

CDI FORCE TESTING MANUAL

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Using this Manual

This manual contains instructions for use and setup of the TFC series Force Testing Kits. A table of contents and table of illustrations are provided to make this manual easy to use.

Some of the information shown in text or illustrations is obtained using optional equipment. A CDI sales representative can determine optional equipment availability.

Conventions

This section contains a list of conventions used in text.

Check Note

A check note provides additional information about the subject in the preceding paragraph.

Example:



System capabilities include, data storage, retrieval, statistical analysis and automatic downloading to a printer or computer.

Chapter References

Additional information in text is reference by chapter number and section name.

Example:



For testing procedures refer to Chapter 4 – Using the TFC 2000.

Equipment Damage

The possibility of damage to equipment is introduced by a signal word indicating this condition.

Example:

IMPORTANT

The connector on single transducer cables contain the EEPROM calibration memory chip. Never attempt to remove the connector from the transducer.

Safety Messages

Safety messages are provided to help prevent personal injury and equipment damage. All safety messages are introduced by a signal word indicating the hazard level. The types of safety messages are:



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.



WARNING

Indicates a potential hazard which, if not avoided, could result in death or serious injury to the operator or to bystanders.



CAUTION

Indicates a potential hazard which, if not avoided, may result in minor or moderate injury to the operator or to bystanders.

The three-part message, used with safety messages, uses three different type styles to further define the potential hazard:

- Normal type states the hazard,
- **Bold type** states how to avoid the hazard, and
- *Italic type* states the possible consequences of not avoiding the hazard.

Some safety messages contain pictorials with signal words, pictorials showing the potential hazard, and pictorials describing how to avoid the potential hazard.

Example:



WARNING

- Flying particles can discharge when applying torque. **Users and bystanders must wear safety goggles.** *Always wear safety goggles when applying torque. Flying particles can cause injury*

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Safety Information

IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety and operating instructions for CDI's TFC series Force Testing Kits. Refer to the information in this manual often for safe operation.

Read All Instructions

Read, understand and follow all safety messages and instructions in this manual and on the test equipment. Safety messages in this section of the manual contain a signal word, a three-part message, and, in some instances, pictorials.

The signal word indicates the level of hazard in a situation:



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.



WARNING

Indicates a potential hazard which, if not avoided, could result in death or serious injury to the operator or to bystanders.



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The three-part message, used with safety messages, uses three different type styles to further define the potential hazard:

- Normal type states the hazard,
- **Bold type** states how to avoid the hazard, and
- *Italic type* states the possible consequences of not avoiding the hazard.

SAVE THESE INSTRUCTIONS

Safety Information

Some safety messages contain pictorials with signal words, pictorials showing the potential hazard, and pictorials describing how to avoid the potential hazard.



WARNING



- Flying particles can discharge when applying torque. **Users and bystanders must wear safety goggles. Always wear safety goggles when applying torque.**
Flying particles can cause injury



WARNING



- Improper use can cause breakage. **Read instructions before operating. Follow manufacturer's instructions, safety precautions, and specifications when operating tools.**
Broken equipment can cause injury



WARNING

- Improper or out of specification equipment can cause breakage. **Make sure all components, including adaptors are rated to match or exceed the torque or load being applied. Do not use the Force Testing Kit if it has loose parts or shows any other sign of damage. Have repairs performed at an Authorized Service Center before use. Do not remove any labels. Replace and damaged labels.**
Broken equipment can cause injury

Introduction

Force testing kits enhance the versatility of your TFC series loader, indicator, and transducers when configured properly can deliver cable tension loads for testing cable tensiometers, compression and tension gauges. The indicator provides measurement, display, storage, and statistical analysis of FORCE inputs. The accuracy of the total system when using force testing kits may be slightly less than the specified accuracy of your TFC series equipment that does take into account the force testing kits.

A one foot force arm attaches to a transducer and the torque measurement is mathematically equivalent to the force measurement for ft-lb torque units. The indicator will automatically convert to the selected units of force (e.g. N, dN, kp, gf, lbf, oz). For example, a 250 ft-lb transducer translates into 250 lbf (pound force). The transducer is installed by lining up the red locator mark with the FORCE marker on the loader. Only single transducers ranging above 400 in-lb can be used to measure force.

The force arm attaches to a transducer and a cable connects to the force arm and a fixture that is secured to the loader. Depending on which test kit is used while under load the cable is in tension for testing cable tensiometers, or the cable pulls a tension gauge, or the cable pulls a compression block for testing compression gauges.

