.24 sq. in.	9.62	19.24	28.86	38.48	48.1	57.72	67.34	76.96
4.0" pair 25.13 sq. in.	12.57	25.13	37.7	50.26	62.83	75.39	87.96	100.56
4.5" pair 31.81 sq. in.	15.91	31.81	47.72	63.62	79.53	95.43	113.34	127.28
5.0" pair 39.27 sq. in.	19.64	39.27	58.91	78.54	98.2	117.81	137.45	157.12

PULLING FORCE (US TONS)

MODEL (CYLINDER): X20 (1.625"/43mm), C20 (1.75"/45mm), C25 (2.0"/50mm), X30 (2.5"/64mm), X50 (2.75"/70mm), M50/V24 (3.5"/89mm), M100 (5.0"/127mm)

Figure 14
Hydraulic Pulling Force Table

STANDARD SWAGED WIRE ROPE (6 x 26 RRL IWRC)					
DIAMETER		WEIGHT		TEST STRENGTH (TONS)*	
inches	mm	lbs/ft	kg/M	US	metric
1/2	12	N/A	N/A	N/A	N/A
9/16	14	0.68	1.01	19.3	17.5
5/8	16	0.85	1.27	23.9	21.7
3/4	19	1.25	1.87	34.5	31.3
7/8	22	1.66	2.47	47.0	42.6
1	25	2.15	3.21	61.5	55.8
1 1/8	28	2.80	4.17	75.0	68.0
1 1/4	32	3.46	5.15	90.0	81.6
1 3/8	35	4.20	6.23	110	99.8

COMPACT SWAGED WIRE ROPE (6 x 25 RRL IWRC)					
DIAMETER		WEIGHT		TEST STRENGTH (TONS)*	
inches	mm	lbs/ft	kg/M	US	metric
1/2	12	0.63	0.94	18.6	16.9
9/16	14	0.78	1.15	23.7	21.5
5/8	16	1.01	1.50	28.5	25.8
3/4	19	1.41	2.10	42.2	38.3
7/8	22	1.91	2.85	56.0	50.8
1	25	2.53	3.77	73.7	66.9
1 1/8	28	2.97	4.43	92.9	84.3
1 1/4	32	N/A	N/A	N/A	N/A
1 3/8	35	N/A	N/A	N/A	N/A

**Listed for comparison only. Field applications vary. Putting a wire rope under load around a radius (wheel or pulley) degrades factory strength ratings. Actual breaking point may be reduced by 20% or more when pipebursting. Use extreme caution and always have a working pressure gauge on pulling equipment.*

Figure 15
Swaged Wire Rope Specifications

SWAGED STEEL SPLITTING HEAD

*Major components of the TRIC swaged steel splitting head: (**a**) HDPE cap, (**b**) pipe linkage, (**c**) expander head, (**d**) splitter blade, (**e**) swage termination, and (**f**) cable.*

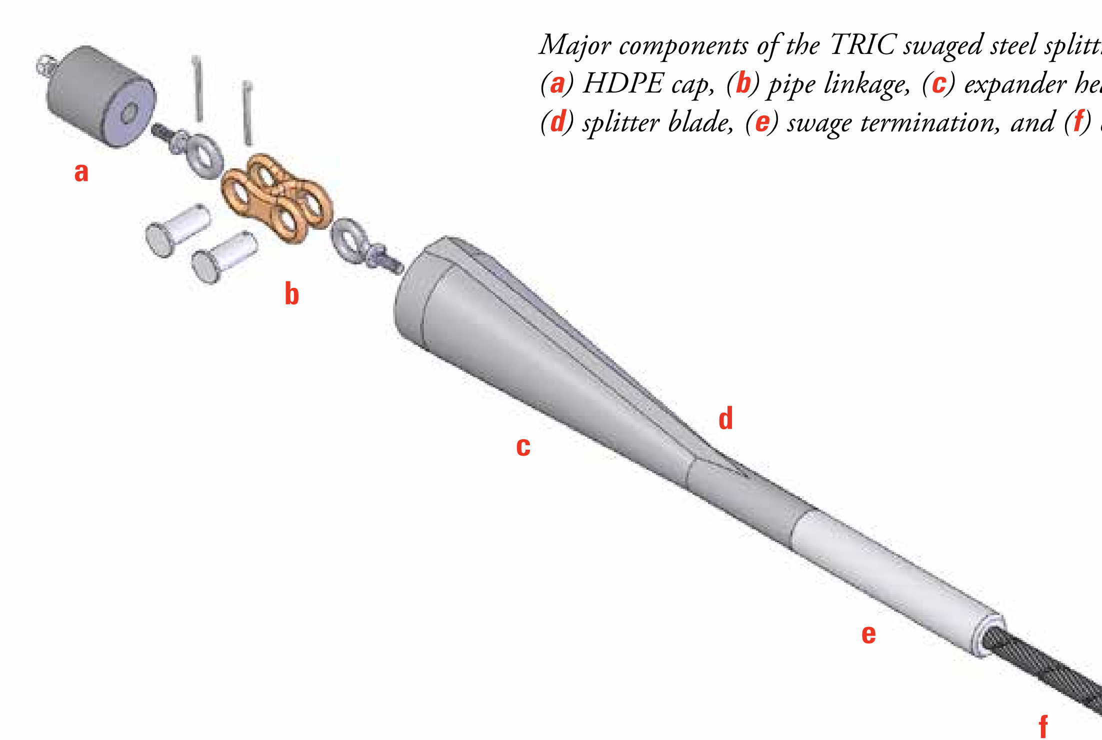


Figure 16

Major components of the TRIC link-blade steel & ductile iron splitter:
*(**a**) bursting head assembly, (**b**) rear linkage, (**c**) link-blade,*
*(**d**) front linkage, (**e**) threaded cable stud*

