TRIC™

User Guide

PULLER MODELS

P51 / M100

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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.

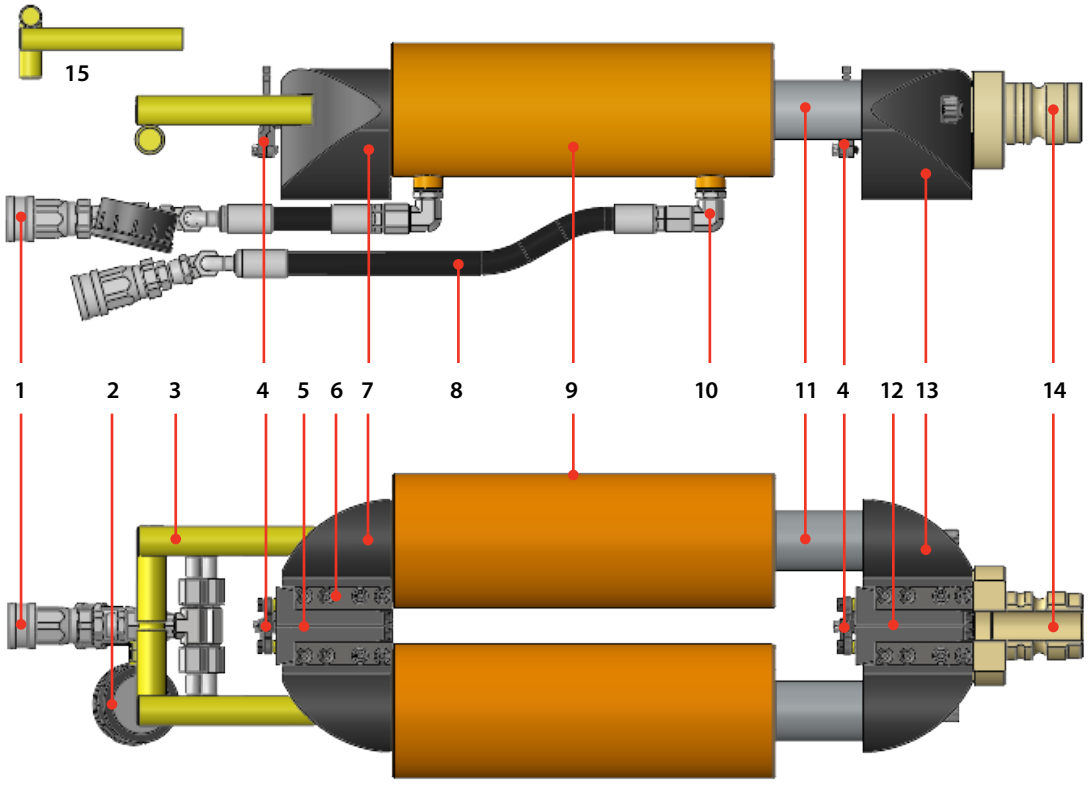
To that intent, please note the warning symbols in this user guide, which indicate two levels of concern. The yellow symbol warns against mechanical failure or undue stress on equipment. The red warning indicates danger of physical injury or death. In some cases, both warning symbols will be displayed 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, or visit www.instagram.com/trictoolstech. Welcome to the TRIC Team!

CONTENTS

ILLUSTRATIONS

P51 ASSEMBLY



1 Hydraulic Fittings
2 Pressure Gauge
3 Handle
4 Gripper Yoke Assembly
5 Grippers (Pulling)
6 Cover Plates
7 Pulling Bridge
8 Hose Assembly
9 Cylinder
10 Cylinder Port Fitting
11 Piston Shaft
12 Grippers (Retaining)
13 Retaining Bridge
14 Nose
15 Cable Guide (handle insert)

16 Resistance Plate

17 Resistance Plate Bolt & Nut

18 Pulley Base

19 Front Plate

20 Side Plate

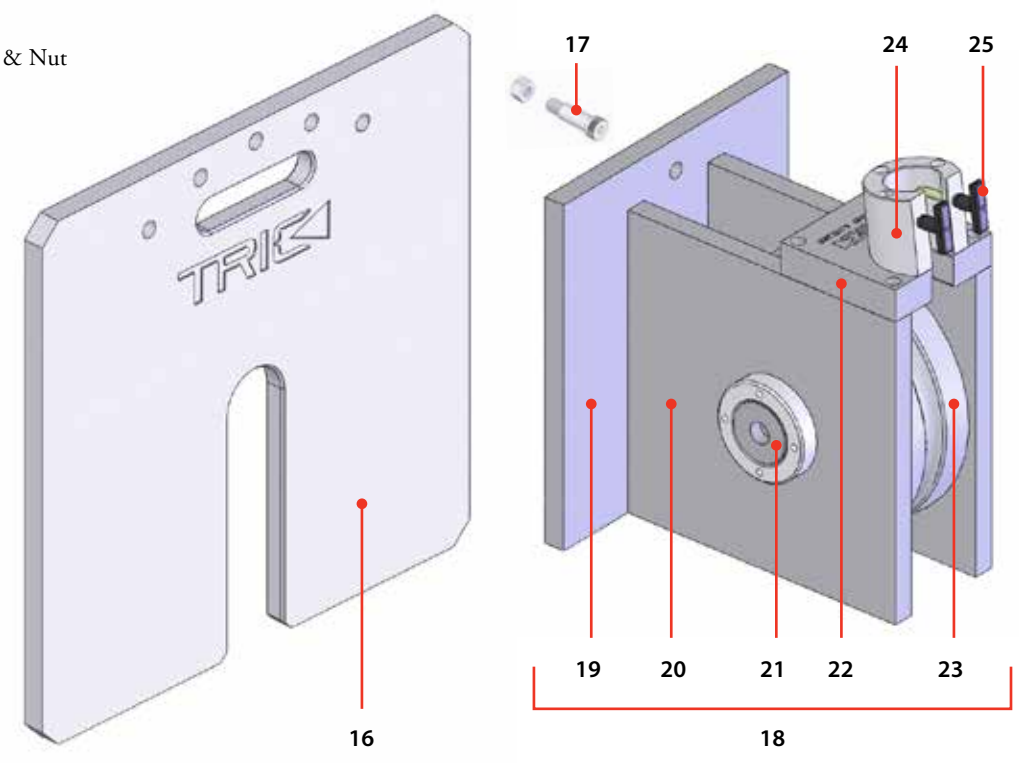
21 Axle

22 Top Plate

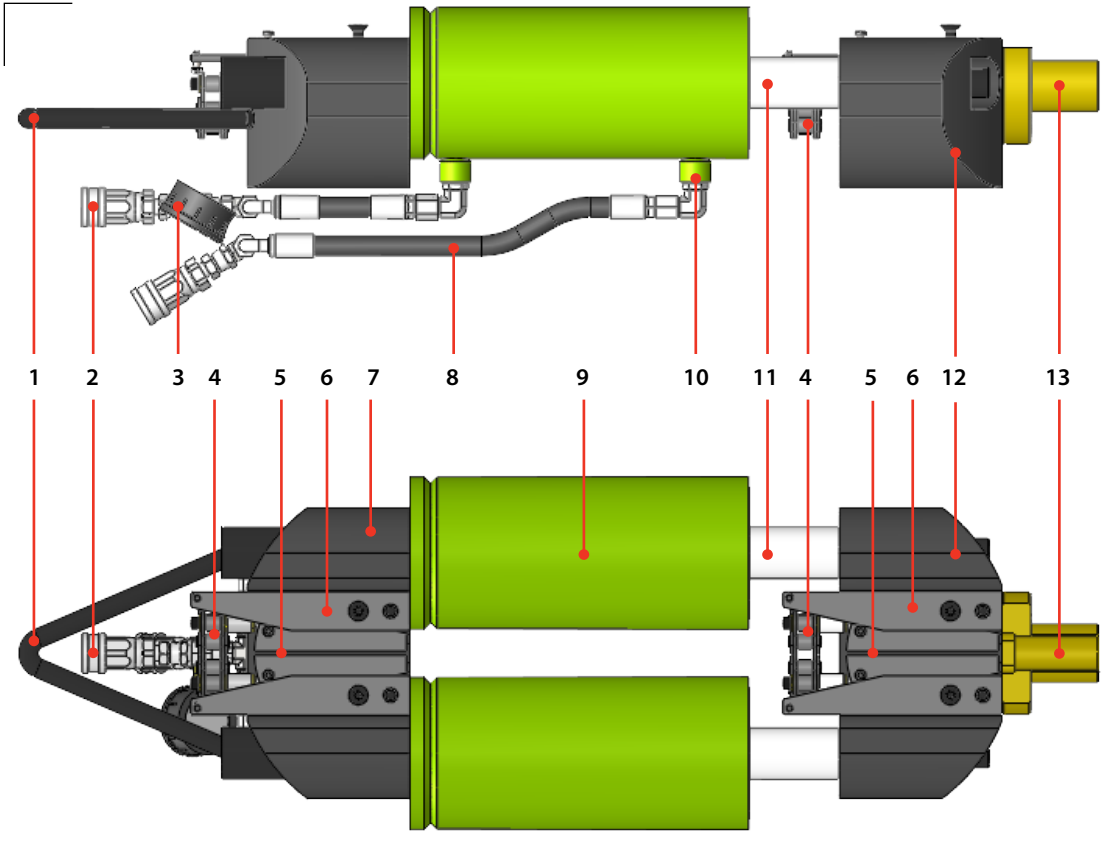
23 Wheel (12”)

