User Guide

PULLER MODELS

M50 / 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. Welcome to the TRIC Team!

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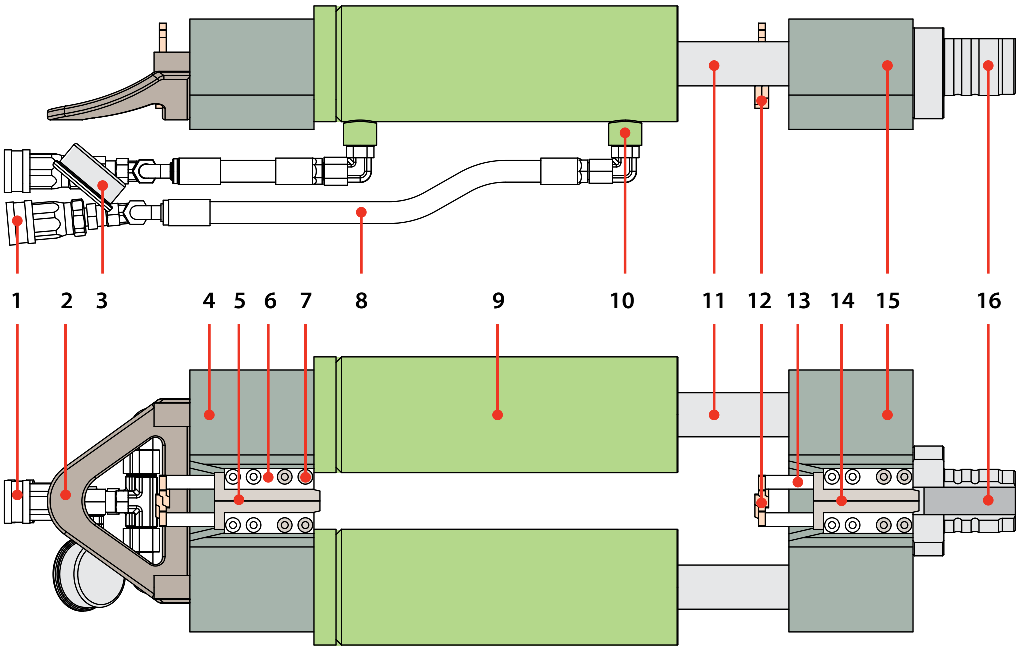


1 Hydraulic Fittings

2 Handle

3 Pressure Gauge

4 Pulling Bridge

5 Gripper Assembly (**12–14**)

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

15 Retaining Bridge

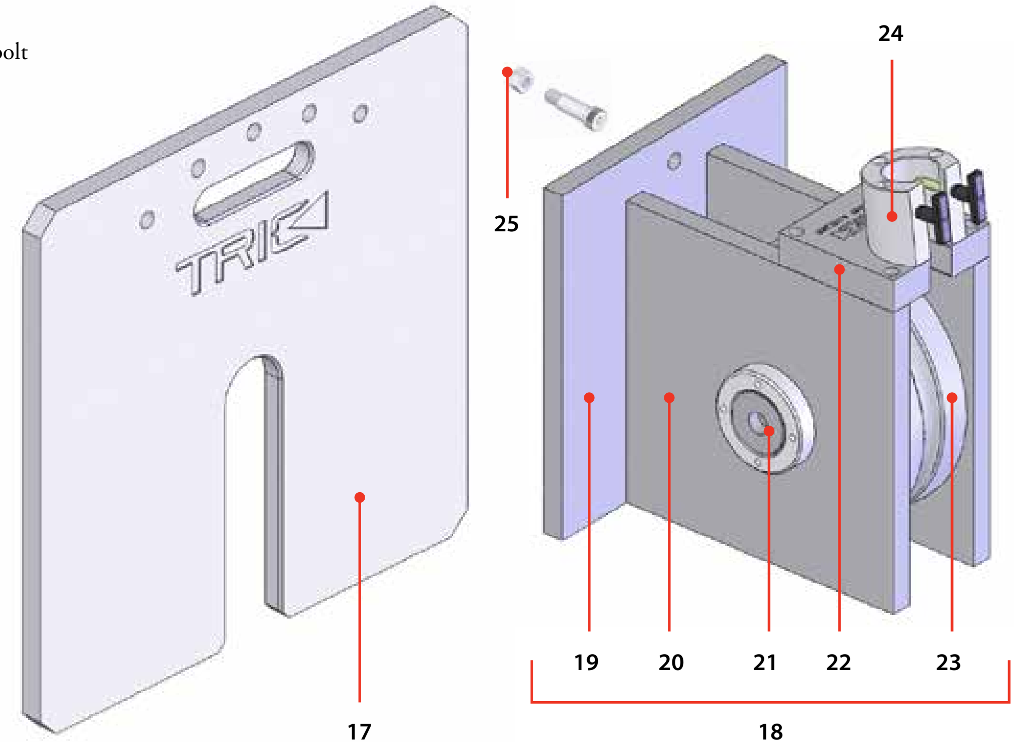
16 Nose

17 Resistance Plate

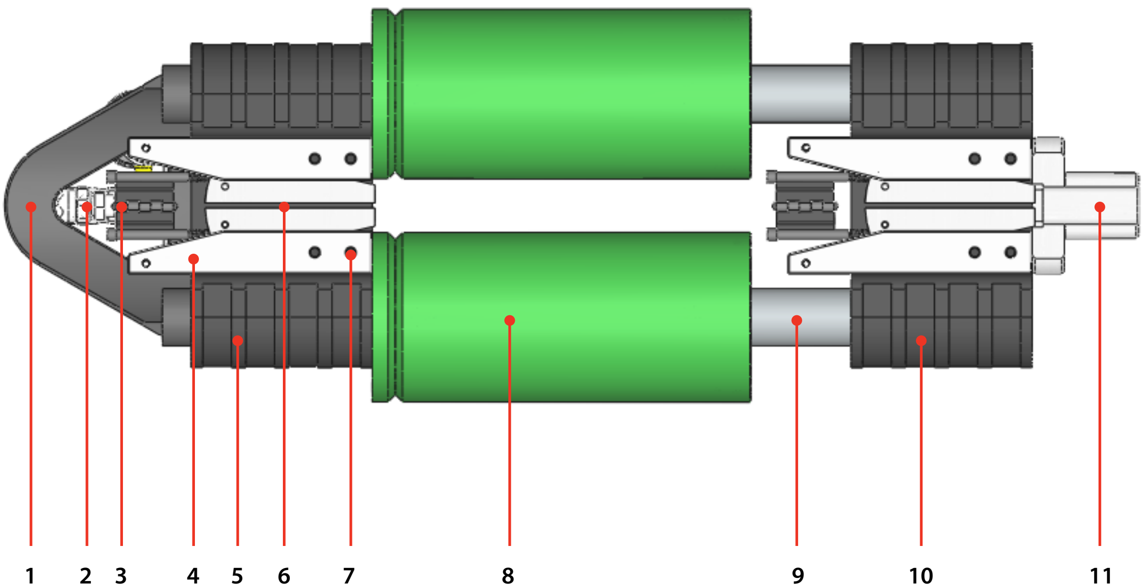
- **25** resistance plate bolt

18 Pulley Base

- **19** front plate
- **20** side plate
- **21** axle
- **22** top plate
- **23** wheel
- **24** annulus



