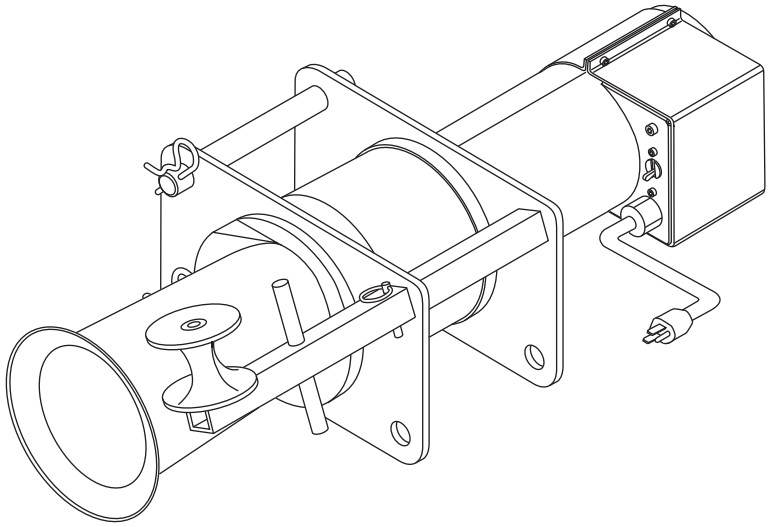
INSTRUCTION MANUAL

GREENLEE®
A Textron Company



Ultra Tugger® 8 Cable Puller and Pulling Packages

Serial Code ABJ

Read and **understand** all of the instructions and safety information in this manual before operating or servicing this tool.

Register this product at www.greenlee.com

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IM 1259 REV 27 8/12

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Description

The Greenlee Ultra Tugger® 8 Cable Puller is intended to be used to pull cable through conduit and in tray. The Ultra Tugger will develop 35.6 kN (8000 lb) of pulling force. Refer to a Greenlee catalog for sheaves, pulling rope, and other cable pulling accessories to create an entire cable pulling system.

No single manual can provide instructions for every possible cable pulling application; this manual contains general information necessary to accomplish cable pulls of many different setups.

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tools provide information for avoiding hazards and unsafe practices related to use of this tool. Observe all of the safety information provided.

Purpose of this Manual

This manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee 6800 series Ultra Tugger cable pullers.

Keep this manual available to all personnel.

Replacement manuals are available upon request at no charge at www.greenlee.com.

All specifications are nominal and may change as design improvements occur. Greenlee Textron Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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KEEP THIS MANUAL

IMPORTANT SAFETY INFORMATION

SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

⚠DANGER

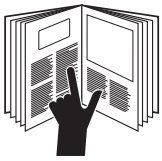
Immediate hazards which, if not avoided, WILL result in severe injury or death.

⚠WARNING

Hazards which, if not avoided, COULD result in severe injury or death.

⚠CAUTION

Hazards or unsafe practices which, if not avoided, MAY result in injury or property damage.



⚠DANGER

Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

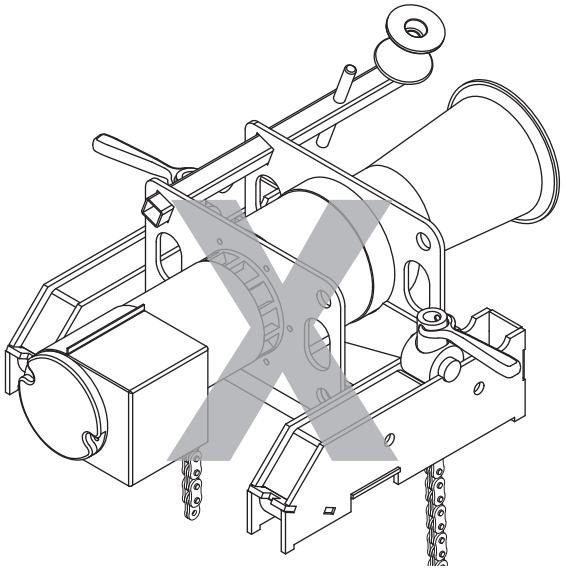
Failure to observe this warning will result in severe injury or death.

⚠DANGER

Do not operate the cable puller in a hazardous environment. Hazards include flammable liquids and gases.

Failure to observe this warning will result in severe injury or death.

⚠DANGER



Do not mount puller as shown above.

The chain mount could break away from the mounting, causing severe injury or death.

⚠WARNING

Electric shock hazard:

Disconnect the cable puller from the power supply before servicing.

Failure to observe this warning could result in severe injury or death.

IMPORTANT SAFETY INFORMATION

⚠WARNING

Inspect and verify the maximum load-bearing capacity or maximum strength of all structural supports, pulling system components and anchoring systems before setting up the puller. Any component that cannot withstand the maximum cable-pulling forces could break and strike nearby personnel with sufficient force to cause severe injury or death.

⚠WARNING

Do not allow anything other than the pulling rope to contact the capstan. A grip, swivel, or other component could break and strike nearby personnel with great force.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

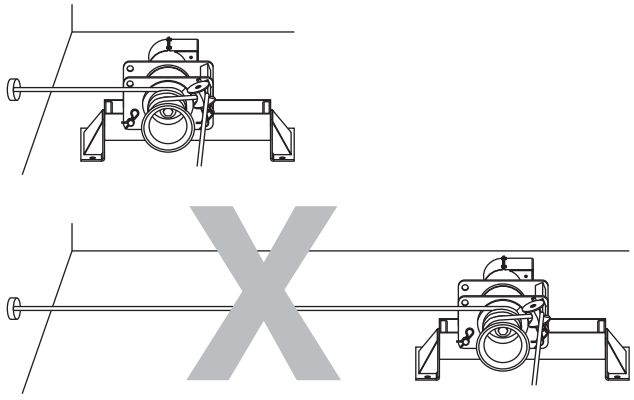
Do not stand directly under a vertical pull. Cable could fall suddenly from the conduit.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

Locate the puller so that it is close to the conduit. Rope, cable, or connectors can break under tension, causing the rope to whip violently.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

An under-rated or worn rope may break and whip violently. Use a double-braided composite rope with the following characteristics:

- Maximum Rated Capacity: at least 35.6 kN (8000 lb)
- Average Breaking Strength: at least 143 kN (32,000 lb)

Failure to observe this warning could result in severe injury or death.

IMPORTANT SAFETY INFORMATION

⚠WARNING

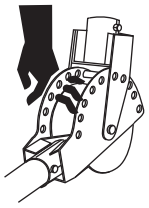
- Check the condition of the entire rope before use. A worn or damaged rope can break under tension and whip violently.
- Do not maintain a stationary rope on a rotating capstan. The wear generated may cause the rope to break under tension and whip violently.

Failure to observe these warnings could result in severe injury or death.

⚠WARNING

Attach the pulling rope to the cable with appropriate types of connectors as described in this manual. Select connectors with a maximum-rated capacity of 35.6 kN (8000 lb). An under-rated connector can break under tension.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

Shear Point:

Do not put fingers through holes in elbow unit. Rotating parts may cut off fingers.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

Keep hands away from the capstan. Rope at the capstan can crush a hand.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

Do not wrap rope around hands, arms, waist or other body parts. Do not stand in spent coils or tailed rope. Hold rope so that it may be released quickly.

⚠WARNING

Rope, cable, or a connecting device can break under tension, causing the rope to whip violently.

- Do not allow any unnecessary personnel to remain in the area during the pull.
- Do not allow any personnel to stand in line with the pulling rope.

Failure to observe these warnings could result in severe injury or death.

⚠WARNING

Do not allow the rope to become overlapped on the capstan. If an overlap begins to develop, relax the tailing force immediately and shut off the cable puller.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

Do not operate without chain guards in place.

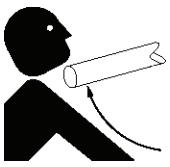
Failure to observe this warning could result in severe injury or death.

⚠WARNING

Use this tool for manufacturer's intended purpose only. Do not use the cable puller as a hoist or winch.

- The cable puller cannot lower a load.
- The load may fall.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

Always lock boom components in place during assembly or disassembly. Adding and removing components may cause rotation. Parts may strike nearby personnel.

Failure to observe this warning could result in severe injury or death.

IMPORTANT SAFETY INFORMATION

⚠WARNING

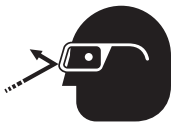
Inspect puller and accessories before use. Replace any worn or damaged components with Greenlee replacement parts. A damaged or improperly assembled item can break and strike nearby personnel with sufficient force to cause severe injury or death.

⚠WARNING

Entanglement hazard:

- Do not operate the cable puller while wearing loose-fitting clothing.
- Retain long hair.

Failure to observe this warning could result in severe injury or death.



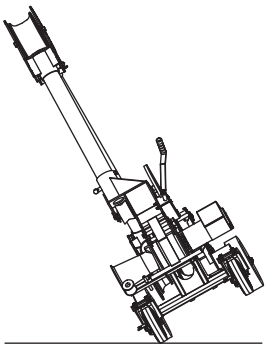
⚠WARNING

Wear eye protection when using this tool. Failure to wear eye protection could result in severe eye injury from flying debris.

⚠WARNING

When using the wheeled carriage to transport the Ultra Tugger:

- Keep personnel out of the path of transport.
- Evaluate the terrain of over which the carriage is to move. If in doubt, obtain additional help and move the carriage slowly.
- Do not transport over inclines of more than 15°.
- Do not transport the carriage with boom tubes longer than the supplied 3' and 4' tubes.



Grounding Instructions

⚠WARNING

Electric shock hazard:

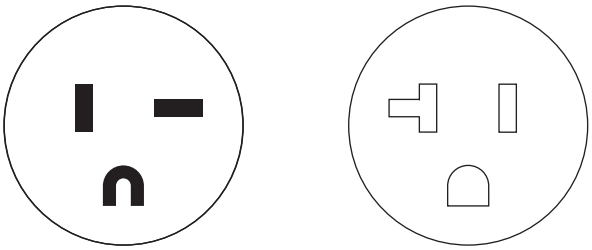
Connect this tool to a grounded receptacle on a 20 amp GFCI-protected circuit.

Failure to observe this warning could result in severe injury or death.

This tool must be grounded. In the event of a malfunction or breakdown, an electrical ground provides a path of least resistance for the electric current. This path of least resistance is intended to reduce the risk of electric shock to the operator.

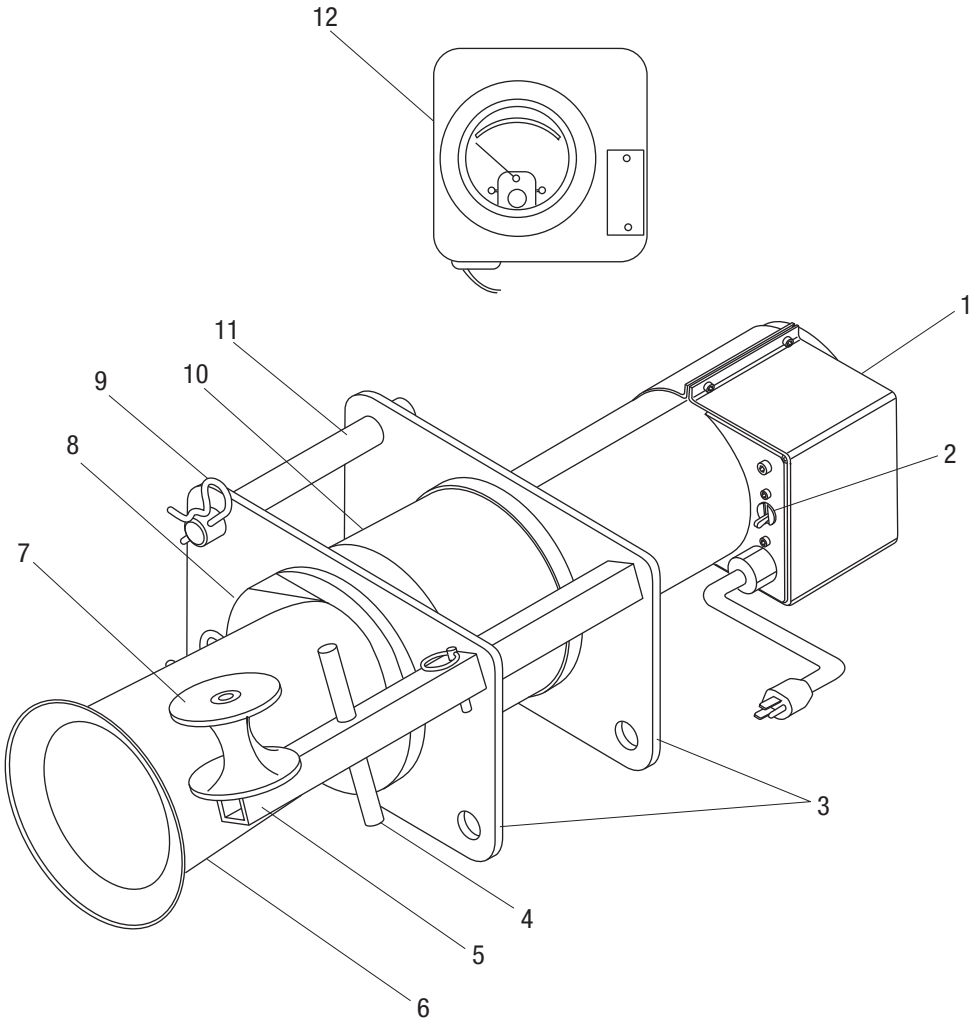
This tool's electric cord has a grounding conductor and a grounding plug as shown. Do not modify the plug. Connect the plug to receptacle that is properly installed and grounded in accordance with all national and local codes and ordinances. Do not use an adapter.

20 Amp / 115 Volt
Plug and Grounded Receptacle



Plug **Receptacle**

Identification



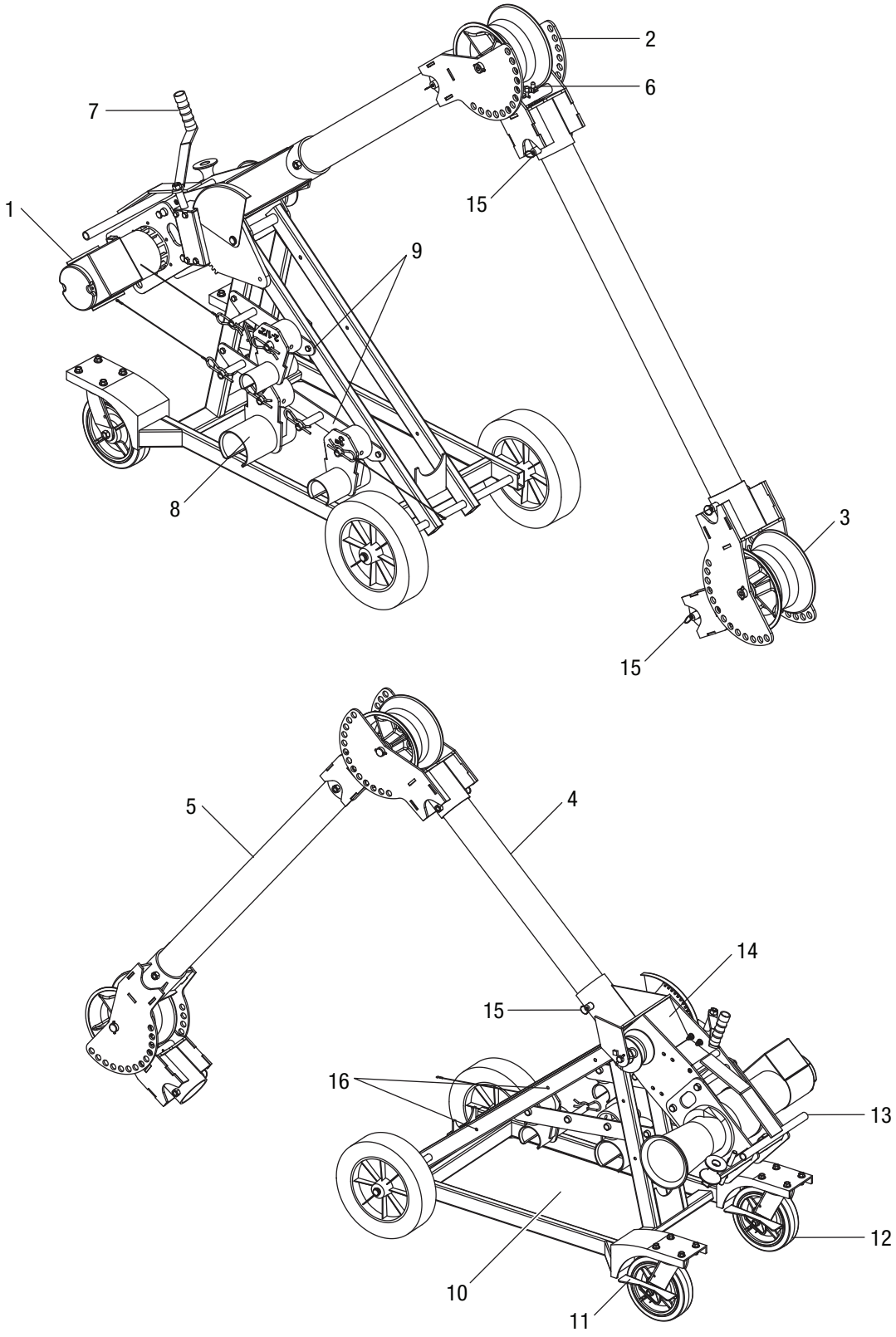
Ultra Tugger 8 Cable Puller

1. Motor
2. Circuit Breaker/Switch
3. Mounting Plates
4. Rope Tie-Off
5. Adjustable Sheave Bracket
6. Tapered Steel Capstan
7. Right Angle Sheave
8. Rope Ramp
9. Hitch Clip
10. Gearbox
11. Mounting Pin
12. Force Gauge with Remote ON/OFF Switch

Identification (cont'd)

Mobile Carriage and Boom

1. Puller
2. Elbow
3. Nose
4. Back Boom
5. Forward Boom
6. Detent Pin
7. Crank
8. Conduit Adapter Couplings
9. Adapter Storage Hanger
10. Storage Tray
11. Brake
12. Swivel Caster
13. Transport Handle
14. Boom Mount
15. Ring Pull Detent Pin
16. Location for Additional Adapter Storage Racks