The information in this manual is general. Operational features, procedures, and specifications may change without notice. **CDI** makes no claims as to the suitability of this information for diverse user applications.

Force Arm Kit

The Force Arm Kit contains force arms for drive type and flange type transducers. A force arm is required for all force measurements. Only single transducers ranging 400 in-lb and above can be used to measure force.

Force Arm Kit

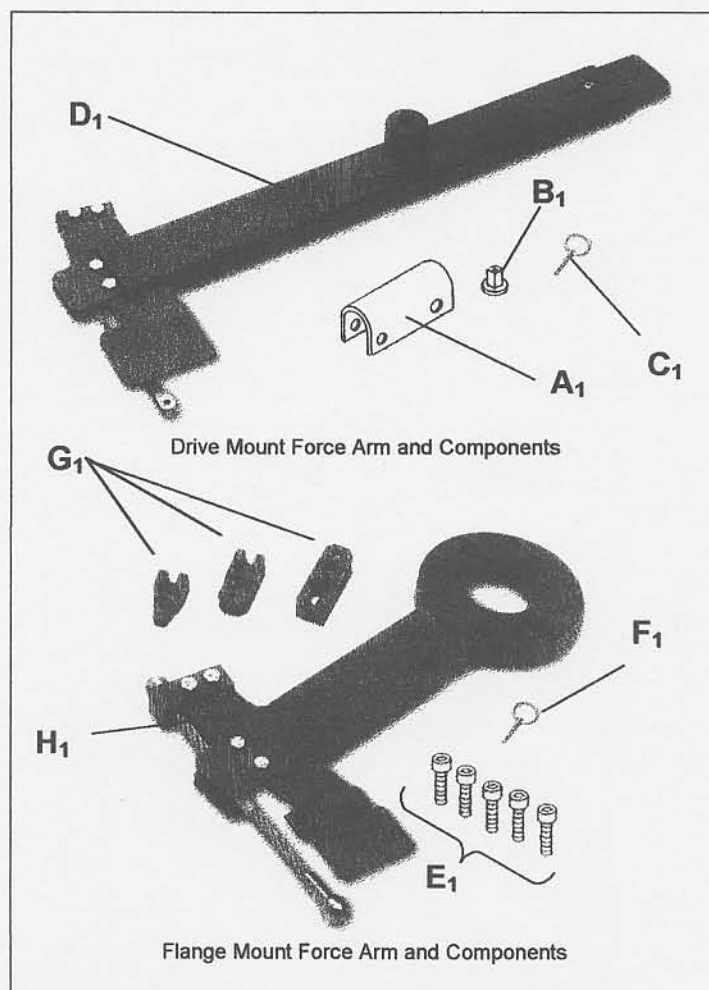


Figure 2-1: Force Arm Kit

Drive Mount Force Arm & Components for testing force to 250 lb maximum

A₁ – Drive Mount Force Arm Cable Adaptor

The drive mount force arm cable adaptor is required when connecting cables whose eyelets are larger than 3/16 inch. Refer to Figure 2-3 for exploded views of the drive mount force arm cable connection.

B₁ – Square Drive Adaptor

The square drive adaptor is required when connecting the drive mount force arm to a 3/8 inch drive transducer. The square drive adaptor converts a 3/8 inch external square drive to a 1/2 inch external square drive.

IMPORTANT

The square drive adaptor is designed specifically for use with the drive mount force arm. Never attempt to use the square drive adaptor in other applications.

C₁ – Quick release pin

A 3/16 inch diameter quick release pin is provided for use with the drive mount force arm cable adaptor.

D₁ – Drive Mount Force Arm

The drive mount force arm has an internal 1/2 inch square drive that attaches to a drive type transducer. To minimize side loading on the transducer, the arm has a counter weight for balance. The counter weight has been factory set and secured using a screw. The screw should not be loosened or removed, doing so will change the factory setting. Only single transducers ranging above 400 in-lb can be used to measure force. Refer to Figure 2-2 for an exploded view of the drive mount force arm and transducer mounting.