M100 ASSEMBLY



1 Handle
2 Hydraulic Fittings
3 Yoke Assembly
4 Cover Plates
5 Pulling Bridge
6 Grippers
7 Cover Plate Screws
8 Cylinder
9 Piston Shaft
10 Retaining Bridge
11 Nose

12 Resistance Plate

- **20** resistance plate bolt

13 Pulley Base

- **14** front plate
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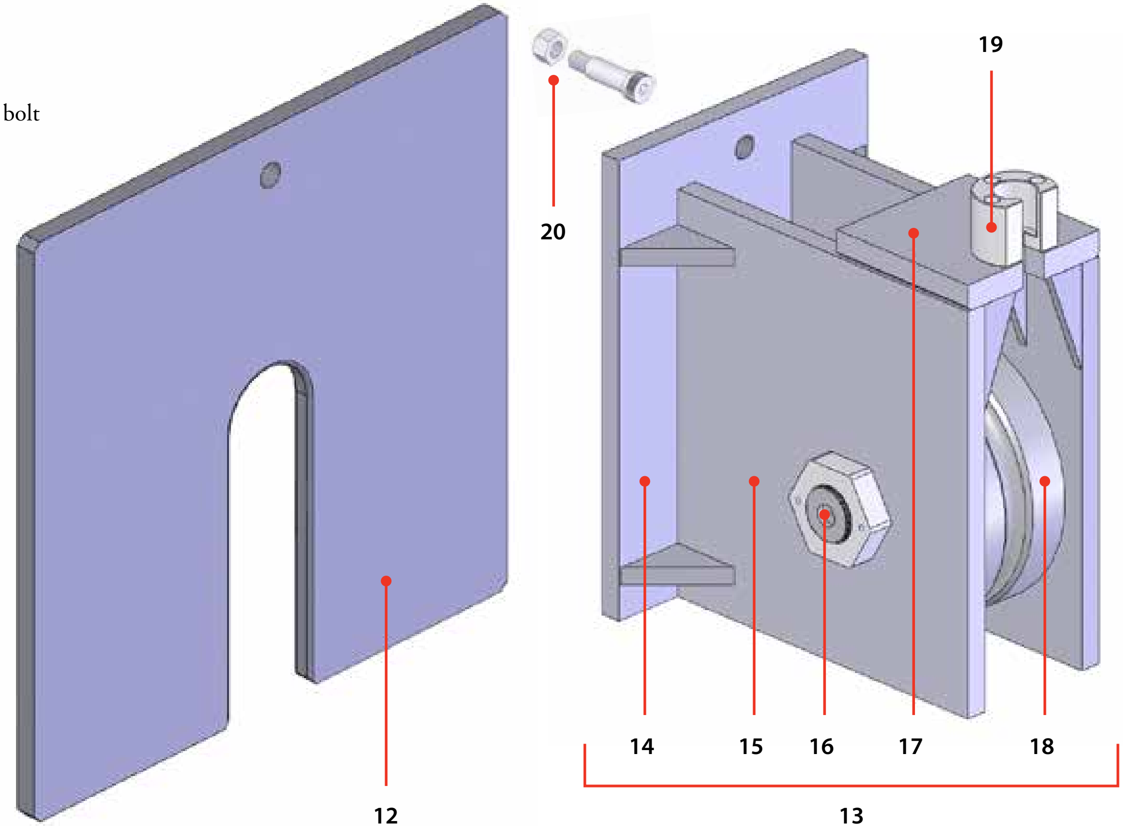


The heart of each TRIC pipe-bursting system is essentially a cable-pulling device. Cable, or wire rope, has been an integral part of the TRIC method since the company introduced trenchless sewer lateral replacement in America back in 1997. Laterals, or residential sewers, are typically constructed with bends (directional changes) in the pipeline from the building foundation exit point to the property line or municipal sewer main connection. A cable is the most efficient way to negotiate these bends. By contrast, larger municipal sewer pipes generally maintain a straight flow path, and each main sewer connection or change of direction becomes an accessible service point, or manhole.

Among the methods and materials commonly used in municipal pipe-bursting, steel cable is valued for its flexibility, compactness, size selection, 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 pipe-bursting system. Please review this information carefully.

BURSTING HEAD	PIPE MATERIAL
Standard	1, 2, 3, 5, 6
Impact	1, 2, 3, 4, 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

The M100 is designed to replace pipe from 200mm to 400mm in diameter, and the M50 is designed to replace pipe from 150mm to 250mm 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 bursting head selection table on the opposite page.

The first step in any pipe-bursting 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 and exit (pulling) pit configurations.

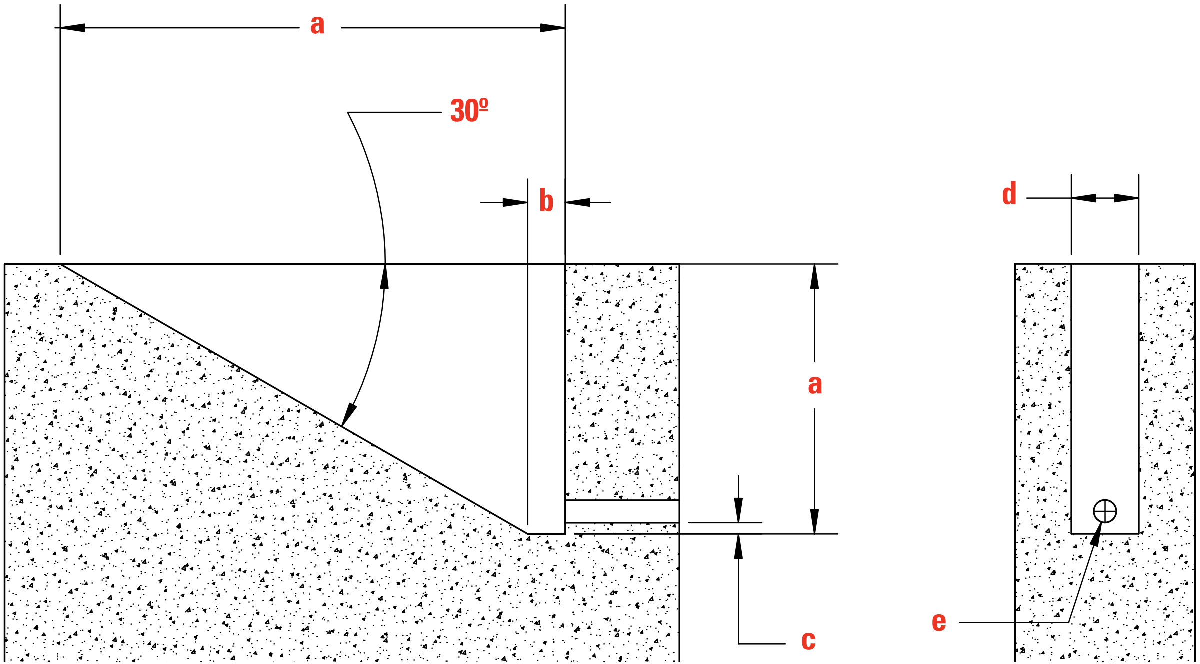


Figure 2: Entry Pit (Municipal)

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 pipe-bursting 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 30° 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.