24 Annulus

25 Locking Pins



M100 ASSEMBLY



1 Handle
2 Hydraulic Fittings
3 Pressure Gauge
4 Yoke Assembly
5 Grippers
6 Cover Plates
7 Pulling Bridge
8 Hose Assembly
9 Cylinder
10 Cylinder Port & Fitting
11 Piston Shaft
12 Retaining Bridge
13 Nose

14 Resistance Plate

15 Resistance Plate Bolt & Nut

16 Pulley Base

17 Front Plate

18 Side Plate

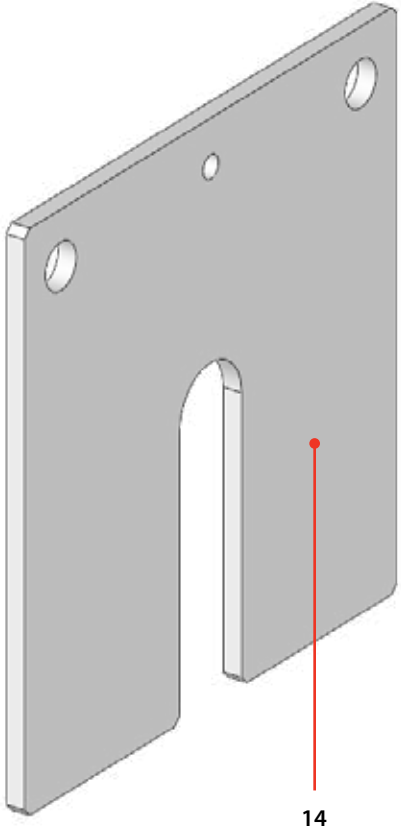
19 Axle

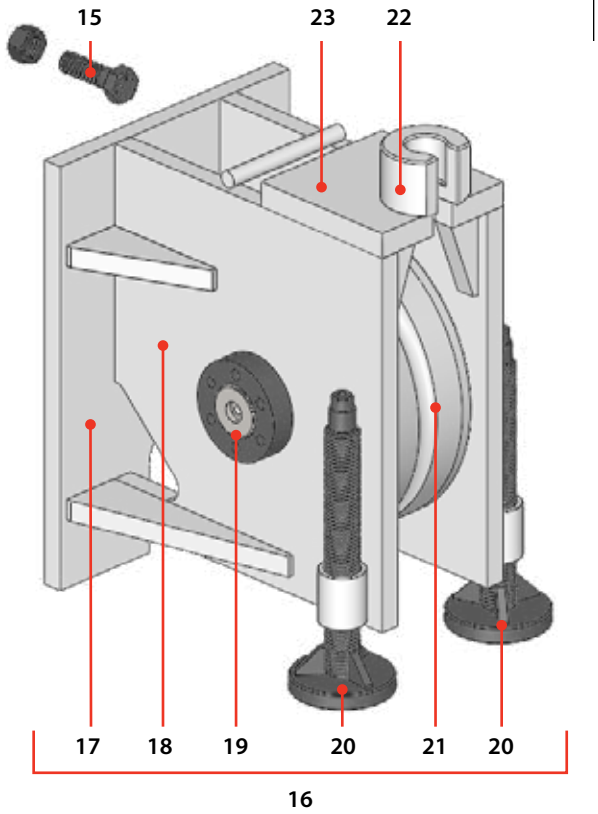
20 Adjustable Foot

21 Wheel (18”)

22 Annulus

23 Top Plate





INTRODUCTION

Every TRIC pipebursting system is basically 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 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 SETUP

BURSTING HEAD	PIPE MATERIAL
Standard	1, 2, 3, 4, 5, 6
Impact	1, 2, 3, 4, 6, 7
Swaged Splitter	2, 6, 7, 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 P51 and M100 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.

BURSTING SETUP

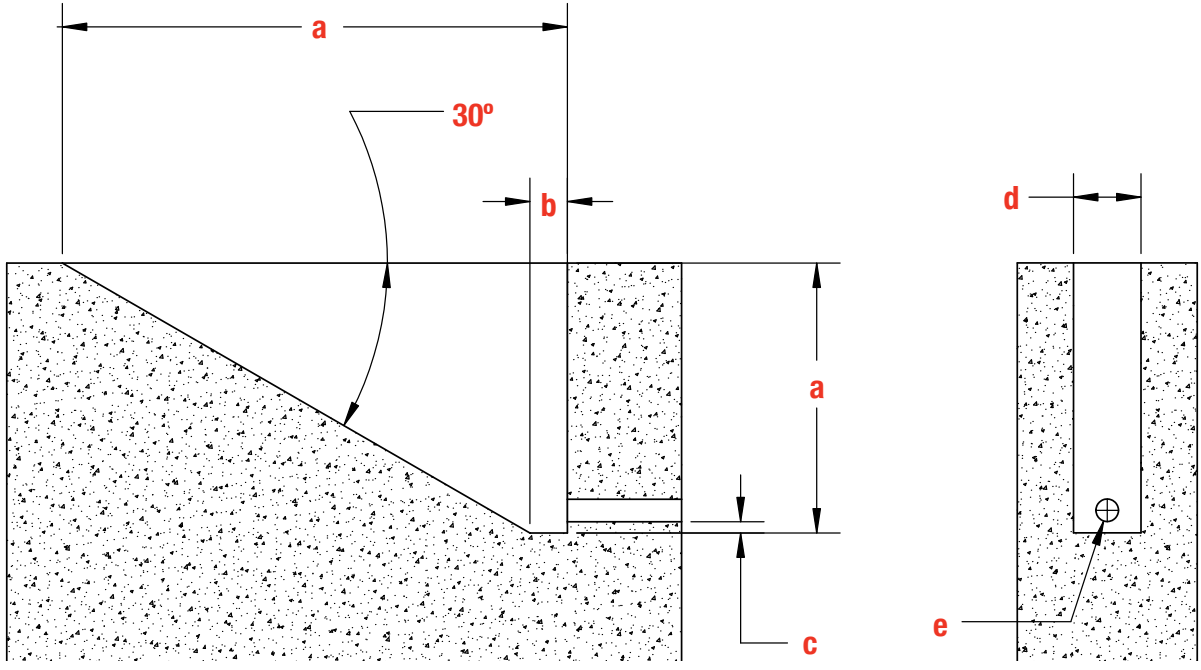


Figure 2
Entry or Launch Pit (Municipal)

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.