Specifications

Weight	38 kg (84 lb)
Dimensions	
Length	29 cm (11.5")
Width	66 cm (26")
Height	17 cm (6.75")
Motor	
Voltage	120 VAC, 50/60 Hz, single phase
Current Draw at Full Load	15 amps
Sound Level	75 dB at 1 meter
Power Source	120 VAC, 60 Hz, 20 amps, single phase
Speed	
No Load	2.74 m/min (9 ft/min)
8900 N (2000 lb)	2.44 m/min (8 ft/min)
17.8 kN (4000 lb)	2.29 m/min (7.5 ft/min)
26.7 kN (6000 lb)	2.13 m/min (7 ft/min)
35.6 kN (8000 lb)	1.83 m/min (6 ft/min)
Pulling Force	
0 kN to 28.9 kN (0 lb to 6500 lb)	Continuous operation
28.9 kN to 35.6 kN (6500 lb to 8000 lb)	15 minutes on / 15 minutes off
Pulling Rope	
Required Rope	7/8" diameter, double-braided, polyester composite
Average Breaking Strength	143 kN (32,000 lb) minimum

Cable Pulling Glossary

anchoring system

any item or group of items that keeps a cable pulling component in place during the cable pull

capstan

the hollow cylinder of the cable puller that acts on the pulling rope to generate pulling force

coefficient of friction

the ratio that compares two amounts of force: (1) the force needed to move an object over a surface and (2) the force holding the object against the surface

This ratio is used to describe how the capstan and the rope work together.

connector

any item, such as a wire grip, clevis, swivel, or pulling grip, that connects the rope to the cable

direct line of pull

the areas next to the pulling rope and along its path; this includes the areas in front of, in back of, and underneath the rope

maximum rated capacity

the amount of pulling tension that any component can safely withstand, rated in kilonewtons (metric) or pounds; the maximum rated capacity of every component must meet or exceed the maximum pulling force of the cable puller

Newton (N)

a metric unit of force, equivalent to 0.225 pounds of force

pipe adapter sheave

attaches to conduit for pulling or feeding cable

pulling grip

connects the rope to the cable; consists of a wire mesh basket that slides over the cable and grips the insulation

pulling force

the amount of pulling tension developed by the cable puller, rated in newtons (metric) or pounds; a cable puller is usually described by the maximum pulling force that it can develop

resultant force

any force that is produced when two or more forces act on an object; applies to the sheaves of a cable pulling system

rope ramp

a device that works with a tapered capstan; guides the rope onto the capstan to prevent rope overlap

sheave

a pulley that changes the direction of the rope and cable

stored energy

the energy that accumulates in the pulling rope as it stretches, described in newton-meters (metric) or foot-pounds

support structure

any stationary object that a cable pulling system component is anchored to, such as a concrete floor (for the floor mount) or an I-beam (for a sheave)

tactile feedback

the way the rope feels as it feeds off of the capstan; the feel of the rope provides information about the progress of the pull to the operator

tail

the portion of the rope that the operator applies force to; this is the rope coming off of the capstan, and is not under the tension of the pull

tailing the rope

the operator's main function; this is the process of applying force to the tail of the pulling rope—refer to the complete explanation under "Cable Pulling Principles"

wire grip

connects the rope to the cable; some use a set screw to clamp onto the conductors of the cable

Cable Pulling Principles

Pulling cable is a complex process. This section of the manual describes and explains four main topics of pulling cable:

- Each cable pulling system component
- How these components work together
- Forces that are generated
- Procedures for the cable puller operator to follow

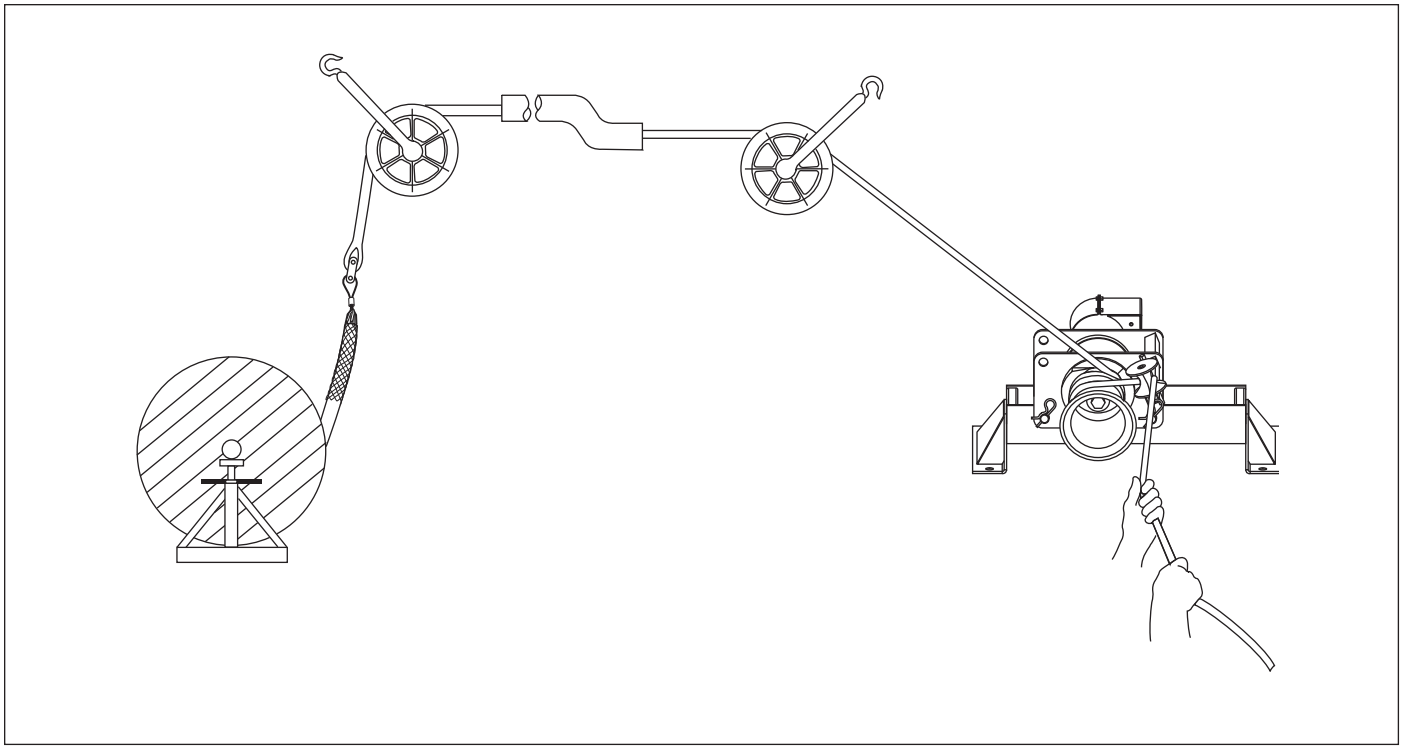
While reading through this section of the manual, look for components that are shaded in the illustrations. The shading indicates components that are associated with the text.

Greenlee strongly recommends that each member of the cable pulling crew review this section of the manual before each cable pull.

Cable Pulling Systems

Pulling cable requires a system of components. At a minimum, a cable pulling system will include a cable puller, a cable pulling rope, and connectors to join the rope to the cable. Most systems will also include, but are not limited to, a cable puller anchoring system, pulling sheaves and sheave anchoring systems.

The cable puller has a maximum amount of *pulling force*, which is the amount of pulling tension that it develops. Every other component of the pulling system has a *maximum rated capacity*, which is the amount of pulling tension that it can withstand. The maximum rated capacity of every component must meet or exceed the cable puller's maximum pulling force.



Typical Cable Pulling System

Cable Pulling Principles (cont'd)

Pulling Theory

This section introduces the main ideas involved with pulling cable.

Pulling Resistance

The cable puller must overcome two types of resistance: gravity and friction.

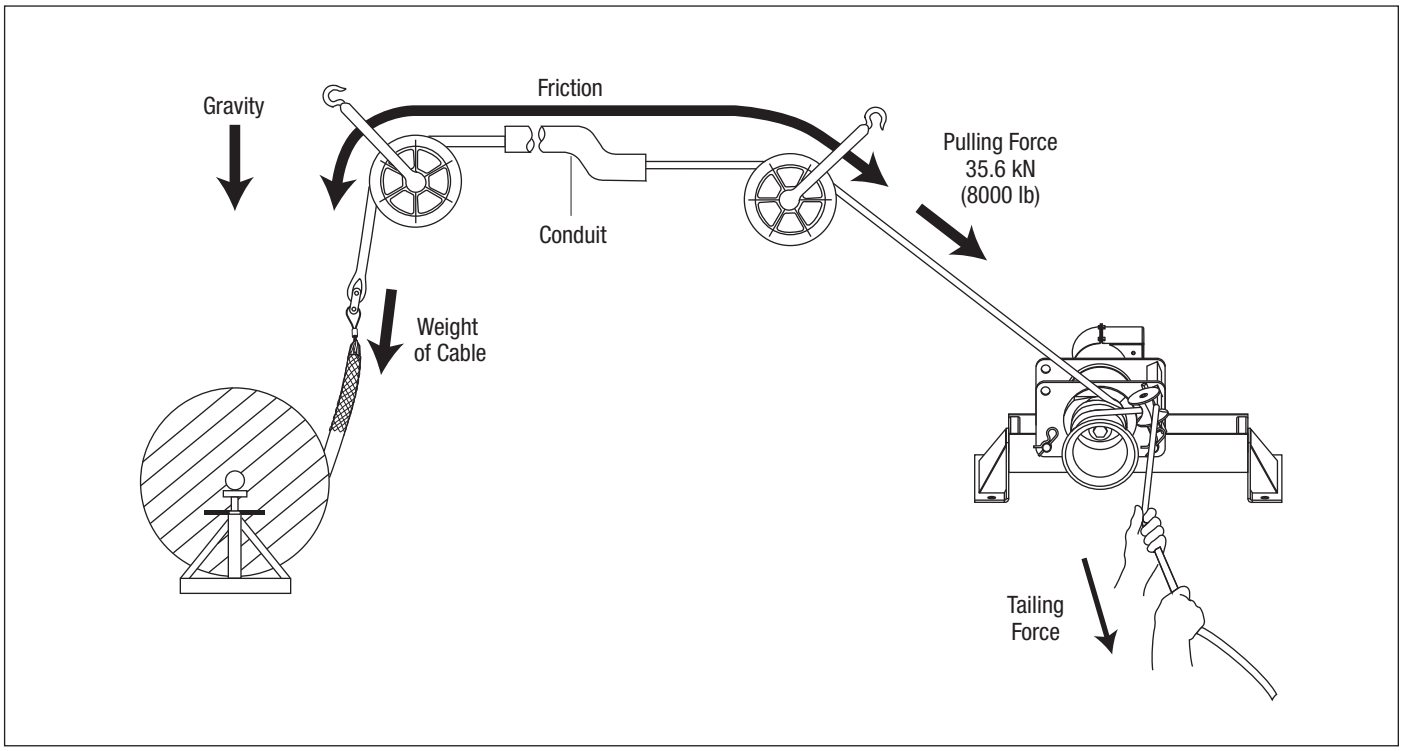
Gravity constantly exerts its force on the vertical portions of the run. When the pulling force is relaxed, gravity attempts to pull the cable downward. Friction develops where the cable contacts the sheaves, conduit and tray. Friction resists any movement, forward or backward, and tends to hold the cables in place.

To accomplish a cable pull, the cable pulling system must develop more force than the combination of gravity and friction.

Generating Pulling Force

To generate pulling force, the capstan works as a *force multiplier*. The operator exerts a small amount of force on the rope. The cable puller multiplies this and generates the pulling force.

This pulling force is applied to the rope, connectors, and cable in order to accomplish the pull. The direction of force is changed, where necessary, with pulling sheaves.



Cable Pulling Theory Illustrated

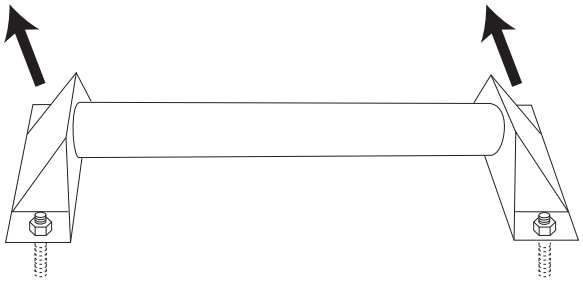
Cable Pulling Principles (cont'd)

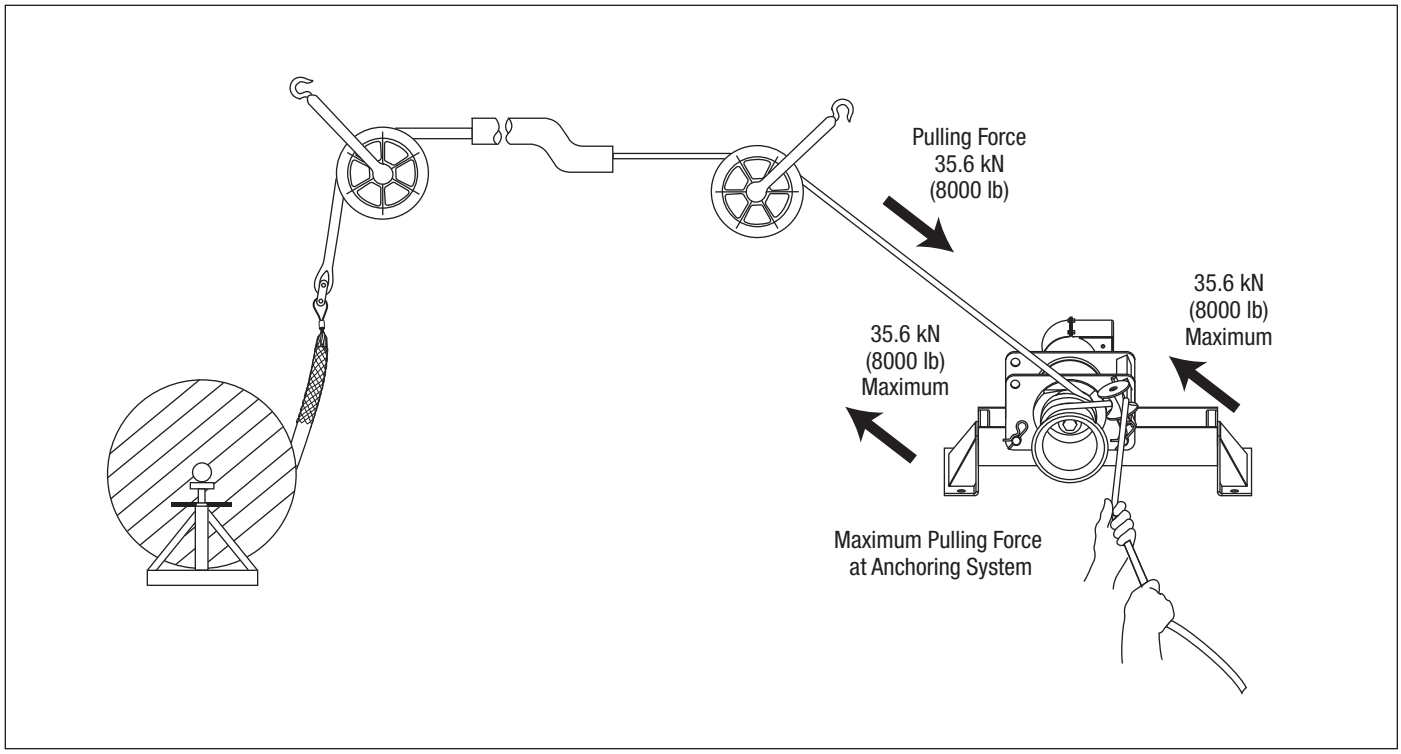
Cable Pulling Forces

This section provides detailed explanations and illustrations of the forces that are generated during the cable pull. These explanations are based on the concepts presented in the last section, "Pulling Theory."

At the Cable Puller Anchoring System

The cable puller will exert its maximum pulling force on cable puller's anchoring system. It is extremely important the anchoring system can withstand this amount of force. Refer to the instruction manual provided with your anchoring system for proper setup or installation.





Pulling Force at the Cable Puller's Anchoring System

Cable Pulling Principles (cont'd)

Cable Pulling Forces (cont'd)

At the Capstan

The capstan acts as a *force multiplier*. The operator exerts a small amount of tension, or tailing force, on the rope; the capstan multiplies this force to pull the cable. The resultant force depends upon the number of times the rope is wrapped around the capstan, as shown in the formula below.

Pulling Force = Tailing Force x $e^{0.0175\mu\text{ø}}$

Where:

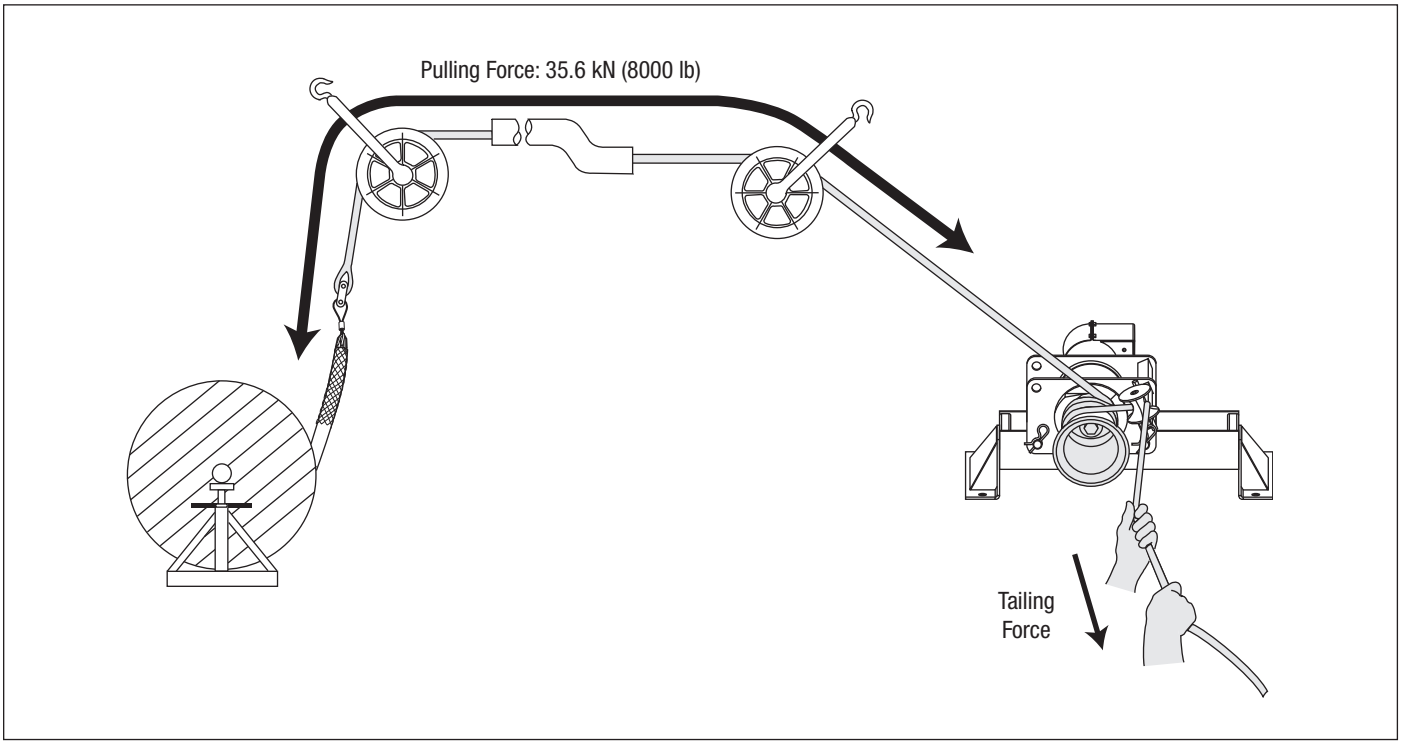
- e = the natural logarithm, or 2.7183
- μ = the coefficient of friction between the rope and the capstan*
- ø = the number of degrees of wrap of rope around the capstan

* The average value for the coefficient of friction when double-braided composite rope is pulled over a clean dry capstan is 0.125.