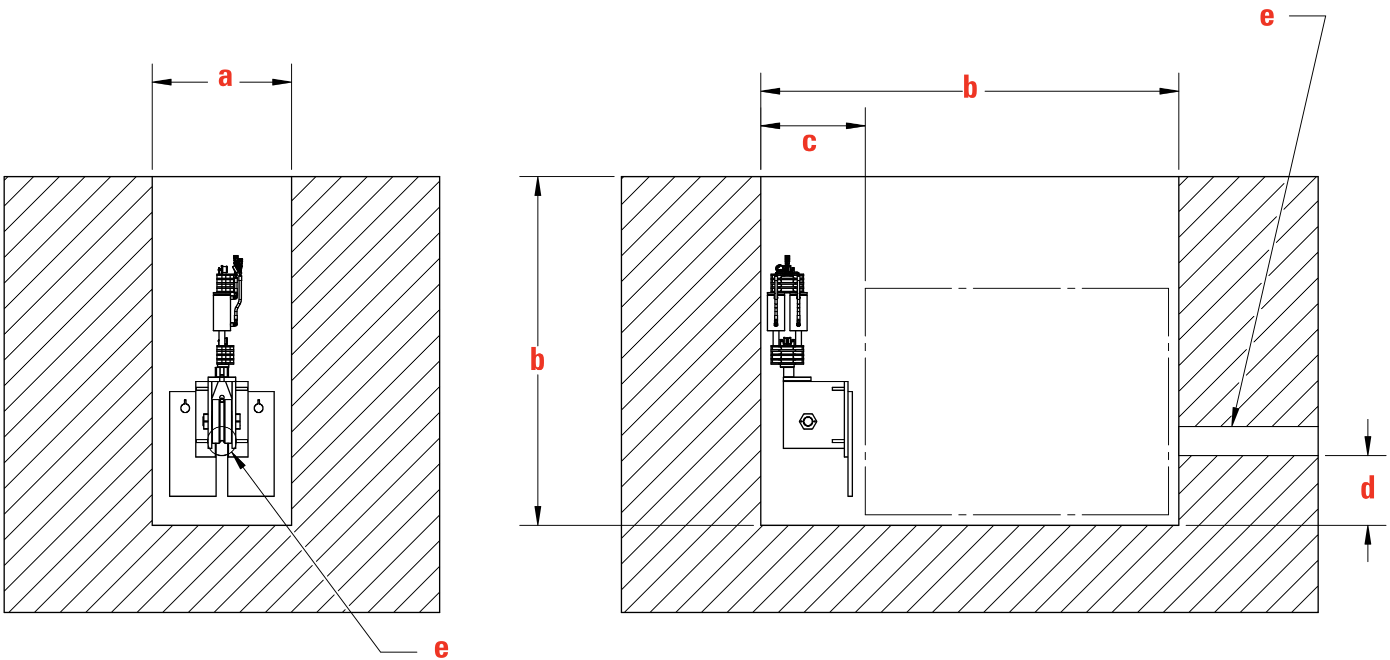


Figure 3: Exit or Pulling Pit (Municipal)

a = 48” minimum (120cm)

b = Variable

c = 36” minimum (90–100cm)

d = 24” (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. Photographs on pages 18 and 19 show typical field applications of the M100 in conjunction with manhole boxes or heavy-duty trench boxes.

Figure 4: M50 with manhole box

Figure 5: M100 with trench box

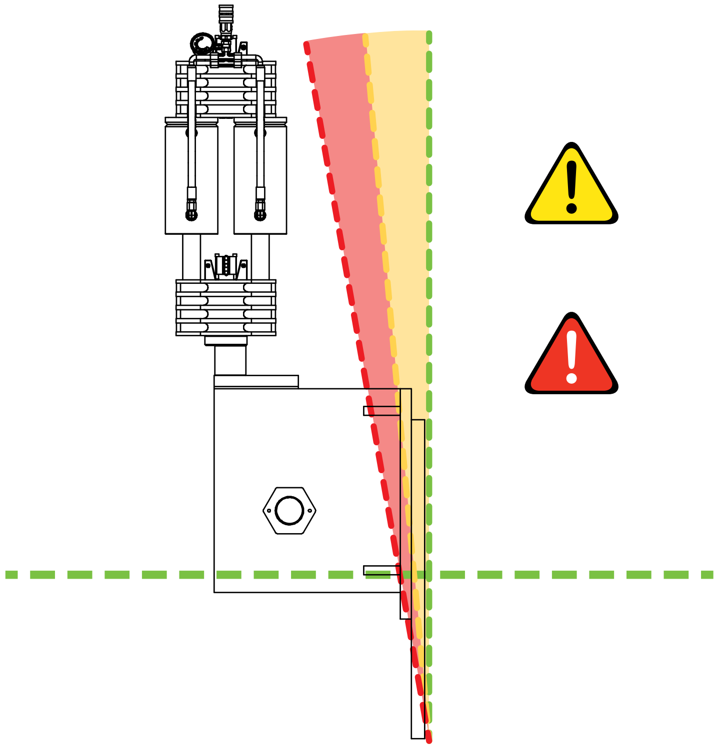


Figure 6: Pulling Unit Reclining

TRIC M-Series pullers are extremely powerful. Consequently, they must be closely monitored during operation. Always keep a working pressure gauge on the puller. Stop if the pulling assembly begins to lean or shift significantly in any direction. Then release cable tension and reset the unit. Figure 6 on the opposite page illustrates the acceptable amount of tilt or recline in the pulling unit while under load. Generally, the harder the pull, the more critical it is that the puller remain relatively vertical, or perpendicular to the pipe line. A safe range of tilt under average conditions (50% of pulling capacity or less) might be 10º of inclination. As the pull gets harder, even 5º of tilt approaches the critical danger zone, where both equipment and workers are at risk. Also, unstable earth or insufficient bracing in the exit pit can cause the pulling assembly to shift out of alignment with the pipe path. In this case the cable will begin to cut into the resistance plate, and in extreme situations the wheel can be destroyed, causing a dangerous reaction. See figure 9 on page 22.