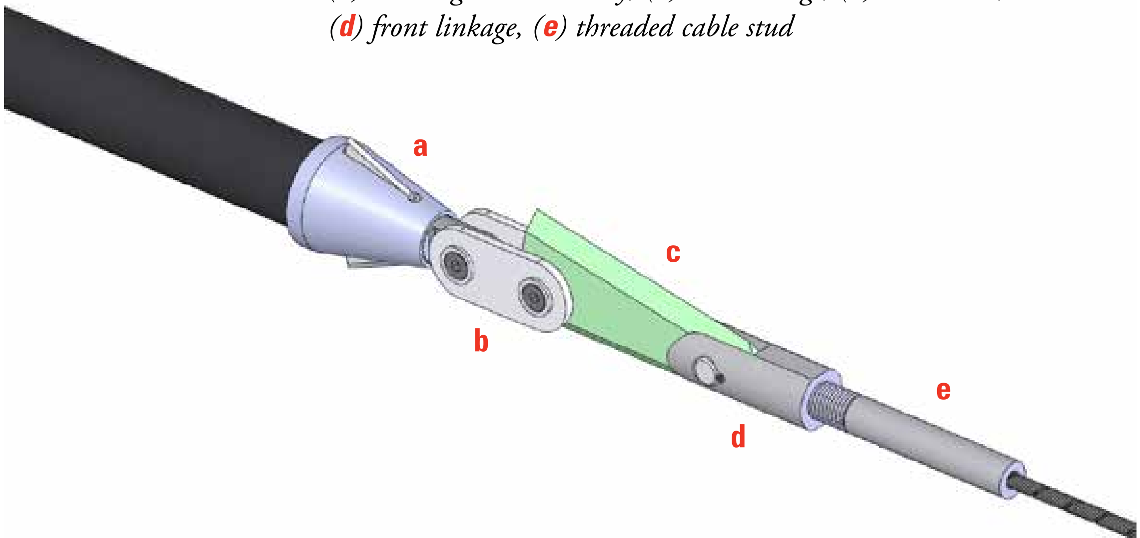
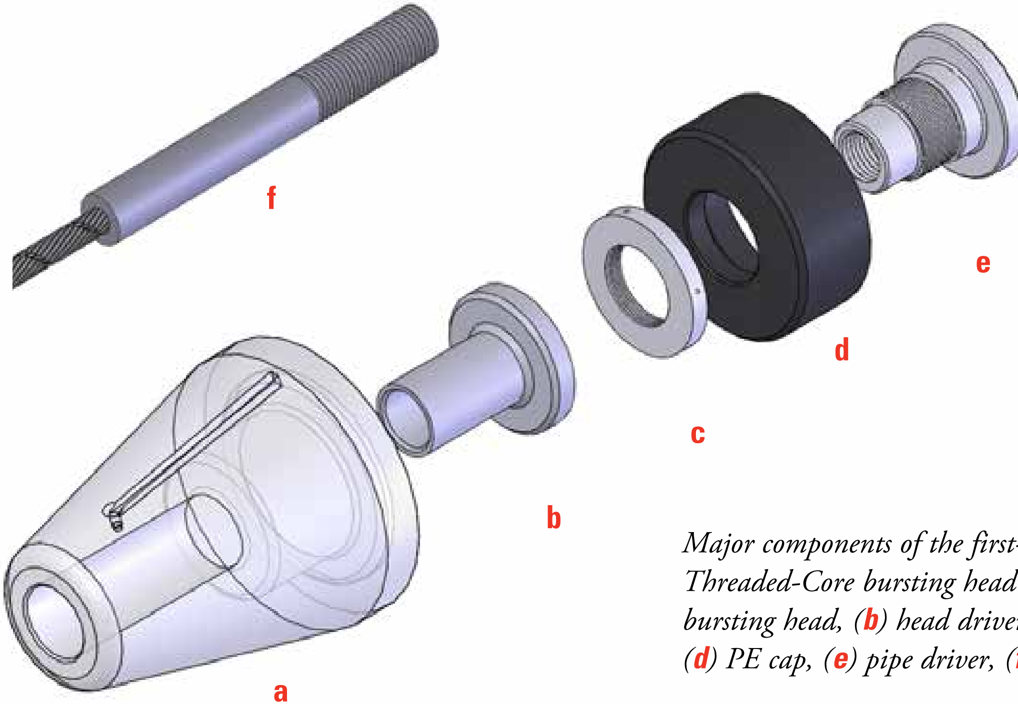


Figure 17

THREADED CORE BURSTING HEAD (first generation)



*Major components of the first-generation TRIC Threaded-Core bursting head assembly: (**a**) mole or bursting head, (**b**) head driver, (**c**) retaining collar, (**d**) PE cap, (**e**) pipe driver, (**f**) cable stud*

Figure 18

Before fusing HDPE cap (**d**) to pipe, secure pipe driver (**e**) to PE cap with retaining collar (**c**). If necessary, fuse a short segment of pipe onto the PE cap before inserting driver to PE cap. Do not tighten retaining collar against PE cap. Leave loose instead, to allow rotation of pipe driver (**e**) onto cable stud (**f**). First slide cable stud through nose of bursting head (**a**). Then thread head driver (**b**) completely onto cable stud termination (**f**) as shown (exposing approximately 75mm of thread behind head driver). Then thread pipe driver (**e**) completely onto threaded stud (**f**) until contact is made with head driver. Keep stud threads clean and protected, and apply anti-seize grease before each assembly. Use pipe wrenches as required to secure the cable stud and rotate drivers.