The following table is based on the formula above. The input, or tailing force, is constant at 44.5 N (10 lb). Increasing the number of wraps increases the pulling force.

Operator's Tailing Force	Number of Wraps of Rope	Approximate Pulling Force
44.5 N (10 lb)	1	93.4 N (21 lb)
	2	213.5 N (48 lb)
	3	474.9 N (106 lb)
	4	1043.8 N (233 lb)
	5	2293.7 N (512 lb)
	6	5048.9 N (1127 lb)
	7	11.1 kN (2478 lb)

This table shows how the capstan acts as a force multiplier. Because the coefficient of friction depends upon the condition of the rope and capstan, this formula cannot determine an exact amount of pulling force.



The Capstan as a Force Multiplier

Cable Pulling Principles (cont'd)

Cable Pulling Forces (cont'd)

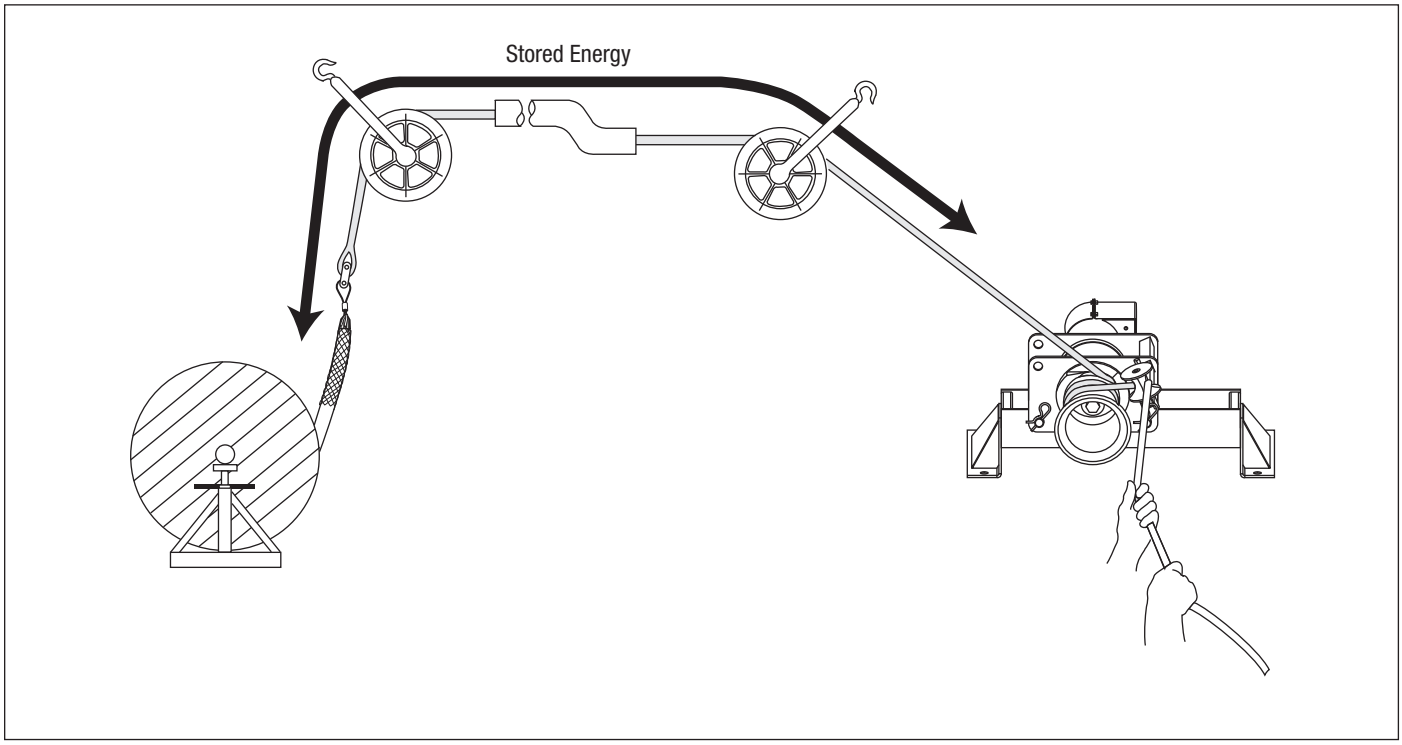
At the Pulling Rope

The product of a force (f) moving through a distance (d) is energy (f x d), and may be measured in newton-meters or ft-lb. Energy is stored in a rope when the rope is stretched. This is similar to the way energy is stored in a rubber band when it is stretched. Failure of the rope or any other component of the pulling system can cause a sudden uncontrolled release of the energy stored in the rope.

For example, a 100 meter nylon rope with a 50,000 newton average breaking strength could stretch 40 meters and store 1,000,000 joules of energy. This is enough energy to throw a 900 kilogram object, such as a small automobile, 113 meters into the air.

A similar double-braided composite rope could store approximately 300,000 joules of energy. This could throw the same object only 34 meters into the air. The double-braided composite rope stores much less energy and has much less potential for injury if it were to break.

Double-braided composite rope is the only type of rope recommended for use with the Ultra Tugger cable puller. Select a double-braided composite rope with an average rated breaking strength of at least 143 kN (32,000 lb).



Stored Energy

Cable Pulling Principles (cont'd)

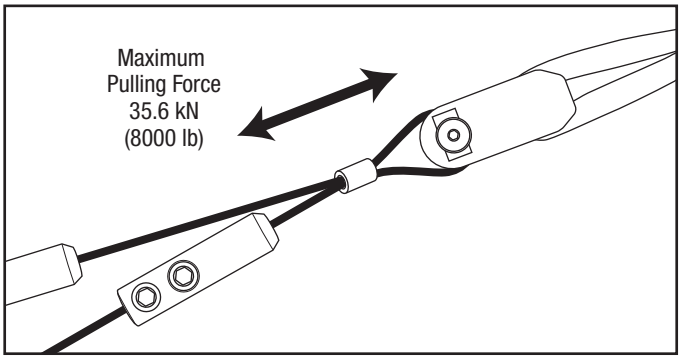
Cable Pulling Forces (cont'd)

At the Connectors

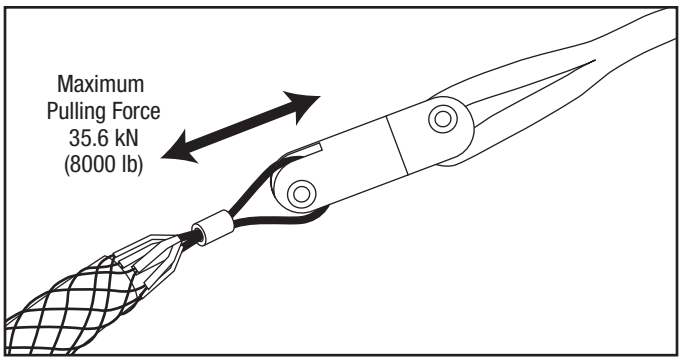
The connectors will be subjected to the cable puller's maximum pulling force.

Several types of rope connectors—clevises, swivels, and rope-to-swivel connectors—are available. Follow the instructions provided with each to provide a good connection.

Two types of wire connectors—wire grips and pulling grips—are available. The wire grip uses a set screw to clamp onto the conductors of the cable. The pulling grip consists of a wire mesh basket that slides over the cable and grips the insulation.



A Typical Grip Setup—Clevis and Wire Grip



A Typical Grip Setup—Swivel and Pulling Grip

When selecting a pulling grip, it is extremely important to select a grip of the correct (1) type, (2) size, and (3) maximum rated capacity.

1. Select the correct type based on the descriptions of each type in the Greenlee catalog.
2. Measure the circumference of the wire bundle. (To do this accurately, fasten a tie strap around the bundle. Cut off and discard the tail. Then cut the tie strap and measure its length.). Use the table provided to find the correct size.
3. Refer to the maximum rated capacities in the Greenlee catalog.

Pulling Grip Size Table

Circumference Range		Required Grip Diameter	
inches	mm	inches	mm
1.57–1.95	39.9–49.5	0.50–0.61	12.7–15.5
1.95–2.36	49.5–59.9	0.62–0.74	15.8–18.8
2.36–3.14	59.9–79.8	0.75–0.99	19.1–25.1
3.14–3.93	79.8–99.8	1.00–1.24	25.4–31.5
3.93–4.71	99.8–119.6	1.25–1.49	31.8–37.8
4.71–5.50	119.6–139.7	1.50–1.74	38.1–44.2
5.50–6.28	139.7–159.5	1.75–1.99	44.5–50.5
6.28–7.85	159.5–199.4	2.00–2.49	50.8–63.2
7.85–9.42	199.4–239.3	2.50–2.99	63.5–75.9
9.42–11.00	239.3–279.4	3.00–3.49	76.2–88.6
11.00–12.57	279.4–319.3	3.50–3.99	88.9–101.3
12.57–14.14	319.3–359.2	4.00–4.49	101.6–114.0
14.14–15.71	359.2–399.0	4.50–4.99	114.3–126.7

Cable Pulling Principles (cont'd)

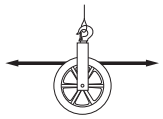
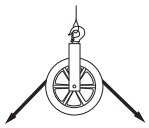
Cable Pulling Forces (cont'd)

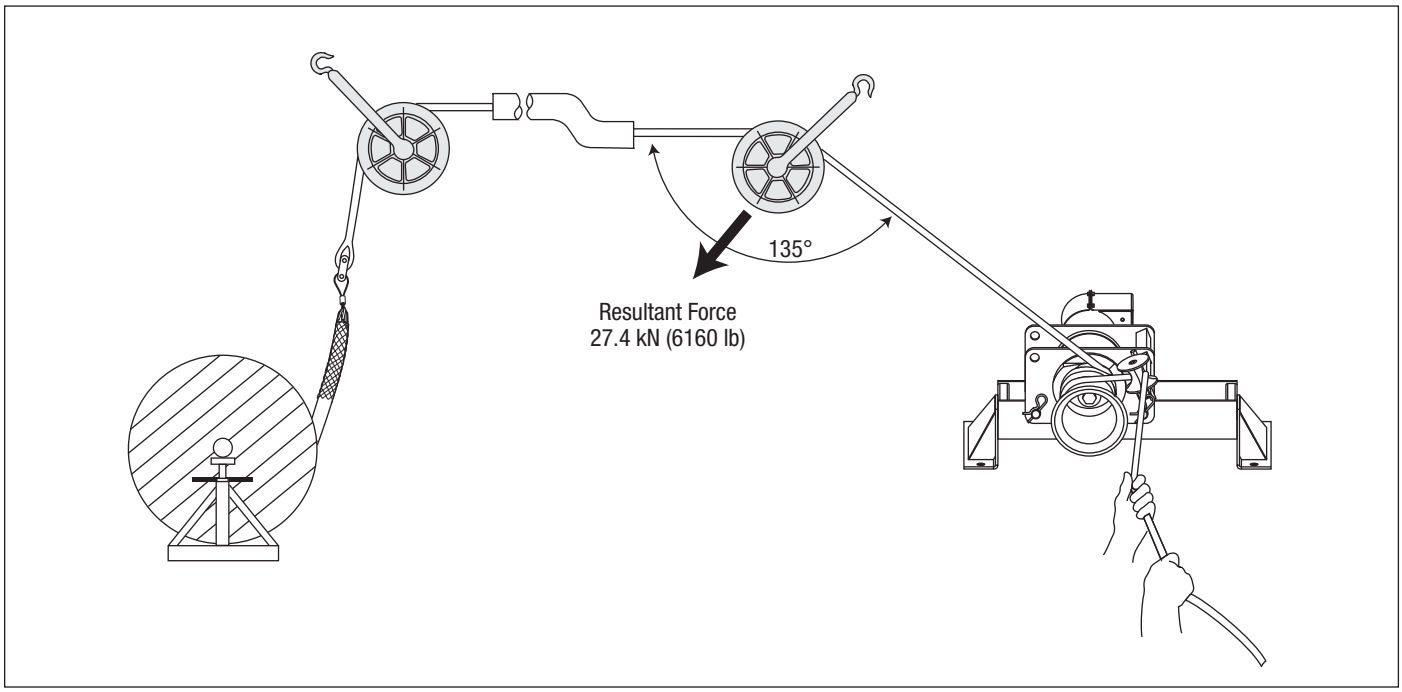
At the Sheaves

Sheaves are used to change the direction of the pull. A change in direction creates a new *resultant force* that may be greater than the cable puller's maximum pulling force. This new *resultant force* exerts itself on the sheaves, sheave anchoring system, and support structures illustrated.

The resultant amount of force depends on the angle of the change in direction. A brief table is provided here; For details on calculating the resultant force for any angle, refer to IM 1363 (99929988).

Resultant Force Table for the Ultra Tugger (35.6 kN or 8,000 lb Maximum Pulling Force)

Illustration	Angle of Change in Direction	Resultant Force in kN (lb)
	180°	0 (0)
	150°	18.5 (4160)
	135°	27.4 (6160)
	120°	35.6 (8000)
	90°	50.2 (11,300)
	60°	61.6 (13,800)
	45°	65.8 (14,800)
	30°	68.7 (15,400)
	0°	71.2 (16,000)



Typical Resultant Force at Sheave

Cable Pulling Principles (cont'd)

Tailing the Rope

The rope must be pulled off of the capstan as the pull progresses. The rope that has left the capstan is the "tail." The process of pulling the rope off of the capstan is called *tailing the rope*.

The resistance of the cable varies throughout the duration of the cable pull. Changes in resistance are due to characteristics of the rope, changes in conduit direction, and changes in the amount of friction. The "feel" of the rope provides this information about the pull. This is called *tactile feedback*. Adjust the tailing force as necessary to compensate for these changes.

Control of the Pull

Decreasing the tailing force will decrease the pulling force, until the rope slips on the capstan and the pull stops. This provides a high level of control over the progress of the cable pull.

Do not allow the rope to slip on the capstan for more than a few moments. If it becomes necessary to completely stop a pull, shut off the puller and maintain enough tailing force to hold cable in place. Tie the rope off to hold it in place.

Amount of Tailing Force

While the rope and cable are under tension, it is important to maintain the proper amount of tailing force.

Too little tailing force will allow the rope to slip on the capstan. This will build up excessive heat and accelerate rope wear, increasing the possibility of breaking the rope.

The proper amount of tailing force will stop the rope from slipping on the capstan and produce a sufficient amount of pulling force to pull in the rope and cable.

Too much tailing force is any amount more than is necessary to stop the rope from slipping on the capstan. Excessive tailing force will not increase the pulling force or pulling speed.

Number of Wraps of Rope Around the Capstan

An experienced operator should choose the number times the rope is wrapped around the capstan.

The proper number of wraps allows the operator to control the progress of the pull with a comfortable amount of effort.

Using *too few* wraps requires a large tailing force to accomplish the pull. Using too few wraps also makes the rope more likely to slip on the capstan. This builds up heat and accelerates rope wear.

Using *too many* wraps causes the rope to grab the capstan tighter. This accelerates rope wear, wastes power, and increases the possibility of a rope overlap. Using too many wraps also reduces tactile feedback, so you receive less information about the pull. You cannot quickly relax the tailing force when there are too many wraps.

If the rope becomes difficult to tail, add another wrap of rope. Turn off the puller and release all of the tension in the rope. Add a wrap and resume pulling. Be aware, however, that some pulls will require tension to hold the cables in place. In these cases, do not attempt to release all of the tension and add a wrap of rope. You will need to anticipate the number of wraps before starting the pull.

Preventing Rope Overlap

Do not allow the rope to become overlapped on the capstan during a pull.

A rope overlap will make it will impossible to continue or back out of the pull.

If the rope becomes overlapped, you will lose control of the pull—the rope will advance with no tailing force and will not feed off of the capstan. The capstan will not allow you to reverse the direction of the rope, so you cannot back out of an overlap.

Set up the puller properly. The rope ramp and tapered capstan are intended to prevent rope overlap. Refer to the instructions in the "Operation" section of this manual.

Every wrap of the rope must remain in direct contact with the capstan. During the pull, take great care to prevent the incoming rope from riding up and overlapping the next wrap. If an overlap begins to develop, immediately relax the tailing force on the rope so that the rope can feed back toward the conduit or tray. When the rope resumes its normal path, apply tailing force and continue the pull.