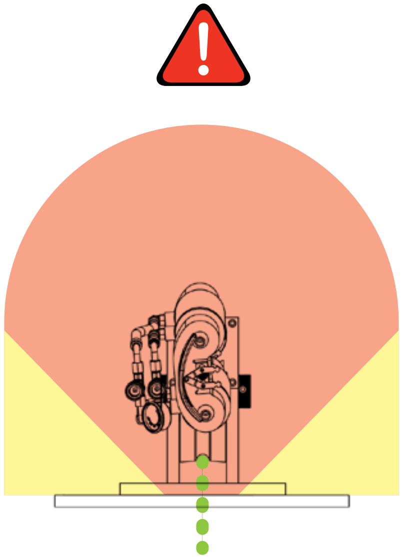


Figure 7:
Critical reaction zone

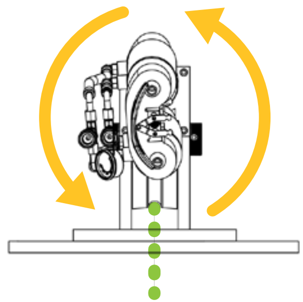


Figure 8:
Rotation of puller on wheel base

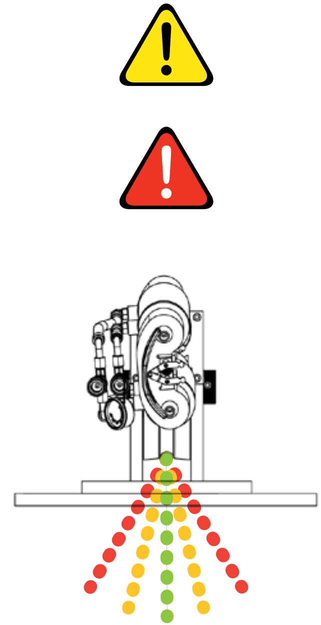


Figure 9:
Unit out of alignment with pipe/
pulling path

Cable tension achieved during pipe bursting can be deadly. Figure 7 on the facing page illustrates the typical areas of reaction in the event of cable failure, wood blocking 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 pit to adjust the pulling assembly.

The M-Series pulling assembly has few moving parts, but all are interdependent. As parts wear, the alignment of the cable path (grippers to wheel-tangent) can change, causing erratic operation. The harder the unit pulls, the more important is this cable path alignment. If the puller is not retaining tension (i.e., if the retaining grippers consistently fail to engage the cable), then the wheel may be worn or otherwise out of alignment with the puller. A temporary solution is to release all cable tension and rotate, or spin, the puller in the annulus of the wheel base to change the alignment of the gripper path and wheel tangent. See figure 8 on the opposite page.

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)

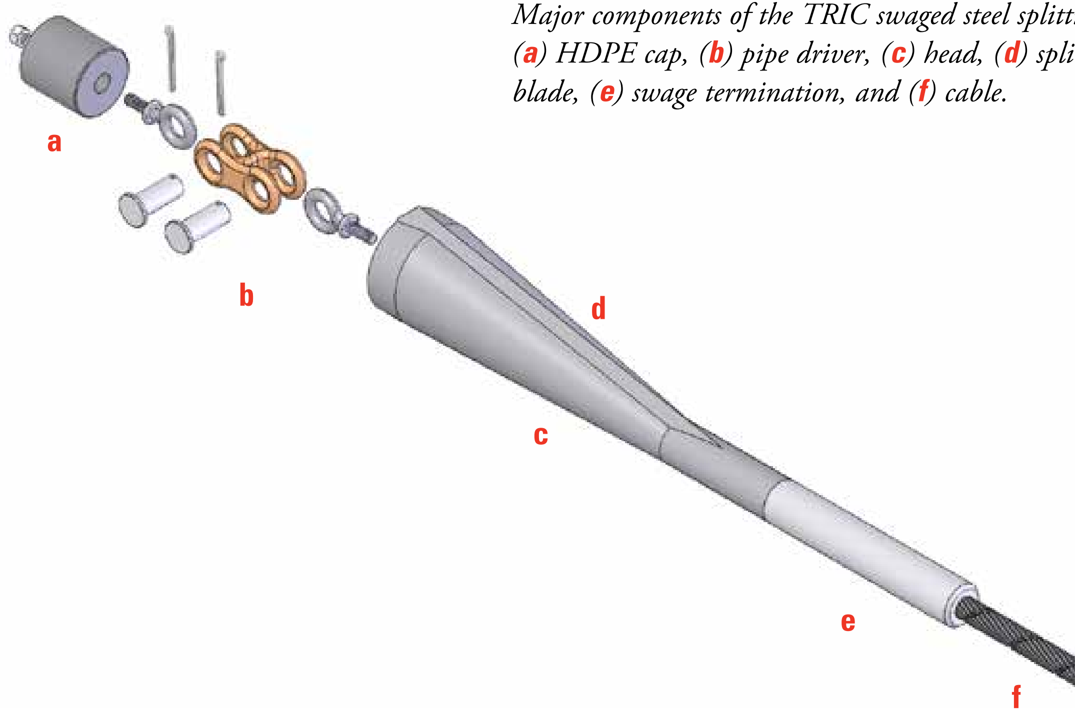
MODEL (CYLINDER): X20 (1.625″/43mm), C20 (1.75″/45mm), C25 (2.0″/50mm), X30 (2.5″/64mm), X50 (2.75″/70mm), M50/V24 (3.5″/89mm), M100 (5.0″/127mm)

Figure 10: Hydraulic Pulling Force Table

STANDARD SWAGED WIRE ROPE (6 x 26 RRL IWRC)						COMPACT SWAGED WIRE ROPE (6 x 25 RRL IWRC)					
DIAMETER		WEIGHT		TEST STRENGTH (TONS)*		DIAMETER		WEIGHT		TEST STRENGTH (TONS)*	
inches	mm	lbs/ft	kg/M	US	metric	inches	mm	lbs/ft	kg/M	US	metric
1/2	12	N/A	N/A	N/A	N/A	1/2	12	0.63	0.94	18.6	16.9
9/16	14	0.68	1.01	19.3	17.5	9/16	14	0.78	1.15	23.7	21.5
5/8	16	0.85	1.27	23.9	21.7	5/8	16	1.01	1.50	28.5	25.8
3/4	19	1.25	1.87	34.5	31.3	3/4	19	1.41	2.10	42.2	38.3
7/8	22	1.66	2.47	47.0	42.6	7/8	22	1.91	2.85	56.0	50.8
1	25	2.15	3.21	61.5	55.8	1	25	2.53	3.77	73.7	66.9
1 1/8	28	2.80	4.17	75.0	68.0	1 1/8	28	2.97	4.43	92.9	84.3
1 1/4	32	3.46	5.15	90.0	81.6	1 1/4	32	N/A	N/A	N/A	N/A
1 3/8	35	4.20	6.23	110	99.8	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 pipe-bursting. Use extreme caution and always have a working pressure gauge on pulling equipment.*