BURSTING SETUP

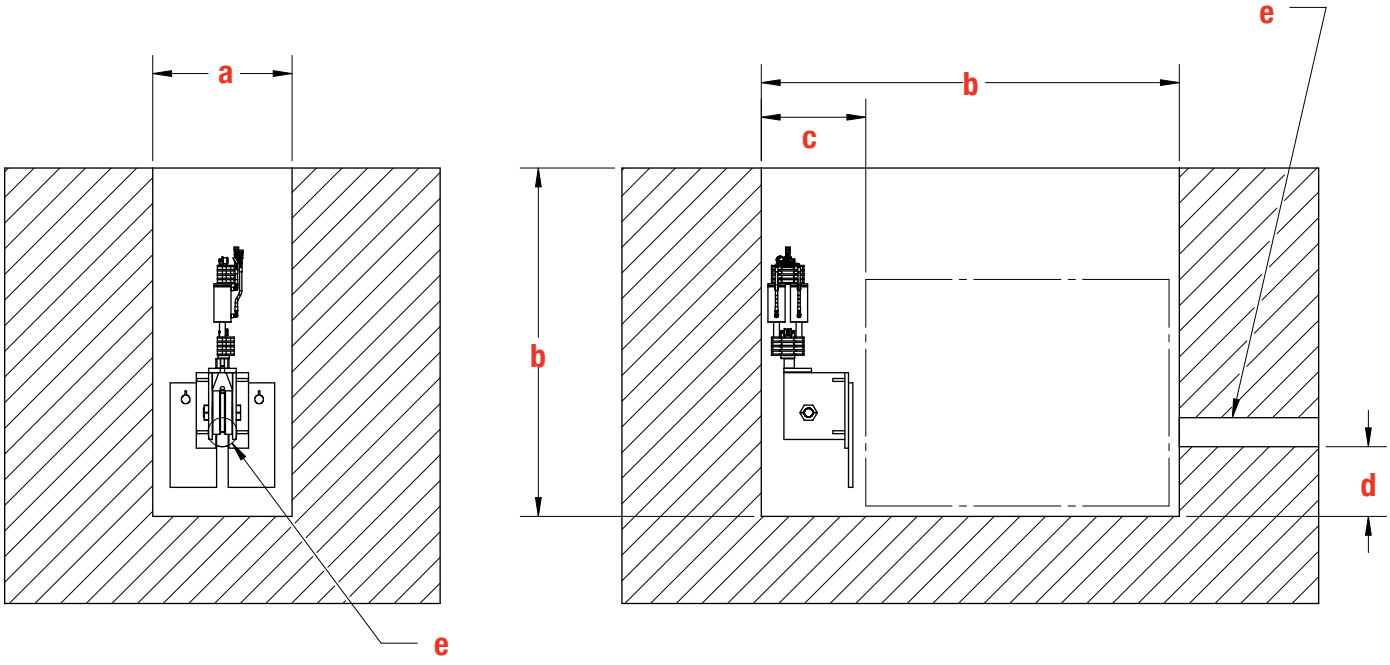


Figure 3
Exit, Receiving, or Pulling Pit (Municipal)

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 TRIC municipal 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 8 and 9 on pages 22 and 23 show typical field applications of the P51 and M100 in conjunction with manhole boxes or heavy-duty trench boxes.

BURSTING SETUP

Figure 4
Connecting the puller to an excavator

POWERING THE PULLING ASSEMBLY

The P51 and M100 pulling assemblies are designed to be operated primarily as accessories to excavators, loaders, and other hydraulic construction vehicles. These vehicles have auxiliary hydraulic circuits, usually with existing fittings, to power additional features and equipment. The TRIC P51 and M100 will usually be supplied with a pair of hydraulic hoses to connect the TRIC pulling unit with the auxiliary ports on a given construction vehicle. Hoses will have fittings to connect to the TRIC puller on one end, and the opposite end will have open NPT threads to adapt to the auxiliary fittings on the construction equipment.

In Figure 4 on page 18 opposite, the P51 is being connected to the auxiliary ports on the boom of the excavator. This requires the excavator operator to have a clear and unobstructed view of the pulling assembly during the job. If for example the pulling assembly is in a deep pit and is hidden from the operator, there must be a technician above the pit who can see both the pulling assembly and the vehicle operator to signal immediate instructions to the operator.

BURSTING SETUP

Figure 5
Inserting cable to upper grippers

Figure 6
Pulling cable slack to help insert cable to lower grippers

Figure 7
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 residential 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 5 and 6 on page 20). Also, the M100 may have gripper stop-screws at the top of the cover plates. In Figure 7 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 inserted, attach gripper O-rings to bolts on cover plates and grippers (yellow arrows), to keep grippers engaged to the cable.

BURSTING SETUP

Figure 8
P51 with manhole box

Figure 9
M100 with trench box

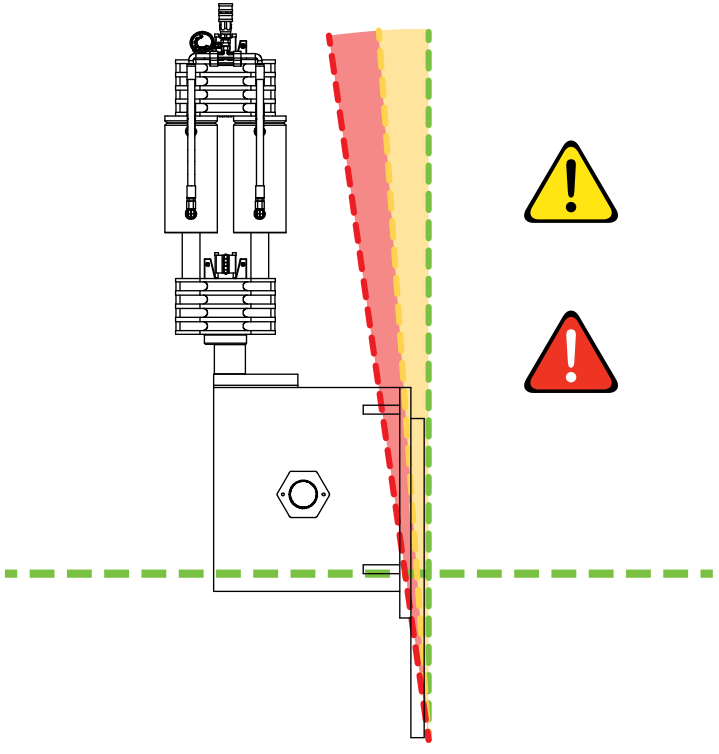


Figure 10: Pulling unit reclining

TRIC municipal 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 10 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 13 on page 26). 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 15 and 16 on pages 28 and 29 to determine safe loads for your particular cables and pulling equipment.

Cable tension achieved during pipe bursting can be deadly. Figure 11 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.

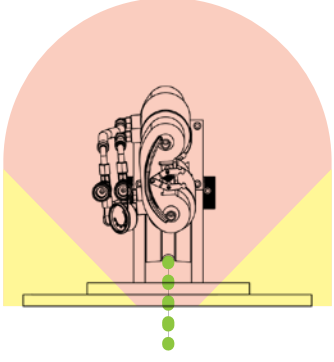


Figure 11
Critical reaction zone

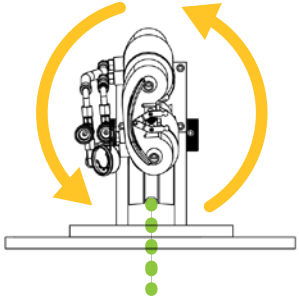


Figure 12
Rotation of puller on wheel base

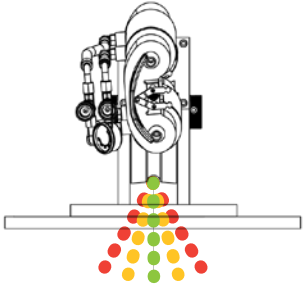


Figure 13
Cable direction / pulling path

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

Figure 14
Cable out of alignment with retaining (lower) grippers

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 14 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 pulley base socket to change the cable alignment (see Figure 12 on page 26). 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): X30 (2.5”/64mm), P51 (4.0”/102mm), M100 (5.0”/127mm)

