TRIC™

User Guide

V24

PIPEBURSTING SYSTEM

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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 if you prefer, call us toll-free at 888-883-8742. Welcome to the TRIC Team!

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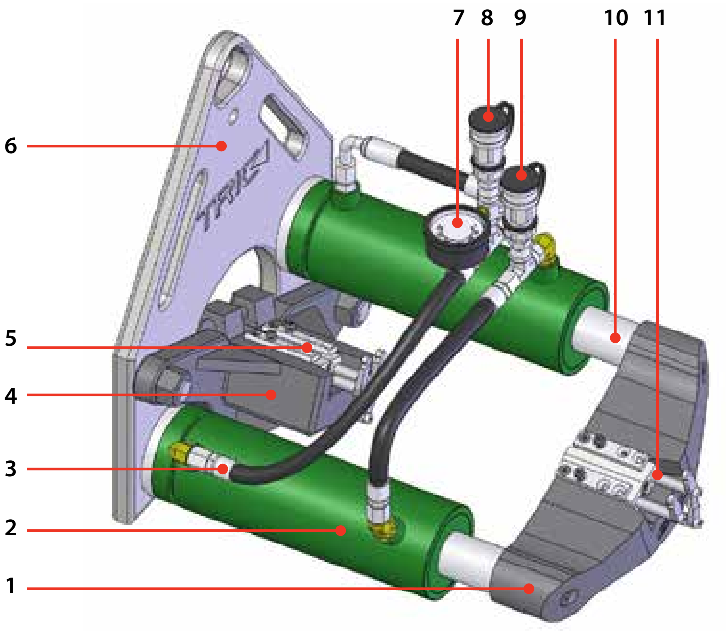


Basic Puller Components*

1 Pulling Bridge

2 Cylinder

3 Hydraulic Hose

4 Retaining Bridge

5 Retaining Grippers

6 Front Plate

7 Pressure Gauge

8 Hydraulic Fitting (extending)

9 Hydraulic Fitting (retracting)

10 Piston Shaft

11 Pulling Grippers

**Materials and specifications subject to change without notice.*

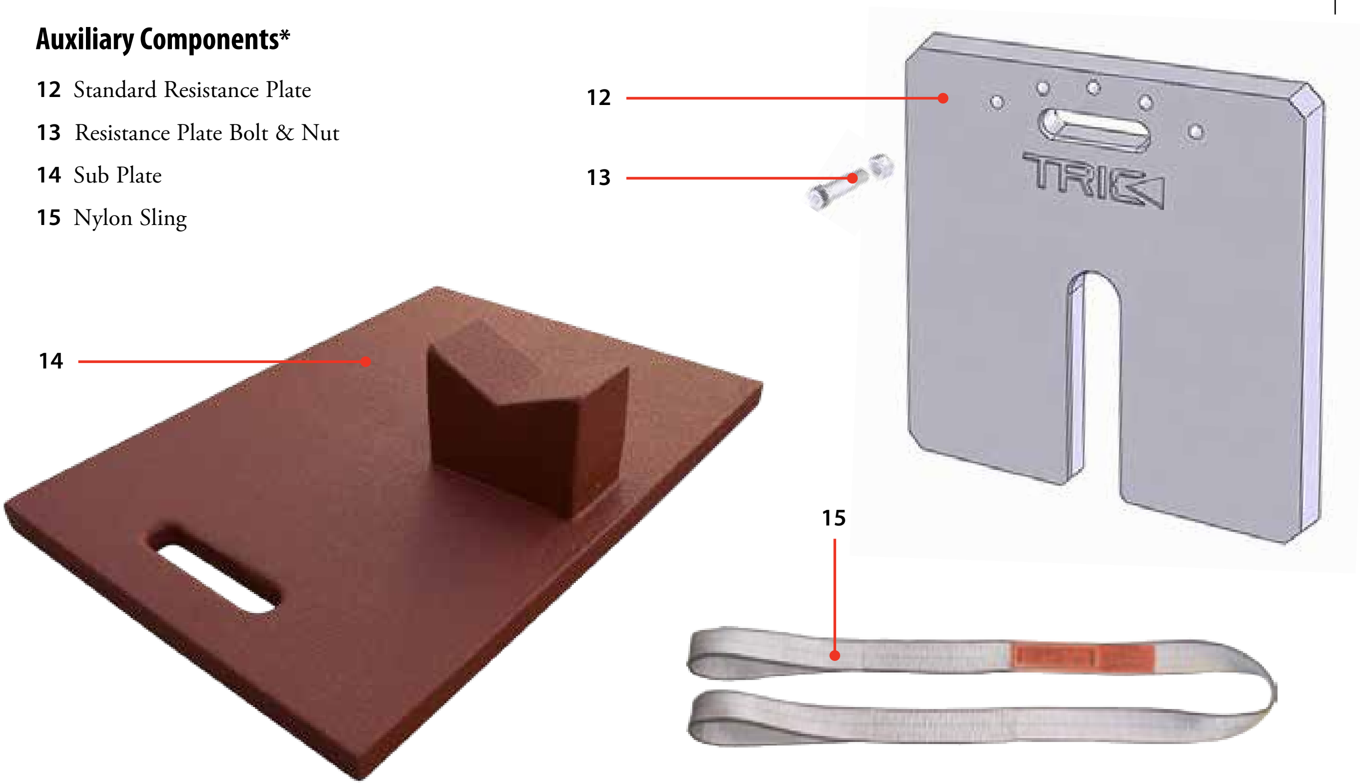
Auxiliary Components*

12 Standard Resistance Plate

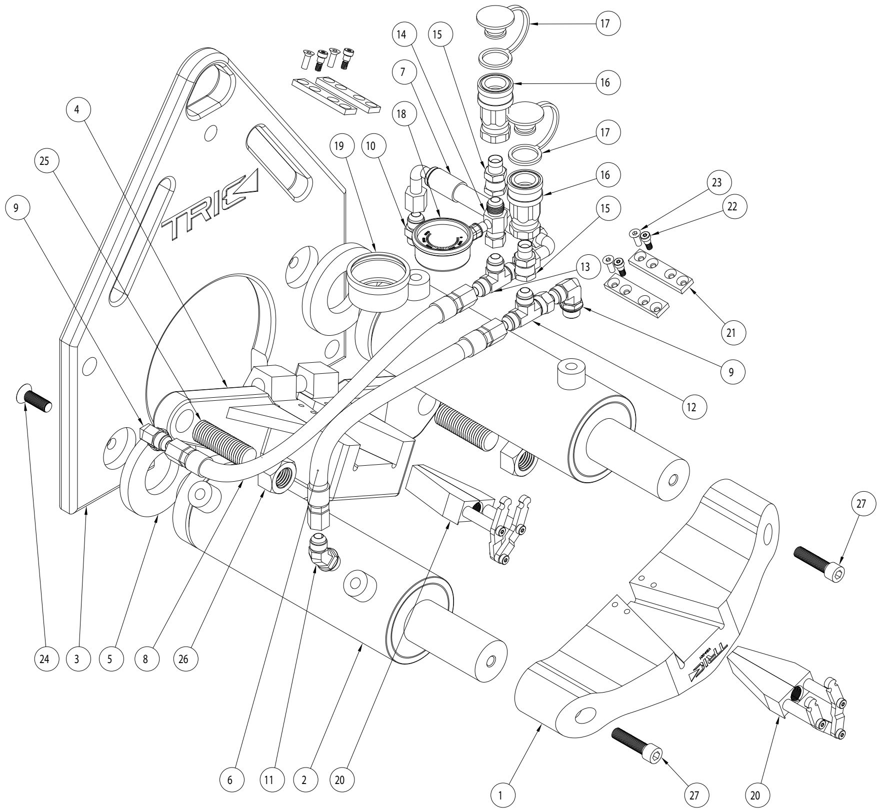
13 Resistance Plate Bolt & Nut

14 Sub Plate

15 Nylon Sling



V24 ASSEMBLY (PARTS BREAKDOWN)



Specifications

Pulling force: 24 tons @ 2,500 psi*

Piston area: 19.24 square inches

Suggested flow rate: 5 to 15 GPM

Cable size: Maximum 3/4” swaged

Puller weight: 230 pounds

**Exceeding maximum pressure rating for this unit is dangerous, and will void any warranty on the pulling equipment. Do not operate the V24 with a hydraulic power supply that exceeds 3,000 psi, and always keep a working pressure gauge on the puller.*

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	V24-PPUL	V24 Pulling Bridge	1
2	V24-SCYL	Cylinder, 3.5"- 2500 PSI	2
3	V24-PFRO	V24 Front Plate	1
4	V24-SLRB	V24 Lower Retaining Bridge	1
5	V24-PCSW	V24 Cylinder Spacer Washer	2
6	TT-HOSE-V12A	V24 Retraction Hose	1
7	TT-HOSE-V12B	V24 Extension Hose, w/ 90-Deg Elbow	1
8	TT-HOSE-V12C	V24 Extension Hose, Sweep	1
9	TT-HFIT-LOB12	1/2" Elbow @ 90-Deg.	2
10	TT-HFIT-R12	1/2" JIC/SAE Straight Adapter	1
11	TT-HFIT-4512	1/2" JIC/SAE Elbow @ 45-Deg	1
12	TT-HFIT-T12S	Tee, JIC/Run	1
13	TT-HFIT-THF	Tee, JIC	1
14	TT-HFIT-T34S	Swivel Fitting	1
15	TT-HFIT-REDS	1/2" JIC/NPT Straight Adapter	2
16	TT-HFIT-6600F	Parker 6601-8-10 PHK	2
17	TT-HFIT-6600FD	Dust Cap, 6600-Series Female	2
18	TT-HFIT-PG6K	6K Pressure Gauge	1
19	TT-HFIT-6KGP	Gauge Protector	1
20	TTA-GA-34M	3/4" Monolithic Grippers	2
21	TT-GCPS-INTP	Gripper Cover Plates - Interchangeable	4
22	TT-FSNR-BA313H	Shoulder Screw	4
23	TT-FSNR-BA750F	Cover Plate Screw	4
24	TT-FSNR-FB1500F	1/2-20 x 1.5" Flat SHCS	2
25	TT-FSNR-KA3000S	1-8 x 3" Stud	2
26	TT-FSNR-KAN	Hex Nut, 1-8, Grade 8	2
27	TT-FSNR-FB2000C	Shaft Bolt	2
28	TTA-QLHA-4ASM	4" TRIC-Loc Head Assm.	1

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 1997. Laterals, or residential sewers, are often constructed with bends (directional changes) between the building foundation and the property line or public sewer main (see Figure 1). A cable is the most efficient way to negotiate these bends. It is quite common to pull through one or two bends in a lateral job, sometimes even three. It is also possible to be stuck at any given point on an unknown obstacle, or because the pull has not been set up advantageously. See the next section on *Bursting Preparation* for logistical advice on some of the the more typical job scenarios.