Figure 11: Swaged Wire Rope Specifications



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

Figure 12

*Major components of the TRIC link-blade steel splitting assembly: (**a**) splitter blade, (**b**) linkage, (**c**) standard head assembly*

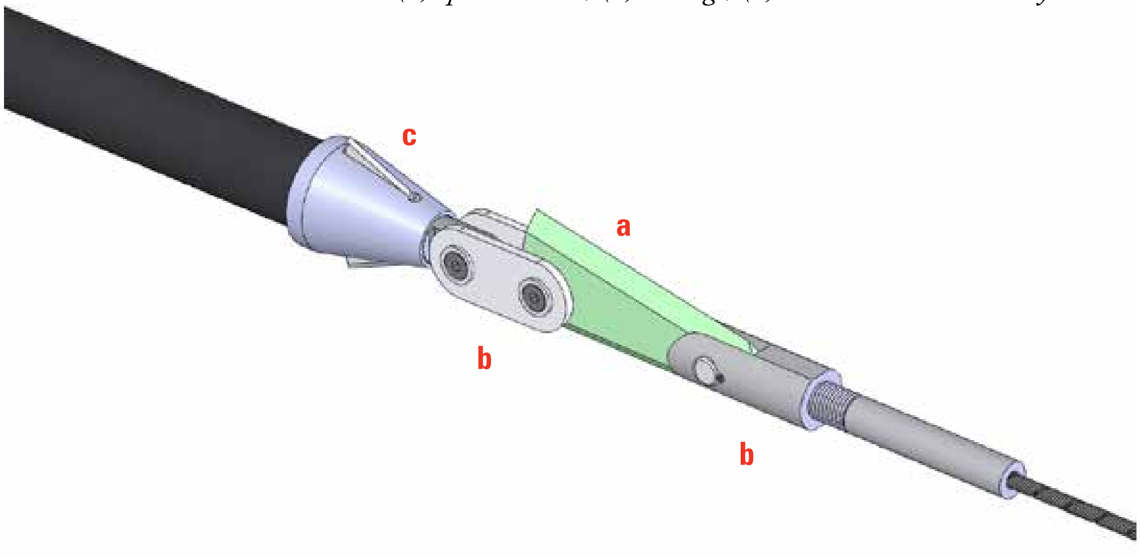
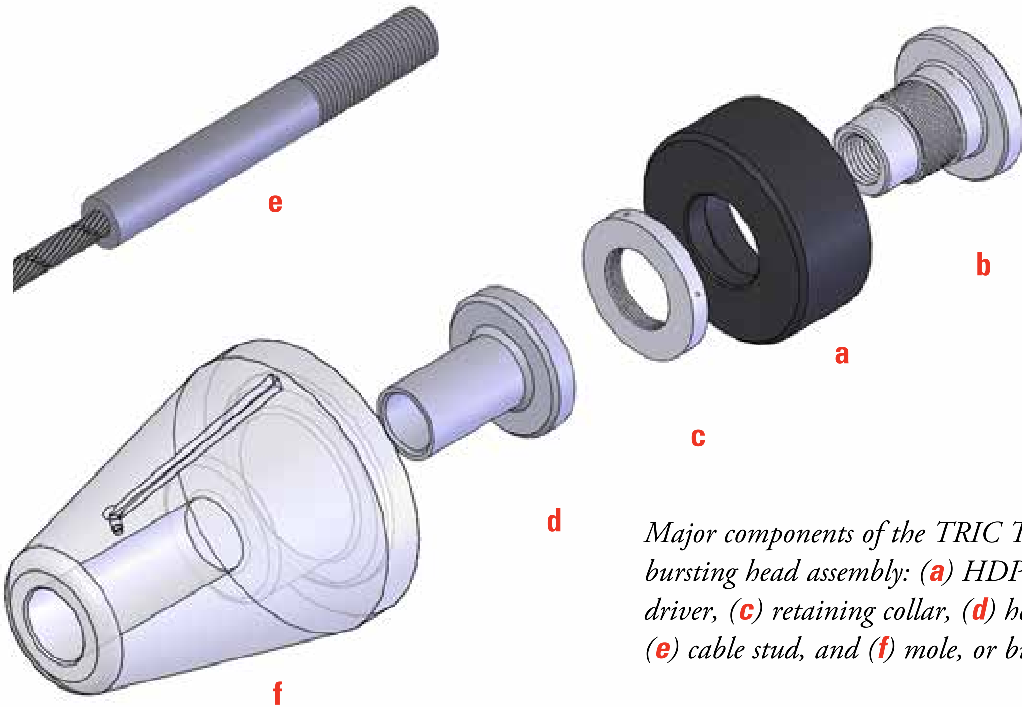


Figure 13

THREADED CORE BURSTING HEAD (first generation)



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

Figure 14

Before fusing HDPE cap (***a***) to pipe, secure pipe driver (***b***) to PE cap with retaining collar (***c***). Do not tighten retaining collar against PE cap. Leave loose instead, to allow rotation of pipe driver (***b***) onto cable stud (***e***). First slide cable stud (***e***) completely through bursting head (***f***). Then screw head driver (***d***) completely onto cable stud termination (***e***) as shown (exposing approximately 75mm of thread behind head driver). Then screw pipe driver (***b***) completely onto threaded stud (***e***) until contact is made with head driver. Use anti-seize grease on threads.