THREADED CORE BURSTING HEAD (second generation)

PARTS

a) cable stud termination

b) bursting head or mole

c) driver collar

d) HDPE cap

e) HDPE pipe segment

f) driver core

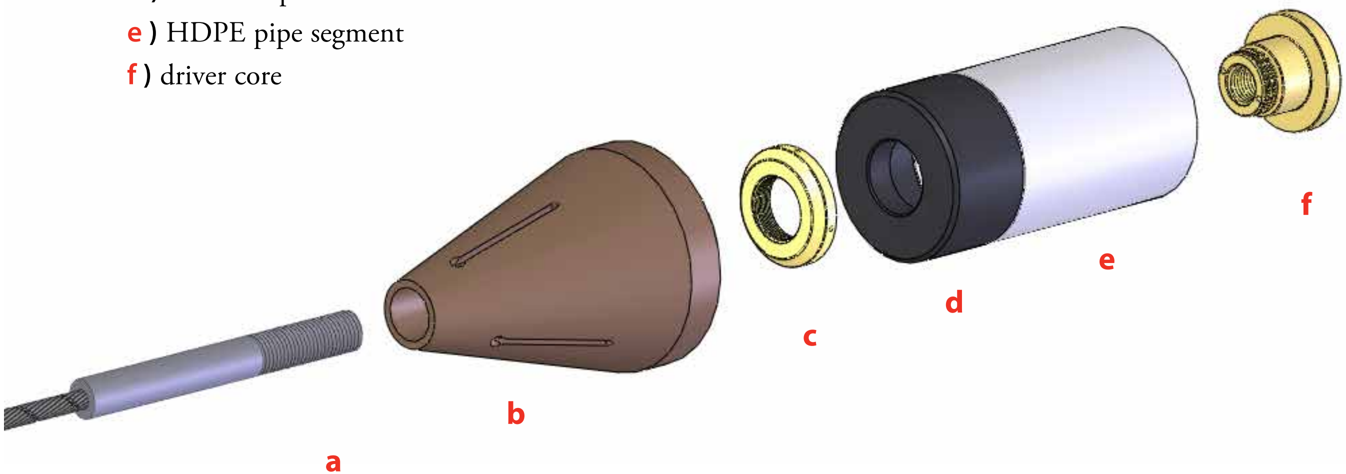
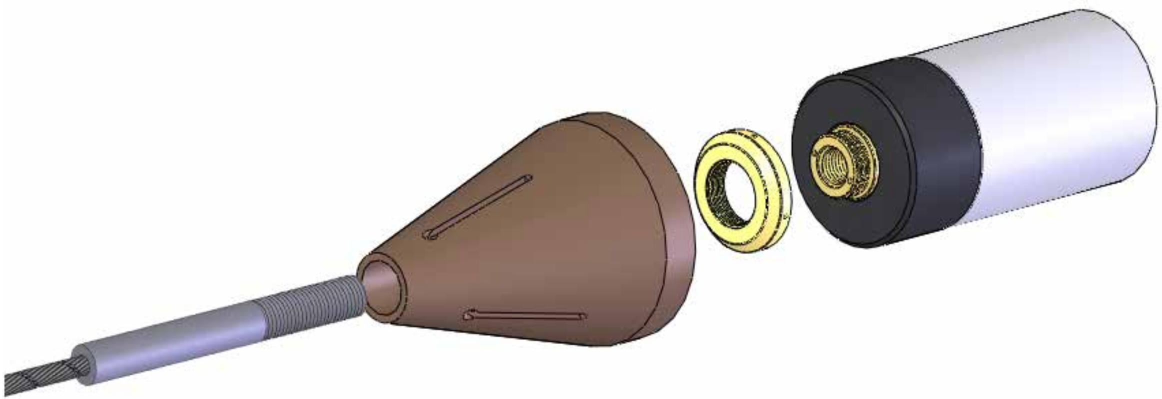


Figure 19

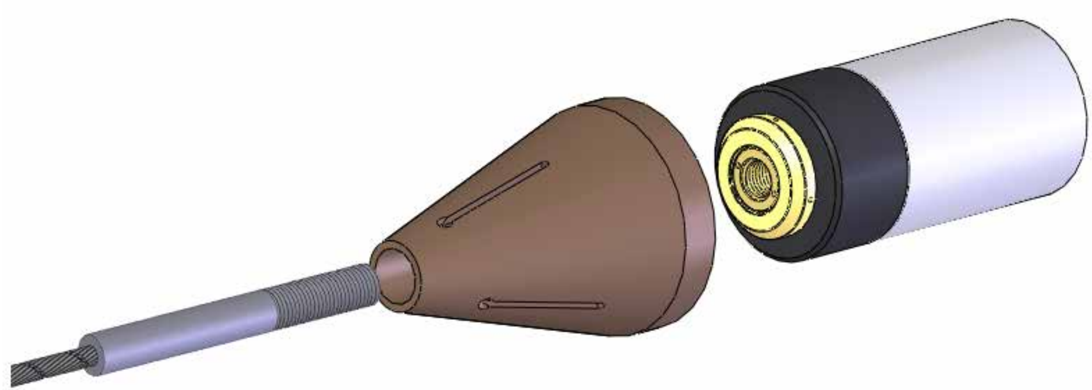
STEP 1

Before assembly, test cable stud (**a**) with driver core (**f**), and make sure that threads mate easily. Then, if necessary, fuse a short segment of pipe (**e**) onto PE cap (**d**) before inserting driver to PE cap. (This will allow enough room to trim and heat the PE cap and driver in the fusion machine.)