There is no suggested remedy for a rope overlap. **Do not allow the rope to overlap!**

Cable Pulling Principles (cont'd)

Summary of Cable Pulling Principles

- A cable pulling system consists of many components that work together to accomplish a pull.
- The cable puller is rated by its maximum pulling force; every other component is rated by its maximum rated capacity. The maximum rated capacity of every component must meet or exceed the maximum pulling force of the cable puller.
- The cable puller must overcome two types of resistance: gravity and friction. The puller's capstan, the pulling rope, and the operator tailing the rope work together to produce pulling force.
- The cable puller exerts force on every component of the cable pulling system, including the anchoring systems and the support structures.
- Energy is stored in a rope when the load causes the rope to stretch. Failure of the rope or any other component can cause a sudden release of energy. Replace any rope that is worn or damaged.
- Carefully select the number or wraps of rope around the capstan before starting the pull.
- Control the pull by tailing the rope. Be familiar with the interaction of the rope and capstan.
- Do not allow a rope overlap to develop.

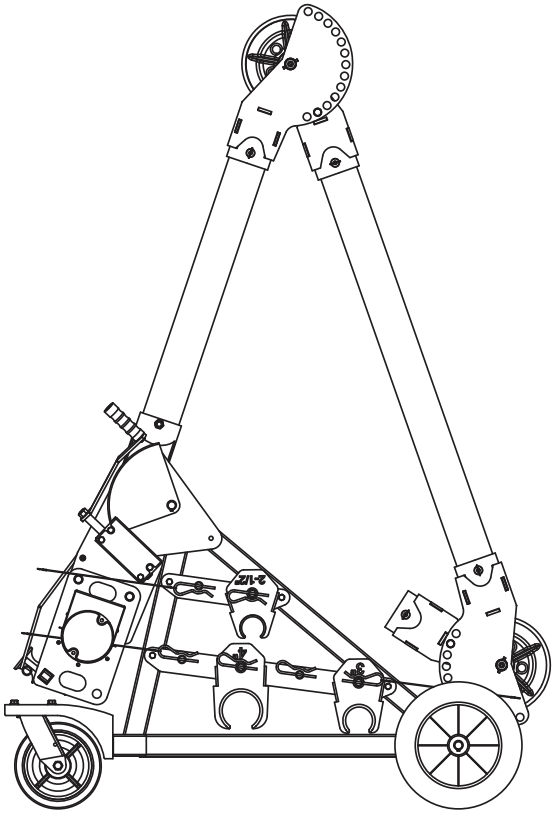
Planning the Pull

- Pull in a direction that will require the lowest amount of pulling force.
- Plan several shorter pulls rather than fewer longer pulls.
- Locate the puller as close to the end of the conduit as possible to minimize the amount of exposed rope under tension.
- Place each component so that the pulling forces are used effectively.
- Select an anchoring system: adapter sheaves, which are preferred, or the floor mount.
- Verify that each component has the proper load rating.
- Inspect the structural supports. Verify that they have enough strength to withstand the maximum forces that may be generated.

Boom Operation

Raising and Lowering

The boom can be raised and lowered using the crank in front of the puller. Turn the crank counterclockwise to raise the boom, and clockwise to lower it. When starting from the Teepee position, unlock the elbow before lowering to prevent the boom from crashing against the carriage.



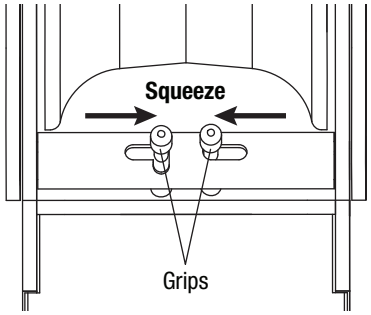
Teepee Position

Pivoting the Elbow and Nose Units

The elbow and nose units are physically identical and can be used interchangeably. For the sake of clarity, in this manual:

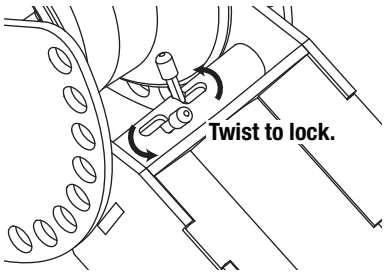
- "Nose" refers to the unit that attaches to the conduit via couplers.
- "Elbow" refers to the unit that connects the two boom tubes.

The elbow/nose units pivot and lock at various degrees of rotation. They are locked in place by a detent pin set located between the sheave and the end of the boom tube receptable. To pivot, squeeze the grips on the detent pins fully inward.



Make sure the detent pins on both sides are fully retracted before trying to pivot. Release the grips when the desired pivot angle is reached, and pivot slightly more to allow both detents to engage in the closest holes.

When the detent pins are squeezed to the fully inward position, they can be locked in place by twisting them counterclockwise.



Never pull cable with the detent pins locked inward; both the elbow and nose must be locked from pivoting before pulling.

Boom Operation (cont'd)

Boom Tubes

The pulling system comes standard with a 4' and 3' long boom. The default setup is with the 3' boom between the puller and elbow, and the 4' tube between the elbow and nose. This setup can be reversed at the user's discretion. The boom tubes are held in place by detent pins with pull rings.

In addition, 3" rigid conduit up to 10' long can be substituted for either or both of the boom tubes. If 3" rigid conduit is used, two conditions must be accounted for:

- Because the detents will not hold the conduit in place in the receptacles, the conduit must be clamped in place opposite the detent pins using 1/2"-13 screws (not supplied).
- Because the weight will be too great to use the crank to raise and lower the boom, manual assist is required.

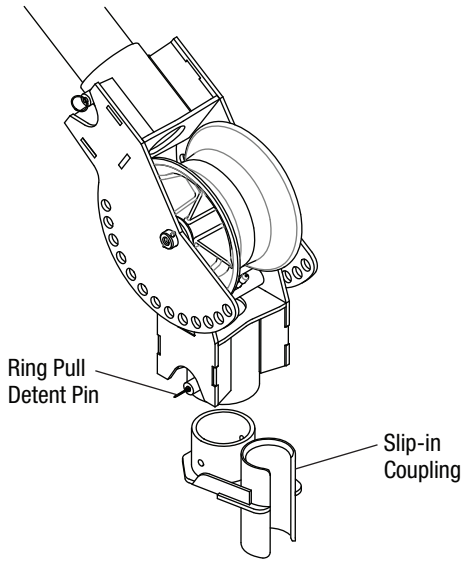
Conduit Adapter Couplings

Couplings to attach the puller system to the conduit are available in 2", 2-1/2", 3", 3-1/2", 4", and 5" sizes.

There are two types: slip-in and screw-on:

- Slip-in couplings are the easiest to use but do intrude on the ID of the conduit.
- Screw-on couplings do not decrease the effective ID of the conduit, but take longer to set up.

If longer than standard booms are being used, screw-on couplings may be necessary to support the boom and prevent it from falling. The conduit adapter couplings fit into the same receptacles as the boom tubes and are retained by the same ring pull detent pins.

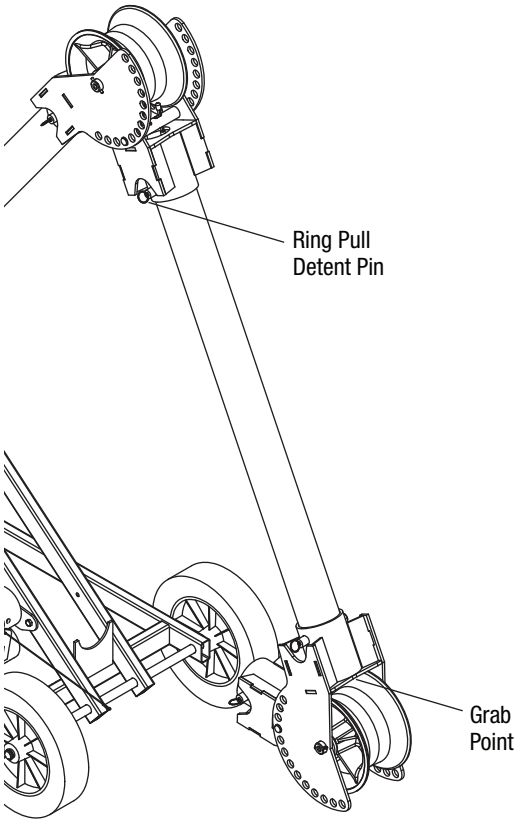


Boom Assembly/Disassembly

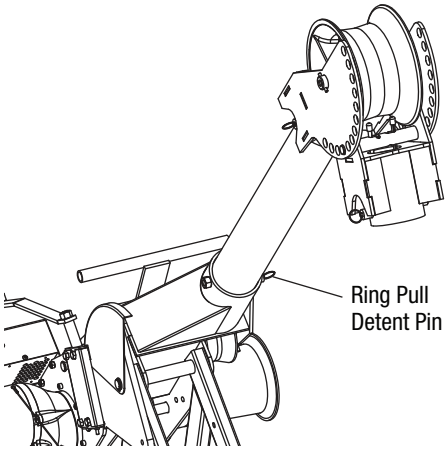
Under normal circumstances, there is no need to disassemble the boom assembly. However, it can be disassembled in order to fit into a small truck, mount the puller head remotely on a floor mount, alter the boom lengths, etc.

To disassemble, follow this procedure:

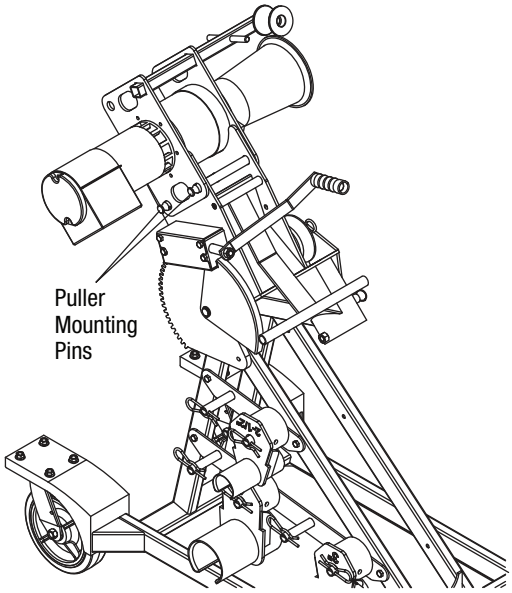
1. Lock the swivel caster brakes.
2. Pivot the elbow until the forward boom is clear of the carriage.
3. Grab the nose by the hole at the end of the boom tube, and lift up to relieve the preload on the detent pins.



4. Pull out on the detent ring that locks the boom tube, and twist the nose slightly so the hole in the boom tube and detent pin are misaligned.



5. Release the detent ring, and pull the nose and forward boom from the elbow.
6. Repeat this process to remove the back boom and elbow. Raise or lower the boom(s) as desired beforehand to gain a comfortable position.
7. Turn the crank clockwise until the puller head is as high as it will go.
8. Remove the clips and pull out the pins that mount the puller head.



9. Lift the puller head off the boom mount using as many people as needed to lift 45 kg (100 lb).

Aside from detaching the other end of the two boom tubes, this is as far as the unit breaks down. Assemble in the reverse order, making sure that all detent pins are fully seated before releasing your hold.

Boom Setup

Up Pull Starting from Teepee Position

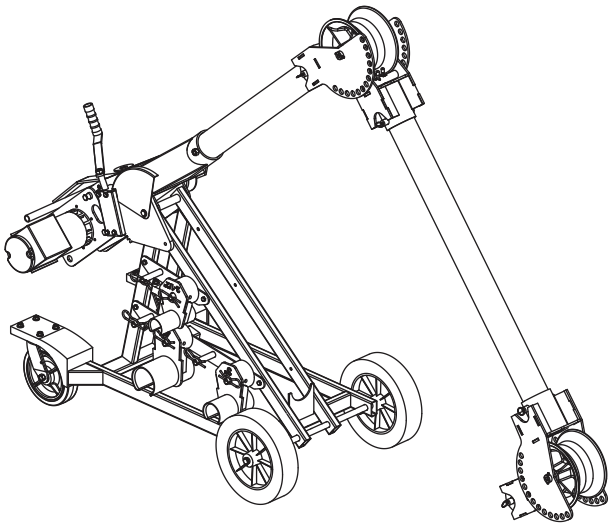
1. Set the brakes.
2. Raise the forward boom as described under “Boom Operation” until it is close to the angle desired for the pull setup,

   or

   a. Lock the elbow detent pins in the fully inward position.

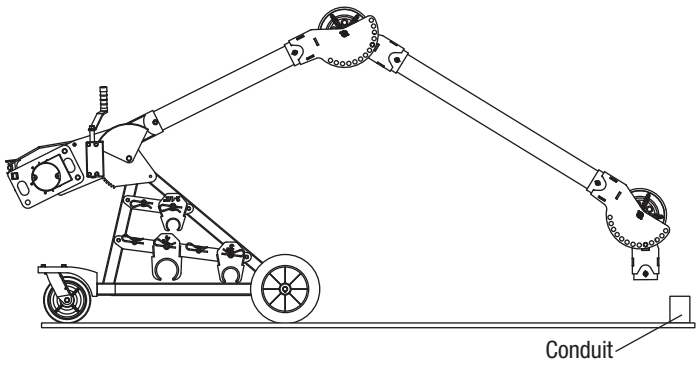
   b. Lower the boom (turn crank CW) until the nose hits the floor.

   c. Release the brakes and continue to lower the boom while walking the carriage backwards until the elbow is at the desired angle and lock it in place.



Position Elbow to Desired Angle

3. Raise or lower the boom until the nose is just above the conduit to be pulled from.



Position Nose Higher than Conduit

To use slip-in couplings:

a. Insert the appropriate slip-in conduit adapter coupling into the nose.

b. Pivot the nose until the coupling is aligned with the conduit and lock in position.

c. Raise the boom until the bottom of the coupling clears the conduit.

d. Release the brakes if not already released.

e. Roll the carriage forward until the coupling is over the conduit and lower it into the conduit.

To use screw-on couplings:

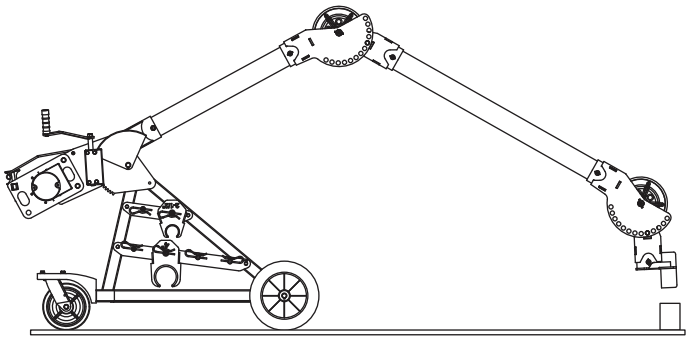
a. Screw the appropriate screw-on adapter coupling fully onto the conduit.

b. Pivot the nose until it is aligned with the coupling and lock in position.

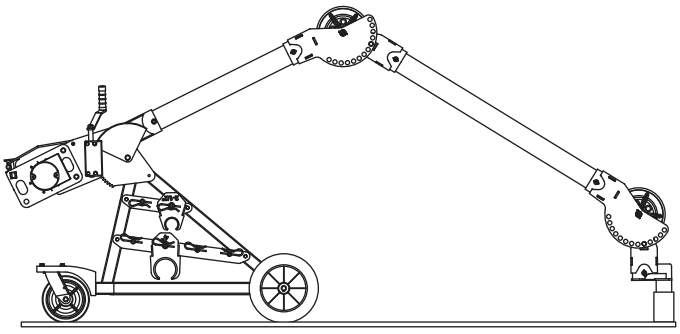
c. Raise the boom until the bottom of the coupling clears the conduit.

d. Release the brakes if not already released.

e. Roll the carriage forward until the nose is over the coupling, pull the detent ring, and lower the nose onto the coupling.



Insert Conduit Adapter and Raise above Conduit

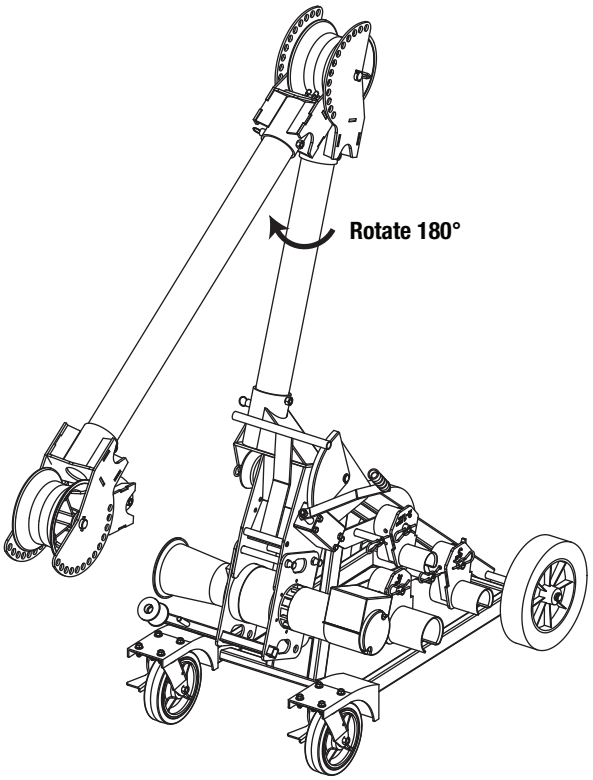


Lower into Conduit

Boom Setup (cont'd)

Down Pull Starting from Teepee Position

1. Set the brakes.
2. Pivot the elbow one or two detent positions outward. Lift up on the nose to release any preload on the detent pin securing the back boom to the elbow.
3. While holding the detent out, rotate the elbow on the back boom 180° by walking it around the carriage.