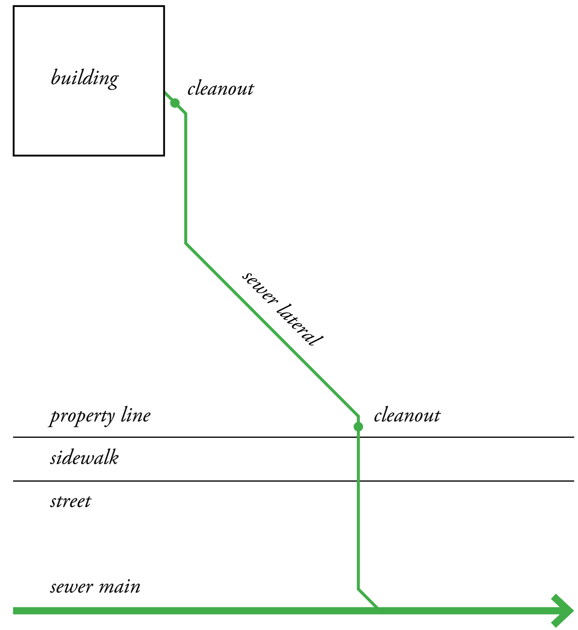


Figure 1

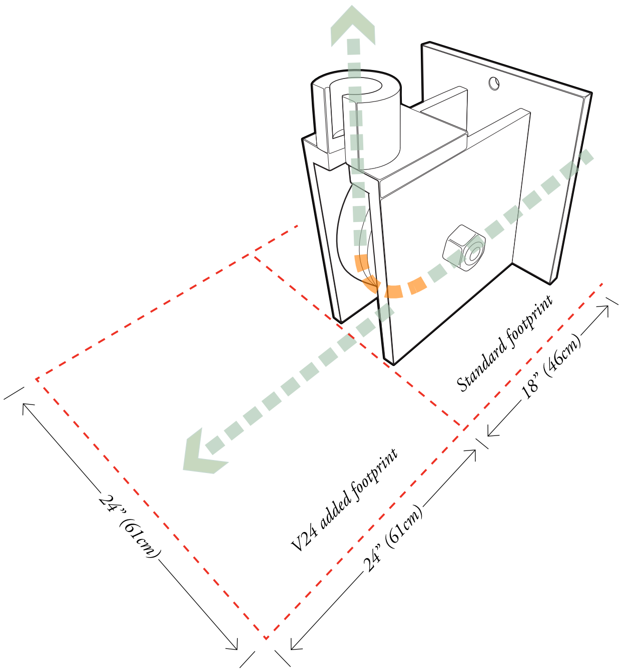


Figure 2

TRIC V-Series pipebursting units are designed to pull cable directly in line with the pipe. This horizontal configuration eliminates the pulley base that is an integral part of the original vertical-pulling TRIC system. While the vertical puller has a smaller footprint (24" wide by 18" long with resistance plate), it also concentrates cable stress on the wheel radius, as illustrated in Figure 2 at left. This reduces the overall test strength rating of the cable by as much as 20%. The V24 thus increases the safety margin of the cable under load. The V24 also requires a longer excavation at pipe level (as shown in Figure 2). This extra operating room becomes less of an issue in deeper excavations, since deeper pits generally become larger at their base. Note that wood or other cribbing adds extra length to the pulling setup (see Figure 11 on page 26).

BURSTING HEAD	PIPE MATERIAL
Standard/Static	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 Vitrified Clay (VCP)
2 Cast Iron (CI)
3 Asbestos Concrete (AC)
4 Reinforced Concrete*
5 Fiber Conduit (Orangeburg)
6 Plastic
7 Ductile Iron*
8 Steel
9 Copper

Not recommended with the V24

Figure 3
Bursting Head Selection Table

The V24 is designed to replace most types of pipe up to 6" (150mm) 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 3 on the facing page to select the correct head for the job.

The first step in any pipe-bursting project 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 (cleanouts) marked on the ground surface. Launching and receiving pits are configured differently from one another, and can have vastly different excavation requirements. Please review the illustrations on the following pages.

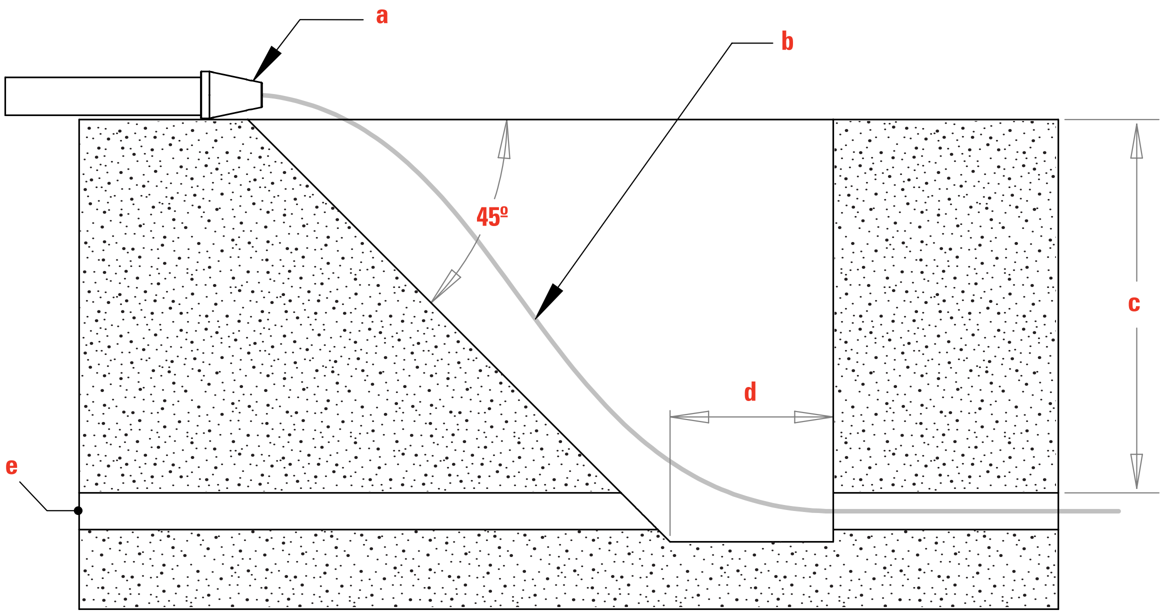


Figure 4
Launching pit (Scenario A)

a 4"– 6" (100–150 mm) bursting head & HDPE pipe

b Cable

c Variable

d 1'– 2' (30–60 cm)

e Existing (old) pipe

HDPE pipe is flexible, which is indispensable for pipe-bursting applications. The relationship between pipe diameter and wall thickness (known as SDR or Standard Dimension Ratio) determines the level of flexibility for each pipe size. A safe formula for the excavation of launching pits for all 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. However, smaller pipe sizes have smaller bending radii. Figure 4 on the facing page shows a typical launch scenario for sewer lateral bursting. Due to the smaller bending radius of 4" pipe (standard for sewer laterals) a steeper ramp-down can be used (here shown at 45º). Allow enough room under the old pipe at the point of entry (**d**) to allow flexing back to grade and to facilitate reconnecting the line after the burst.

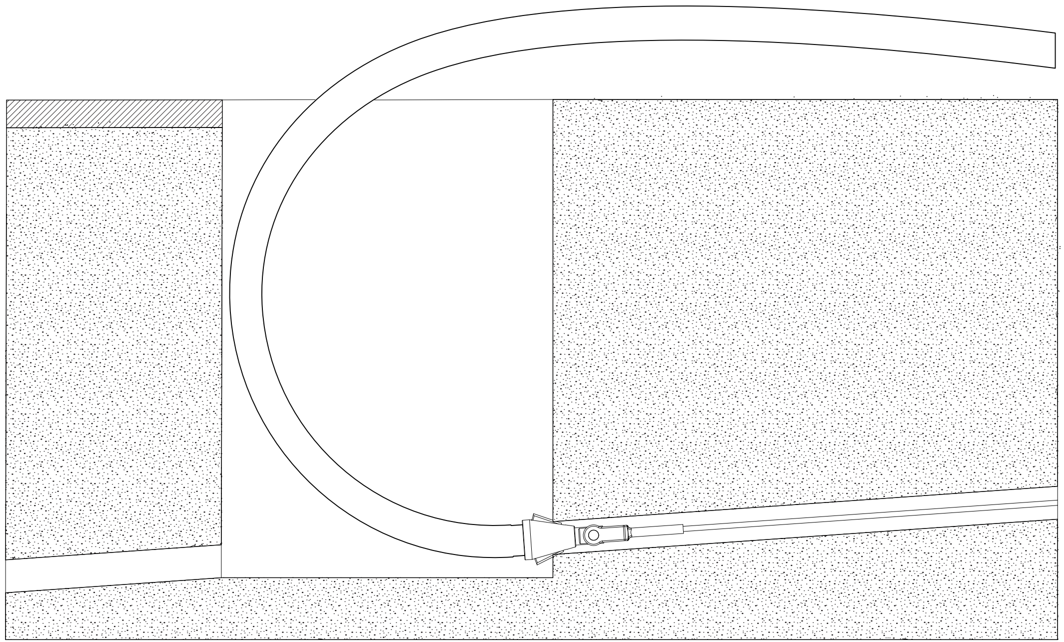


Figure 5
Launching pit (Scenario B)

Figure 6
3/4" swaged cable with shackle termination

Launching pits that are deeper than they are long are often best negotiated by creating a "C" curve with the HDPE pipe, as illustrated in Figure 5 on the facing page. This works best with smaller pipe diameters such as 4 inch (100mm) and under, and in some cases 6 inch (150mm).The standard cable for 4" and 6" lateral bursting is 3/4" swaged wire rope with an open shackle or clevis termination (see Figure 6). The large socket pin that connects the bursting head to the cable also acts as a hinge to facilitate pipe entry. After attaching the bursting head to the cable, position the head assembly in the launch pit with the shackle inside the old pipe, and the head with new pipe diving straight down. As the pull begins, assist the pipe as it flexes into the "C" shape. Then as the pull progresses, maintain a large curve in the new pipe as it enters the pit.