STEP 2

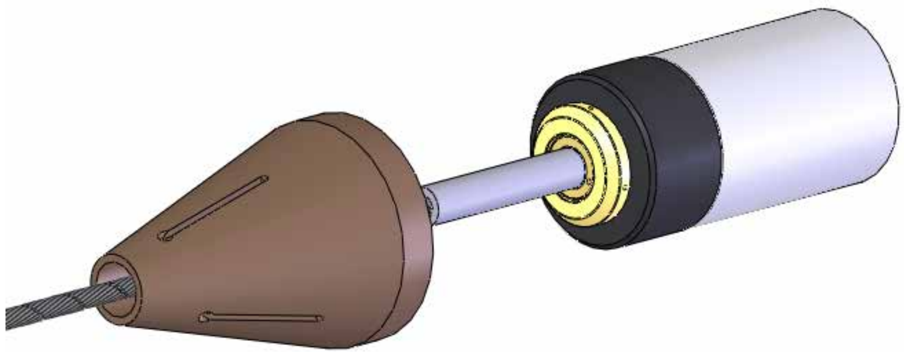
Apply anti-seize grease to driver collar threads. Attach driver collar to driver core and turn counterclockwise until collar stops against core. Driver assembly should rotate freely inside PE cap. Use spanner to secure core while turning collar with Phillips head screw driver (see photo on opposite page). Pipe can now be fused to the PE cap/core assembly.



STEP 3

Apply anti-seize grease to the cable stud threads. Pass the cable stud through bursting head as shown, and into the driver core assembly. Hold the cable stud with a pipe wrench, and thread the driver assembly onto the cable stud as far as possible using the spanner.

***NOTE:** Another option is to pass the cable stud through the core collar and PE cap & pipe segment, and then thread the core completely onto the cable stud from behind the PE cap & pipe segment before fusing the rest of the pipe onto the head driver assembly. You may either thread the stud through the nose of the bursting head first (as shown here), or—if pipe fusion takes place far from the launch pit—you may also thread the other end of the cable through the back of the bursting head at the launch or entry pit.*



STEP 4

TRIC 8”, 10”, and 12” static head assemblies are designed to slide freely forward on the cable, and may do so upon entering the launch pit. Monitor the new pipe and core assembly as they join the bursting head upon entry, and make sure that the cable stud and core assembly dock cleanly with the bursting head. (See photo series below.) Otherwise, it is possible to damage the threaded stud cable end.

STANDARD BURSTING HEAD (First Generation with PE Cap)

Major components of the TRIC standard bursting head assembly:
*(**a**) mole, (**b**) pulling core, (**c**) PE cap, (**d**) core washer, (**e**) core bolt*

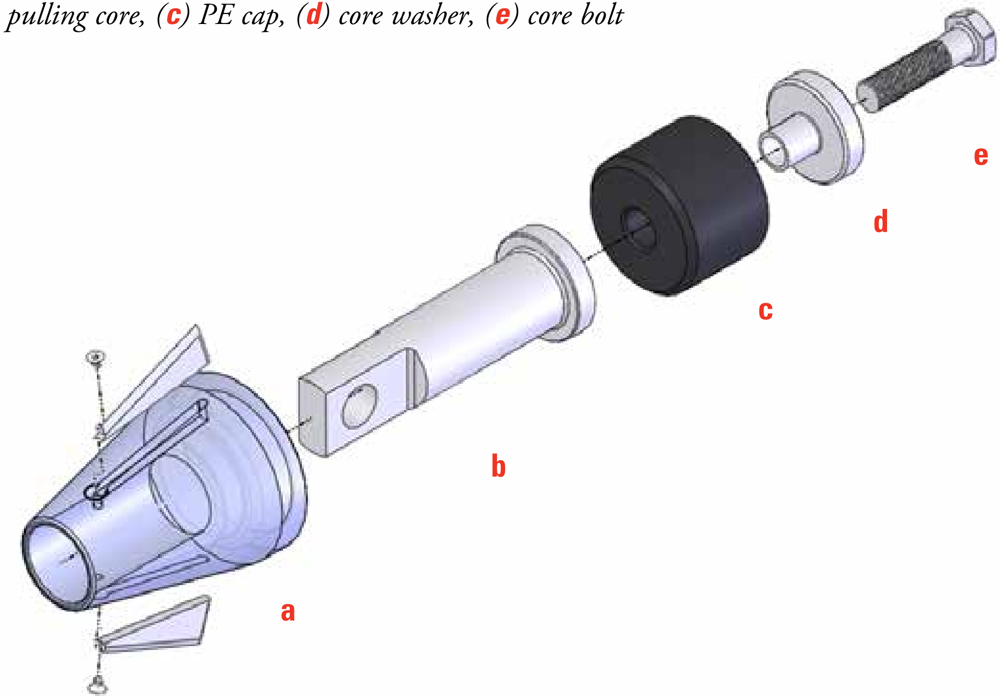


Figure 20

TRIC standard bursting heads are lighter than their TRIC-Lock counterparts, and are slightly better configured to negotiate difficult entry angles and bends in the pipe path.

TRIC-Lock heads, on the other hand, do not require fusing to the pipe, which eliminates the need for PE caps. This is a significant savings, as well as a great convenience on the job.