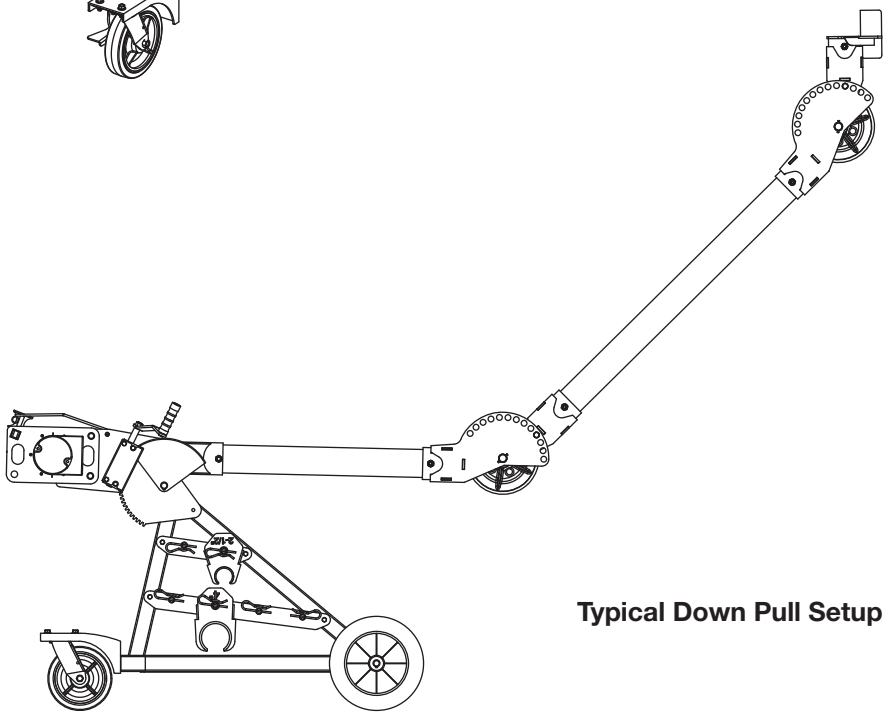
4. Lower the entire boom until the forward boom is close to vertical.
5. Lower the forward boom until the elbow is close to the angle desired for the pull setup.
6. Raise or lower the boom until the nose is just below the conduit to be pulled from.

To use slip-in couplings:

a. Insert the appropriate slip-in conduit adapter coupling into the nose.
b. Pivot the nose until the coupling is aligned with the conduit and lock in position.
c. Lower the boom until the coupling clears the conduit.
d. Release the brakes.
e. Roll the carriage forward until the coupling is under the conduit and raise it.

To use screw-on couplings:

a. Screw the appropriate screw-on adapter coupling fully onto the conduit.
b. Pivot the nose until it is aligned with the coupling and lock in position.
c. Lower the boom until the coupling clears the conduit.
d. Release the brakes.
e. Roll the carriage forward until the nose is under the coupling, pull the detent ring, and raise the nose onto the coupling.



Typical Down Pull Setup

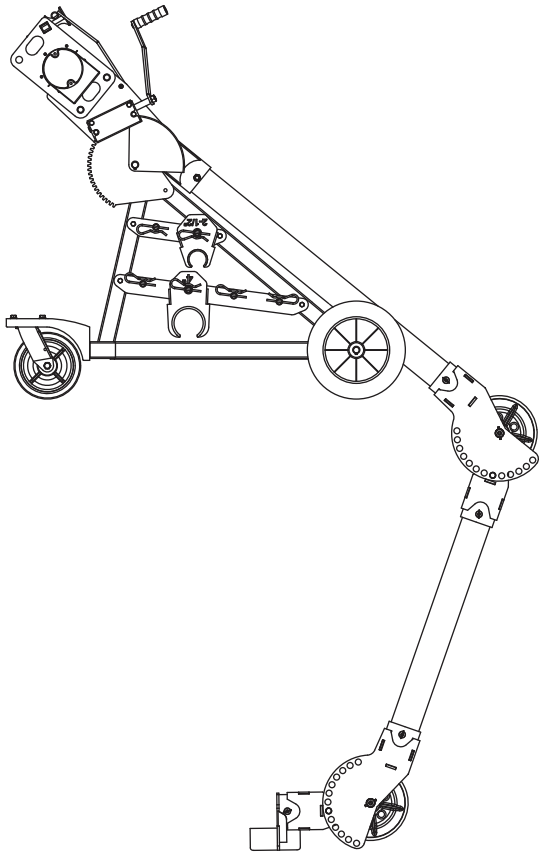
Boom Setup (cont'd)

Horizontal Pull

Horizontal pulls are essentially the same as an up pull or a down pull.

- If the conduit is above the puller, follow the up pull instructions.
- If the conduit is below the puller, follow the down pull instructions.

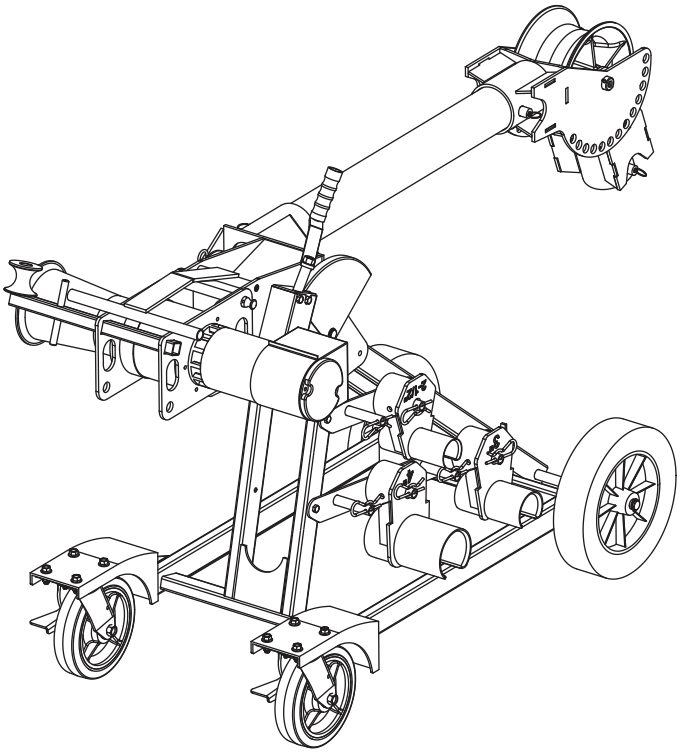
The only difference is in the horizontal alignment of the coupling with the conduit and using the carriage to walk the coupling into the conduit (or the nose into the coupling for the screw-on adapters).



Horizontal Pull in Underground Vault

Single Boom Pull

All of the previous boom setup instructions assume that two booms are used. While using two booms can be useful for working around obstructions, keeping angles over sheaves to a minimum, and pulling out extra tail, it is not always necessary. A single 3', 4', or 3" rigid conduit up to 10' long can be used to keep setups even simpler.



Single Boom Setup

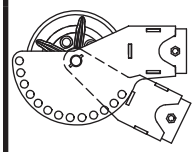
Boom Setup (cont'd)

Boom Components

⚠WARNING

- Use only Greenlee supplied booms or straight 3" diameter rigid steel conduit or Schedule 40 steel pipe for the boom tubes.
- Do not use boom tubes longer than 3 meters (10'). Longer booms may bend or break.

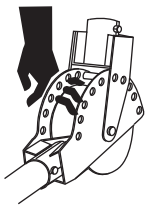
Failure to observe this warning could result in severe injury or death.



⚠WARNING

If the elbow/nose unit is disassembled, reassemble unit as shown. Improper setup will cause the elbow unit to collapse.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

Shear point:

Never put fingers through holes in boom components. Pivoting of mating arts may cut off fingers. Always keep elbow unit locked with pivot pin except while adjusting.

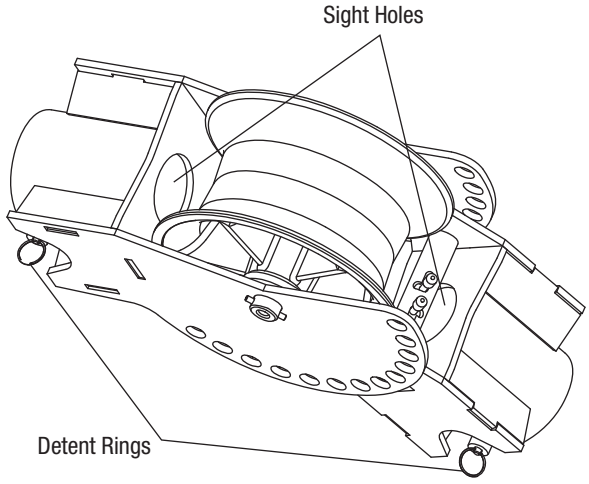
Failure to observe this warning could result in severe injury or death.

Use these boom tubes only:

- Boom tubes supplied with the UT10
- 3" rigid steel conduit (3 m or 10' maximum)
- 3" Schedule 40 pipe (3 m or 10' maximum)

If using 3" rigid conduit in place of the standard booms:

1. Insert the conduit while pulling out the detent rings.
2. Slide the conduit fully in and verify it is seated through the sight holes.
3. Use 1/2"-13 screws (not supplied) in the weld nuts to lock the conduit in place.

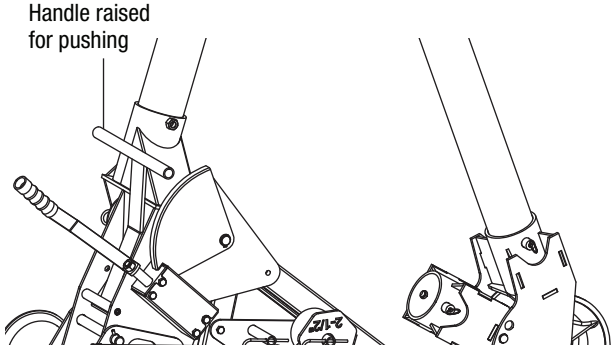


Transporting the Boom

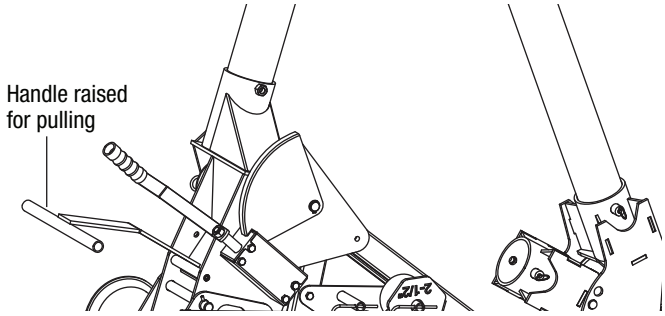
Wheeling

1. **If the unit had been set up for an up pull:**
   a. Lower the nose to the floor to get to the Teepee transport position.
   b. Lock the elbow pivot detents in the inward position.
   c. Raise the boom by cranking until the nose is off the floor, and release the detents.

   If the unit had been set up for a down pull:
   a. Release the elbow pivot detents, fold the forward boom back to the next to last position, and lock the elbow.
   b. Raise the boom all the way up until it hits the stop.
   c. Release the ring pull detent that locks the back boom to the elbow, and rotate the elbow 180° into its Teepee position.
2. Lift the push/pull handle up until it contacts the boom mount to push the carriage. Use the same handle to pull the unit.



Handle Position for Pushing

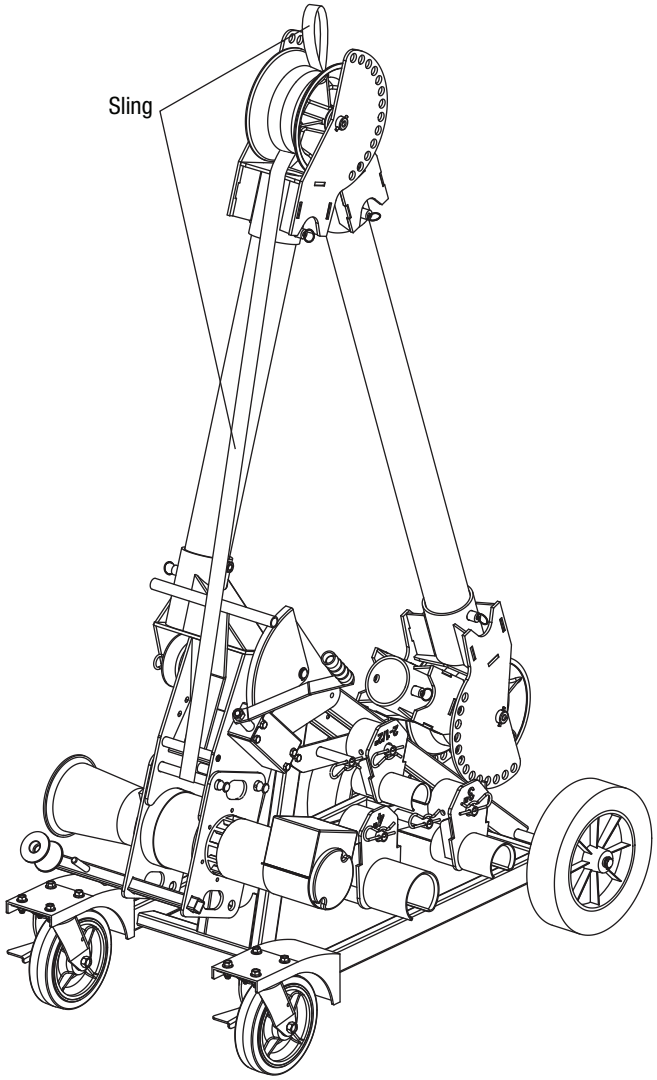


Handle Position for Pulling

3. Fold the handle down on top of the puller head when not in use to keep it out of the way.

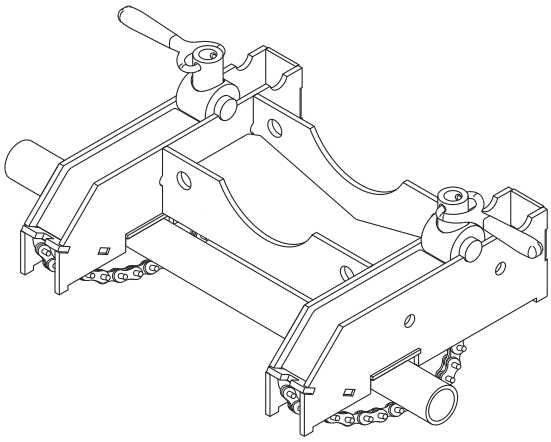
Lifting

1. Connect a lifting sling to the top puller head mounting pin.
2. Feed the sling up between the sheave and frame of the elbow so that it is trapped.
3. Lift the sling from above the elbow.

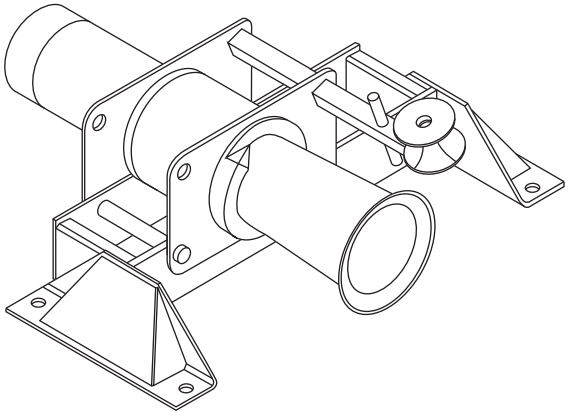


Other Setups

Setups are shown without force gauge. Place the force gauge so the operator has an unobstructed view of the meter and quick access to its ON/OFF switch.



Chain Mount—Secured to Steel Conduit or Pipe



Floor Mount—Secured to a Concrete Floor

Setup—Pipe Adapter

As of 2006, the pipe adapter has been discontinued and replaced by the 11147 boom adapter. This information is reference for existing units.

Requires: Exposed metallic pull conduit of least 63.5 mm (2-1/2") diameter

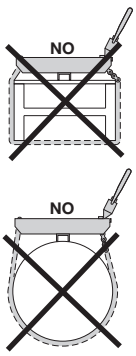
⚠WARNING

Do not mount the pipe adapter to the following:

- steel conduit less than 65 mm (2-1/2”) in diameter
- PVC conduit of any size

These conduits will not support the loads imposed by the puller.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

When setting up the pipe adapter, do not use the vise chains on a structural support that is less than 51 mm (2") or more than 254 mm (10") wide. An oversized or undersized structural support can allow the puller to slide or break loose and strike nearby personnel.

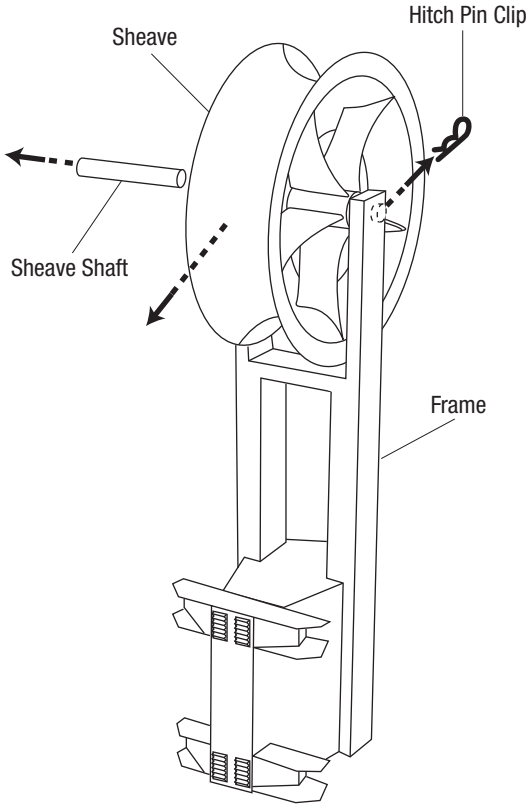
Failure to observe this warning could result in severe injury or death.

⚠WARNING

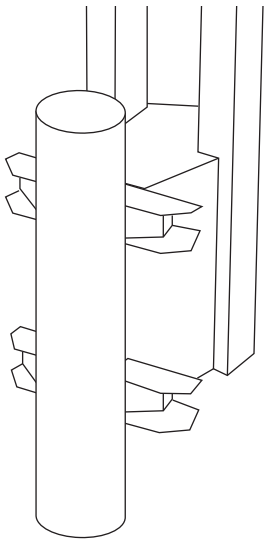
Mount pipe adapter only to conduit to be pulled from.

Failure to observe this warning could result in severe injury or death.

1. Remove the sheave from the frame.



2. Position the frame against the conduit.



Setup—Pipe Adapter (cont'd)

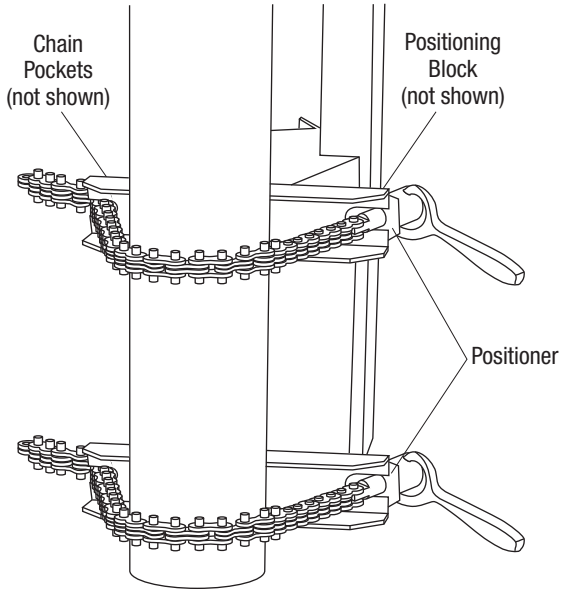
⚠WARNING

Install the vise chains properly.