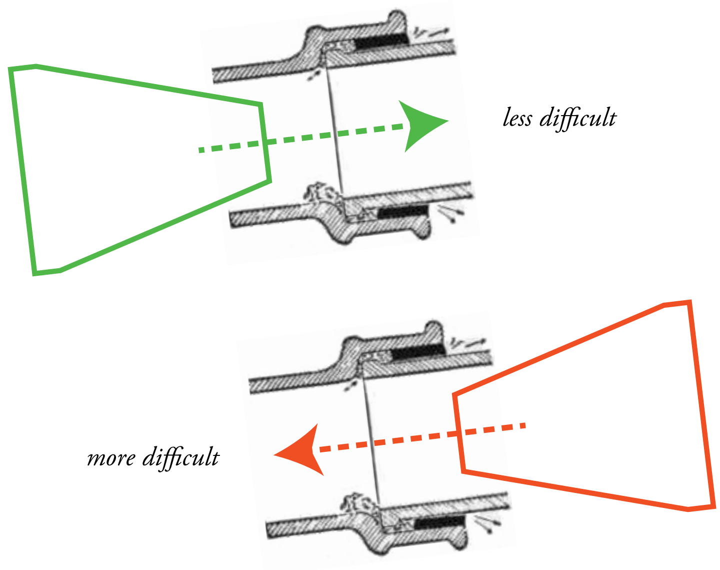


Figure 7
Up-grade versus down-grade bursting in cast iron pipe

Bursting up-grade, as pictured in Figure 5 on page 16 and at top in Figure 7 on the facing page, has additional benefits. This method allows the introduction of water to the host pipe from the upper pulling pit (receiving pit), so that the bursting head is immersed in water as it is pulled through the old pipe. This facilitates bursting, and softens the earth to ease expansion as the old pipe is broken. When working in particularly hard soil, hydraulic pressures can be reduced by as much as 50% simply by adding water to the host pipe during a burst. Lower operating pressures often result in faster bursting, depending on the hydraulic power source used. It is not always necessary to add water to a pull. However, it is important to monitor pulling pressures at all times to gauge how hard the system is working.

Another benefit of pulling up-grade pertains to cast iron bell-and-spigot pipe connections. Cast iron bell joints are broken more easily from behind—in other words from the pipe side of the bell rather than into the open end of the bell—as illustrated at top in Figure 7. This is true whether the host pipe is wet or dry. However, adding water is still often recommended, especially if bursting pressures are consistently high. When high pressures persist, release excess cable tension (see instructions on page 48), leaving only enough tension to keep cribbing and puller in place. Then insert a garden hose a few feet down the line and turn water on fully. Reduce or stop flow if your pulling pit becomes flooded.

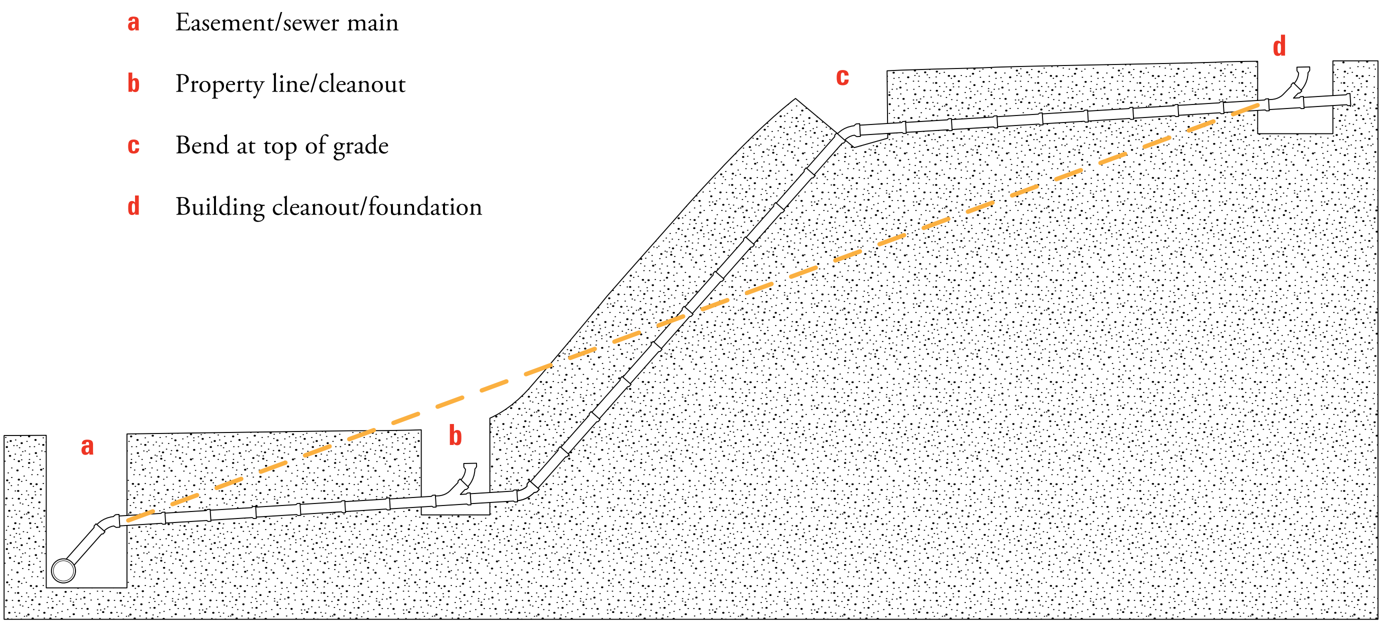


Figure 8
Stitching up a steep grade

Figure 8 at left illustrates a common situation, in which the sewer lateral runs down a steep hill or embankment, and has bends at both top and bottom of the slope. If the burst is attempted from the main **a** to the building **d** or vice versa, the cable will tend to follow the path of least resistance—indicated by the dotted orange line—and in most cases will slice out of the old sewer at street level (**a**–**b**), and/or cut into the earth excessively at the top of the grade **c**. This can be avoided by a process called "stitching." First, excavate at points **a**, **b**, **c**, and **d** as shown. Remove old pipe, couplings, and connections from all pits. Fuse the entire length of HDPE pipe from main **a** to building **d**, plus an extra 10 or 12 feet (3 or 4 meters). Attach the bursting head to the new pipe. Thread the cable from pit **a** to pit **b**. Position the HDPE pipe and bursting head at launch pit **a** and connect it to the cable. Then insert the puller in pit **b** and burst from **a** to **b** first. Thread the cable from **b** up to **c**, during or after the first pull. When the bursting head arrives at pit **b**, move the puller up to pit **c** and continue. When the bursting head arrives at pit **c**, move the puller up to pit **d** and finish the pull. Stitching maintains continuity of flow path by avoiding three separate launches. There is only one launch, with one entire length of pipe, pulled in three stages. Note also the resistance wall in pit **c**, which faces downhill *because it must be perpendicular to the host pipe path.* This is critical for stable, effective, and safe bursting. Do not use the ground surface to gauge the angle of the resistance wall. Use the pipe path instead, and cut a flat wall 90º opposed to the pipe.