Warning: *Longer pipebursting jobs can result in significant pipe and cable stretch, especially when upsizing and/or under adverse ground conditions. When using a TRIC-Lock head, if cable tension must be released during the pull for any reason, there is a possibility that the new HDPE pipe will pull away from the head gripper assembly. A properly fused standard PE-cap head assembly eliminates this possibility.*

*Major components of the TRIC-Lock bursting head: Mole (**a**), grip assembly (**b**), expander cone (**c**), and pulling core (**d**). Small parts include blade(s) and grip assembly O-rings. Shown here is the 6-inch model.*

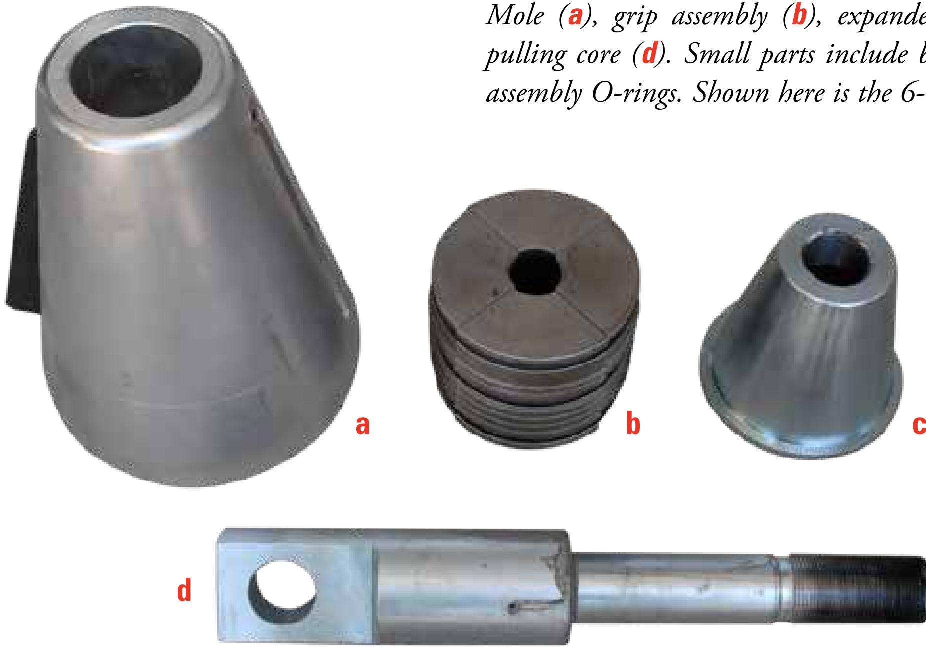
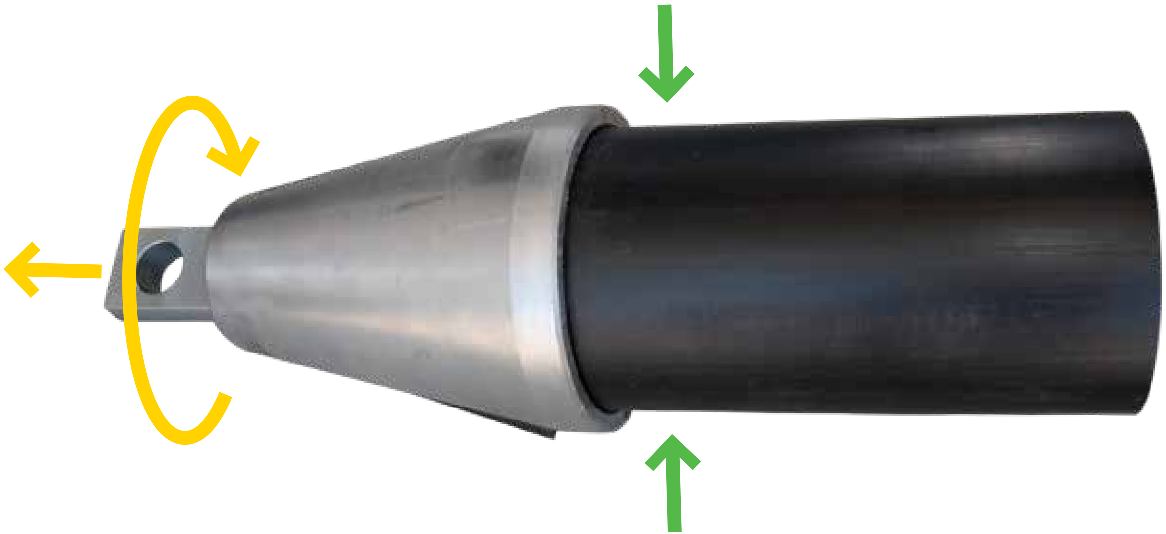


Figure 21

Unit loosely assembled, ready to attach to pipe. TRIC-Lock heads are designed to fit IPS SDR17 HDPE pipe, but may also fit slight dimensional variations (such as metric equivalents). If you must pull a different gauge pipe (such as SDR11) it may be necessary to fuse a short piece of SDR17 onto the end of the heavier gauge pipe.



Attaching the TRIC-Lock head to SDR17 HDPE pipe (see facing page)

TRIC-LOCK ATTACHMENT

Cut a clean, straight edge on the end of the pipe to be attached. You can also trim the pipe end in a fusion machine, and then use the fusion jig to secure the pipe while attaching the head assembly. Keep the head aligned with the pipe and pushed all the way onto the pipe end. Then hold the head against the pipe while pulling on the core to begin expanding the internal gripper unit (this is easier with two people). Turn the pulling core COUNTERCLOCKWISE until the expander contacts the inner wall of the pipe and the unit becomes hand-tight (yellow arrows). Then use a crowbar or similar device in the pulling eye to tighten the core until the pipe begins to visibly swell immediately behind the mole (green arrows). At this point the mole should not spin or slide forward off the pipe end. If it does, continue tightening until the mole will not detach, indicating that the pipe end is properly compressed between the mole skirt and expanding gripper pack.

Please refer to www.trictools.com/support/ for further information.