- Follow the vise chain tightening instructions carefully. Improperly tightened chains can allow the puller to slide or break loose and strike nearby personnel.
- Do not allow the vise chains to bind at the corners when mounting the puller to a square or rectangular support. The vise chain must be uniformly tight at all points.

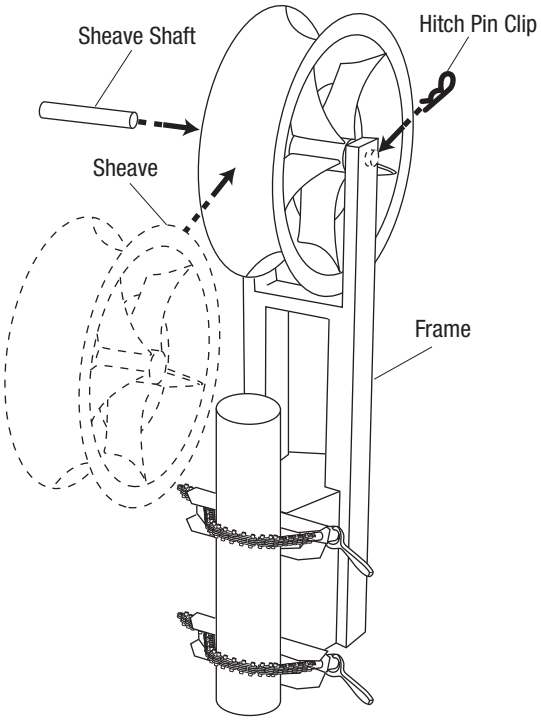
Failure to observe this warning could result in severe injury or death.

3. On each vise chain unit:
   a. Rotate the vise chain handle counterclockwise to expose most of the threads. Leave only three or four threads engaged in the handle.
   b. Insert the chain into the slot in the frame. Wrap the chain around the conduit, pipe sheave adapter, or structural element.
   c. Set the positioner against the positioning blocks that protrude from the frame.
   d. Pull the vise chain tight and insert the chain pins into the chain pockets, or recesses.
   e. Turn the handle clockwise to slightly tighten the chain.

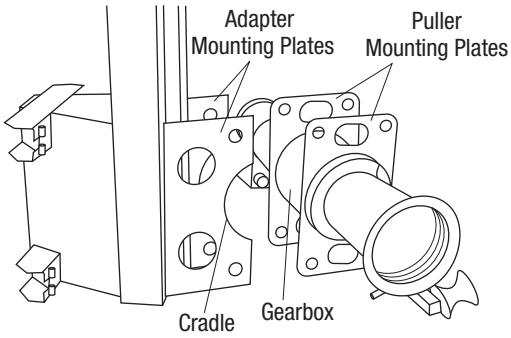


4. Rotate the vise chain handles, by hand, clockwise to tighten the chain. Do not use tools, extensions or "cheaters."
5. Put the sheave back onto the frame. Install the pin and hitch pin clip.

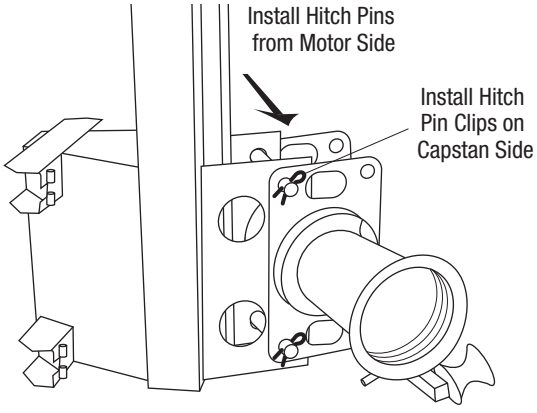
Note: If the 18" sheave interferes with existing structures, install a 12" sheave (Greenlee 00843).



6. Align the puller so that the gearbox will fit into the cradle of the pipe adapter AND the puller mounting plates straddle the pipe adapter mounting plates.



7. Install two pins from the motor side. Secure the pins with two hitch pin clips.



Setup—Chain Mount

Requires: Exposed metallic conduit with the following characteristics:

- 63.5 – 254 mm (2-1/2" – 10") in diameter
- capable of withstanding at least 35.6 kN (8000 lb) of force

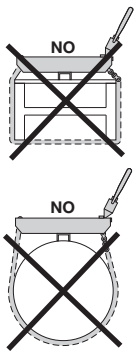
⚠WARNING

Do not mount the chain mount to the following:

- steel conduit less than 63.5 mm (2-1/2") in diameter
- PVC conduit of any size

These conduits will not support the loads imposed by the puller.

Failure to observe this warning could result in severe injury or death.



⚠WARNING

When setting up the pipe adapter, do not use the vise chains on a structural support that is less than 51 mm (2") or more than 254 mm (10") wide. An oversized or undersized structural support can allow the puller to slide or break loose and strike nearby personnel.

Failure to observe this warning could result in severe injury or death.

⚠WARNING

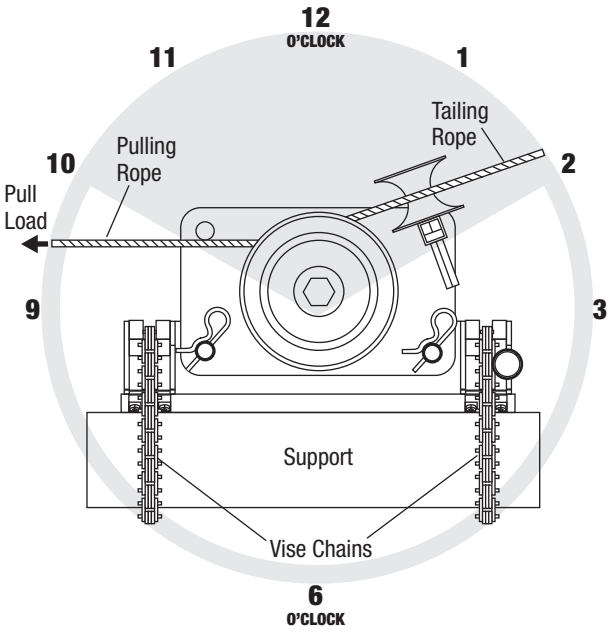
Install the vise chains properly.

- Follow the vise chain tightening instructions carefully. Improperly tightened chains can allow the puller to slide or break loose and strike nearby personnel.
- Do not allow the vise chains to bind at the corners when mounting the puller to a square or rectangular support. The vise chain must be uniformly tight at all points.

Failure to observe this warning could result in severe injury or death.

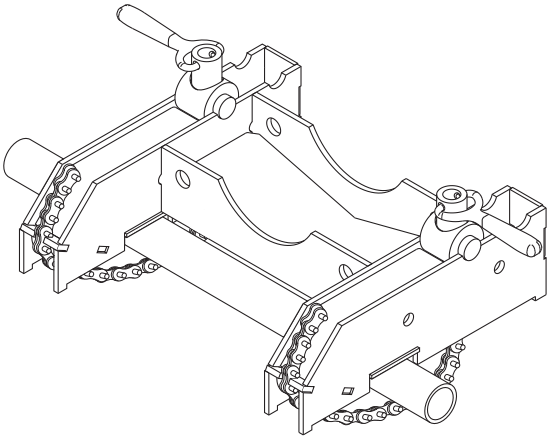
⚠WARNING

Do not pull between the 10 o'clock and 2 o'clock directions. Pulling between 10 o'clock and 2 o'clock could damage the mounting conduit.

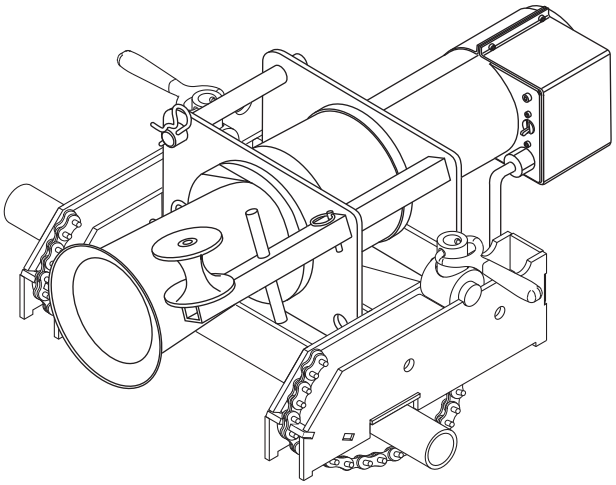


Setup—Chain Mount (cont'd)

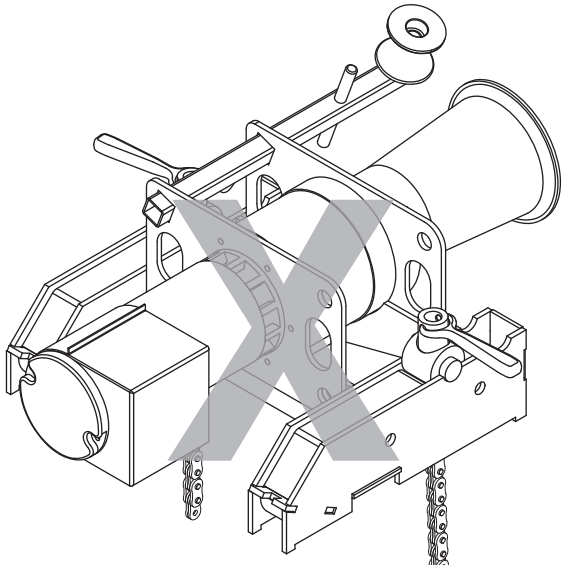
1. On each vise chain unit:
   a. Rotate the vise chain handle counterclockwise to expose most of the threads. Leave only three or four threads engaged in the handle.
   b. Wrap the chain around the conduit.



   c. Pull the vise chain tight and insert the chain pins into the chain pockets, or recesses.
   d. Turn the handle clockwise to tighten the chain. Tighten as much as possible by hand. Do not use a "cheater."
2. Set the puller into the cradle of the chain mount, as shown, so that the inside of the capstan is directly over the mounting.
3. Install two pins from the motor side. Secure the pins with two hitch pin clips.



⚠DANGER



Do not mount puller as shown above.

The chain mount could break away from the mounting, causing severe injury or death.

Setup—Floor Mount

Requires: A concrete floor with the following characteristics:

- fully cured structural-type concrete
- minimum compressive strength of 211 kg/cm^2 (3000 psi)
- free of cracks, crumbling, or patchwork

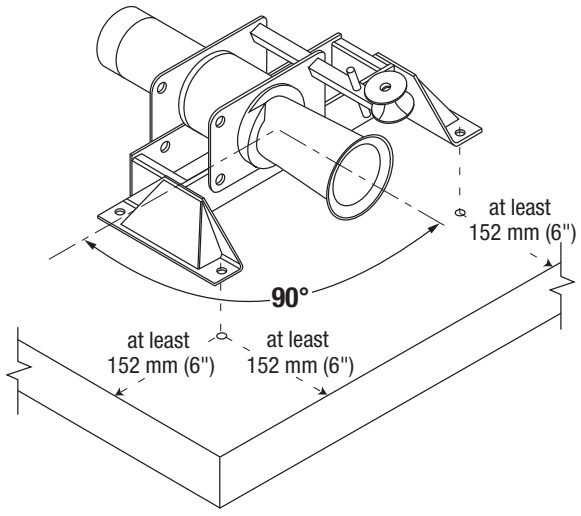
⚠WARNING

Follow all floor mounting instructions carefully.

- An improperly attached floor mount can come loose and strike nearby personnel.
- Do not attach the floor mount to masonry, brick, or cinder block. These materials will not hold the anchors securely.

Failure to observe this warning could result in severe injury or death.

1. Determine the best position for locating the floor mount. Locate the floor mount:
   - on a flat section
   - at least 152 mm (6") from edge of concrete
   - as close to the conduit as possible to reduce the amount of exposed rope under tension
   - so that the pull rope will approach the puller's capstan at a 90° (± 5°) angle.



2. Set the floor mount in the desired location. Use the floor mount as a template to drill four 5/8" holes at least 152 mm (6") deep.

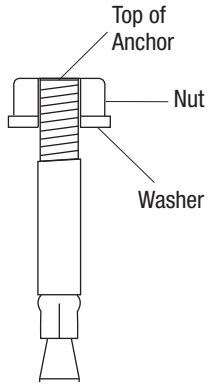
   Note: Use a 5/8" carbide-tipped masonry bit manufactured in accordance with ANSI standard B94.12-77.

3. Vacuum the debris from the holes.

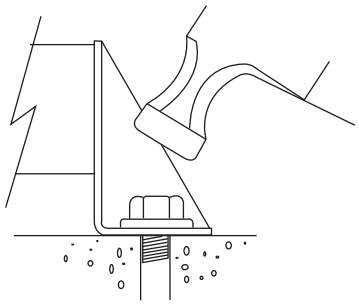
Installation

Greenlee recommends using Greenlee 35607 Wedge Anchors. If another type of anchor is used, they must have an ICBO (International Conference of Building Officials) allowable tension and shear rating of 10.7 kN (2400 lb) in 211 kg/cm^2 (3000 psi) concrete.

1. Assemble the nut and washer to the anchor so the top of the nut is flush with the top of the anchor, as shown.



2. Insert the four anchors through the floor mount and into the holes in the floor.
3. Hammer the anchors in until the washer is in firm contact with the floor mount.



4. Expand the anchors by torquing the nuts to 122 to 128 Nm (90 to 95 ft-lb).

⚠WARNING

If any of the four anchors spin before the minimum torque is achieved, abandon the location and start elsewhere. An improperly installed anchor can allow the puller to break loose.

Failure to observe this warning could result in severe injury or death.

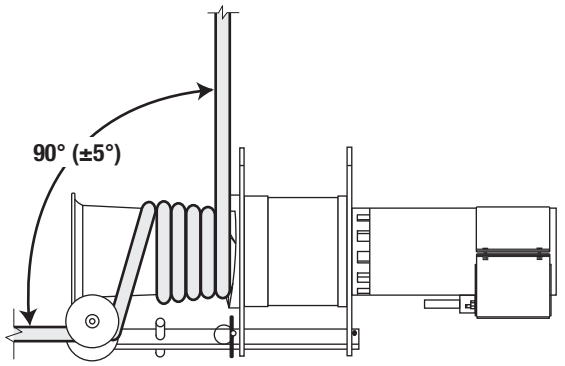
5. Have the installation checked by a qualified inspector.

Operation

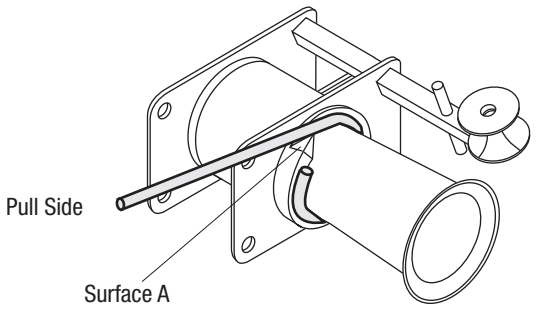
1. Fish the rope through the conduit.
2. Set up the cable puller. Refer to Typical Setups illustrations and instructions in this manual.

⚠WARNING

Set up the cable puller so that the rope will approach the capstan at an angle of 90° (±5°). Angles outside of this range may cause the rope to overlap.



3. Set the rope ramp as follows:



   a. Wind the rope several times around the capstan.
   b. Pull the ramp away from the mounting plate and rotate it until Surface A contacts the rope.
   c. Push the ramp toward the mounting plate and rotate it counterclockwise until it locks into place.

4. Check the ON/OFF switch on the puller to be sure it is OFF. Plug the puller into the receptacle of the standard force gauge.
5. Connect the force gauge to an appropriate power supply (refer to “Grounding Instructions” in this manual).

   Note: If using an extension cord, it must be rated for 20 amps. Use the shortest cord possible. Longer cords reduce puller speed.
6. Position the force gauge so that it can be monitored by the puller operator.

Color Band on Meter	Pounds of Pulling Force	Alarm	Duty Cycle (in minutes)
Green	0–6500	OFF	continuous
Yellow	6500–8000	ON	15 ON / 15 OFF
Red	over 8000	ON	puller will stop

7. Turn the circuit breaker in the force gauge ON.
8. Grasp the tailing end of the rope. Apply a slight amount of tailing force.
9. Turn the puller ON.
10. Tail the rope, allowing the spent rope to accumulate on the floor between the operator and the puller.
11. When the pull is complete, turn the puller OFF. Tie off the rope and anchor the cable.

Removing Cable

Removing old cable involves the same principles as installing new cable. However, there are some important differences.

Pulling Force

It is difficult to predict the amount of pulling force necessary to remove an old cable. The cable may be damaged, and it may break with an unexpectedly low pulling force.

The required pulling forces may be very high:

- The cable has probably "taken a set." Unlike the new cable on a reel, cable in conduit has probably been in the conduit for years, or perhaps decades. The cable will resist bending and straightening as it is pulled through the conduit.
- The pulling lubricant has probably hardened, increasing pulling resistance.
- The insulation may be damaged and the cable may be corroded.
- Dirt or other foreign matter may have entered the conduit and may have cemented the cable in place.

Using a Force Gauge

When pulling old cable out of a conduit, the pulling force will be highest when *starting* the pull. Select a cable puller and pulling components to meet or exceed the estimated amount of pulling force necessary to remove the old cable. Because breaking the cable free will require the largest amount of pulling force, it is necessary to use a force gauge to prevent overloading the system components. Select either the 01069 Standard Force Gauge or the 00967 Deluxe Force Gauge.

Carefully monitor the pulling force at the force gauge; if the puller is not able to begin the pull, shut off the puller and disassemble the setup. Start over with a puller and components of a higher force rating.

Puller Placement

Pulling out old cable is generally accomplished with the puller located some distance away from the end of the conduit. This allows the pulling crew to pull out a long section of cable before turning off the puller, cutting off the cable, and reattaching the grip(s). Mounting the cable puller a distance away from the end of the conduit increases the amount of exposed rope, which greatly increases the amount of violent whipping action which would occur if the rope were to break.