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

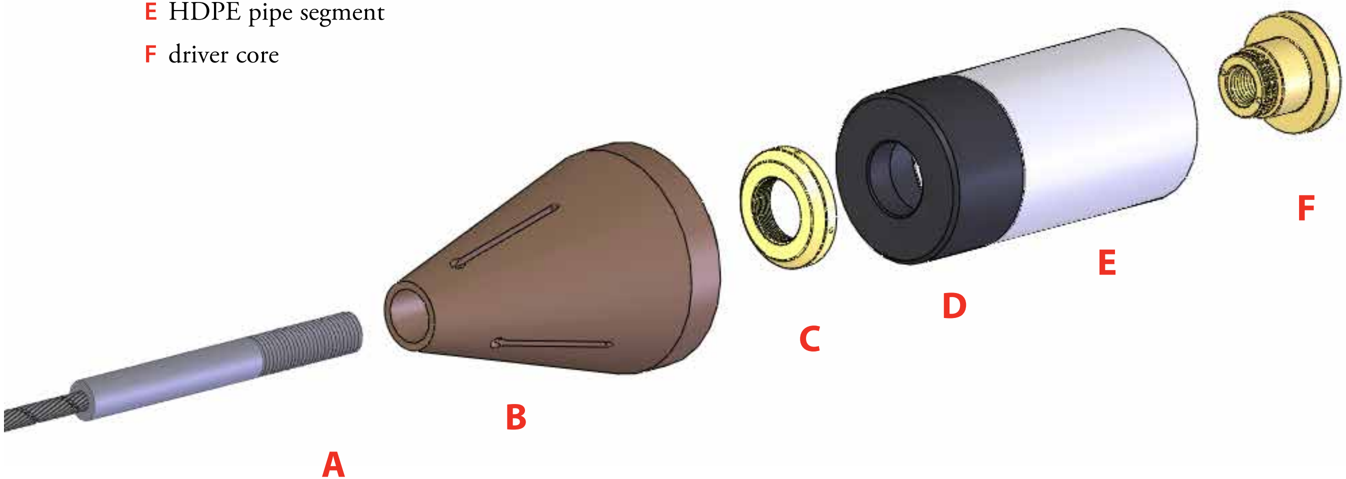
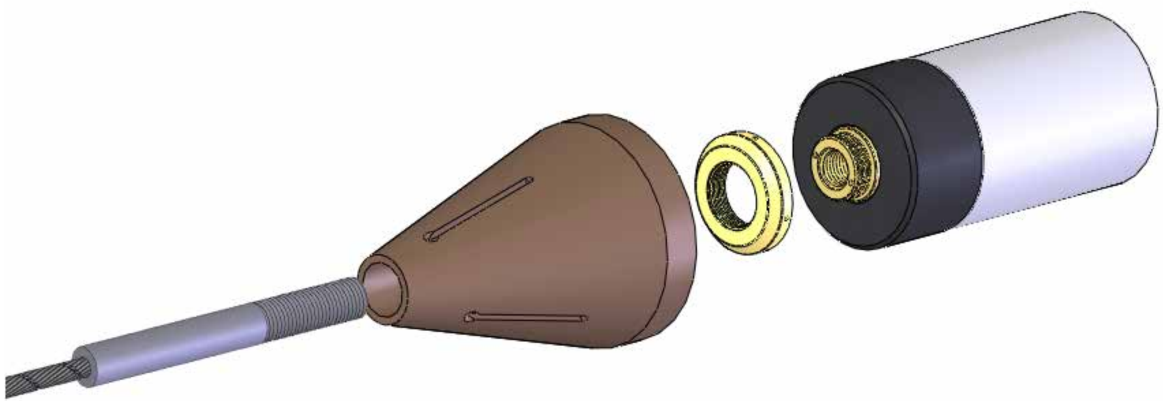


Figure 15

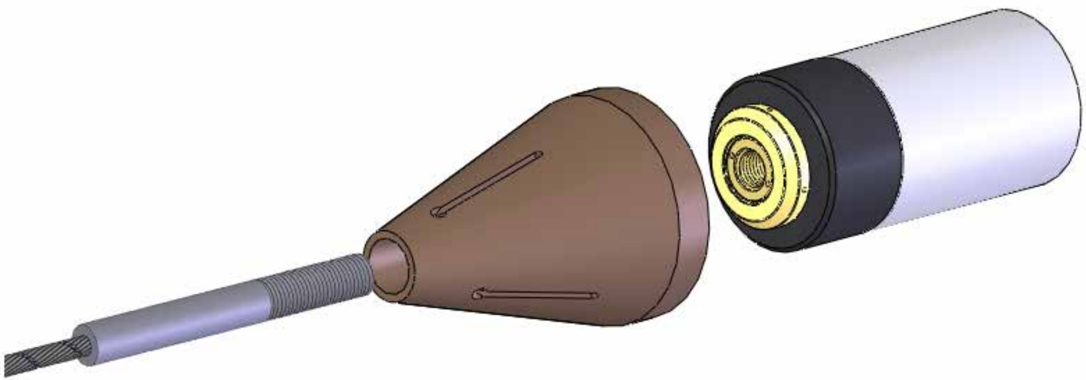
STEP 1

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 is to allow enough room to trim and heat the PE cap in the fusion machine.)



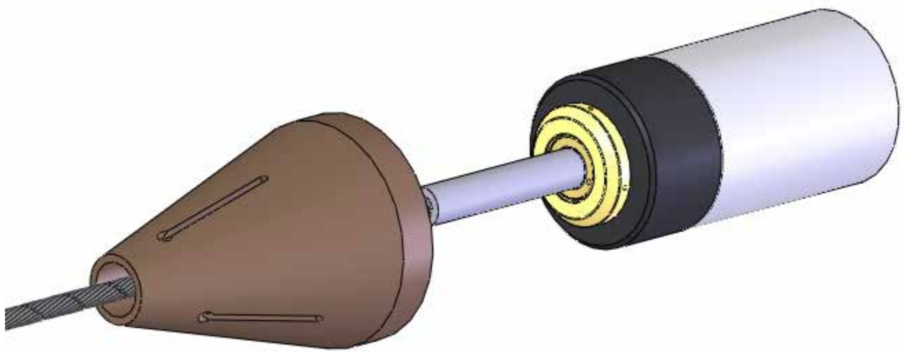
STEP 2

Apply anti-seize grease to driver collar threads. Attach driver collar to driver core and turn clockwise 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.



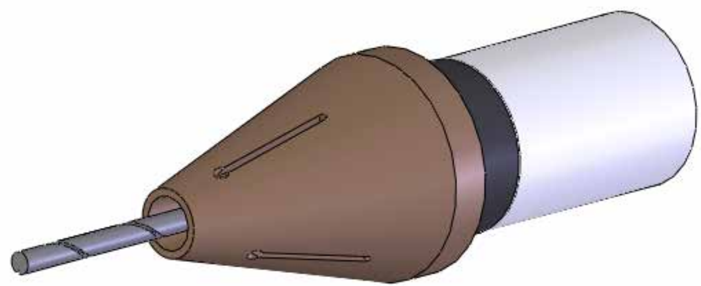
STEP 3

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



STEP 4

Slide bursting head back against driver assembly, and unit is ready for use. TRIC 8" and 10" static bursting heads are designed to slide freely forward on the cable, and will often do so upon entering the launch pit. If this happens, monitor the entry as the new pipe and core assembly catch up to the bursting head, and make sure that the cable stud and core assembly dock cleanly with the bursting head upon contact with the host pipe.