RELEASING CABLE TENSION (DETENSIONING)

A fundamental technique in the use of all TRIC pipebursting equipment is detensioning, or releasing cable tension to free the pulling unit. Each TRIC cable puller has two gripper assemblies. Pulling grippers engage the cable and pull it as the cylinders extend. Retaining grippers hold cable tension as the cylinders retract, allowing the pulling grippers to release the cable and reposition for another cycle. It is important to monitor pulling force at all times (a pressure gauge is essential), and to anticipate the effects of hydraulic pressures and cable tension, so as to allow an "escape" from dangerously high tension or adverse movement of the pulling assembly. In precarious situations under high load, use a gaff to manipulate grippers remotely (see page 51).

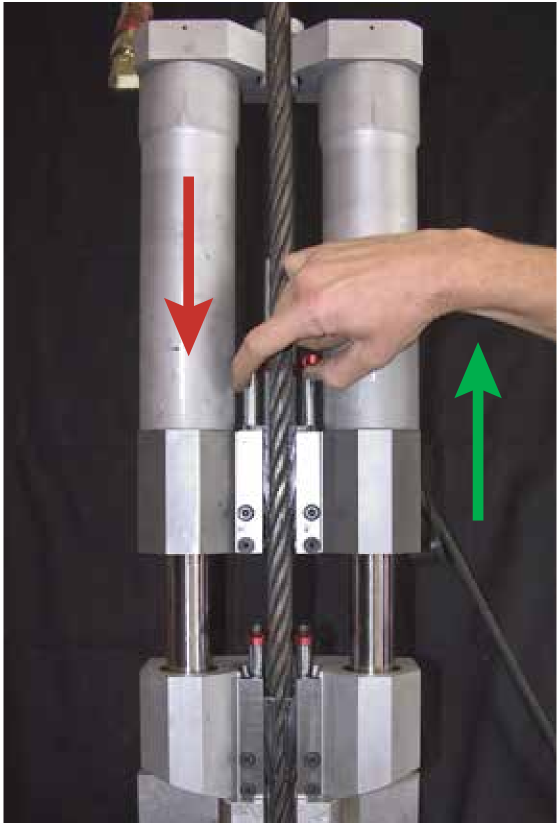
DO NOT enter a pit with a TRIC puller that is unstable and under load. Stop and release tension, then investigate. Adjust the pulling assembly as necessary before proceeding further. Read sections regarding proper setup and cable load capacities.

In the following illustrations, **RED ARROWS** (on cylinders) indicate cylinder direction, and **GREEN ARROWS** (by hands) indicate gripper action or hand movement.

PLEASE NOTE: The TRIC puller shown in this section is our discontinued Model C25. However, the procedure of detensioning is the same for all TRIC pullers. Please see pages 6 through 9 for an illustration of parts specific to M-Series pullers.

STEP 1:
Remove gripper O-rings

Remove gripper tension O-rings before inserting or removing the cable from the puller. This allows for easy manipulation of the grippers. If the puller is near full extension when your pipe bursting is finished, proceed to Step 4. If the puller is more retracted (as shown), proceed to Step 2.



STEP 2:
Free pulling grippers

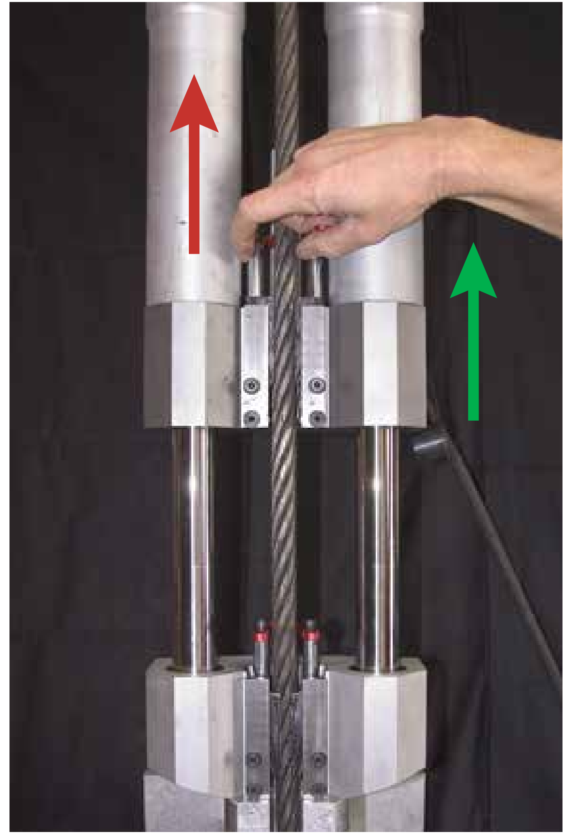
Retract cylinders to free pulling grippers. If puller is already retracted, raise cylinders enough to allow roughly a half-stroke downward (4” or 100mm). Then close retaining grippers fully onto cable before lowering unit to free pulling grippers.

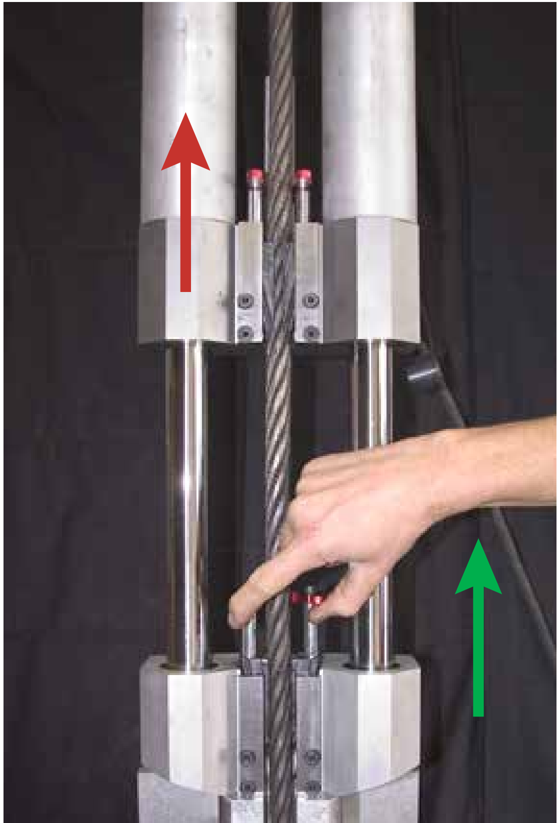
WARNING: Avoid hitting or prying yoke assemblies to move or free grippers.