To isolate the operator from the rope path:

- Locate the puller so that you will stand behind an obstruction, such as a wall. Set up the puller so that you will be able to maintain control of the pull. You need a clear view of the rope as it feeds onto the capstan, including several feet of the rope in front of the capstan. You must be able to turn off the puller before the pulling grip, connector, or swivel contacts the capstan.
- Use an additional pulling sheave (if necessary) to change the direction of the tailing rope. Anchor the sheave so that you are close enough to maintain control of the pull. You need a clear view of the rope as it feeds onto the capstan, including several feet of the rope in front of the capstan. You must be able to turn off the puller before the pulling grip, connector, or swivel contacts the capstan.

  Note: Use the additional pulling sheave to change the direction of the tailing rope (after the rope leaves the capstan). Do not change the direction of the pulling rope.
- Use a longer tailing rope than usual and stand away from the puller. Stand as far from the puller as possible, while maintaining control of the pull. You need a clear view of the rope as it feeds onto the capstan, including several feet of the rope in front of the capstan. You must be able to turn off the puller before the pulling grip, connector, or swivel contacts the capstan.

Maintenance

IMPORTANT

Maintenance should be performed by authorized personnel only.

General Maintenance Notes

- Replace any part that is broken, cracked or worn.
- Replace any bearings that don't turn freely.
- Clean all mating surfaces before assembly.
- Replace gearbox grease with Sentinel SL-WPG or equivalent.

Specific Service Notes

- Average brush life for commutator brushes is about 100 hours. Replace brushes if they are shorter than 9.5 mm (3/8").
- Replace rope ramp if it is grooved more than 6.5 mm (1/4").
- Replace the capstan if it is grooved more than 0.15 mm (1/16").
- The puller should not require any lubrication during its normal service life.

Switchbox Removal

1. Remove the four hex head cap screws (12) and nuts (13) that secure the clamp (6) to the switchbox (5).
2. Remove the clamp and pull switchbox from the motor.
3. Disconnect the white and black motor leads from the rectifier.
4. Unscrew the green ground wire from the motor.
5. Remove switchbox.

Switchbox Assembly Notes

1. If replacing the rectifier, use a heat conductive paste between the rectifier and the switchbox.
2. Connect the white motor lead to the positive (+) terminal on the rectifier. Connect the black motor lead to the negative (–) terminal.

IMPORTANT

The first reduction hub will be damaged if the leads are reversed.

3. Secure motor leads to motor using tie-wraps. Make sure the wires will not contact the commutator.
4. Position the switchbox and clamp so that the vent holes are towards the rear of the motor.

Motor Removal

Refer to Illustration – Motor.

1. Remove switchbox.
2. Push in and pull out the tab to release the commutator brush springs.
3. Use a 7/16" socket to remove nuts and washers at rear of motor.
4. Pull the motor off of the tail housing (3).
5. Pull off commutator brush assembly (1, 2 and 4).
6. Pull off magnet housing (5).
7. Pull out armature (6).
8. Remove screw holding the air vent protective screen. Remove protective screen.

Motor Assembly Notes

1. Apply gasket sealant between gearbox housing and the outside of the front armature housing.
2. If the armature does not turn freely after installation, the wrong gear teeth were engaged.
3. Hold armature in place when installing the magnet housing. Position magnet housing with the roll pin outward and pointed towards 8 o'clock. The square hole of the mounting plate should be positioned at 10 o'clock.
4. Install commutator brush assembly. Wires should be at the 9 o'clock position.
5. Insert magnet housing roll pin into the recess on the tail housing.

Capstan Removal

1. Use a 1-inch 18 point socket to remove capstan retaining bolt (11) and washer (19).
2. Pull the capstan (2) off of the shaft.

   If the capstan is stuck: Pull out the rope ramp. Use two pry bars on opposite sides of the capstan between the gear housing and the capstan.

IMPORTANT

The first reduction hub will be damaged if the leads are reversed.

3. Remove key (24).
4. Remove rope ramp (3).

Capstan Assembly Notes

1. Remove oxidation before assembling.
2. **Do not hammer capstan onto shaft.** Use a 65 mm (2-1/2") or longer bolt to draw the capstan onto the shaft.

Maintenance (cont'd)

Right Angle Sheave Bracket Removal

1. Remove detent pin (22).
2. Slide arm towards motor. Use a small punch to remove the roll pin (20).
3. Remove bracket (4).

Gearbox Disassembly

1. Remove motor, capstan and right angle sheave bracket.
2. Remove the screws (38) on the motor side of the gearbox. Remove the mounting plate (20).
3. Remove the motor mounting housing (2).
4. Pull out the 1st reduction planet gear assembly and thrust washer.
5. Pull out the center shaft (12).
6. Pull out the 2nd reduction planet gear assembly and thrust washer.
7. Push out the output shaft/3rd reduction gear assembly and thrust washer.
8. Remove the screws holding the ring gear (37).
9. Tap the bearing housing off the ring gear and dowel pins. **Do not mar the mating surface to the ring gear.**

Gearbox Assembly Note

1. Clean all ring mating surfaces. Apply a flange sealant (Loctite® 515 or equivalent) to all ring mating surfaces.
2. Install center shaft with the small diameter towards the motor.
3. Install the mounting plates. When viewed from the motor end, the motor mounting studs should be positioned at 1 and 7 o'clock. The square hole in the mounting plate should be between 10 and 11 o'clock.
4. Position mounting plates so the screw heads on the capstan side fit into the counterbores of the mounting plates.

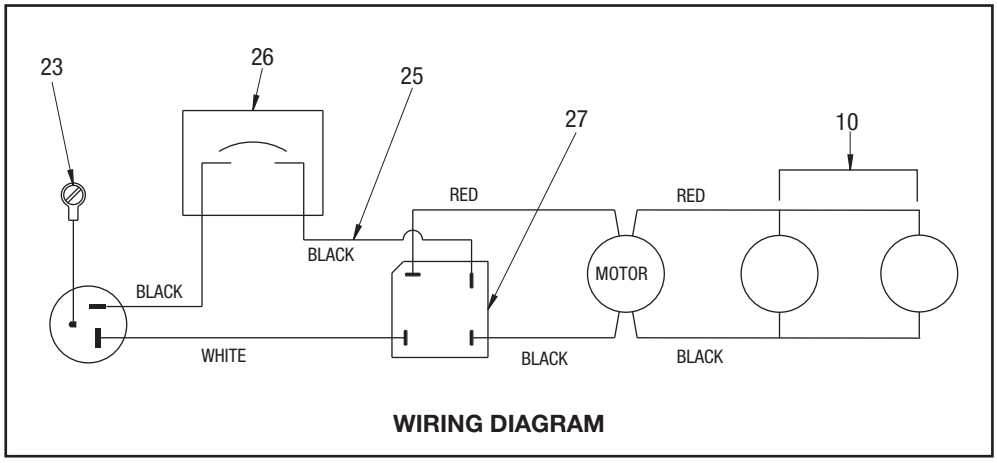
Disassembly of Planet Gear Carriers

1. Remove the flat head screws.
2. Tap or pry off the hub plate from the hub and dowel pins.
3. Remove the thrust washers, gears, thrust washers and shaft.
4. Remove sun gear ONLY if replacement is required.

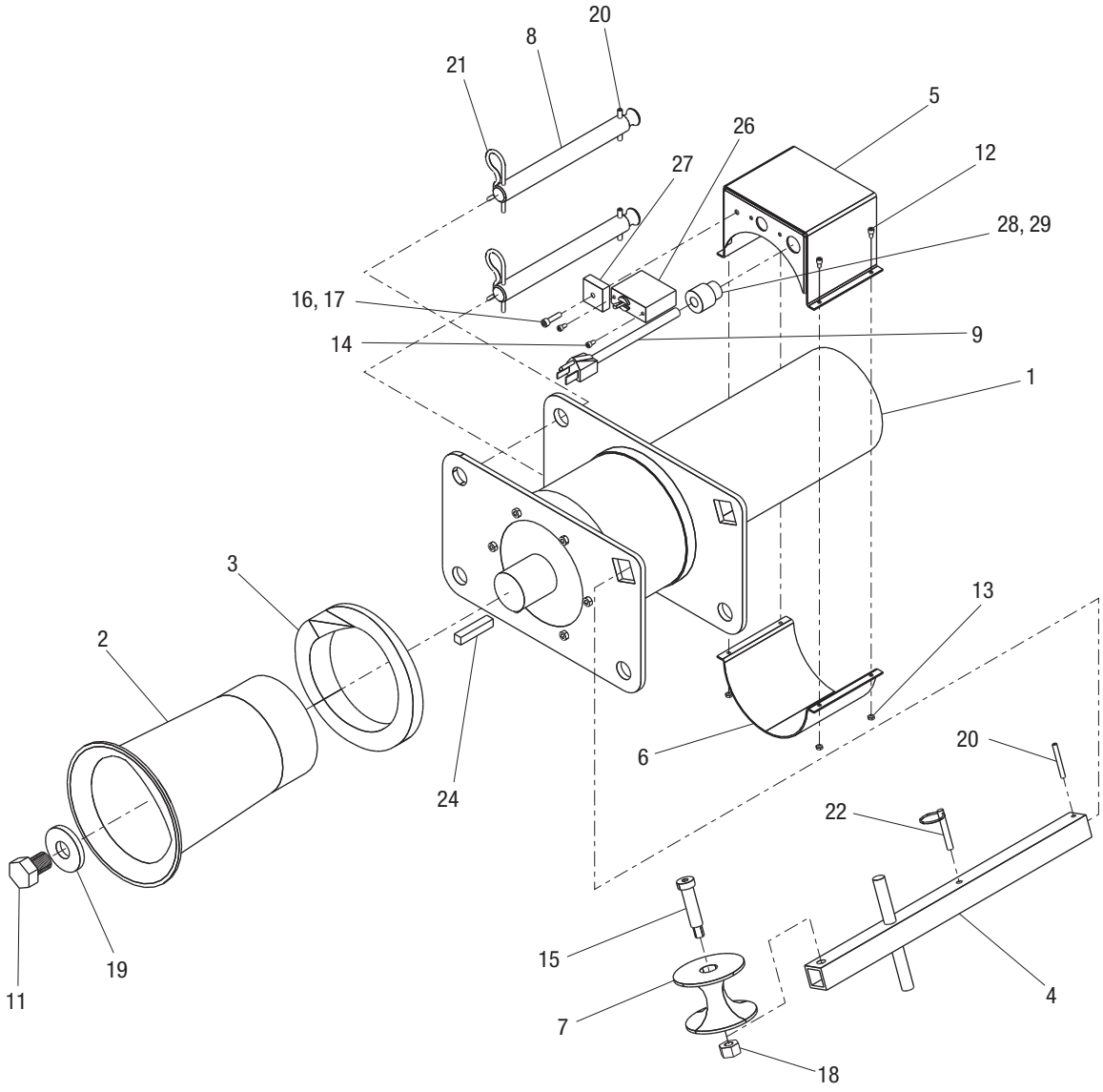
Planet Gear Carrier Assembly

1. Place the shafts in the hub. The end with the flat should face outward.
2. The 1st planet reduction gears must be positioned with the gear end towards the capstan.
3. When replacing the 1st reduction gear bearing/clutch, the locked arrow direction must be counter-clockwise (when viewed from the gear end).
4. **When replacing the ball bearing on the output shaft, the thick side of the outer race must face the capstan.**
5. Use a removable thread-locking compound, such as Loctite® 242® Threadlocker or equivalent, on the #10–32 flat head screws (items 35 and 36 on the gearmotor). Follow the manufacturer's instructions for curing.

Illustration and Wiring Diagram–Ultra Tugger 8



WIRING DIAGRAM



Parts List—Ultra Tugger 8

Key	Part No.	Description	Qty
1	50006460	Gearmotor	1
2	50007440	Capstan	1
3	50007513	Ramp, rope	1
4	50007416	Bar, tie	1
5	50007491	Switchbox	1
6	50007505	Clamp	1
7	50353110	Sheave, right angle	1
8*	50007432	Puller pin	2
9	50008757	Cord unit, power	1
10	50006690	Capacitor unit	1
11	90548485	Screw, cap, 3/4–16 x 1.500 hex head, grade 5	1
12		Screw, cap, #6–32 x .500 socket head	4
13		Nut, hex, #6–32	4
14	90522036	Screw, machine, #6–32 x .250 round head	2
15	90539214	Screw, shoulder, .5/8 x 1-3/4 x 1/2–13	1
16	90524918	Screw, machine, #10–24 x .750 round head	1
17	90533453	Nut, hex, #10–24 lock, zinc-plated	1
18	90527941	Nut, hex, 1/2–13 zinc-plated	1
19	90548507	Washer, flat, .780 x 2.000 x .250	2
20*	90507002	Pin, roll, .187 x 1.50	3
21*	90503023	Clip, hitch pin, #8	2
22	90548523	Hitch pin, Rein Leitzke #30–07	1
23		Screw, machine, #8–32 x .328 hex head, green	1
24	90548515	Key, square, .375 x 1.88	1
25	50008765	Wire unit	1
26	91871328	Switch / circuit breaker	1
27	91868130	Rectifier, 50 amp, bridge	1
28	90541243	Bushing, strain relief	1
29		Nut, conduit, 1/2" lock	1

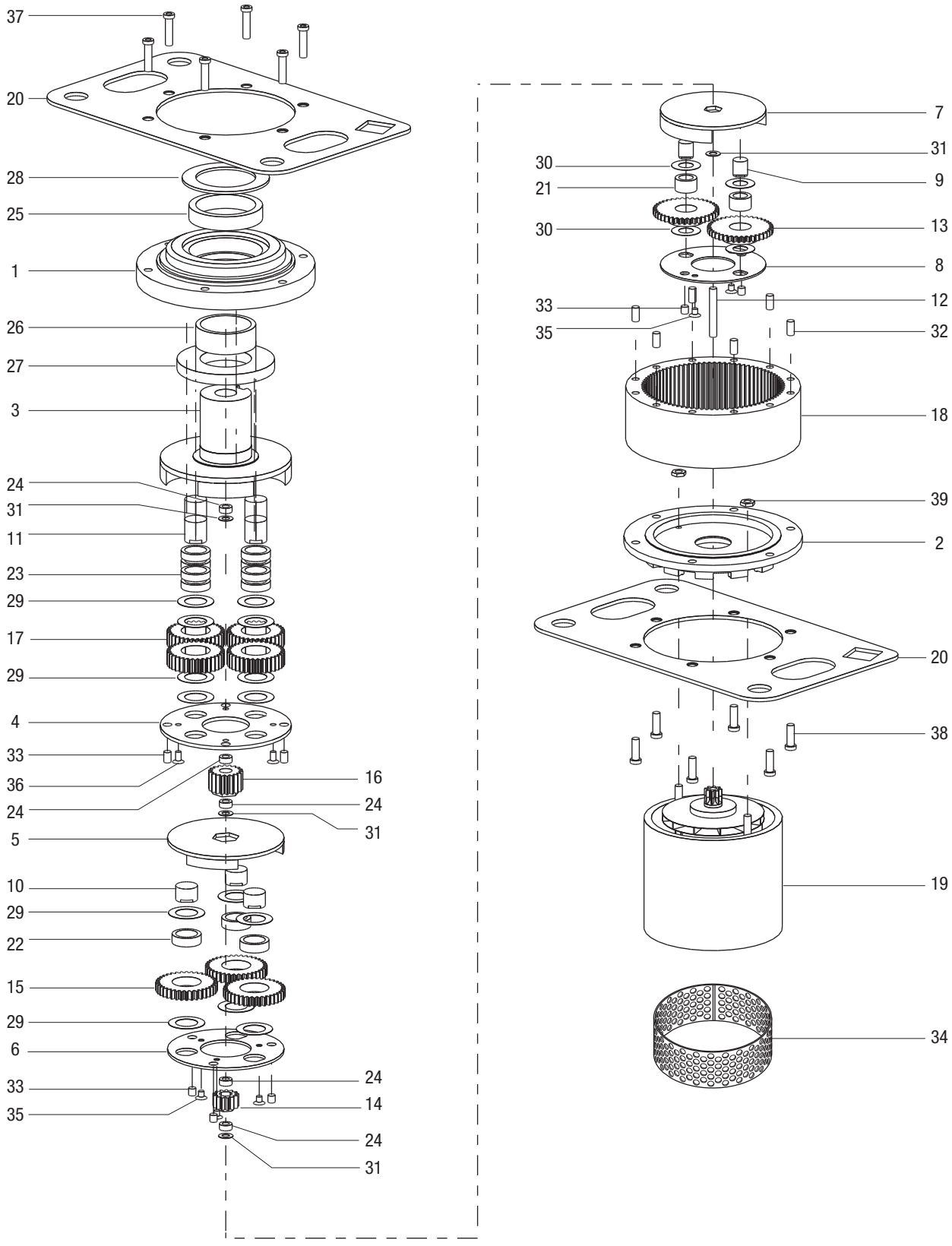
Repair Kit

*	50061887	Kit, puller pin (includes one each of the items marked with an asterisk)	2

Decals

		Decal, warning	1
		Decal, read IM	1
	99935767	Decal, technical assistance	1

Illustration—Gearmotor (50006460)



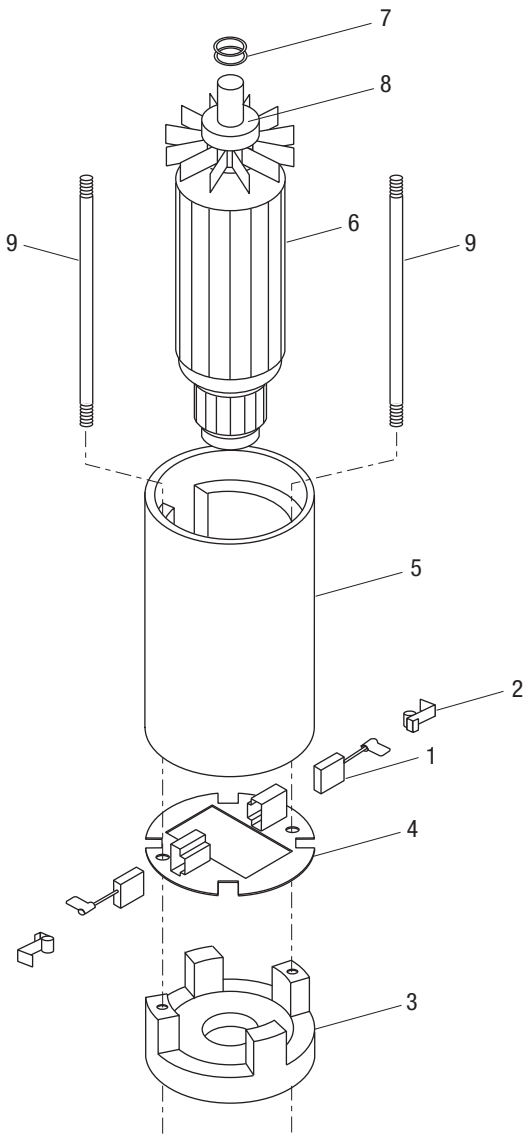
Parts List—Gearmotor (50006460)