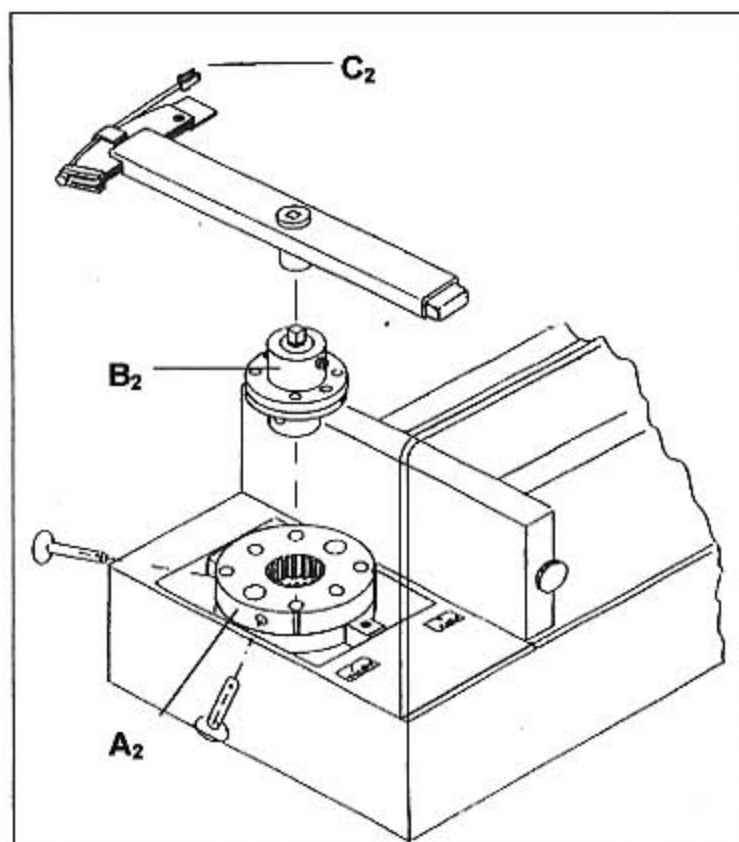


Figure 2-2: Exploded view of drive type force arm setup

A₂ – Transducer Mounting

The transducer must be installed into the loader by lining up the red mark with the "FORCE" label on the loader and securing it using two quick release pins that are provided with the loader. Refer to the instructions for the loader for proper transducer mounting.

IMPORTANT

The connector on single transducer cables contains the EEPROM calibration memory chip. Never attempt to remove the cable from the transducer.

B₂ – Transducer

The recommended drive type transducers available for the drive mount force arm are shown below:

Transducer	Drive Size	Range	Force Range
2000-7-02	3/8 inch	30-400 in lb	2.5-33 lb
2000-8-02	3/8 inch	80-1000 in lb	6.6-83 lb
2000-10-02	1/2 inch	10-125 ft lb	10-125 lb
2000-11-02	1/2 inch	20-250 ft lb	20-250 lb
① square drive adaptor required.			

C₂ – Cable Connection

Connecting cables to the drive mount force arm require the use of a 3/16 inch quick release pin. When connecting cables whose eyelets are larger than 3/16 inch the drive mount force arm cable adaptor is required. Quick release pins for cable attachment are available in 2000-260-0 Tensiometer Testing Kit, 2000-261-0 Force (Tension) Gage Kit, or 2000-262-0 Force (Compression) Gage Kit. Refer to Figure 2-3 for exploded views of the drive mount force arm cable connection.