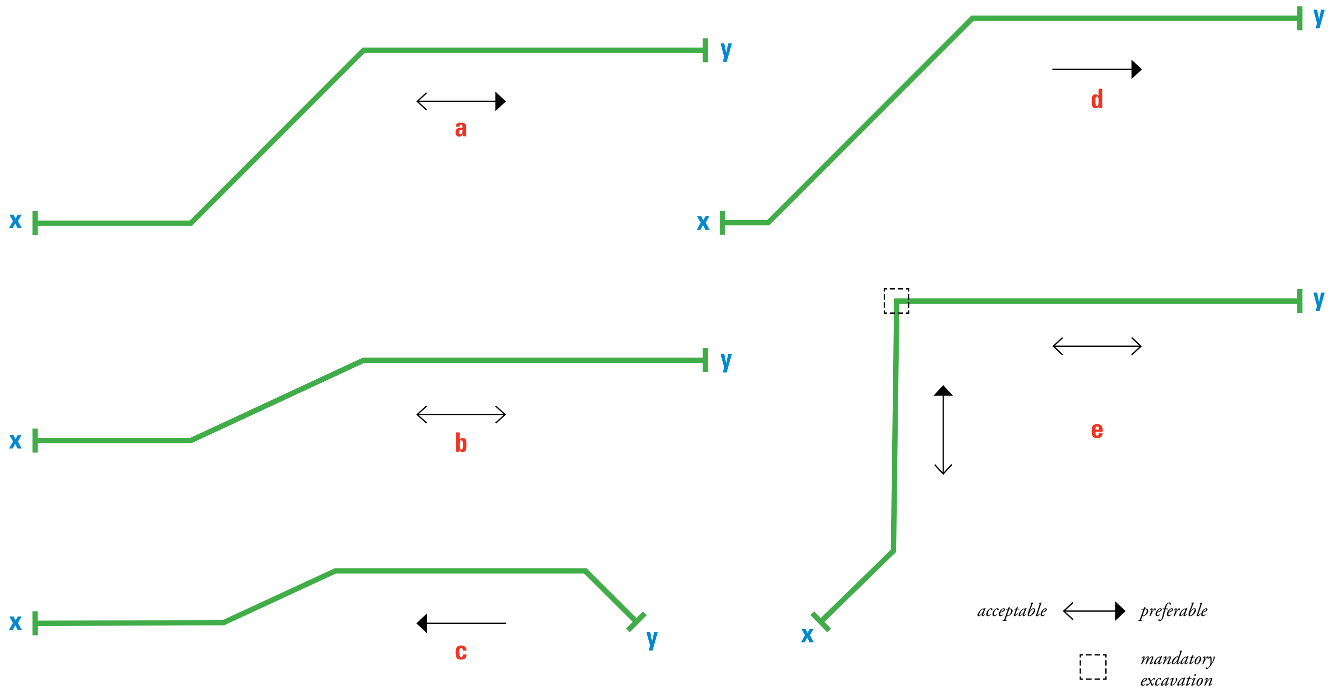


Figure 9
Basic lateral bursting scenarios

Figure 9 shows common examples of laterals with two or more bends. *These schematics are all top views, as in a road map*. Arrows indicate pull direction, or which way the bursting head is going. A number of factors influence which direction to pull, including accessibility of the pipe at either end, adjacent utilities, slope, ground conditions, pipe path and material, and of course physical bends or elbows in the line. The most common of these are the 1/16 bend (22.5º) and the 1/8 bend (45º). It's best to know the type and number of bends in the line, and especially where they are positioned in the lateral path. For example, scenario **a** could go either way, with preference to pull from end **y** because it has the longer section of straight pipe. The more straight pipe there is in front of the puller, the less likelihood there is for the cable to cut out of the pipe path at the receiving pit, and come out of alignment with the puller. Excessive cutting into the earth with the cable can stop a pull, break equipment, or both. Scenario **b** presents no challenge in either direction. Scenarios **c** and **d** have clear directional preference due to the very short distance before a major bend at one end. However, sometimes it is impractical to place a pulling pit at the desirable end of the lateral. In scenario **c**, end **x** is where you want the puller, but if end **y** is where the pulling pit has to be, it is best to dig at the 45º bend close to end **y**. Scenario **e** depicts a lateral with a 90º bend, usually found at the corner of a building. This scenario requires two pulls, with a third excavation at the 90º bend. In all cases, it is best to remember that the puller and cable want to straighten out the line between ends **x** and **y**.

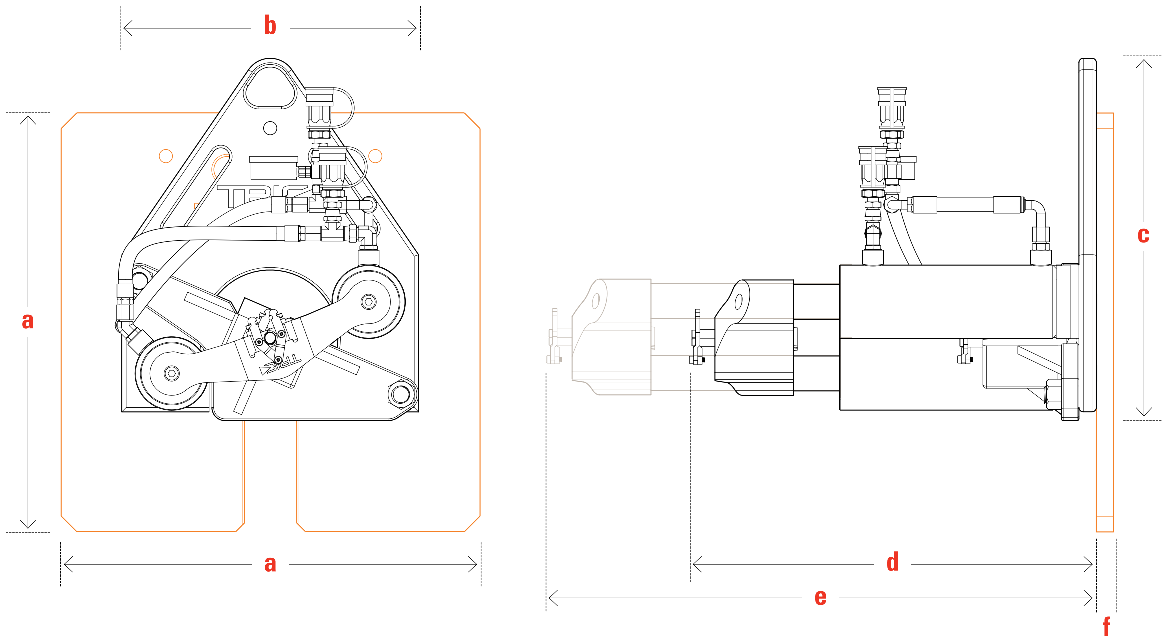


Figure 10
V24 basic unit dimensions

a = 24” (610 mm)

b = 17” (432 mm)

c = 20.3” (514 mm)

d = 25.6” (651 mm)

e = 31.3” (795 mm)

f = 1” (25 mm)

The V24 can be set up in various ways, depending on excavation and ground conditions, pipe path, adjacent utilities or other obstacles, etc. Figure 10 on the facing page displays the overall dimensions of the pulling unit, both by itself and with the resistance plate (shown in orange).

It is highly recommended to use the resistance plate whenever possible. The unit in full extension (**e**) requires additional cable clearance at the pulling bridge, and almost always requires wood or other cribbing between the puller and the resistance wall of the excavation, whether or not the resistance plate is used. Both these factors extend the working dimensions of the pulling unit. See cribbing examples on the following pages.

BURSTING PREPARATION

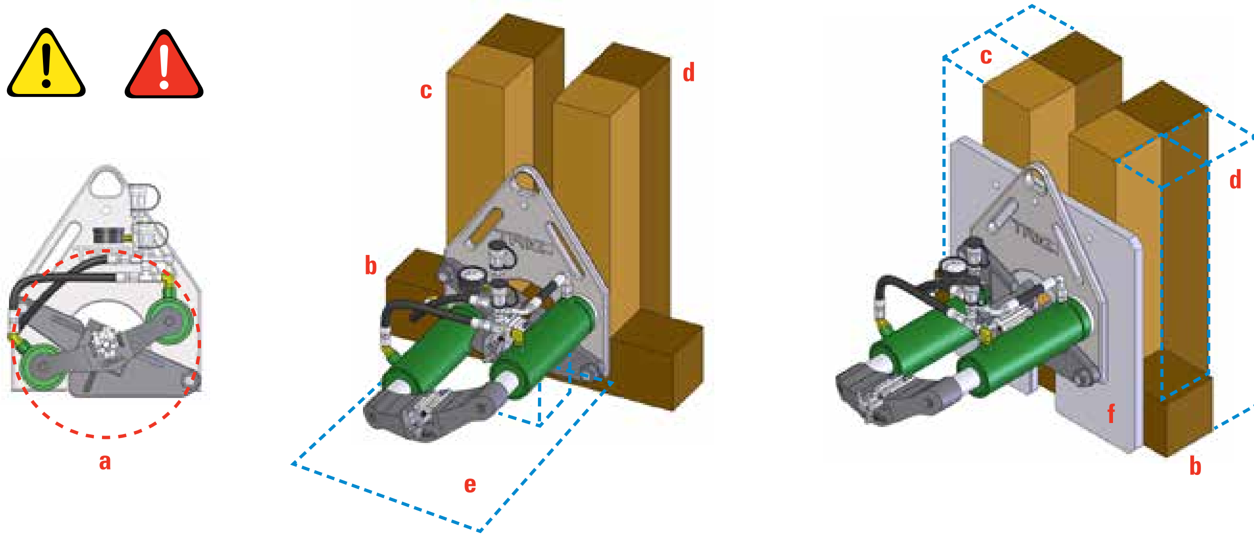


Figure 11
V24 cribbing (with and without resistance plate)

The better the cribbing setup, the faster, easier, and safer the job will go. The point is to *make the pulling unit as stable as possible, maintain alignment with the cable when under load, and monitor hydraulic pressure at all times*. Figure 11 at left illustrates V24 cribbing setup variations. In all situations the objective is to create a "wall of integrity" to spread the load evenly over as large a surface area as possible in the pulling pit. Every pit is different, so the best material to have on hand to accommodate each scenario is wood, in various sizes and lengths. The first thing to keep in mind—especially when setting up without a resistance plate—is the "center of the pull," as illustrated in item **a** at far left. Items **b**, **c**, and **d** are 6" X 6" timbers. Other useful wood sizes are 4" X 6" and 2" X 6". Start by setting a horizontal timber **b** *under* the cable path, to create a low anchor of support. Then build on that as shown by adding timbers **c** on top of **b**. If possible add longer wood **d** on either side (puller side or wall side) of the other timbers. Depending on the size of the pit, cribbing can be stacked horizontally as well as vertically. The optional base plate **e** helps keep the puller aligned with the cable during the pulling cycle, and is especially helpful when pulling without a resistance plate. Use flat wood to adjust the base plate elevation as necessary in the pit. The standard resistance plate **f** has a narrow cable threshold for maximum surface area and to prevent the old pipe from driving into the pulling unit. *With or without the resistance plate, be aware of the bursting head as it approaches the puller.* See instructions on page 32 for a full explanation.