STANDARD BURSTING HEAD

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

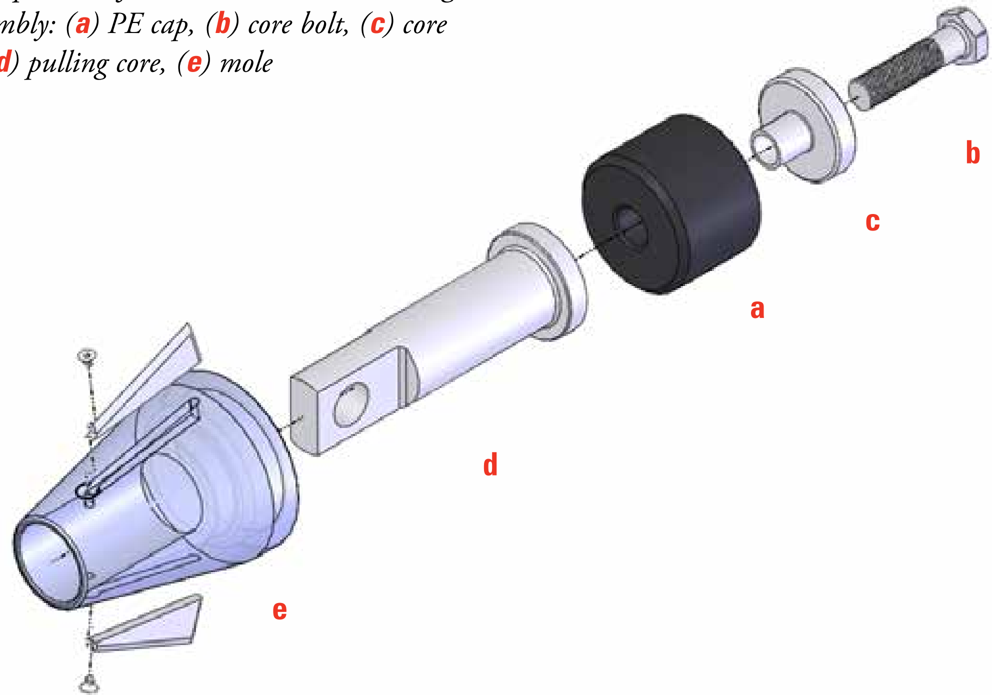


Figure 16

TRIC standard bursting heads are lighter than their TRIC-Lock counterparts, and are 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.

TRIC-LOCK BURSTING HEAD

*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.*

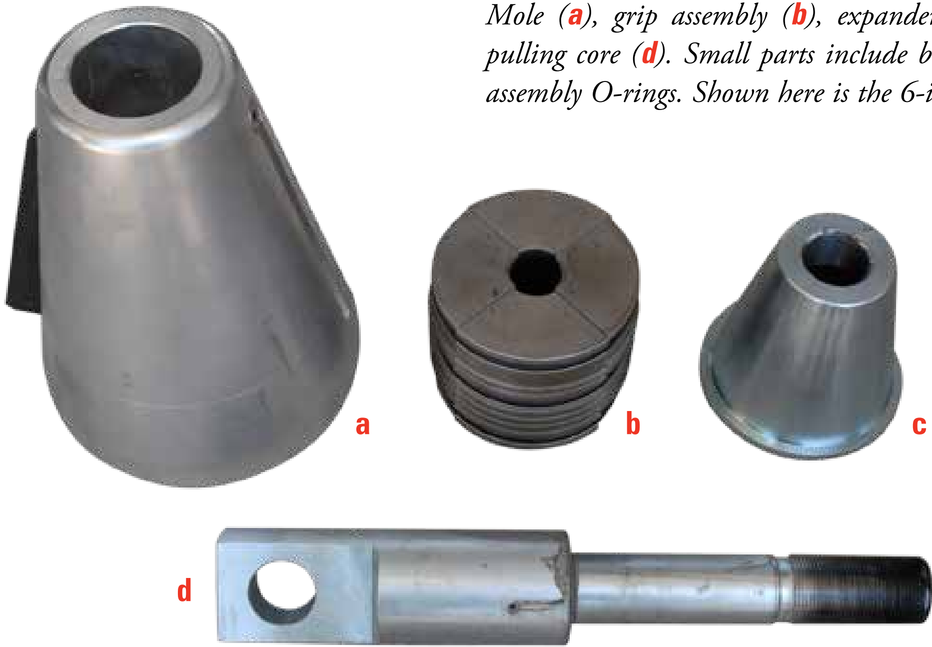
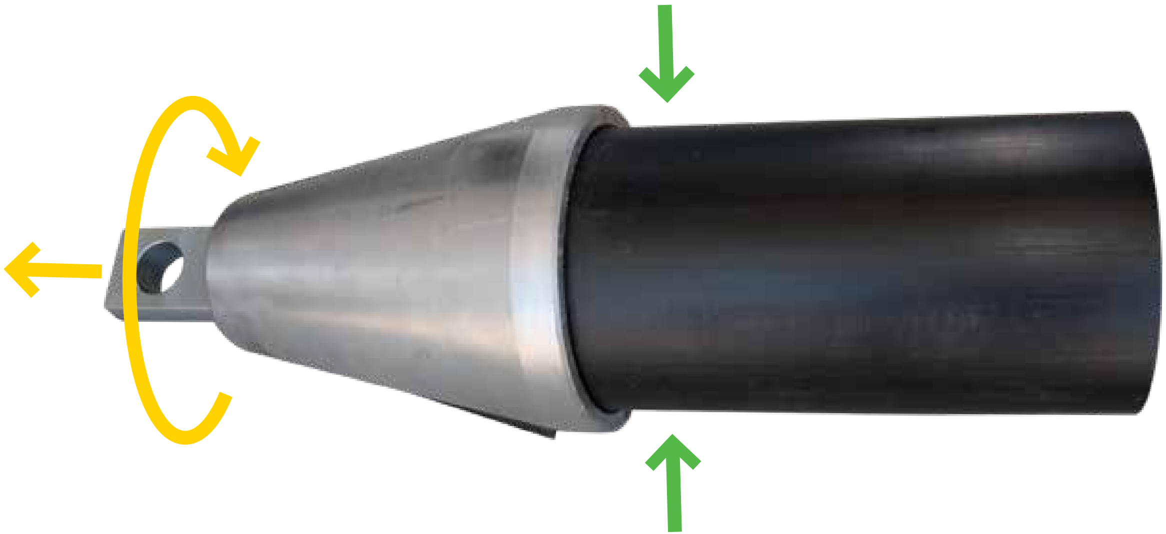


Figure 17

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) we recommend that you fuse a short piece of SDR17 onto the end of the other 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 edge in a fusion machine. 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 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 to tighten the core at least one more revolution, or until the pipe just begins to visibly swell immediately behind the mole (green arrows). Do not overtighten. As the head is pulled, the grip assembly will further tighten against the pipe.

RELEASING CABLE TENSION (DETENSIONING)

An essential 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 43).