Figure 15
Hydraulic Pulling Force Table

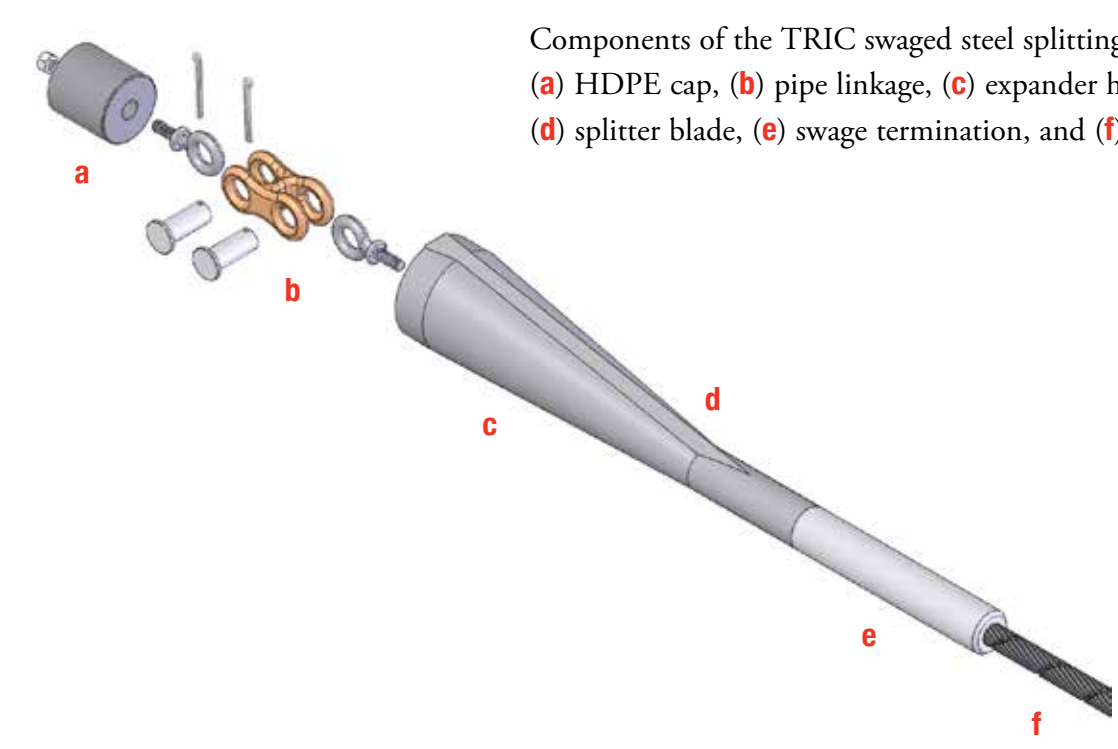
STANDARD SWAGED WIRE ROPE (6 x 26 RRL IWRC)					
DIAMETER		WEIGHT		TEST STRENGTH (TONS)*	
inches	mm	lbs/ft	kg/M	US	metric
1/2	12	N/A	N/A	N/A	N/A
9/16	14	0.68	1.01	19.3	17.5
5/8	16	0.85	1.27	23.9	21.7
3/4	19	1.25	1.87	34.5	31.3
7/8	22	1.66	2.47	47.0	42.6
1	25	2.15	3.21	61.5	55.8
1 1/8	28	2.80	4.17	75.0	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	3.43	4.67	103	93.4
1 3/8	35	4.20	5.72	120	108.9

**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 16
Swaged Wire Rope Specifications

SWAGED STEEL SPLITTING HEAD



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 17

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

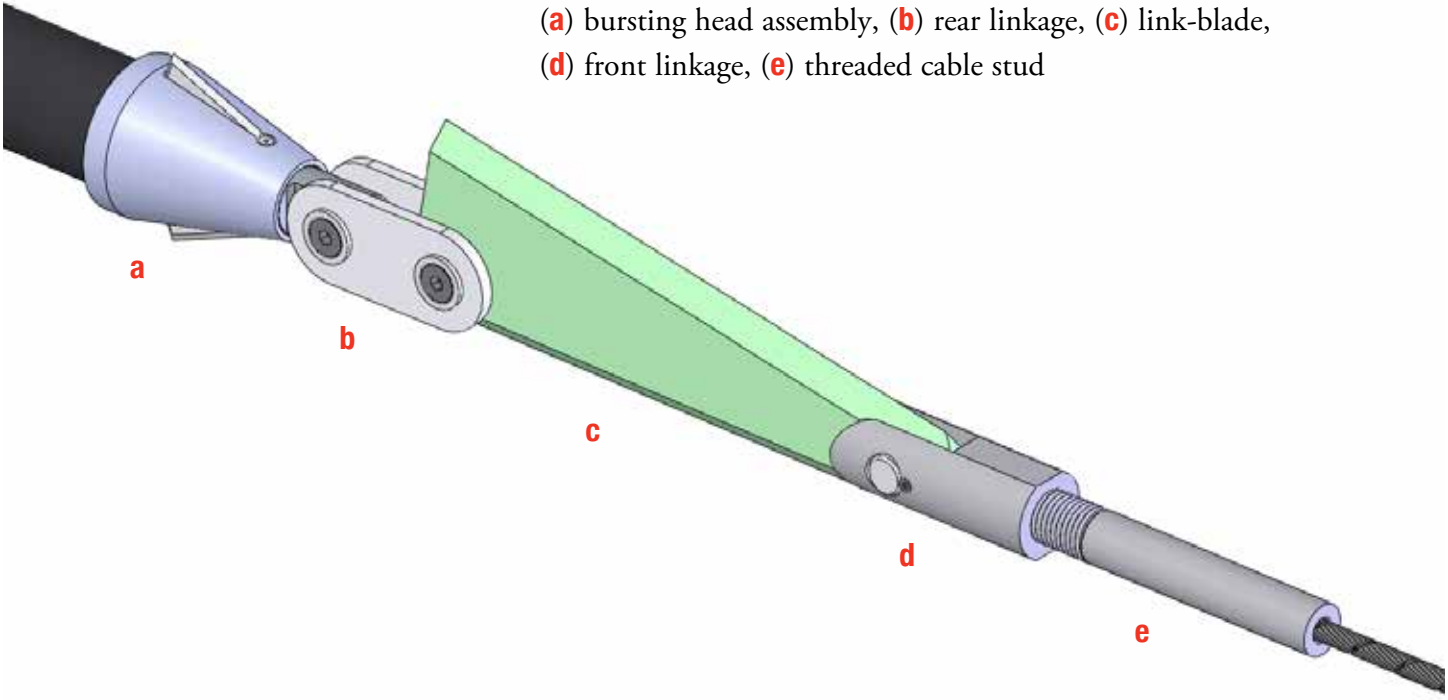


Figure 18

THREADED CORE BURSTING HEAD

PARTS

- a Threaded Stud Cable Termination
- b Removable Blade
- c Bursting Head
- d Driver Collar
- e HDPE Cap
- f HDPE Pipe Segment
- g Driver Core
- h Driver Core Spanner
- j Bursting Head Retainer

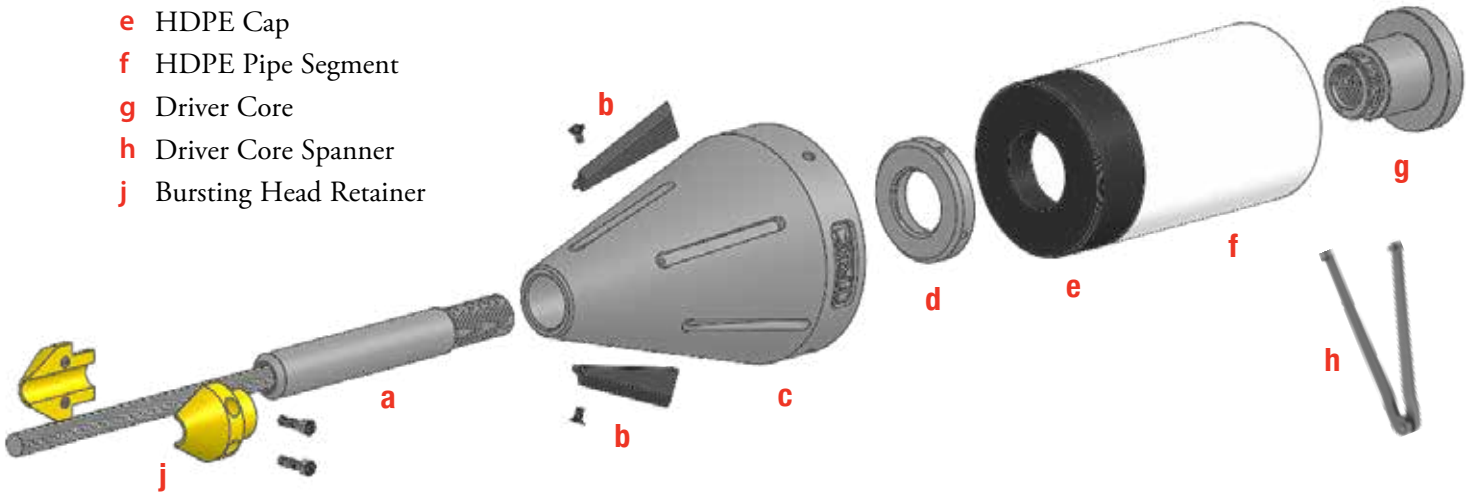


Figure 19

ASSEMBLY STEP 1

Before assembly, test cable stud (**a**) with driver core (**g**), and make sure that threads are intact, clean, and greased so that the parts screw together easily. If the PE cap (**e**) is new, fuse a short piece of HDPE pipe (**f**) onto PE cap before inserting the driver core to the PE cap as shown below in Figure 20. (The PE cap is too short to fuse onto pipe with the driver core assembly attached.)