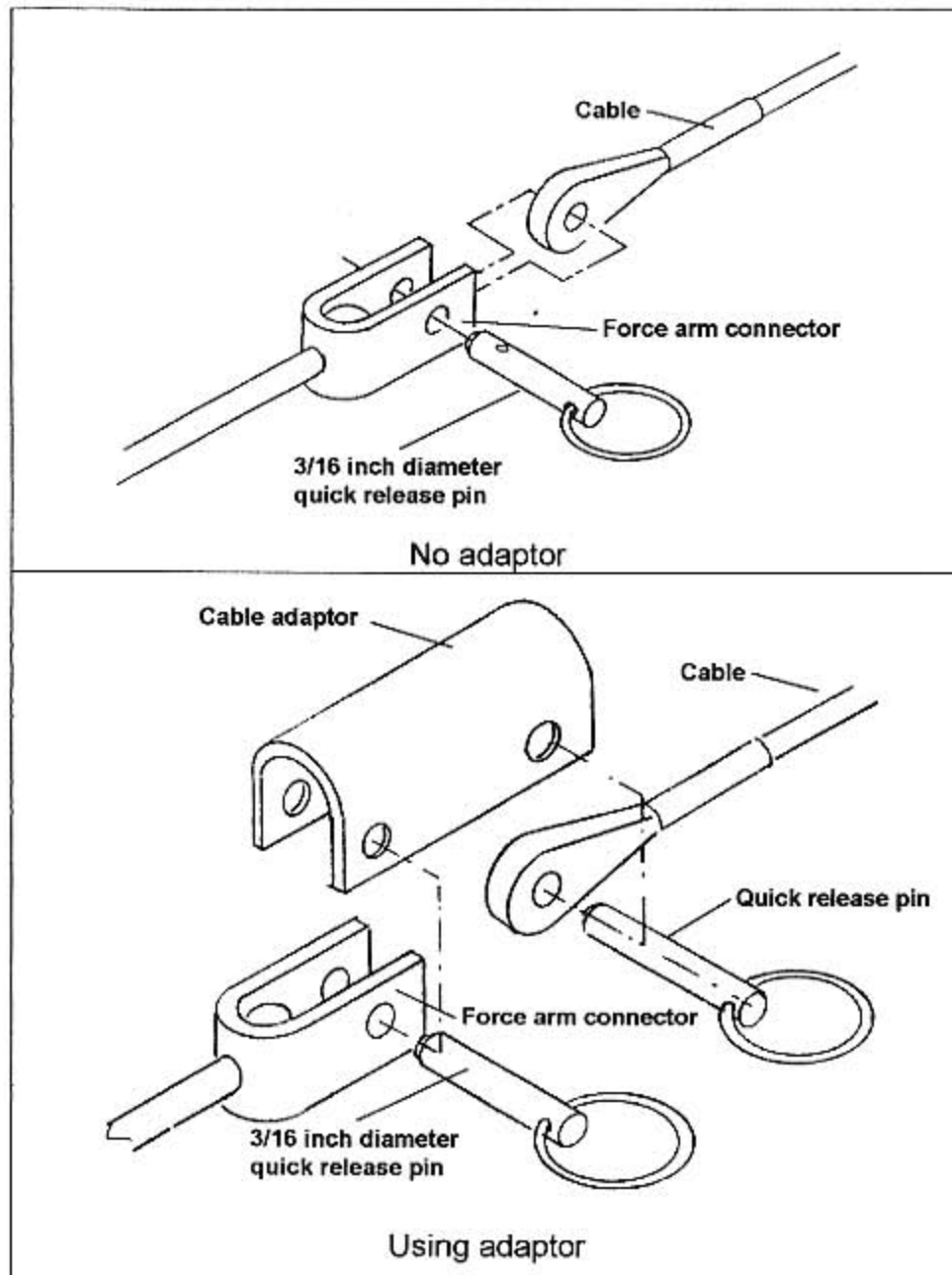


Figure 2-3: Exploded view of flange type force arm cable connection

E₁ –Mounting Screws

5 screws [1/2-13 x 1-3/4 inch] are provided to secure the flange mount force arm to the transducer. Only single transducers ranging 400 in-lb and above can be used to measure force. Refer to Figure 2-4 for an exploded view of the flange mount force arm and transducer mounting.

Flange Mount Force Arm & components from 100 – 2500 lb

F₁ – Quick Release Pin

A 3/16 inch diameter quick release pin is provided for use with the flange mount force arm cable adaptors.

G₁ – Flange Mount Force Arm Cable Adaptors

Flange mount force arm cable adaptors are needed when connecting the tension cables to the flange mount force arm. Connecting the force arm requires the appropriate adaptor, a 3/16 inch diameter quick release pin, the appropriate tension cable, and appropriate quick release pin. Make sure the proper flange mount force arm adaptor, tension cable, pin holes, and quick release pins are used.

H₁ – Flange Mount Force Arm

The flange mount force arm has a flange that mates with the flange on the transducer. Provided screws secure the force arm to the transducer. Only single transducers ranging above 400 in-lb can be used to measure force. Refer to Figure 2-4 for an exploded view of the flange mount force arm and transducer mounting.