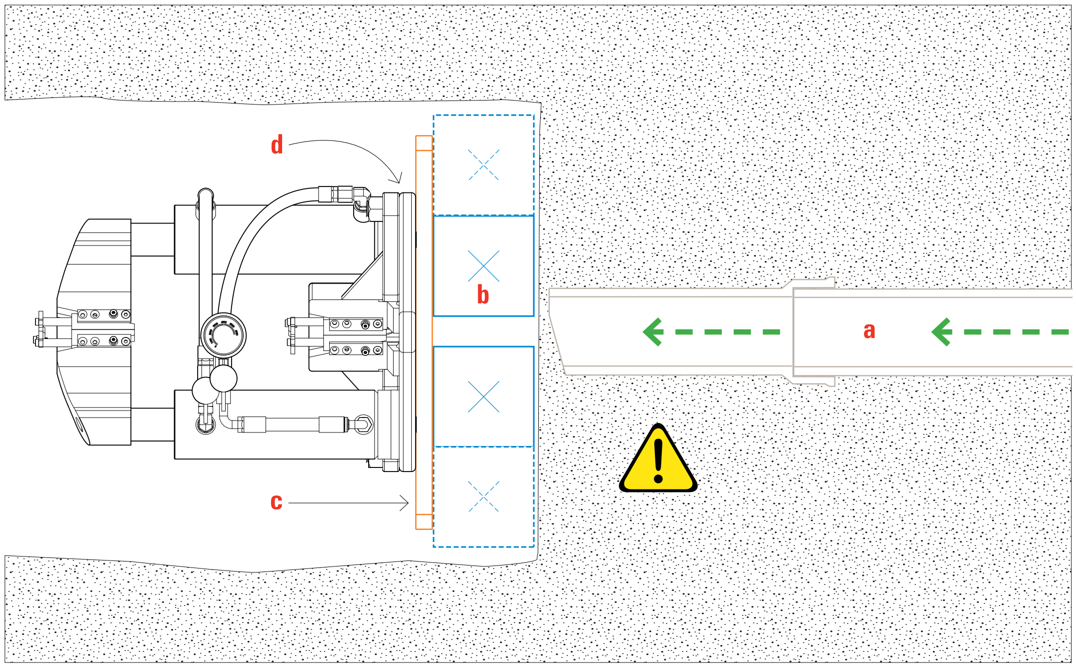


Figure 12
Cribbing against pipe intrusion

Pipe intrusion is a common occurrence in the receiving pit. *This is when the bursting head forces the old pipe* (**a**) *out of the ground towards the pulling assembly.* It happens near the end of the burst, usually when the bursting head is within a few meters from the receiving pit. Pipe intrusion is relatively common when bursting bell-and-spigot cast iron, particularly when pulling downstream—i.e., into the bell or hub—as shown in Figure 12 opposite. If the resistance plate (**c**) is used, its narrow cable slot (about 3" or 75 mm) will prevent pipe 3" or larger in diameter from encroaching upon the pulling unit. If pipe is driven into the receiving pit, it is stopped by the resistance plate and the pull continues without interruption. If the resistance plate is not used, extra care must be taken with cribbing. Figure 12 shows close placement of 6" X 6" vertical timbers (**b**) in front of the resistance plate (**c**) and/or front plate (**d**). In this example, the timbers flanking the cable path (solid blue lines) form a gap that is 2" to 3" (50–75 mm) wide. For maximum stability, additional timbers (dashed blue lines) should be added when space permits. Also, the end of the cable should be brightly painted 2 to 3 meters before the termination, to indicate that the bursting head is approaching. Please see page 32 for more information on extracting the bursting head at the end of a pull.

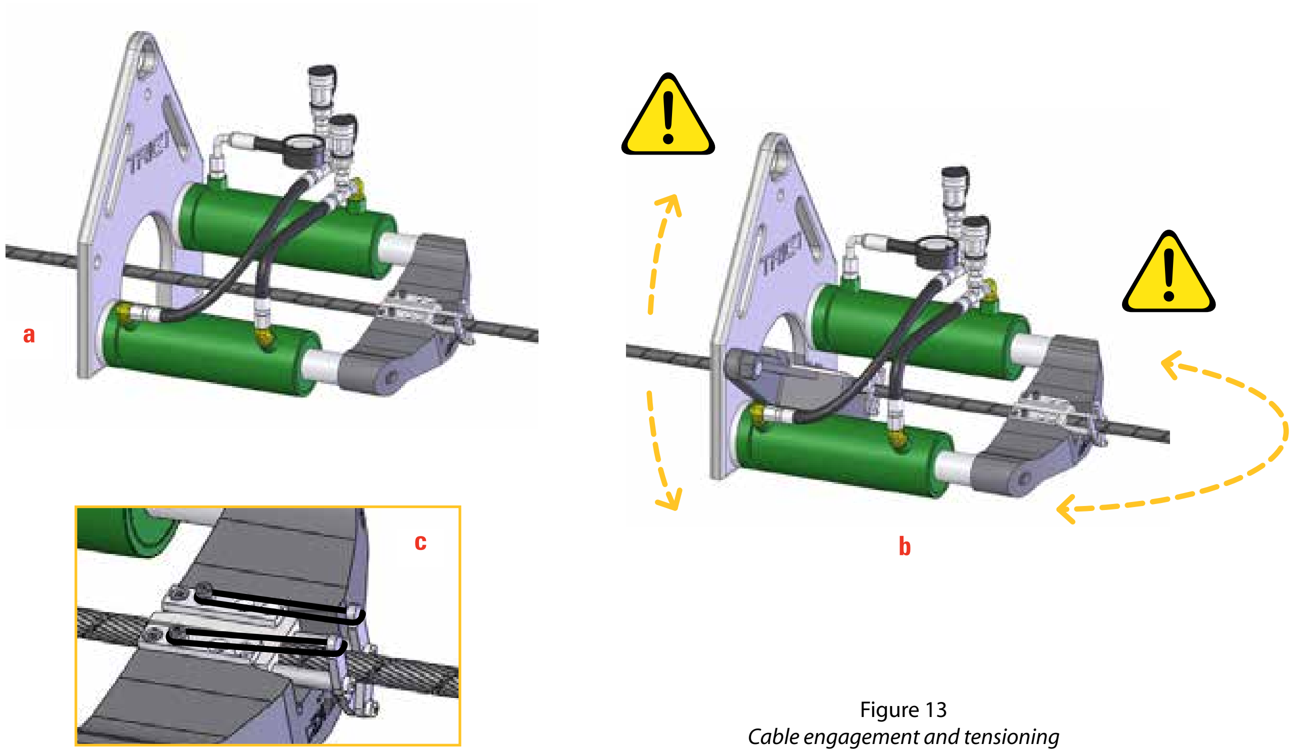


Figure 13
Cable engagement and tensioning

To feed the cable through the old pipe, first use a duct-rodder or similar device. If the line is clogged or in serious disrepair, use a sewer snake or hydro-jetter to navigate the line. Then pull back a stout nylon rope to pull the cable. Attach the new PE pipe to the bursting head. Position the head at the launching pit, and attach it to the cable. Take up cable slack at the pulling pit. With at least two people, using one or two nylon loading straps, lower the puller into the pit, *without the retaining bridge*. Feed the cable through the front plate and over the pulling bridge into the pulling grippers (see Figure 13**a** opposite). Then slip the retaining bridge under the cable and attach it to the front plate (13**b**). Fix the retaining grippers to the cable and attach retainer O-rings to each gripper assembly (13**c**). Gripper assemblies should be clean and well-lubricated. Apply anti-seize grease or equivalent to the gripper housings, and make sure grippers move freely back and forth before each job. Adjust cribbing, and support puller as necessary to align cable with gripper path before bringing cable up to full tension. Begin pulling slowly, making sure that the V24 is stable and that each gripper assembly engages and releases the cable immediately as the puller cycles. Once the burst has begun, pay close attention to hydraulic pressures and puller alignment as you go. *If the V24 becomes unstable and pitches up or down, or swings left or right, cable alignment will be compromised.* It will then become difficult or impossible to maintain cycle efficiency (proper engaging and releasing of cable). Stop, reduce cable tension, and make adjustments in the pit before continuing.