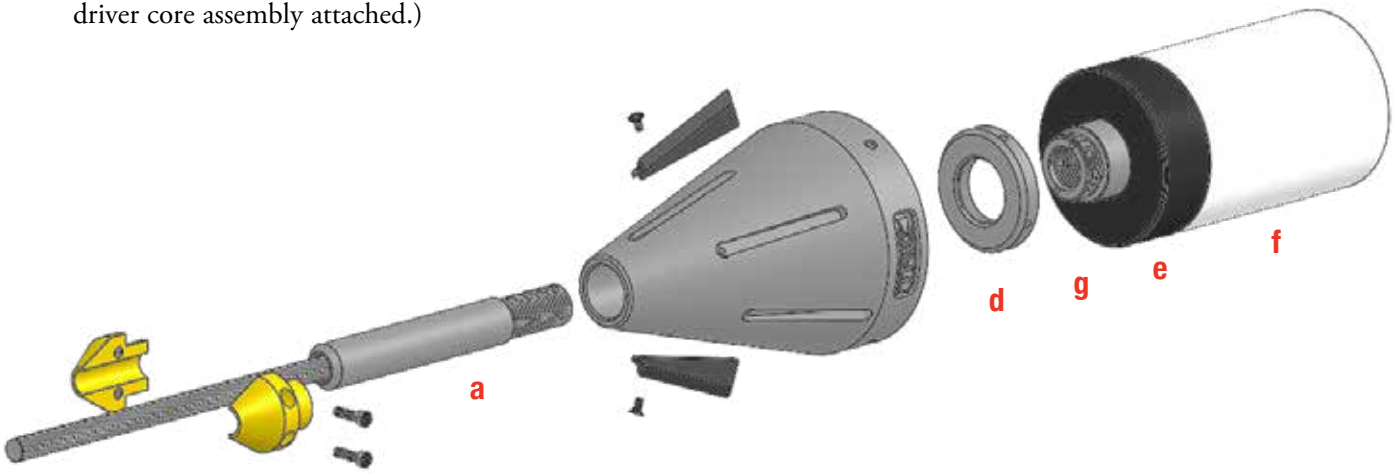


Figure 20

ASSEMBLY STEP 2

After fusing PE cap (**e**) to a short piece of HDPE pipe (**f**), assemble driver core (**g**) and driver collar (**d**) to PE cap as shown before fusing to full length of pipe. To attach cable to the driver core assembly, secure the cable stud (**a**) with a pipe wrench or similar tool, and thread driver core (**g**) onto cable stud with driver core spanner (**h**). Alternately, the driver core assembly can be attached to the cable stud by hand from behind the short piece of HDPE pipe (**f**) before fusing to full length of HDPE pipe.

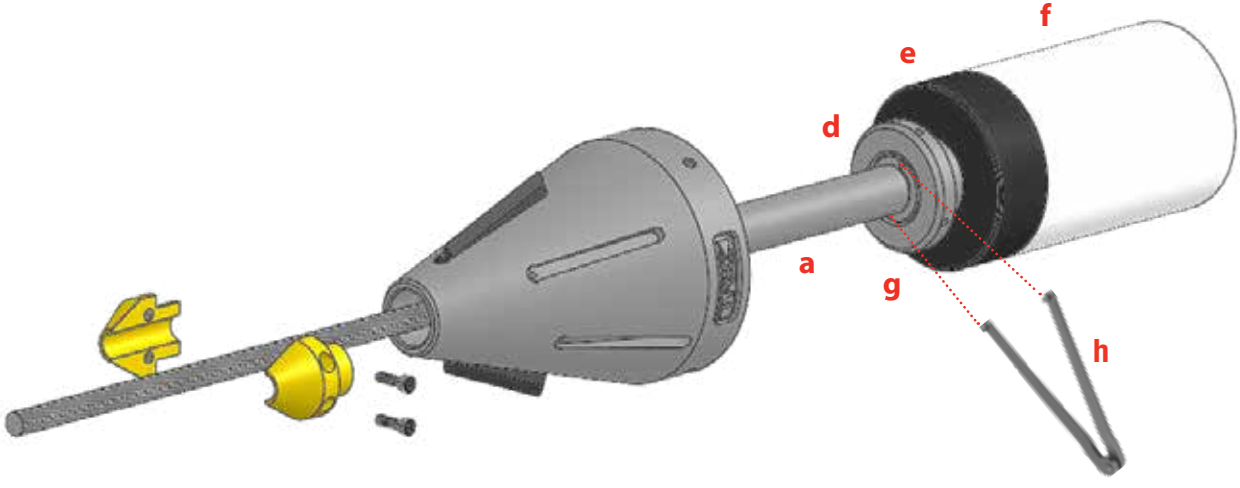


Figure 21

ASSEMBLY STEP 3

Slide bursting head (**c**) back against driver core and pipe, then insert bursting head retainer (**j**) into nose of bursting head and fasten onto cable. This will keep the bursting head assembly together when entering the launch pit.

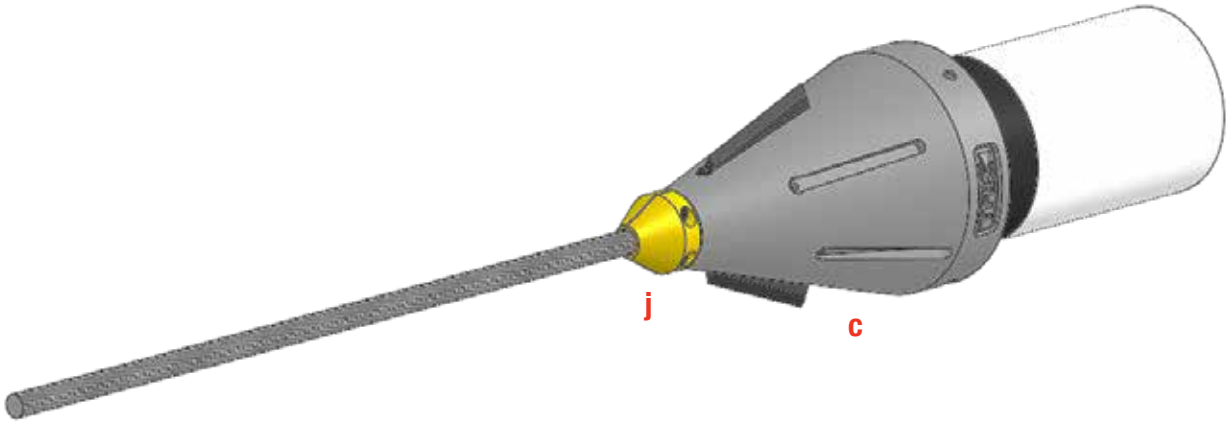


Figure 22

THREADED CORE BURSTING HEAD (Expander Skirts)

EXPANDER SKIRT ASSEMBLY

TRIC 6” and 8” bursting head assemblies can be adapted to burst larger sizes of pipe. In Figure 23 below, the standard 8” bursting head (**c**) is followed by a 10” adapter skirt (**k**) and IPS 10” PE cap (**m**) which is 10.75” or 273mm outside diameter (OD). A PE cap washer (**n**) is used with the driver core (**g**) for pipe diameters larger than 8” IPS (OD 8.625” or 219mm).