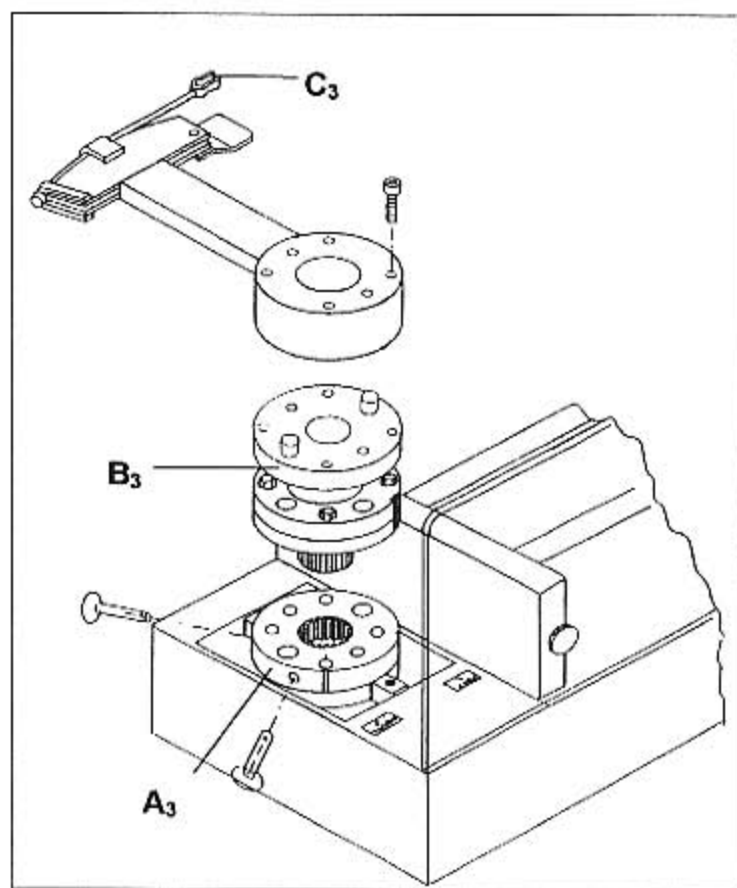


Figure 2-4: Exploded view of flange type force arm mounting

A₃ – Transducer Mounting

The transducer must be installed into the loader by lining up the red mark with the "FORCE" label on the loader and securing it using two quick release pins that are provided with the loader. Refer to the instructions for the loader for proper transducer mounting.

B₃ – Transducer

Remove the internal drive adaptor flange that is factory installed on the transducer by removing the screws. Attach the force arm to the transducer using the provided screws [1/2-13 x 1-3/4 inch]. The recommended flange type transducers available for the flange mount force arm are shown below:

Transducer	Range
2000-13-02	100–1000 ft lb
2000-14-02	200–2000 ft lb

C₃ – Cable Connection

Connecting cables to the flange mount force arm requires the use of a flange mount force arm cable adaptor, a 3/16 inch quick release pin, and an appropriate quick release pin for the eyelet of the cable being connected that is in 2000-260-0 Tensiometer Testing Kit 2000-261-0 Force (Tension) Gage Kit, or 2000-262-0 Force (Compression) Gage Kit. Refer to Figure 2-5 for typical exploded view of the flange mount force arm cable connection.

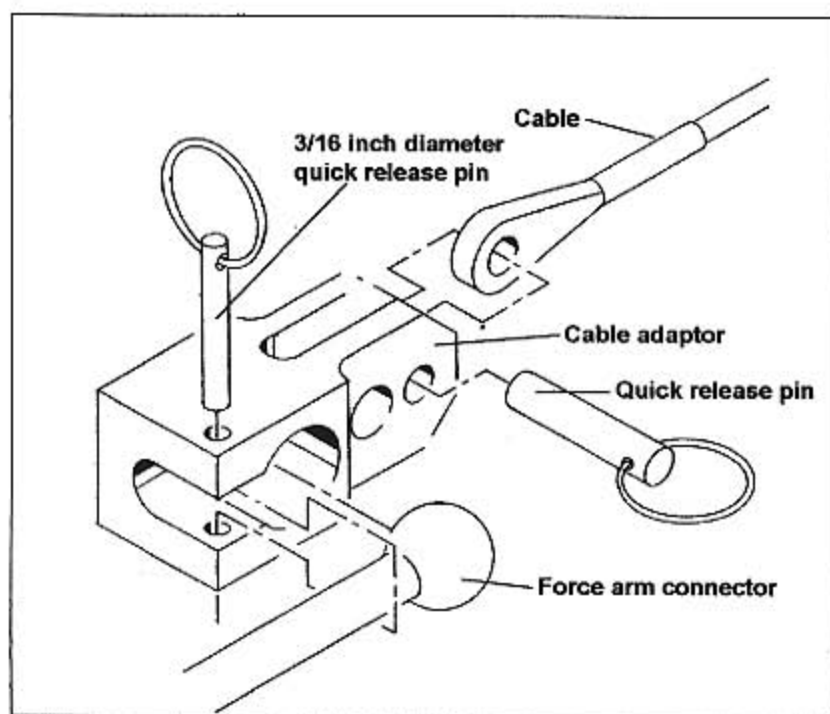


Figure 2-5: Exploded view of flange type force arm cable connection

Tensiometer Testing Kit

The Tensiometer Testing Kit contains tension cables, quick release pins, and a universal reaction cable adaptor.