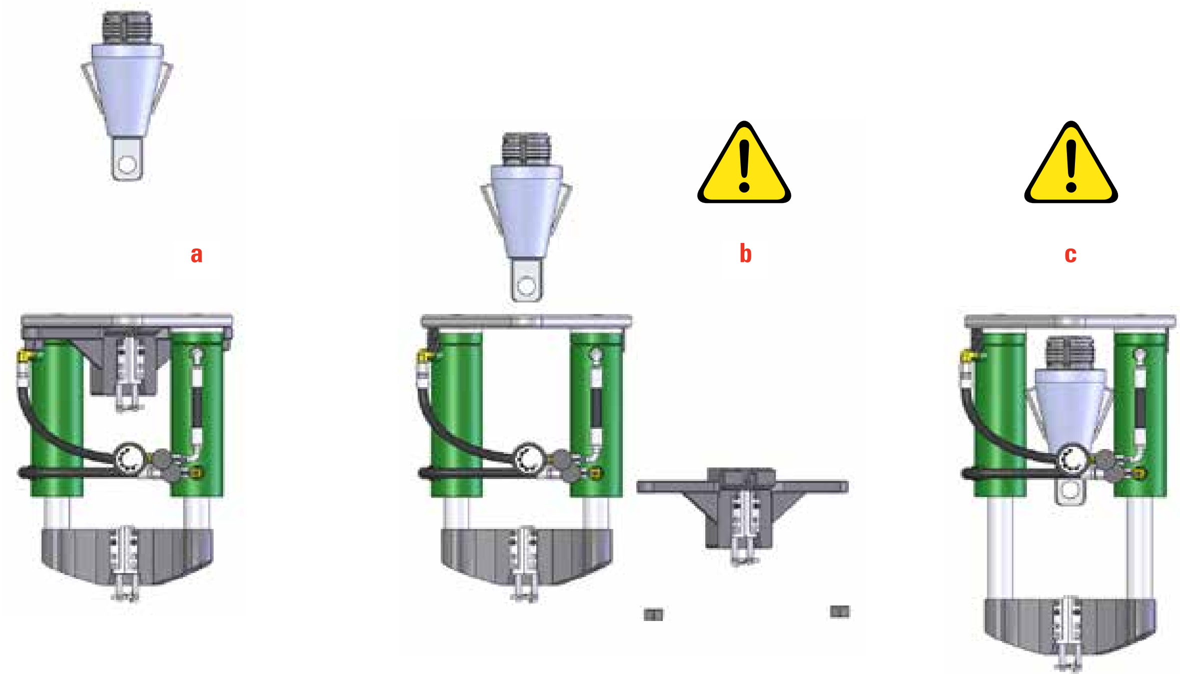


Figure 14
V24 head extraction sequence

The V24 is designed to pass a 4" and smaller bursting head, with blades, through the front plate. A standard 6" bursting head will pass at least halfway through the front plate, depending on blade configuration, possible obstructions, and head alignment. In any case, *it is important to know when the bursting head is near the end of the pull to avoid hitting the retaining bridge and/or resistance plate.* The best way to assure this is to paint the last 6 to 8 feet (2–3 meters) of cable with a bright color. Depending on setup and cribbing, there may or may not be a window of visibility in front of the puller. Even if there is, the last few pulling strokes often drive accumulated roots, earth, and pipe debris into the receiving pit along with the bursting head, hiding the head and cable termination. Keep a clear view of the cable and grippers at all times. Anticipate the end of the pull by monitoring the movement of the new pipe into the launching pit, and by watching for the painted cable at the receiving pit. When the bursting head approaches the front plate (Figure 14**a**), remove the retaining bridge from the front plate (14**b**). Clear any debris around the head and cable termination if possible, and continue pulling slowly. Fully extend the piston shafts on each cycle to help release cable stretch on the return stroke. If necessary, reattach the retaining bridge but avoid using the hex nuts to secure it. For most head assemblies, the cable termination will precede the bursting head by as much as a foot (30cm). Before the head assembly arrives, remove the retaining bridge and pull the head as far as possible through the front plate (14**c**).

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"/41mm), 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)

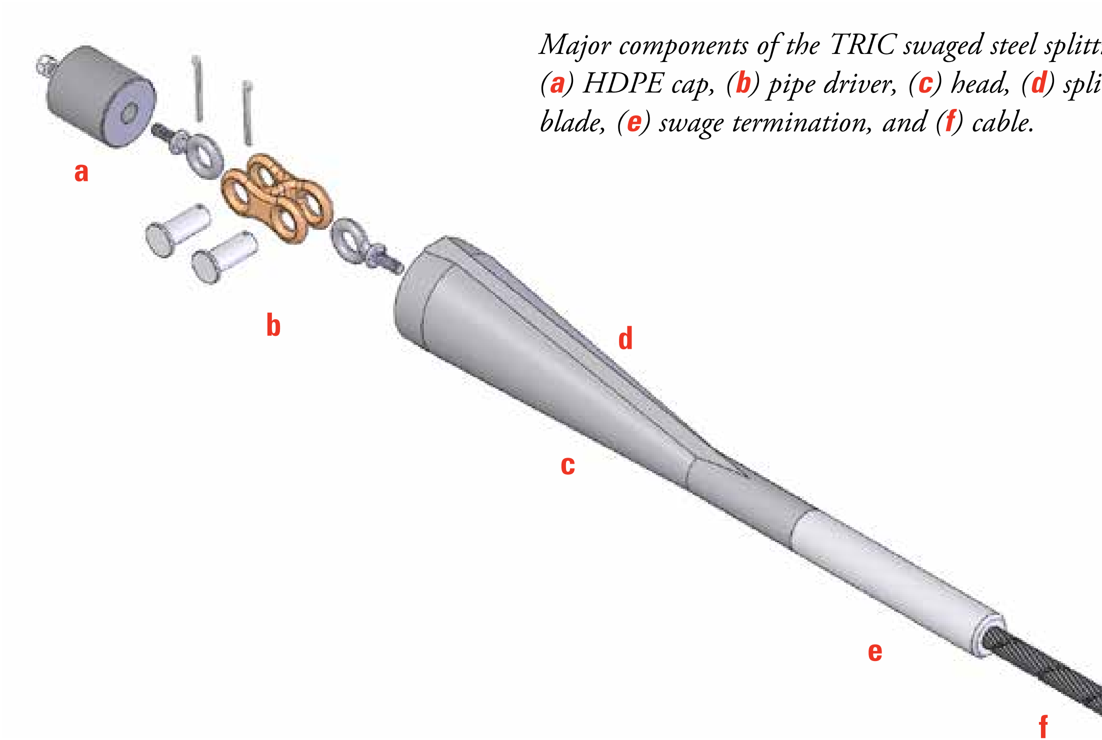
Figure 15
Hydraulic Pulling Force Table

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**	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 pipe-bursting. Use extreme caution and always have a working pressure gauge on pulling equipment.*

Figure 16
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 17

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

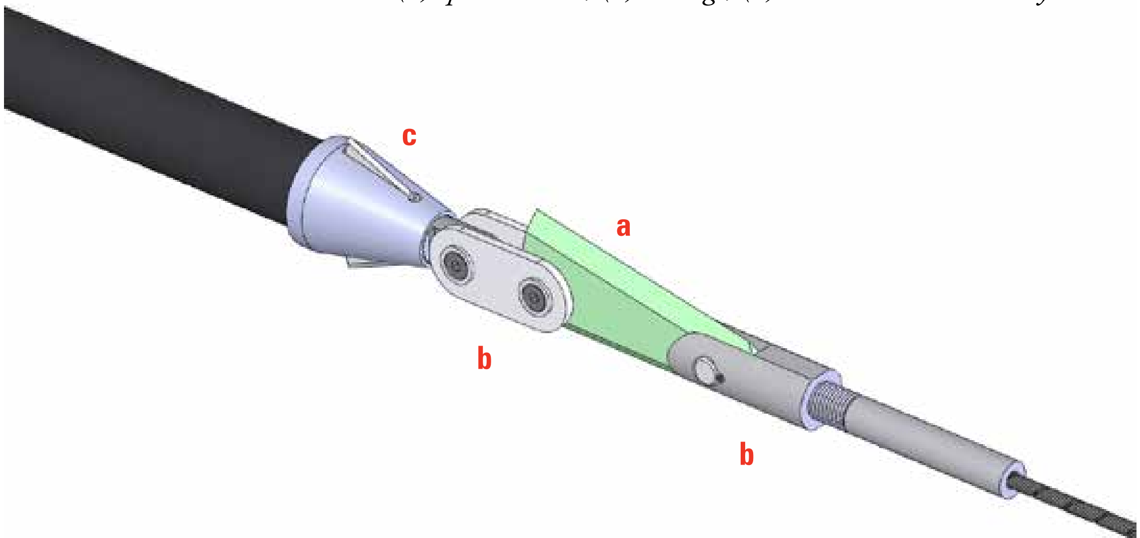
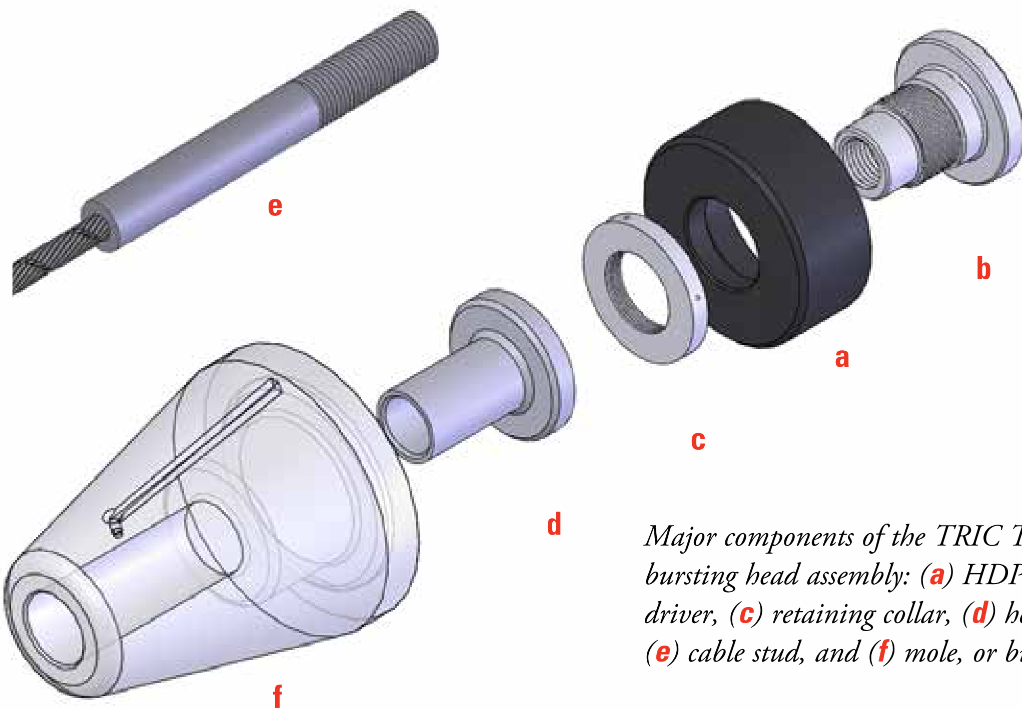


Figure 18

THREADED CORE BURSTING HEAD (8" and 10")



*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 19

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. Keep stud threads clean and protect them during storage, transport, and deployment by wrapping them with rags and duct tape, or by threading a nut onto the end. (The stud is 2” x 4.5 TPI.) The bursting head assembly is shown here without removable blade, which comes standard.