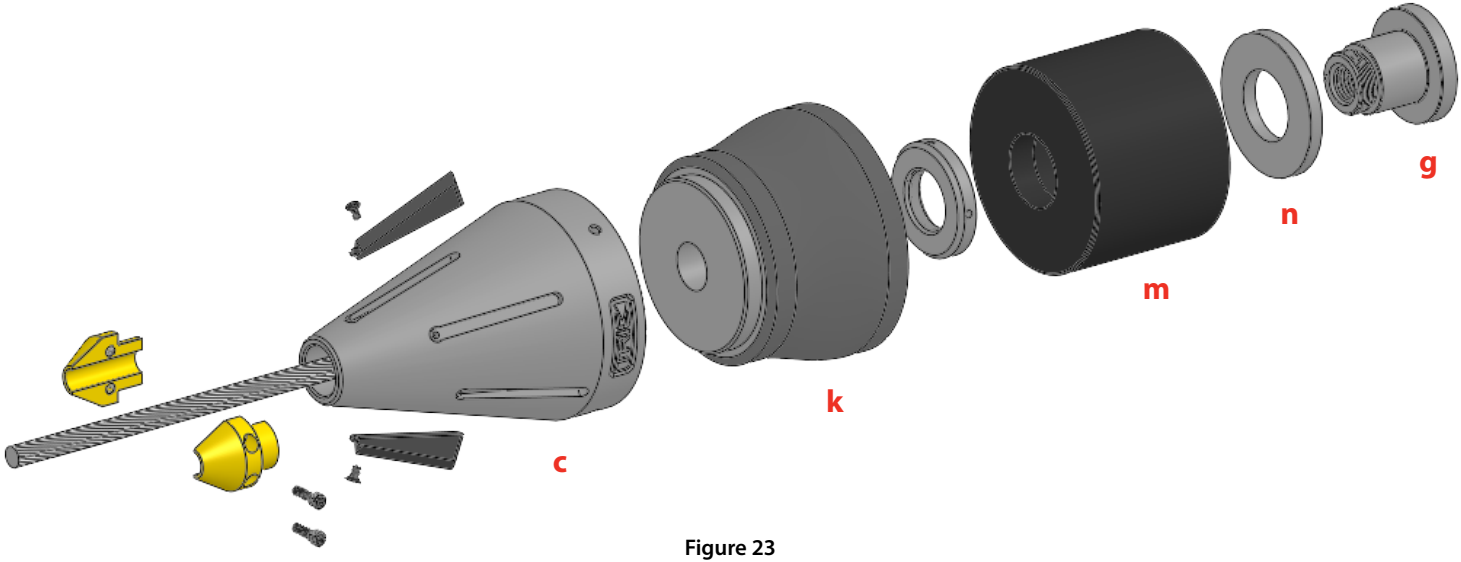


Figure 23

EXPANDER SKIRT ASSEMBLY

Assemble driver core to PE cap and cable as shown in Figures 20 and 21, including all parts shown in Figure 23 at left, so that bursting head (**c**) and expander skirt (**k**) are back against driver core and PE cap (**m**). Then insert bursting head retainer (**j**) into nose of bursting head and fasten onto cable. This will keep the bursting head and expander assembly together when entering the launch pit.

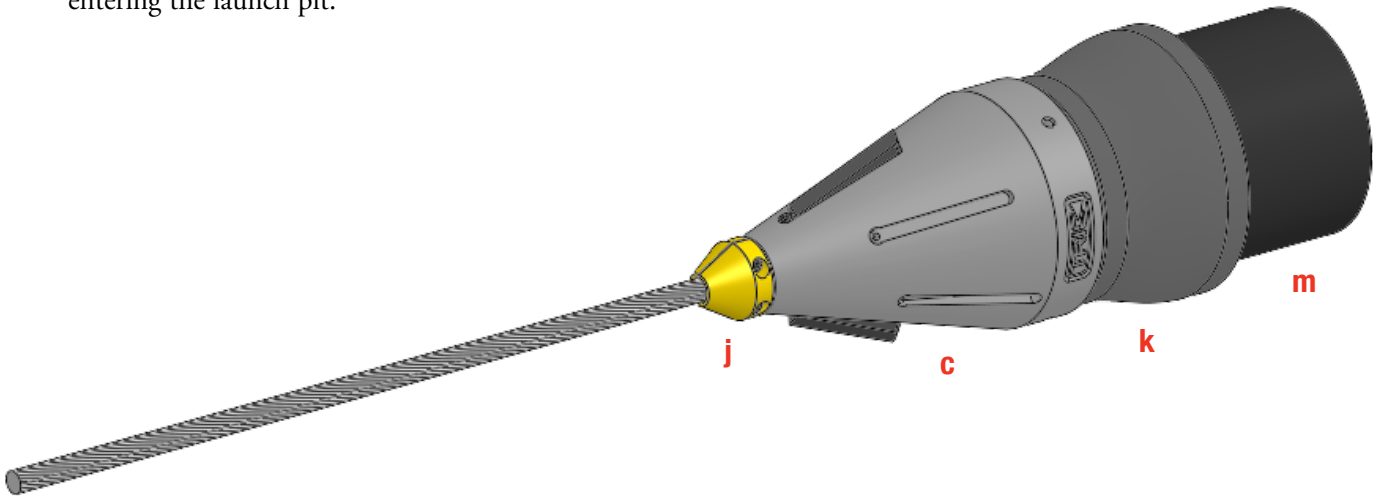


Figure 24

STANDARD BURSTING HEAD (Fuse-On PE Cap)

Components of the TRIC standard bursting head assembly:
(**a**) bursting head or shell, (**b**) removable blade, (**c**) pulling core (for threaded stud), (**d**) PE cap, (**e**) core washer, (**f**) core bolt

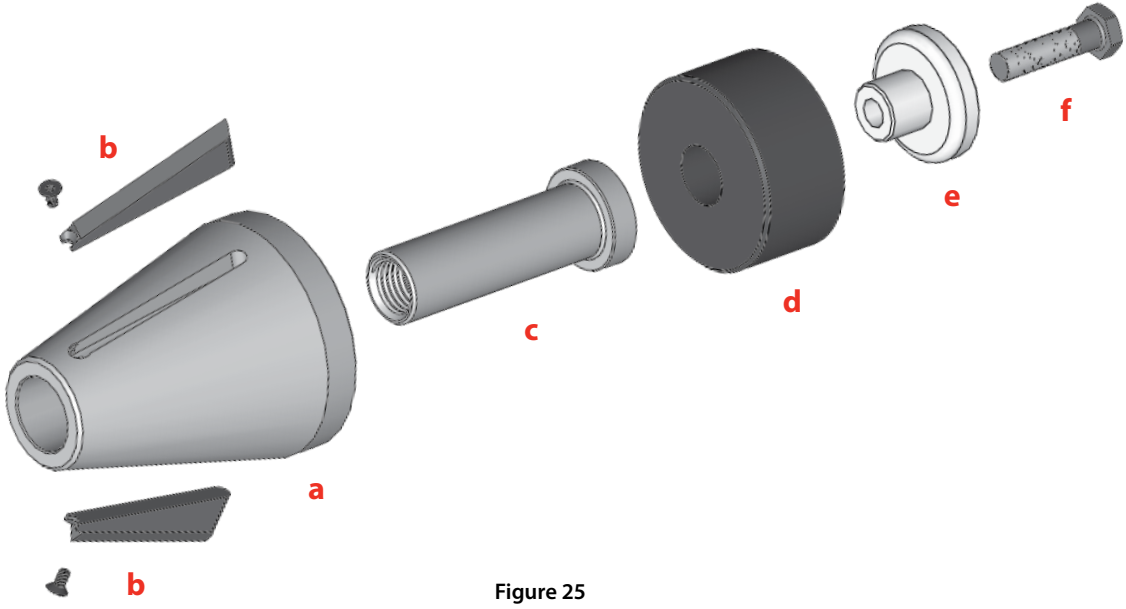


Figure 25

TRIC standard bursting heads are lighter than TRIC Quick-Lock bursting head assemblies, and the fuse-on PE cap assembly offers a slight advantage in situations with difficult entry angles and bends in the pipe path. Also, a proper fusion joint is at least as strong as the pipe itself.