Force Tensiometer Testing Kit

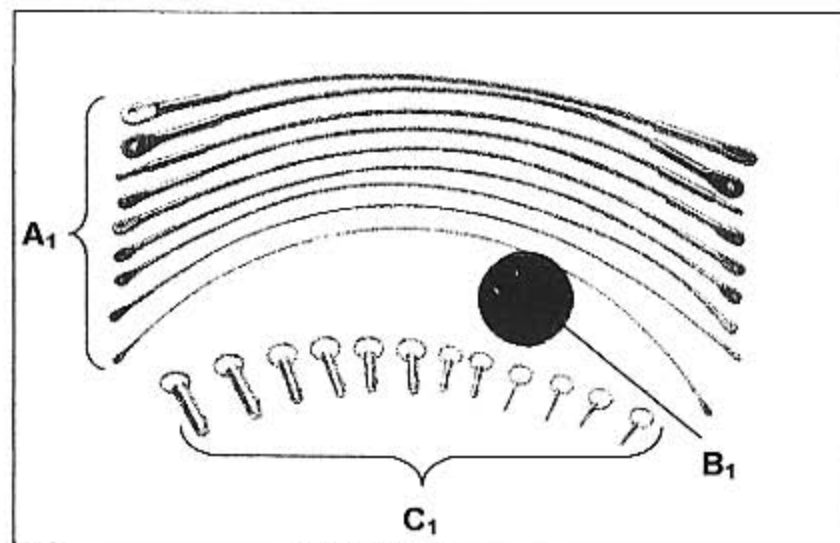


Figure 3-1: TTC2600 Tensiometer Testing Kit

A₁ – Tension Cables

The following tension cables are provided in the Tensiometer Testing Kit

TTC2630 Tensiometer Testing Kit

Flange mount force arm cable adaptor	Cable diameter	Quick release pin diameter	Maximum Allowable Working Load
	1/16 inch	3/16 inch	100 lbs
	3/32 inch	3/16 inch	185 lbs
	1/8 inch	3/16 inch	350 lbs
	5/32 inch	1/4 inch	580 lbs
	3/16 inch	5/16 inch	740 lbs
	7/32 inch	5/16 inch	1000 lbs
	1/4 inch	3/8 inch	1280 lbs
	9/32 inch	7/16 inch	1560 lbs
	5/16 inch	7/16 inch	1800 lbs
	3/8 inch	1/2 inch	2000 lbs



WARNING

- Exceeding the maximum allowable working load can cause breakage.

Follow manufacturer's safe allowable working load limit.

Broken equipment can cause injury

B₁ – Universal Reaction Cable Adaptor

The universal reaction cable adaptor has six holes to accommodate the different tension cable hole diameters. The universal reaction cable adaptor slides into the center hole on the end side rail of the loader. Attach the eyelet of the desired cable diameter to the appropriate hole of the universal reaction cable adaptor using the appropriate quick release pins.

C₁ – Quick Release Pins

The following quick release pins are provided in the Tensiometer Testing Kit:

Quantity	Quick release pin diameter
2	3/16 inch
2	1/4 inch

2	5/16 inch
2	3/8 inch
2	7/16 inch
2	1/2 inch



WARNING

- Undersized quick release pin can cause breakage. **Follow manufacturer's recommendation for quick release pin selection.**
Broken equipment can cause injury

Setup

Selecting and mounting a transducer

When selecting a transducer, choose a single transducer that covers the low to high end capacity of the tensiometer being tested.

- ✓ Never attempt to use the 4-in-1 transducer for force measurements
- ✓ Only single transducers of 400 in-lb and higher range are recognized by the Indicator unit when in FORCE mode.

Install the transducer by lining up the red mark with the "FORCE" label on the loader. For additional information on installing a transducer refer to your loader documentation.

Selecting, mounting a force arm and a connecting tension cable

Use the drive mount force arm with external square drive transducers and use the flange mount force arm with internal square drive flange transducer.

Connecting tension cables to the force arm are different depending on which force arm is used and whether cable adaptors are need.

- ✓ For connecting cables to the force arm refer to Chapter 2 – TTC2630 Force Arm Kit.

Test Procedure for Testing Tensiometers

Force (Tension) Gage Testing Kit

The Force (Tension) Testing Kit contains a gage support, quick release pins, tension cables, and a reaction pin.