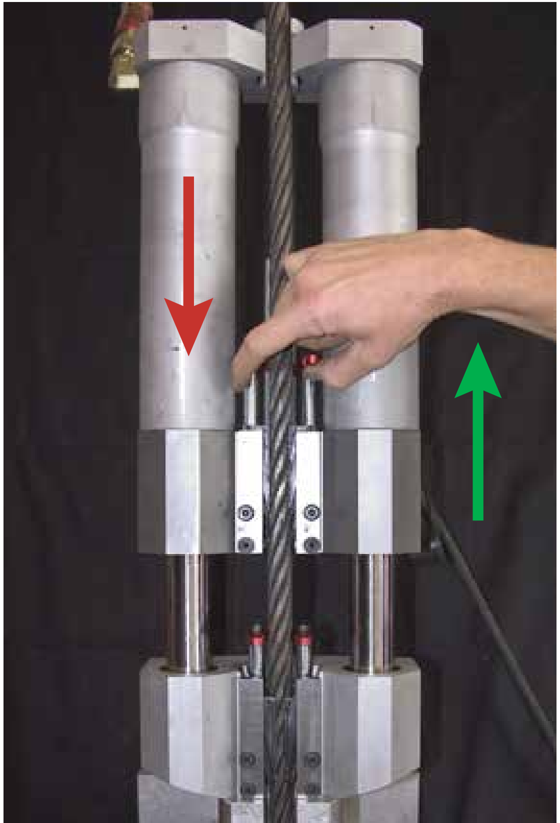
DO NOT enter a pit with a TRIC puller that is unstable and under load. Stop and release tension, then investigate. Adjust the pulling assembly as necessary before proceeding further. Read sections regarding proper setup and cable load capacities.

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 puller shown in this section is Model C25. However, the procedure of detensioning is the same for all TRIC pullers. Please see page 6 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

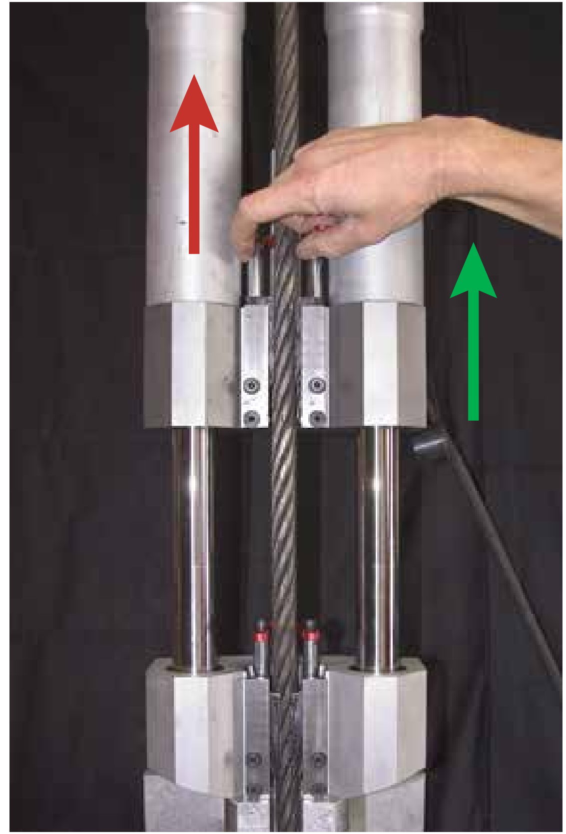
Pull back/up on pulling grippers while retracting cylinders until the pulling grippers are free. Retaining grippers will hold cable tension and allow pulling grippers to release cable.

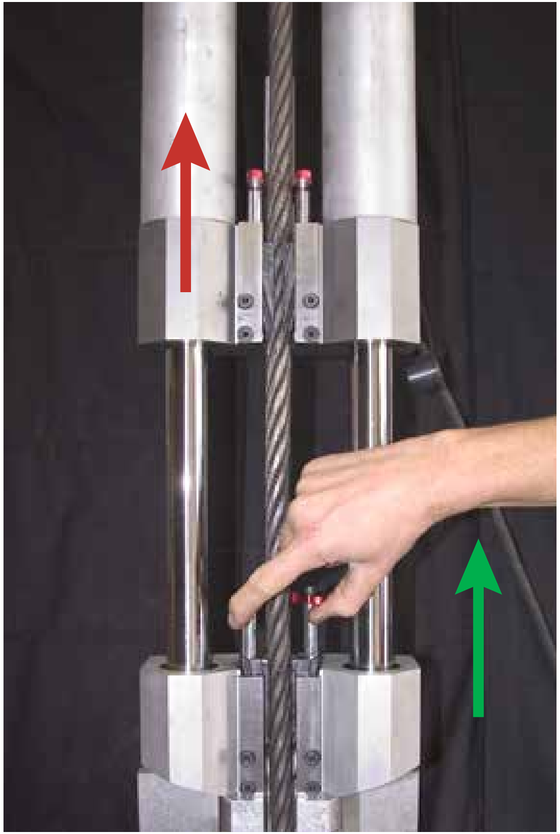
WARNING: Avoid hitting or prying yoke assemblies to move or free grippers.

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 43 for illustration).

STEP 3:
Extend puller without engaging cable

Hold pulling grippers away from the cable, then extend the cylinders to near the end of the stroke (leaving some piston travel remaining). Then, slide pulling grippers onto the cable.



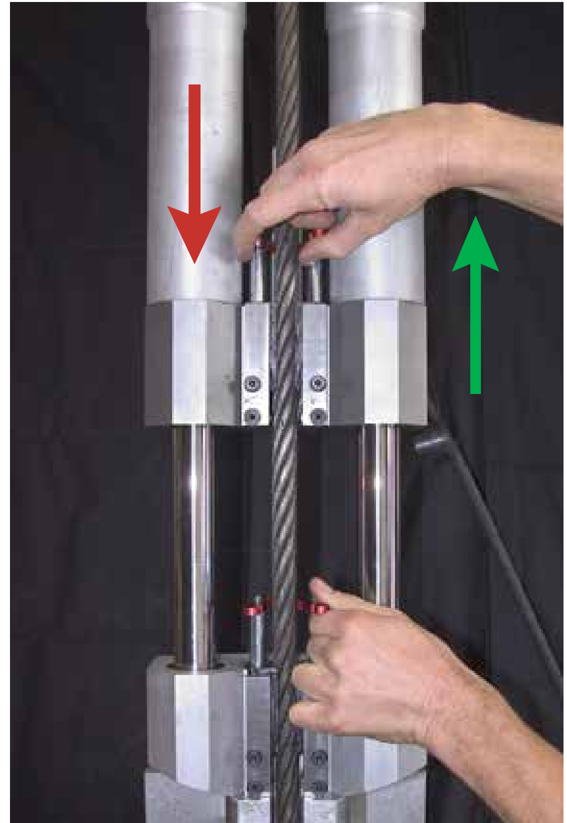


STEP 4:
Free retaining grippers

Using remaining piston travel, extend ram while pulling retaining grippers back 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

Keeping retaining grippers away from the cable, pull back on pulling grippers while retracting the cylinders. With the retaining grippers loose, the puller will "feed back" cable tension. (On some occasions, cable stretch is such that Steps 2 through 5 must be repeated.)



STEP 6:
Remove cable from puller

Remove cable completely from both grippers. Before detaching hydraulic hoses, retract puller to protect chrome piston rods during storage and transport, both on the job an off. (Serious scuffing or denting of chrome rods will cause hydraulic seals to leak.)

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.