The Quick-Lock bursting head assembly does not require fusing to the pipe, eliminating the need for PE caps. Quick-Lock heads are very convenient, saving time and materials; however they must be kept clean and well-maintained.

Important Notes:

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

*Threaded stud pulling cores—(**c**) in Figure 25 and (**g**) in Figures 19, 20, 21, and 23—are for cable diameters 7/8", 1.125", and 1.25" (22mm, 28mm, and 32mm). The P51 can also pull 3/4" cable, which has an open socket or clevis termination to connect to a pulling eye core. See items (**b**) and (**f**) in Figure 26 on page 40.*

When the P51 is pulling 3/4" (19mm) compact swaged cable, the maximum recommended pulling pressure is 2,300psi (160 BAR) or about 29 tons of pulling force with the P51. *See tables 15 and 16 on pages 28 and 29 for more information on cable use with different pulling assemblies.*

QUICK-LOCK BURSTING HEAD

Quick-Lock bursting head assembly: (**a**) bursting head or shell, (**b**) pulling-eye core, (**c**) pulling core spacer, (**d**) expanding gripper assembly (with O-rings), (**e**) expander cone, (**f**) 3/4” (19mm) cable with open socket termination, (**g**) socket pin and (**h**) cotter pin

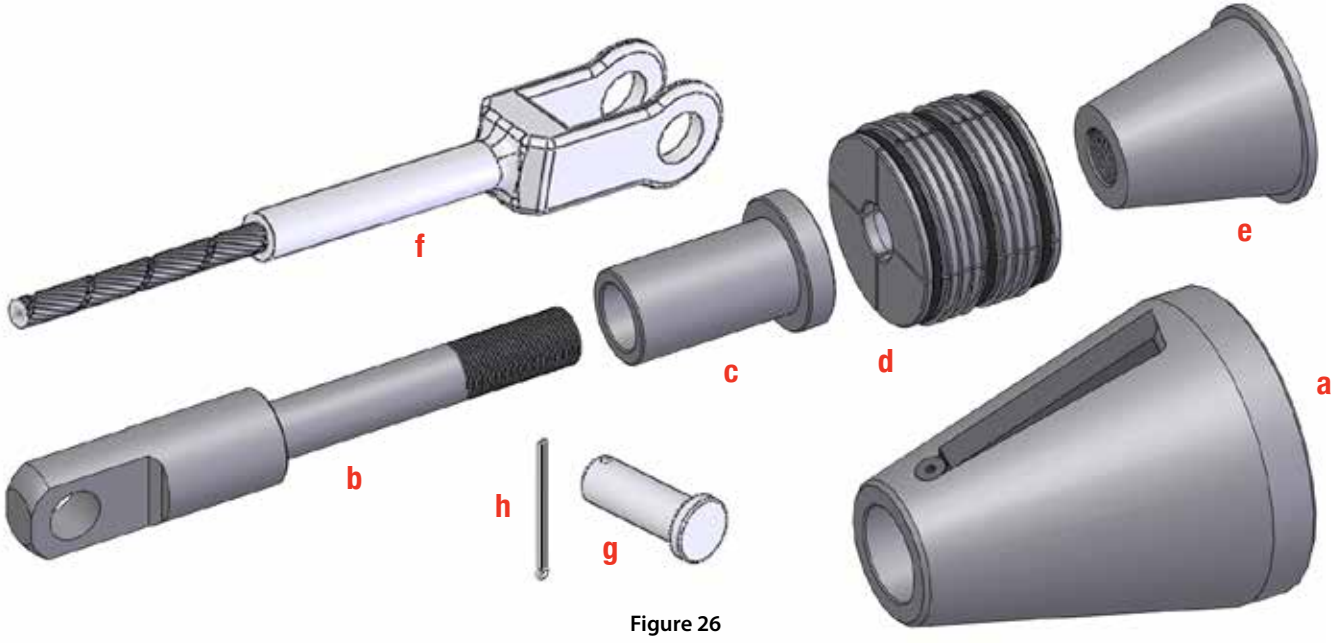


Figure 26

Figure 27

QUICK-LOCK BURSTING HEAD

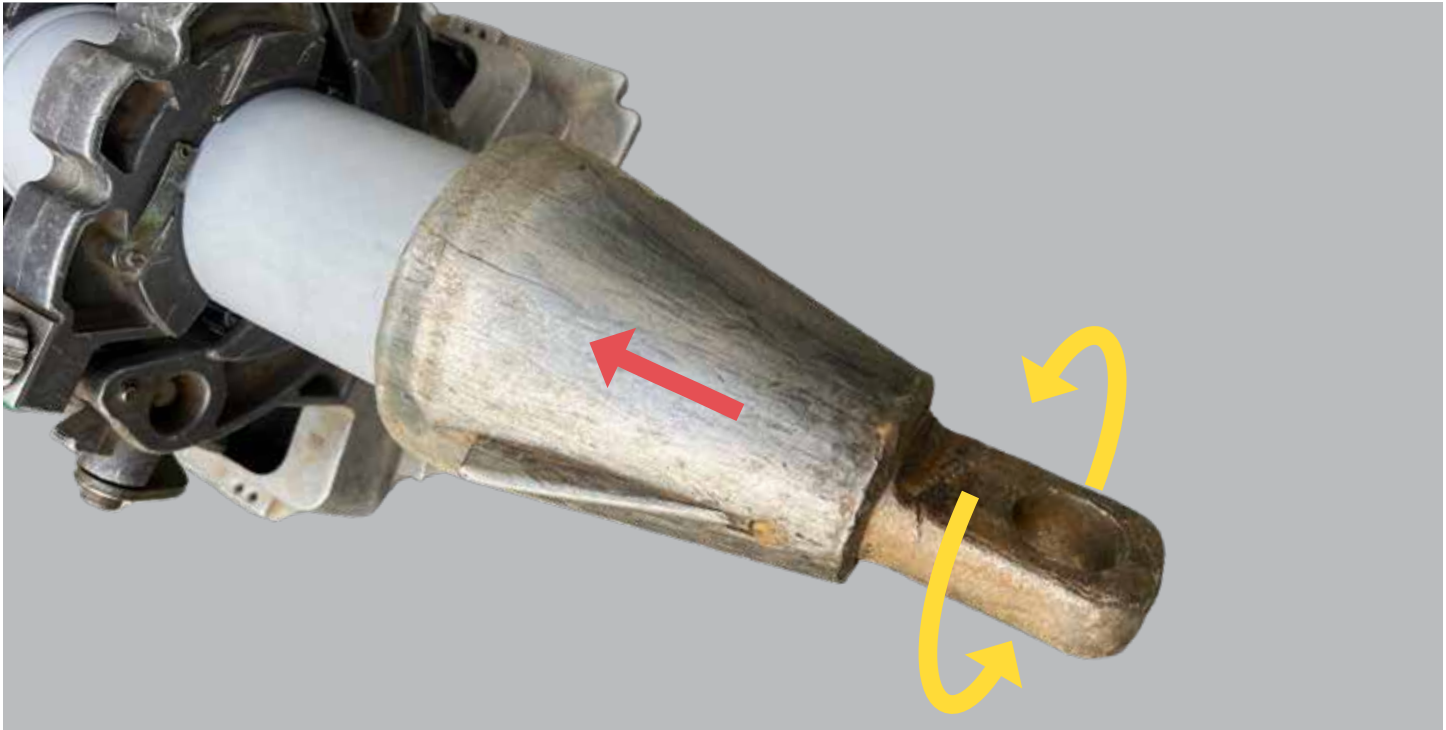


Figure 28

QUICK-LOCK BURSTING HEAD 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 using the pipe facing tool, and then use the fusion jig to hold the pipe while attaching the bursting head assembly (See Figures 27 and 28). Grease the surface of the expander cone (**e**), and the pulling core shaft threads (**b**). (See Figure 26 on page 40.) Insert the loosely assembled pulling core (parts **b**, **c**, **d**, and **e**) into the pipe end, just enough to cover the gripper assembly (**d**), leaving the core spacer (**c**) just outside the end of the pipe (See Figure 27 on page 41). Then turn the pulling core COUNTERCLOCKWISE until the gripper assembly expands against the inner wall of the pipe enough to hold the core assembly in place. Then slide the bursting head shell (**a**) over the pulling core and onto the pipe end (see Figure 28 on page 42). Hold the head shell in place (red arrow) and use a crowbar or similar device in the pulling eye to tighten the core assembly (yellow arrows) until the bursting head will not rotate or slide off the pipe end. The pipe will begin to visibly swell immediately behind the bursting head. The head shell should overlap the end of the pipe about 32-38mm (1.25”-1.5”).