Force (Tension) Testing Kit

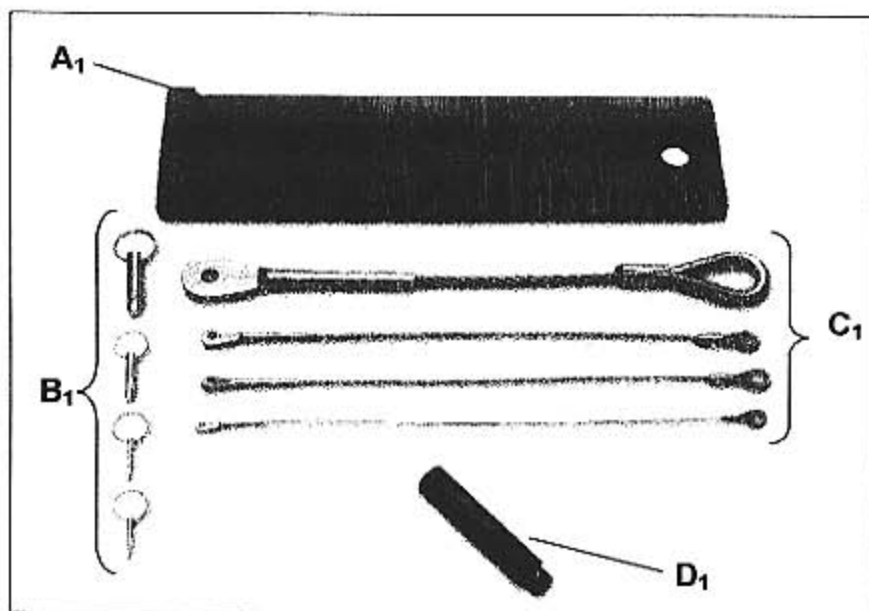


Figure 4-1: TTC2610 Force (Tension) Testing Kit

A₁ –Gage Support

The gage support mounts onto the reaction pin and rests on the end side rail of the loader. Several pre-drilled mounting holes that match many force gages on the market are used to attach the force gage to the gage support. If the force gage you are testing does not align with the mounting holes, please ask your **Snap-on** sales representative for assistance.

B₁ – Quick Release Pins

The following quick release pins are provided in the Force (Tension) Testing Kit:

Quantity	Quick release pin diameter
1	3/16 inch
1	1/4 inch
1	5/16 inch

Force (Tension) Gage Testing Kit

Quantity	Quick release pin diameter
1	3/8 inch



WARNING

- Undersized quick release pin can cause breakage. Follow manufacturer's recommendation for quick release pin selection.

Broken equipment can cause injury

C₁ – Tension Cables

The following tension cables are provided in the Force (Tension) Testing Kit:

Cable diameter	Quick release pin diameter ①	Maximum allowable working load
1/8 inch	3/16 inch	500 lbs
5/32 inch	1/4 inch ②	1,000 lbs
7/32 inch	5/16 inch ②	1,000 lbs
1/4 inch	3/8 inch ②	2,000 lbs

① cable adaptor required when attaching to the flange mount force arm.
② cable adaptor required when attaching to the drive mount force arm.



WARNING

- Exceeding the maximum allowable working load can cause breakage.

Follow manufacturer's safe allowable working load limit.

Broken equipment can cause injury

D₁ – Reaction Pin

The reaction pin has a reduced diameter at one end with a ball-type retention device that fits into the center hole on the end side rail of the loader. Using the appropriate hole in the gage support, slide it over the reaction pin. The gage support should rest on the side rail of the loader.

Setup

Selecting and mounting a transducer

When selecting a transducer, choose a single transducer that covers the low to high end capacity of the force gage being tested.

- ✓ Never attempt to use the 4-in-1 transducer for force measurements
- ✓ Only single transducers of 400 in-lb and higher range are recognized by the Indicator unit when in FORCE mode.

Install the transducer by lining up the red mark with the "FORCE" label on the loader. For additional information on installing a transducer refer to your loader documentation.

Selecting, mounting a force arm, and connecting tension cable

Use the drive mount force arm with external square drive transducers and use the flange mount force arm with internal square drive flange transducers.

Connecting tension cables to the force arm are different depending on which force arm is used and whether cable adaptors are need.

- ✓ For connecting cables to the force arm refer to Chapter 2 – Force Arm Kit.

Force (Compression) Gage Testing Kit

The Force (Compression) Testing Kit contains a compression block gage support, quick release pins, tension cables, and a reaction pin.