STANDARD BURSTING HEAD (4" and 6") with PRE-BURSTER

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

*Ancillary components include (**g**) 3/4" swaged cable with open shackle (clevis) termination, (**h**) socket pin, (**k**) cotter pin, (**m**) pre-burster*

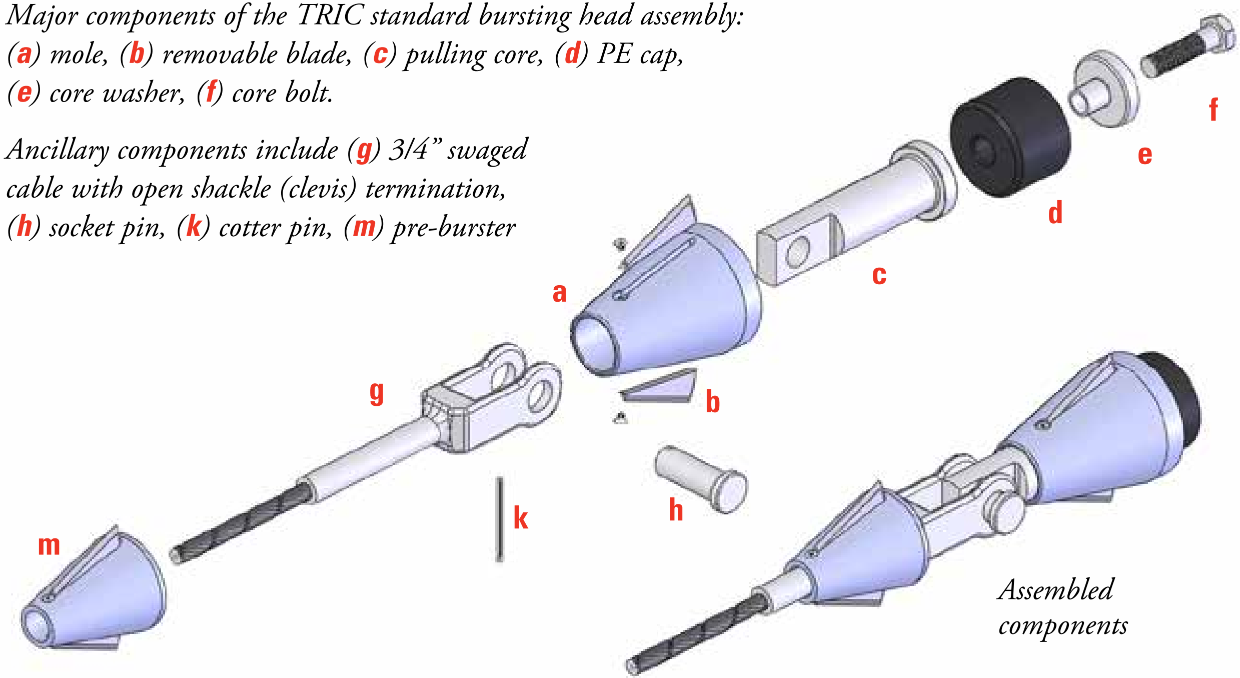


Figure 20

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 4" and 6" bursting head assemblies—both standard and TRIC-Lock models—employ the open shackle or clevis type cable termination (***g***) in Figure 20 opposite, and Figure 6 on page 17).

Custom threaded-core 4" and 6" heads (configured like the 8" and 10" heads shown on page 38) are available on special order.

The pre-burster (***m***) shown in Figure 20 is used primarily when upsizing 3" pipe to 4" HDPE. Its function is to enter and break or split the smaller diameter pipe before the shackle connection makes contact. This is particularly important when replacing cast iron and plastic, even when bursting size-to-size. The shackle pin itself (***h***) measures 4" in length, while the ID of standard 4" cast iron sewer pipe is slightly less than that. PVC drain pipe is nominal ID or less, depending on size and ASTM rating.

Both the pre-burster and 4" mole use the same removable blades (***b***). Blades are absolutely necessary when replacing plastic pipe. They are optional with cast iron and clay pipe (VCP). For plastic, generally two opposing blades are best.

STANDARD BURSTING HEAD (2" and 3")

*2" and 3" standard TRIC bursting head assemblies include: (**a**) 2" mole, (**b**) 2" PE cap, (**c**) 2" core washers, (**d**) 2" core bolt, (**e**) 3" mole, (**f**) 3" PE cap, (**g**) 3" core washer, (**h**) 3" core bolt, (**k**) removable blade, (**m**) 5/8" swaged cable with threaded stud termination (1-1/8" x 7 TPI)*

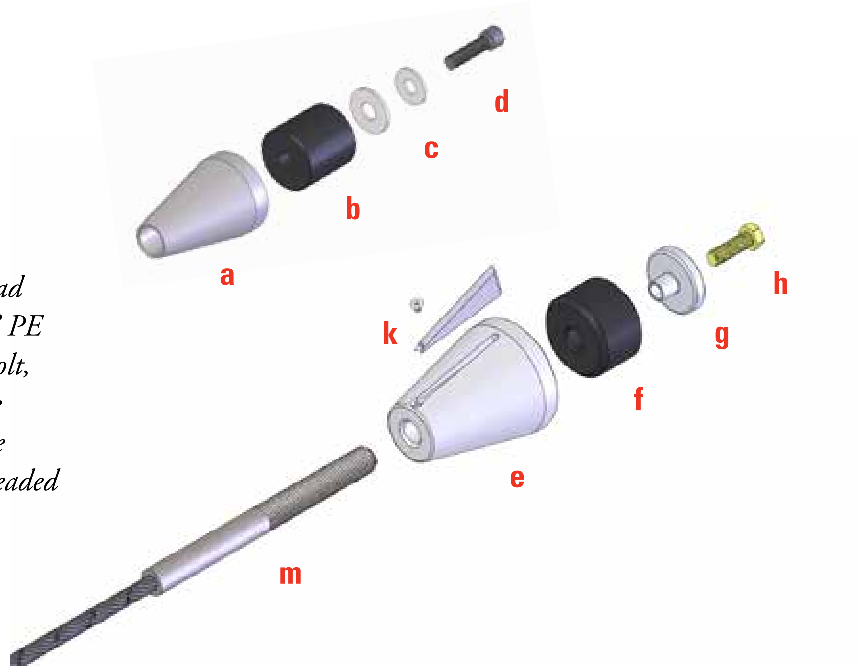


Figure 21

2" and 3" TRIC standard bursting heads use 5/8" swaged cable with a threaded stud termination (***m***). Both 2" moles (***a***) and 3" moles (***e***) thread directly onto the cable termination. *The complete head assembly must be fully attached to the cable before fusing the pipe to the PE cap.* During a burst, the cable stretches and relaxes with each pulling cycle. The harder the pull, the more the cable stretches. As the cable relaxes with each cycle, it recoils with a counterclockwise motion, which can retract the cable stud from the head. For this reason the head needs to be threaded as far as possible onto the cable stud before beginning a job.

Moles screw clockwise onto the cable stud, and should have a minimum engagement of 2" to 3" (50 to 75 mm). Lubricate threads with anti-seize grease. Keep stud threads clean, and protect them during storage, transport, and deployment by wrapping them with rags and duct tape, or by threading a nut onto the stud end. (The stud is 1-1/8" x 7 TPI.)

After a burst, cut the new pipe at least a few inches back (75–100 mm) from the PE cap fusion joint, to leave enough material behind the PE cap to trim and refuse next time.