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).

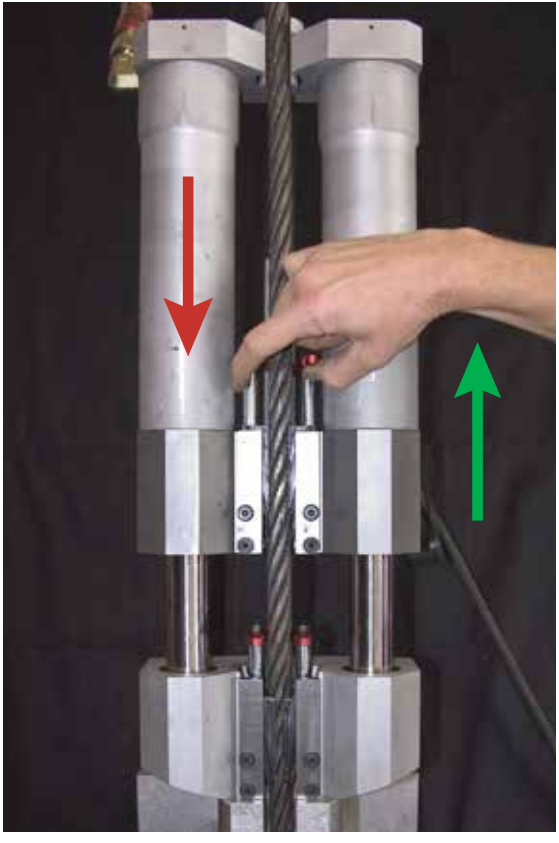
DO NOT enter a pit with a TRIC puller that is unstable and under load. Stop and release tension, then investigate. Adjust the pulling assembly as necessary before proceeding further. Read sections regarding proper setup and cable load capacities.

In the following illustrations, **RED ARROWS** indicate pulling bridge 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.

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 pipe bursting is completed, proceed to Step 4. If the puller is more retracted (as shown) at the end of the pull, proceed to Step 2.



STEP 2:
Free pulling grippers

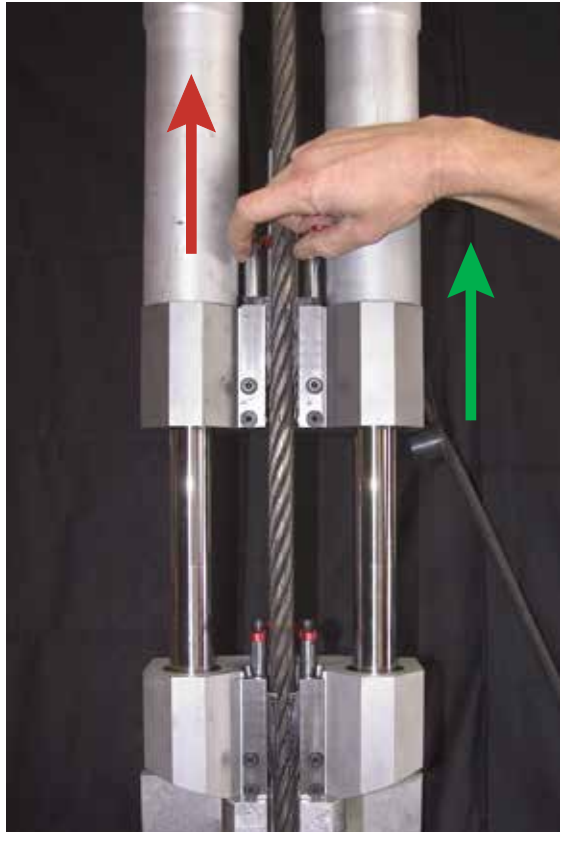
Retract puller to free pulling grippers. If puller is already retracted (at bottom of stroke), raise puller 2" to 4" (50-100mm). Then close retaining (lower) grippers fully onto cable before lowering unit to free upper (pulling) grippers.

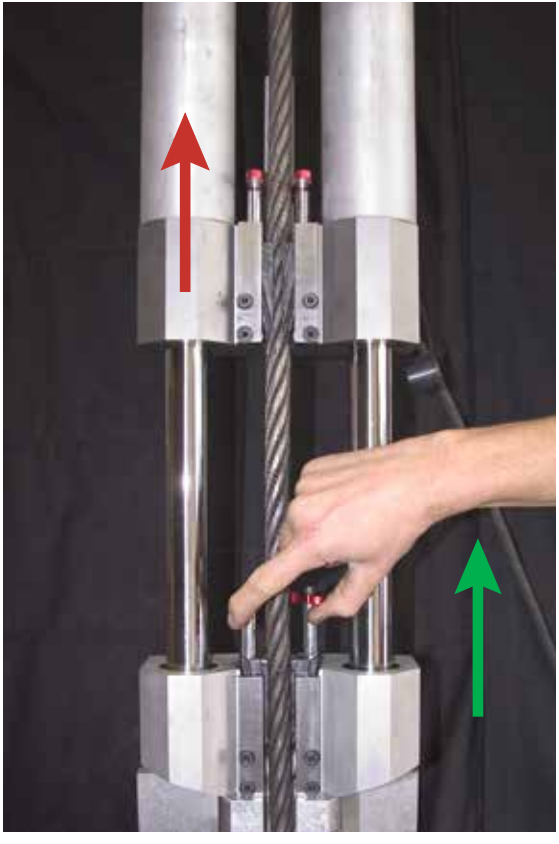
WARNING: Avoid hitting or prying yoke assemblies to move or free grippers.

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 upper (pulling) grippers open and away from the cable, then raise puller to nearly full extension (leaving 1”- 2” or 25-50mm piston travel remaining). Then, close upper (pulling) grippers onto the cable.



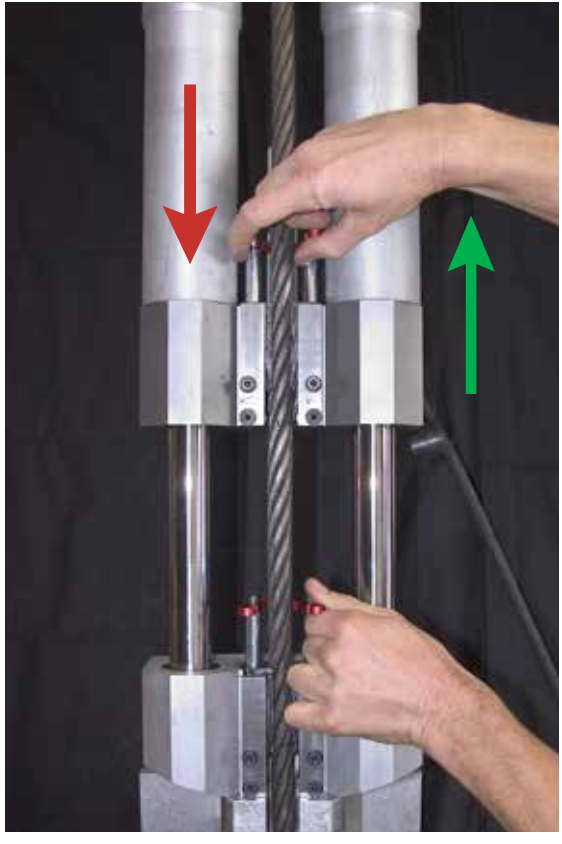


STEP 4:
Free retaining grippers

Using remaining piston travel, extend puller while holding retaining (lower) 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 (lower) grippers.

STEP 5:
Free pulling and retaining grippers

Keep the (lower) retaining grippers open and away from the cable, and pull up on the pulling grippers while lowering or retracting the puller. 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.

GLOSSARY OF TERMS

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.