Key	Part No.	Description	Qty
1	50006657	Bearing housing	1
2	50006630	Motor mount	1
3	50006576	Output hub	1
4	50006584	Output hub plate	1
5	50006622	2nd reduction hub	1
6	50006592	2nd reduction hub plate	1
7	50006606	1st reduction hub	1
8	50006517	1st reduction hub plate	1
9	50006487	1st reduction shaft	2
10	50006495	2nd reduction shaft	3
11	50006509	3rd reduction shaft	4
12	50006479	Center shaft	1
13	50006525	1st reduction planet gear	2
14	50006533	2nd reduction sun gear	1
15	50006541	2nd reduction planet gear	3
16	50006550	3rd reduction sun gear	1
17	50006568	3rd reduction planet gear	4
18	50006614	Ring gear	1
19	50006649	Motor	1
20	50006665	Motor mounting plate	2
21	90548230	Clutch, Torrington #RCB-081214	2
22	90548248	Bearing, Torrington #B-1210	3
23	90548256	Bearing, Torrington #B-128	8
24	90548264	Bearing, Torrington #B-46	5
25	90548272	Bearing, Torrington #BH-3316	1
26	90548280	Inner race, Torrington #IR-2824	1
27	90548299	Bearing, Fafnir #7209W	1
28	90548302	Seal, Freudenberg-Nok #UF-0216E	1
29	90548329	Thrust washer, .760 x 1.25 x .020	14
30	90548310	Thrust washer, .510 x 1.00 x .020	4
31	90548337	Thrust washer, .260 x .50 x .030	8
32	90534719	Dowel pin, .250 x 1.250	6
33	90541036	Dowel pin, .312 x .625	9
34	91869218	Screen	1
35	90548345	Screw, cap, #8–32 x .500, socket flat head	5
36	90548353	Screw, cap, #8–32 x .750, socket flat head	4
37	90548361	Screw, cap, 1/4–28 x 2.00, socket head	6
38		Screw, cap, 1/4–28 x 1.500, socket head	6
39		Nut, hex, 1/4–20	2

Repair Kits

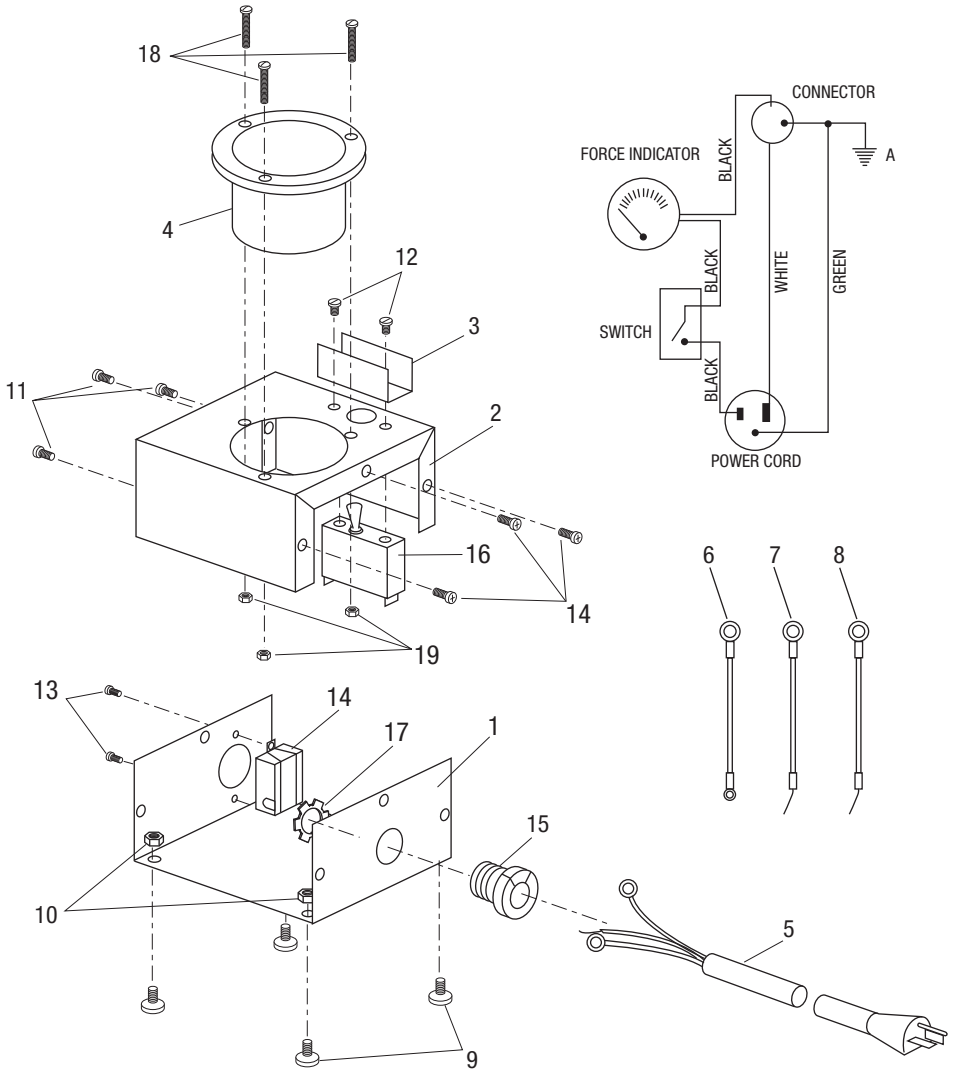
50022920	Gearmotor repair group #1 (includes 3, 4, 11, 17, 23, 24[2], 29[2], 33, 36)
50022954	Gearmotor repair group #2 (includes 5, 6, 10, 15, 16, 22, 24, 29[2], 34, 35)
50022970	Gearmotor repair group #3 (includes 7-9, 13, 14, 21, 24, 30[2], 31, 34, 35)

Illustration and Parts List—Motor (50006649)



Key	Part No.	Description	Qty
	50006649	Motor	
1	91867053	Commutator brushes	2
2	91867061	Commutator brush retention spring	2
3	91865590	Tail housing	1
4	91865603	Brush assembly plate	1
5	91865611	Magnet housing	1
6	91865620	Armature	1
7	90543483	Belleville washers	2
8	91860717	Bearing	1
9	91869145	Threaded rod	2

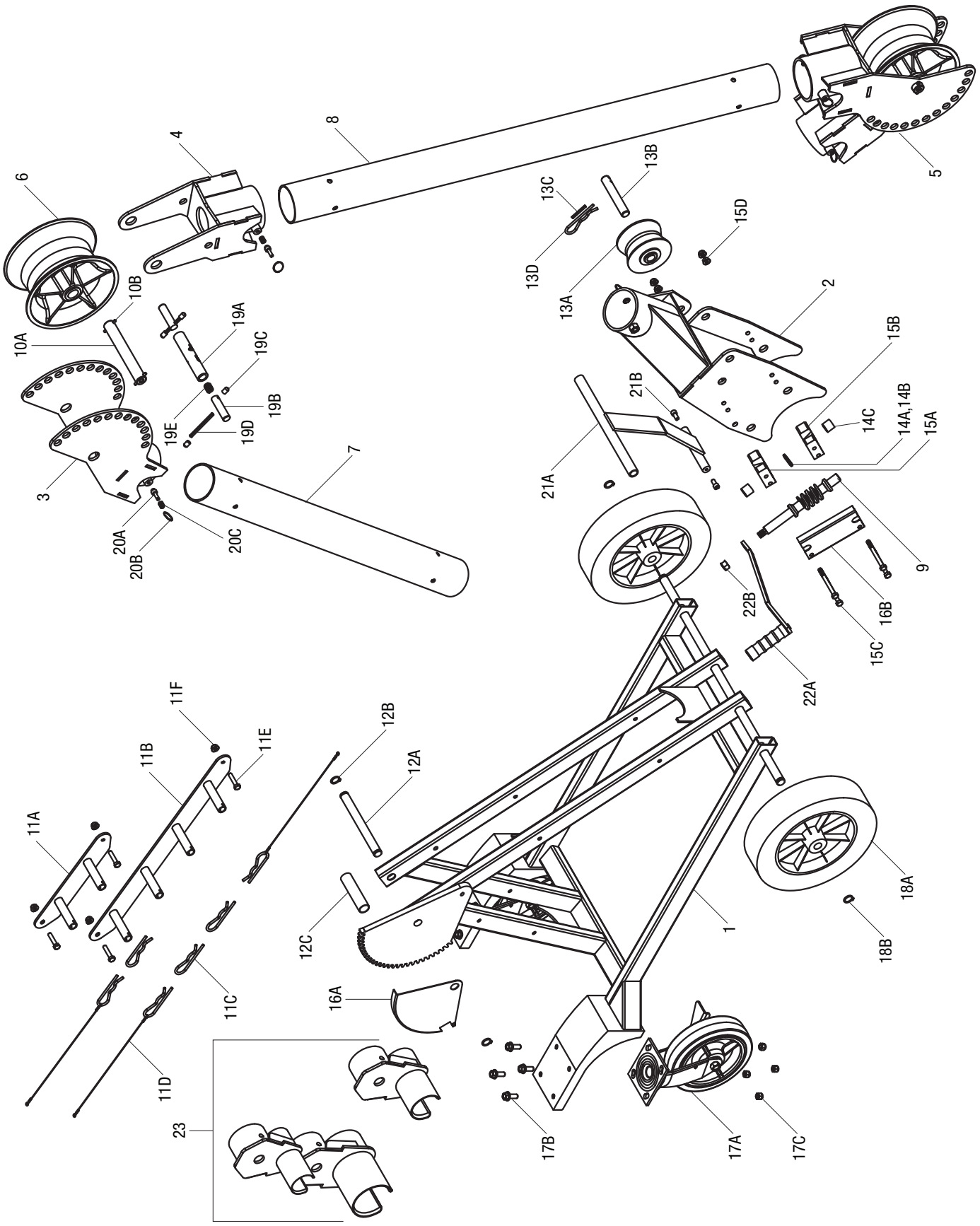
Illustration and Parts List—Force Gauge (50010697)



Key	Part No.	Description	Qty
1	50371088	Box, lower	1
2	50371070	Box, upper	1
3	50297082	Guard, switch	1
4	50010760	Meter	1
5	50371703	Cord, power	1
6		Wire unit, 12 AWG x 3.00, black	1
7		Wire unit, 12 AWG x 7.00, black	1
8		Wire unit, 12 AWG x 4.00, green	1
9	90539346	Bumper, #8–32 machine screw, rubber	4
10	90506332	Nut, hex, #8–32	4
11	90531949	Screw, self-tapping, #10–16 x .250 Phillips head	6

Key	Part No.	Description	Qty
12	90522036	Screw, machine, #6–32 x .25, slotted pan head	2
13		Screw, machine, #8–32 x .375, round head	2
14	91866847	Receptacle, 20 amp female	1
15	90541243	Bushing, strain relief	1
16	91863830	Switch	1
17		Nut, conduit, 1/2" lock	1
18	90537254	Screw, cap, #6–32 x .750, socket button head	3
19	90506324	Nut, hex, #6–32	3
Decals			
	50303929	Decal, damp warning	1
		Decal, identification	1

Illustration—Mobile Carriage and Boom

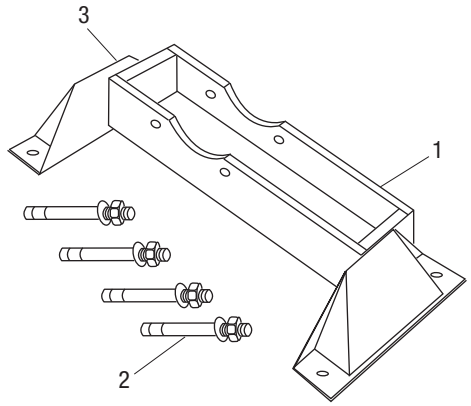


Parts List—Mobile Carriage and Boom

Key	Part No.	Description	Qty
1		Carriage weldment	1
2		Boom mount weldment	1
3		Elbow/nose weldment	2
4		Pivot weldment	2
5		Elbow assembly	2
6		Sheave unit, 9"	2
7		Boom, 3'	1
8		Boom, 4'	1
9		Worm	1
10	52061270	Sheave shaft kit (includes 10A, 10B)	2
10A		Shaft	2
10B		Roll pin, 3/16 x 1.50	4
11	00471	Coupling hanger kit (includes 11A–11F)	1
11A		Hanger weldment, short	1
11B		Hanger weldment, long	1
11C		Hairpin, cotter	6
11D		Lanyard	3
11E		Screw, 5/16-18 x 1.50 hex head	4
11F		Nut, 5/16-18 flange	4
12	52061273	Pivot shaft kit (includes 12A–12C)	1
12A		Shaft, main pivot	1
12B		Ring, retaining	2
12C		Spacer, mount	1
13	52061274	Idler wheel kit (includes 13A–13D)	1
13A		Wheel unit, idler	1
13B		Shaft	1
13C		Roll pin, 3/16 x 1.50	1
13D		Hairpin, cotter	1
14	52061275	Bearing kit (includes 14A–14C)	1
14A		Race, bearing–thrust	2
14B		Bearing, thrust needle	1
14C		Bearing, bronze	2
15	52061276	Bearing block set (includes 15A–15D)	1
15A		Block, upper bearing	1
15B		Block, lower bearing	1
15C		Screw, 5/16-18 x 3.25 hex head	4
15D		Nut, 5/16-18 flange	4
16	52061277	Guard kit (includes 16A, 16B)	1
16A		Guard, gear	1
16B		Guard, worm	2
17	52061278	Swivel caster kit (includes 17A–17C)	2
17A		Caster	1
17B		Screw, 3/8-16 x 1.00 hex head	4
17C		Nut, 3/8-16 hex lock	4
18	52061279	Wheel kit (includes 18A, 18B)	1
18A		Wheel	2
18B		Ring, retaining	2
19	52061280	Elbow detent pin kit (includes 19A–19E)	2
19A		Sleeve, long detent	1
19B		Detent, long	2
19C		Grip, detent	4
19D		Roll pin, 1/4 x 3.00	2
19E		Spring, detent	1
20	52061281	Boom detent pin kit (includes 20A–20C)	3
20A		Plunger	2
20B		Ring, pull	2
20C		Spring	2
21	52060823	Transport handle kit (includes 21A, 21B)	1
21A		Push handle weldment	1
21B		Screw, 5/16-18 x .625 socket head cap	2
22	52061283	Crank handle kit (includes 22A, 22B)	1
22A		Crank	1
22B		Nut, 1/2-20 hex	1
23	00563	2" slip-in conduit adapter	1
	00564	2-1/2" slip-in conduit adapter	1
	00565	3" slip-in conduit adapter	1
	00566	3-1/2" slip-in conduit adapter	1
	00567	4" slip-in conduit adapter	1
	00610	5" slip-in conduit adapter	1
	00583	2" screw-on conduit adapter	1
	00584	2-1/2" screw-on conduit adapter	1
	00585	3" screw-on conduit adapter	1
	00586	3-1/2" screw-on conduit adapter	1
	00587	4" screw-on conduit adapter	1
Decal			
		Decal, warning	3

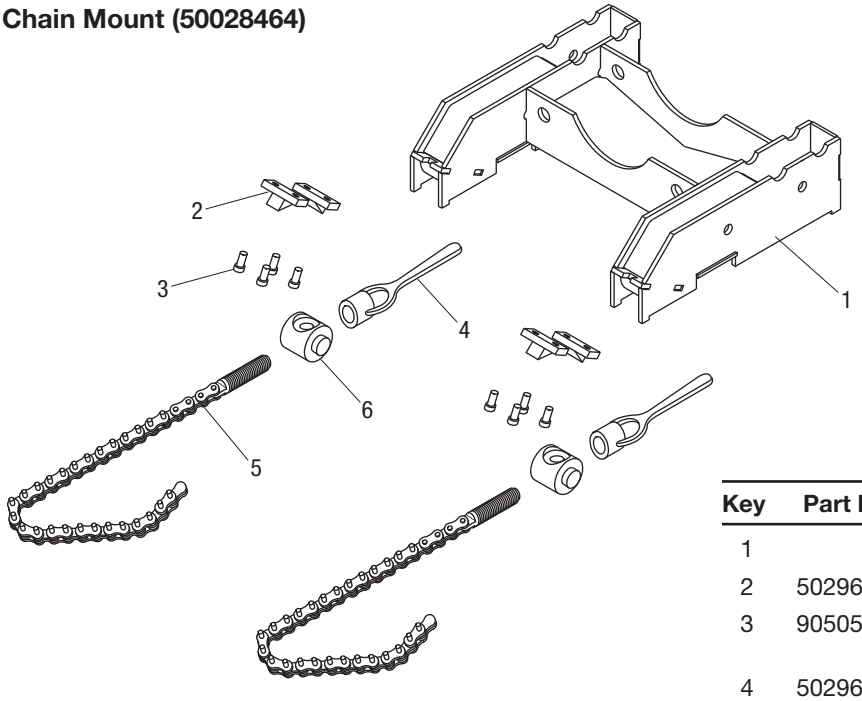
Accessories

Floor Mount (50008650)



Key	Part No.	Description	Qty
1		Frame	1
2	50356070	Anchor, wedge, .625 x 6.00	4
3		Decal, warning	1

Chain Mount (50028464)



Key	Part No.	Description	Qty
1		Frame	1
2	50296647	Foot	4
3	90505794	Screw, cap, 1/4-20 x .500, socket head	8
4	50296302	Handle unit, vise chain	2
5	50356615	Screw unit, vise chain	2
6	50007734	Block, pivot	2
		Decal, warning (not shown)	1

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