WARNING: If puller is under load and is unstable or in a confined area, use a gaff to release tension remotely before entering pit with equipment *(see page 51 for illustration).*

STEP 3:
Extend puller without engaging cable

Hold pulling grippers open and away from the cable, then raise the cylinders to nearly full extension (leaving some piston travel remaining). Then, close pulling grippers onto the cable.



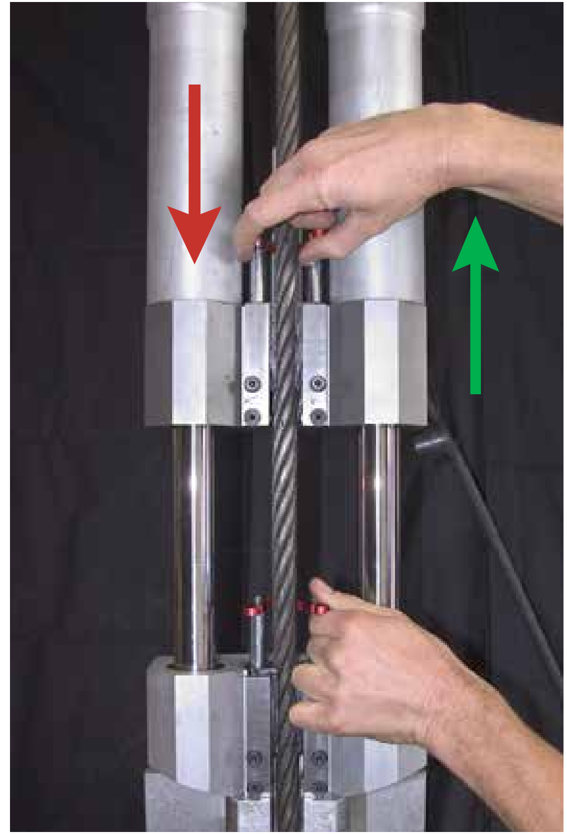


STEP 4:
Free retaining grippers

Using remaining piston travel, extend ram while pulling retaining grippers up and away from cable. If retaining grippers do not release, repeat steps 2 and 3, and allow more upward piston travel to free retaining grippers.

STEP 5:
Free pulling and retaining grippers

Keep the retaining grippers open and away from the cable, and pull up on the pulling grippers while lowering or retracting the cylinders. With the retaining grippers open, the puller will “feed back” cable tension until both grippers are free. (On some occasions, cable stretch is such that Steps 2 through 5 must be repeated.)



STEP 6:
Remove cable from puller

Remove pulling cable completely from both upper and lower grippers. Before shutting down or disconnecting your hydraulic power source, retract the puller to protect piston rods. (Scuffing or denting the chrome rods will cause hydraulic seals to leak.) Close the puller almost to full stop, but not fully closed, as this can leave fluid pressure trapped in the puller or hoses, making it difficult to attach hoses again.

Remote Detensioning

To release cable tension remotely, use a gaff, or even a crowbar if nothing else is available on the job site. The gaff shown on this page is assembled from elements easily found around the home or at the local hardware store: an old broom-stick, 60cm of insulated 2–3mm cable, two 30mm hose-clamps, and a ceiling hook. Use the hook-end to remove tension O-rings, and use the loop-end to manipulate gripper yoke assemblies.

ANSI: American National Standards Institute (www.ansi.org)

ASTM: American Society for Testing and Materials (www.astm.org)

Bending Radius: Regarding HDPE pipe, the smallest radius bend that the pipe can sustain before folding or deforming.

Bridge, Pulling: The part of a cable puller that spans the center point between hydraulic cylinders, and which houses the pulling grippers.

Bridge, Retaining: The part of a cable puller that spans the center point between hydraulic cylinders, and which houses the retaining grippers.

Burst: (Noun) Pipebursting job.

Cage, Extraction: Metal frame built to extend the puller away from the resistance wall in the receiving pit.

Chuck: See Gripper.

Cleanout: Point of access on a sewer line, to facilitate inspection and cleaning.

Collet: Segmented band or sleeve with flanged or conical exterior designed to tighten against a cable or shaft.

Cover Plate: Removable steel plate that retains the gripper assembly in the pulling/retaining bridge.

Cribbing: Blocking and other support materials, including wood timbers, I-beams, and other structural steel, used to position and stabilize the pulling unit in the receiving pit.

D to d Ratio: The relationship between the diameter of a wire rope (d) as it is bent around the diameter of a drum or wheel (D) is expressed as a (D/d) ratio.

GPM: Gallons Per Minute, in reference to hydraulic fluid transfer systems.

Gripper: Metal wedge with concave, ribbed mating surface sized for a specific cable diameter. TRIC grippers come in matched pairs.

Gripper Assembly: Grippers (left and right), yoke towers, and yoke arms with connecting hardware.

Gripper Pair: Two matching grippers (one left and one right), also one complete gripper assembly.

Gripper Set: Two complete gripper pairs (one pulling and one retaining) for a specific cable size and pulling unit.

Head Assembly, Bursting: Complete pipebursting unit to connect with cable and replacement pipe, designed to replace breakable pipe materials.

Head Assembly, Splitting: Complete pipe-splitting unit to connect with cable and replacement pipe, designed to replace malleable pipe materials.