*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.*

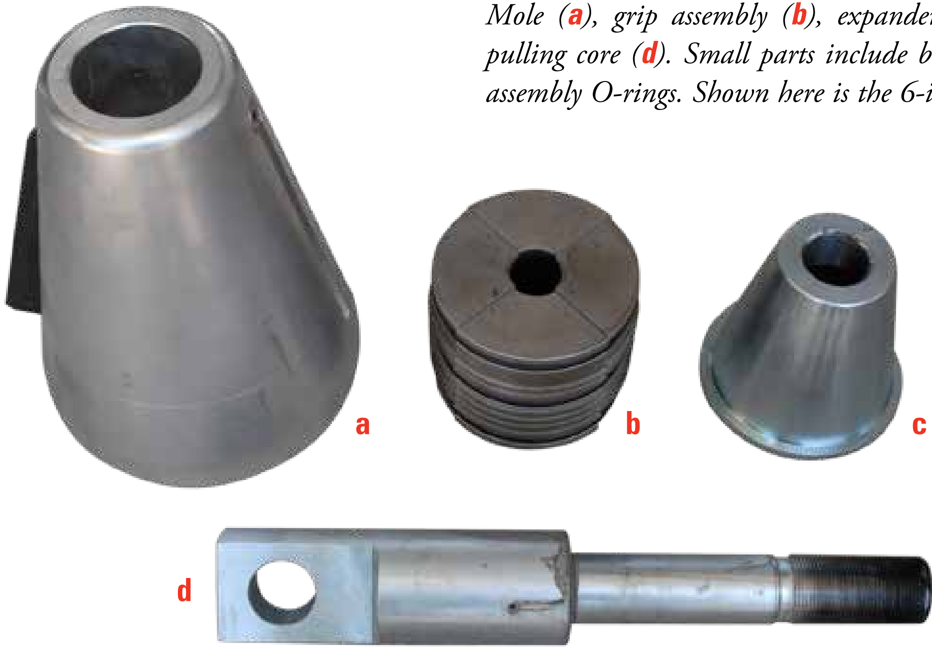
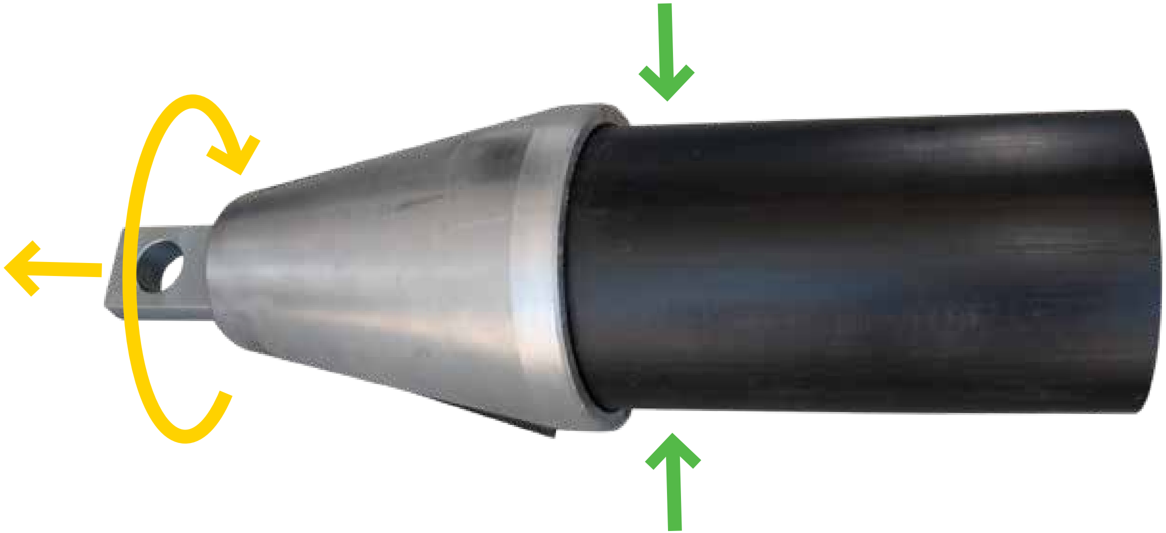


Figure 22

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.

Figure 23



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

Figure 24

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 55).

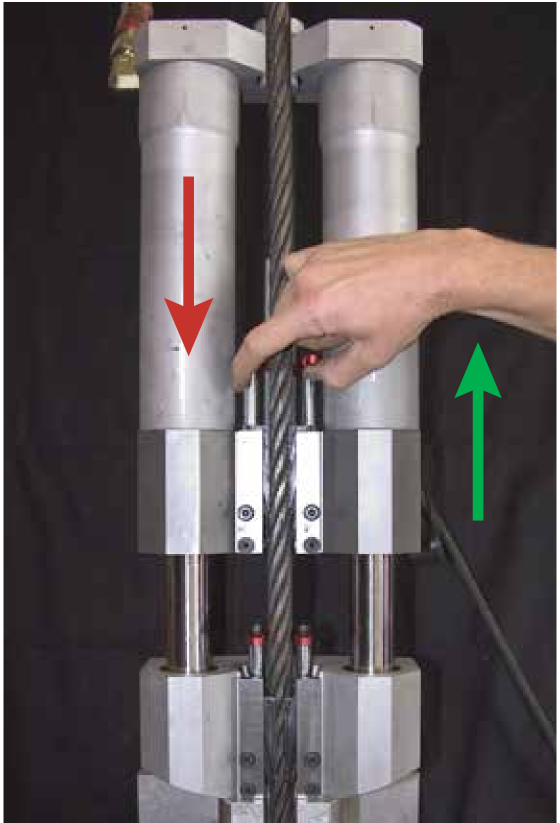
DO NOT enter a pit with a TRIC puller that is unstable and under load. Stop and release tension, then investigate. Adjust the pulling assembly as necessary before proceeding further. Read sections regarding proper setup and cable load capacities.

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 sequence is Model C25. However, the process of releasing cable tension is the same for all TRIC pullers. Please see page 6 for a basic illustration of parts for the V-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 here), proceed to Step 2.



STEP 2:
Free pulling grippers

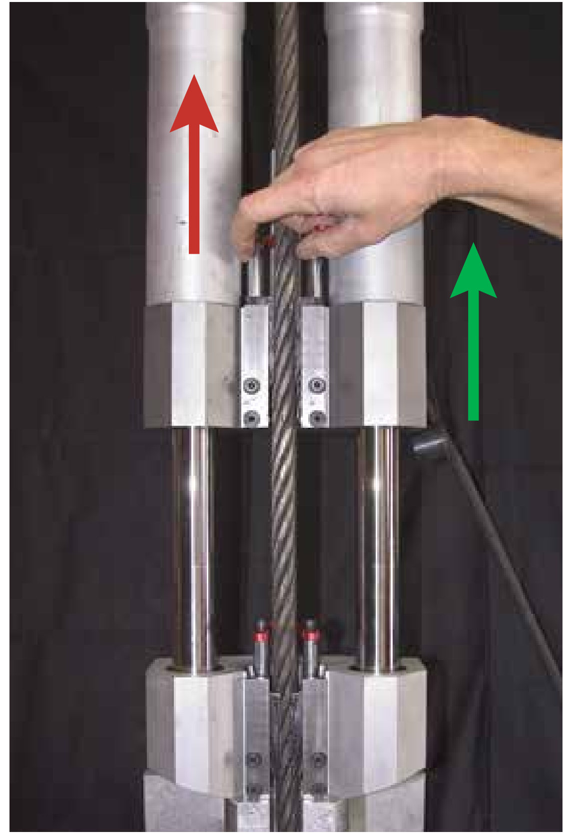
Pull back/up on pulling grippers while retracting cylinders until the pulling grippers are free. Retaining grippers will hold cable tension and allow pulling grippers to release cable.

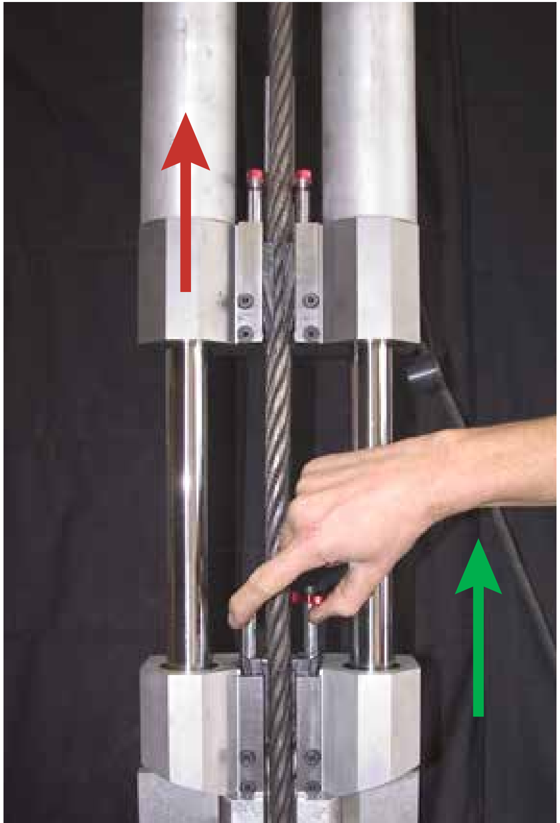
WARNING: Avoid hitting or prying yoke assemblies to move or free grippers.

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 55 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.



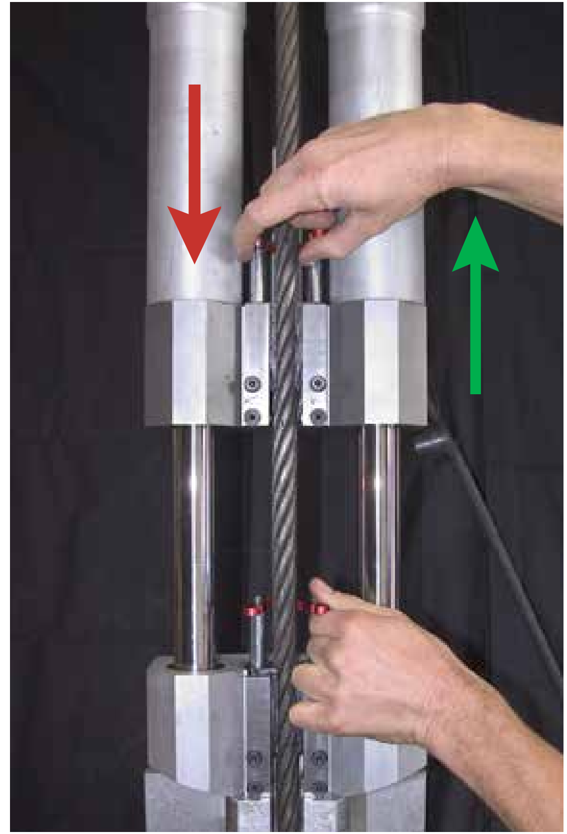


STEP 4:
Free retaining grippers

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, clean and inspect puller and gripper assemblies

Remove cable from puller. Before detaching hydraulic hoses, retract puller to protect chrome piston rods during storage and transport. (Serious scuffing or denting of chrome rods will cause hydraulic seals to leak.) Hose off pulling unit to remove dirt and debris, then remove gripper assemblies. Thoroughly clean grippers with a stiff wire brush. Inspect yokes and towers for damage, and repair or replace as necessary. Apply grease to grippers and gripper housings, then reassemble to puller. Keep extra yokes and towers on hand.

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 broomstick, 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: (ASTM International) 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 pipe-bursting 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 (Standard): 24" (61cm) square plate of 1-inch thick (25mm) hard aluminum, designed to distribute the compressive load of the pulling unit against the resistance wall (or cribbing) in the receiving pit.

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.