Force (Compression) Gage Testing Kit

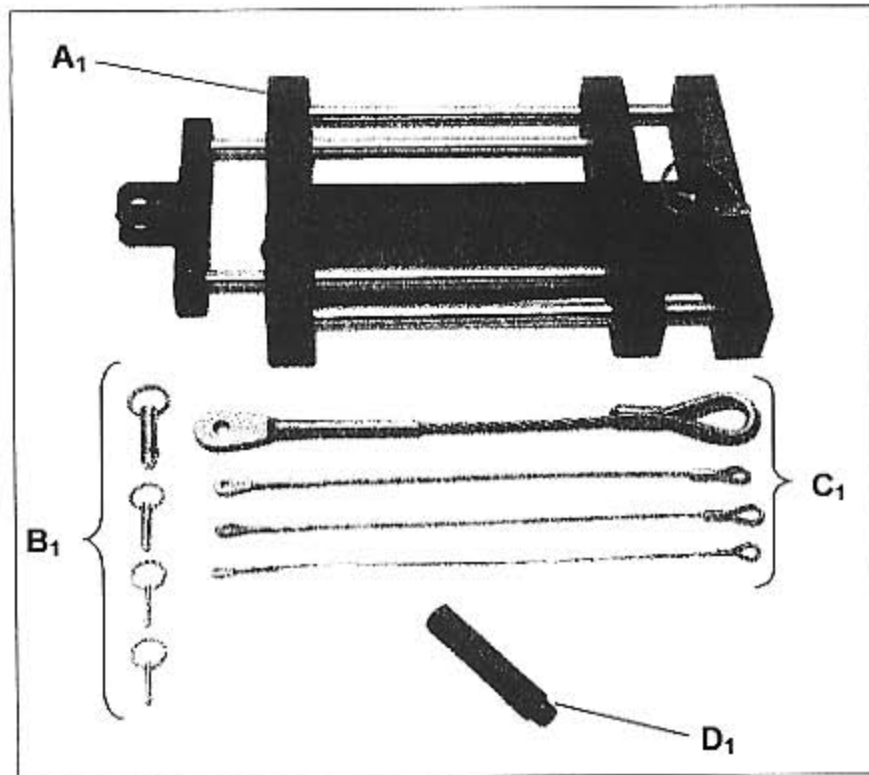


Figure 5-1: Force (Compression) Gage Testing Kit

A₁ – Compression Block Gage Support

The compression block gage support mounts onto the reaction pin and rests on the end side rail of the loader. Several pre-drilled mounting holes that match many compression gages on the market are used to attach the compression gage to the compression block. If the compression gage you are testing does not align with the mounting holes, please ask your CDI sales representative for assistance.

B₁ – Quick Release Pins

The following quick release pins are provided in Force (Compression) Gage Testing Kit:

Quantity	Quick release pin diameter
1	3/16 inch
1	1/4 inch
1	5/16 inch
1	3/8 inch



WARNING

- Undersized quick release pin can cause breakage. Follow manufacturer's recommendation for quick release pin selection.

Broken equipment can cause injury

C₁ – Tension Cables

The following tension cables are provided in the Force (Compression) Gage Testing Kit:

Cable diameter	Quick release pin diameter ①	Maximum allowable working load
1/8 inch	3/16 inch	500 lbs
5/32 inch	1/4 inch ②	1,000 lbs
7/32 inch	5/16 inch ②	1,000 lbs
1/4 inch	3/8 inch ②	2,000 lbs

① cable adaptor required when attaching to the flange mount force arm.
② cable adaptor required when attaching to the drive mount force arm.



WARNING

- Exceeding the maximum allowable working load can cause breakage.

Follow manufacturer's safe allowable working load limit.

Broken equipment can cause injury

D₁ – Reaction pin

The reaction pin has a reduced diameter at one end with a ball-type retention device that fits into the center hole on the end side rail of the loader. Using the appropriate hole in compression block gage support, slide it over the reaction pin.

The compression block gage support should rest on the side rail of the loader.

Setup

Selecting and mounting a transducer

When selecting a transducer, choose a single transducer that covers the low to high end capacity of the compression gage being tested.

- ✓ Never attempt to use the 4-in-1 transducer for force measurements
- ✓ Only single transducers of 400 in-lb and higher range are recognized by the Indicator unit when in FORCE mode.

Install the transducer by lining up the red mark with the "FORCE" label on the loader. For additional information on installing a transducer refer to your loader documentation.

Selecting, mounting a force arm, and connecting tension cable

Use the drive mount force arm with external square drive transducers and use the flange mount force arm with internal square drive flange transducers.

Connecting tension cables to the force arm are different depending on which force arm is used and whether cable adaptors are needed.

- ✓ For connecting cables to the force arm refer to Chapter 2 – Force Arm Kit.