Hydraulic Flow Rate: The rate of fluid movement through a hydraulic fluid transfer system.

Hydraulic Pressure: A measurement of the force that is applied to a contained liquid, transmitting equally in every direction to all parts of the containment system (i.e., pump, hoses, cylinders).

Jaw(s): See Gripper.

LPM: Liters Per Minute, in reference to hydraulic fluid transfer systems.

Mole: The steel cone portion of the bursting head assembly.

Pipe Path: The exact underground route taken by a pipe system from point A to point B, including grade and physical bends.

Pipe, ABS: Acrylonitrile Butadiene Styrene pipe, used in most plumbing applications, both inside and outside building foundations. Pre-formed ABS joints and couplings can be solvent-welded (glued) together.

Pipe, AC: Asbestos Cement pipe, used extensively in America since the 1950s for water supply lines as well as sewers. Controlled as a hazardous substance. Manufactured in straight (no-hub) segments as well as bell-and-spigot segments.

Pipe, CI: Cast Iron pipe, used for water, gas, and sewer applications. Available in straight (no-hub) segments as well as bell-and-spigot segments.

Pipe, Concrete: Precast segments used for both storm and sanitary sewer systems. Smaller diameters (4” to 36” or 100mm to 900mm) available non-reinforced, and larger diameters (12” to 144” or 300mm to 3600mm) available steel reinforced.

Pipe, DI: Ductile Iron pipe, used for water, gas, and sewer applications. Available in straight (no-hub) segments as well as bell-and-spigot segments. Extra durable for use in areas where pipeline is exposed or under heavily traveled roads and railways, etc.

Pipe, Fiber Conduit: Also known as Orangeburg, after the Fiber Conduit Company in Orangeburg, New York, which produced the pipe for most of the 20th century. Used for electrical conduit, and subsequently sewers and drains. Made of wood pulp sealed with hot pitch. Relatively short service life, although some fiber conduit sewer lines are still in use after four or five decades.

Pipe, HDPE: High Density Polyethylene pipe is used for all major underground utilities. Extremely durable and flexible, HDPE pipe is supplied in 40-foot lengths for most sizes, and also on rolls for sizes up to 4" (100 mm) diameter. HDPE pipe segments are heat-welded together with a process called "butt-fusion," which when properly executed produces a joint at least as strong as the pipe itself. Pre-fabricated HDPE fittings can be fused to the pipe, producing a homogenous, pressure-rated piping system. Special HDPE couplings with internal heating elements, called "electrofusion couplings," are also used to join sections of HDPE pipe. Other fusible connection methods are saddle fusion and socket fusion, by which smaller diameter pipe segments are heat-welded to larger diameter pipe.

Pipe, Host: Refers to the existing (old) pipe to be replaced or rehabilitated via pipebursting, slip-lining, or CIP lining. The "host" pipe provides a conduit for the pipe replacement method.

Pipe, Orangeburg: See Pipe, Fiber Conduit.

Pipe, PVC: Polyvinyl Chloride pipe is used in multiple utility applications, including sewer, water, gas, and electrical conduit. PVC bell joints and couplings can be solvent-welded (glued) together. PVC pressure bell joints and couplings (employing O-ring seals) require no glue or bands. Fusible PVC (C-900, C-905, FPVC) is available for various underground utilities.

Pipe, Soil: Waste disposal drain pipe (sanitary sewer, as opposed to storm sewer).

Pipe, VCP: Vitrified Clay Pipe, or "terra cotta" is the most widely used material for sanitary sewer drains of all sizes, from 42-inch mains to 4-inch home laterals. Available in straight no-hub segments (requiring band couplings) and bell-and-spigot segments, including "Y" and "T" connections, bends, and reducers. Newer VCP bell & spigot connections employ polyurethane compression joints.

Piston Area: Surface area of the top of one or more pistons in a hydraulically powered machine. Hydraulic power is a function of the fluid pressure applied to a machine's total piston surface area.

Pit, Launching: Excavation where bursting/splitting head (with new pipe attached) enters pipe to be replaced. Also called Entry Pit.

Pit, Receiving: Excavation where pulling unit is assembled, and where bursting head arrives at the end of the pull. Also called Pulling Pit or Exit Pit.

Plate, Resistance: Square or rectangular plate of steel or hard aluminum, designed to distribute the compressive load of the pulling unit against the resistance wall (or cribbing) in the receiving pit. Attaches to pulley base in TRIC system.

Plate, Sub: Flat surface of various materials and construction, used to support and align the V24 (or other puller) in the receiving pit.

Pull: (Noun) Pipebursting job.

SDR (Standard Dimension Ratio): The ratio of pipe diameter to wall thickness. The formula is ($SDR = D/s$) where D = outside diameter and s = pipe wall thickness.

Service Line (Underground): Municipal utilities including sewer, electrical, gas, water, and communications.

Service Point: Point of access to utility line. For sewer systems, the examples are cleanouts and manholes.

Sewer Lateral: Also called a side sewer, a lateral is the pipeline that carries plumbing wastewater from a building to the municipal sanitary sewer.

Slip Line: Pipeline rehabilitation using new material of slightly smaller diameter, typically fused HDPE, pulled through the existing pipe.

Tower(s): Steel extender posts that connect the grippers to the yoke arms.

Underground Service Alert (USA): A non-profit organization providing free on-site location and marking of underground utilities, as a precaution for contractors and homeowners prior to excavation (Dial 811).

Upsize: Replace a pipe with one of larger diameter, via pipebursting.

Yoke(s): Steel arms that hinge on a pivot screw and hold gripper pair together.

Wall, Resistance: In the receiving or pulling pit, the wall of the excavation that supports the puller and cribbing during a burst.