RETAIL PRICE $65.00

TECHNICAL MANUAL

OPERATION, CALIBRATION AND MAINTENANCE INSTRUCTIONS

FOR

TORQUE/FORCE CALIBRATOR SERIES 2000

CONSOLIDATED DEVICES INC.
19220 San Jose Avenue
City of Industry, California 91748

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INTRODUCTION

This manual provides operation, calibration and maintenance instructions with illustrated parts lists for the Torque and Tension Calibrator, Series 2000, manufactured by Consolidated Devices, Inc. City of Industry, California. The manual is divided into six sections, as follows:

Section I	—	Description and General Information
Section II	—	Preparation for Use and Installation
Section III	—	Operating Instructions
Section IV	—	Calibration
Section V	—	Maintenance Instructions
Section VI	—	Illustrated Parts Breakdown

TORQUE FORCE CALIBRATOR LIMITED WARRANTY

All CDI mechanical and electronic parts are warranted against defects in materials and workmanship for a period of five years from the date of manufacture. We or our authorized representative will, at our option, repair or replace any defective parts manufactured by us, postage prepaid.

The foregoing obligation is CDI's sole liability and your sole remedy under this warranty. There are no other warranties expressed or implied including those of merchantability or fitness for purpose. Under no circumstances shall CDI be liable for any special incidental or consequential damages.

This warranty does not apply to any components of the Torque/Force Calibrator if they have been altered, damaged, abused or improperly maintained.

This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

For technical assistance call toll-free 1-800-525-6319.

NOTE

Torque Transducers are sensitve measuring instruments. "Over-Torquing" past useable range may result in permanent damage to the transducer. This damage is not covered by the Warranty, so extreme care must be taken in use.

NOTE

The Digital Indicator and all transducers supplied with the Torque/Force Calibrator have had the fasteners on the covers sealed. If the seals are broken and/or the Digital Indicator or the transducers are tampered with internally by anyone other than CDI or an authorized CDI repair representative the warranty will be void.

SECTION I

DESCRIPTION AND GENERAL INFORMATION

1.1 INTRODUCTION

This section describes the purpose of the Torque Force Calibrator Model 2000 (hereafter referred to as the TFC), provides a general physical description, and lists physical and functional characteristics, capabilities and features.

1.2 DESCRIPTION

This manual covers two TFC stations which are a High Torque Station, Part No. 2000-0-3 and a Low Torque Station, Part No. 2000-0-4. The stations are used for testing and calibrating torque, tension, and compression of various commercially available tools and gages.

1.3 APPLICATION

The following is a list of tools and gages which can be tested and/or calibrated by the TFC:

- Torque Wrenches:
  Most manufacturers; model numbers, types, classes, styles and forms in each category.
  - Deflecting Beam Indicating Torque Wrenches
  - Dial Indicating Torque Wrenches
  - Micrometer Adjustable (Feel Impulse Type) Torque Wrenches
  - Screwdriver Type Torque Wrenches
  - "T" Handle Type Torque Wrenches
  - Preset and Other Feel Impulse Specialty Torque Wrenches (Both Limiting and Adjustable)
- Torque Multipliers:
  Those listed require special adapters and/or fixtures to test that are included in series 2000 TFC. Other brand name and model number torque multipliers could be tested on this system if adapters and/or fixtures are approved by CDI.
  - CDI Model DPT 1200 Torque Multipliers
  - Power-Dyne Model DP-1201 Torque Multiplier
  - Sweeney Model 102E Torque Multiplier
- Force Gages:
  Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number force gages could be tested on this system if adapters and/or fixtures are approved by CDI.

- Chatillon DPP and DPPH Series Force Gages
- Hunter L and D Series Force Gages

- Cable Tensiometer:
  Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number cable tensiometers could be tested on the system if adapters and/or fixtures are approved by CDI.
  - Pacific Scientific C5, C6, C7, C8, C9, T5-2000 Series, T5-500 Series, T6-8000 Series and 401 Series Cable Tensiometer
- Torque Watch Gages

1.4 EQUIPMENT SUPPLIED

The following equipment is supplied with the TFC:

a. Digital Indicator and Printer for both High Torque Station and Low Torque Station.

b. A calibration stand and all required weights, cables, adapters and fittings to perform required calibration.

1.5 PERFORMANCE CHARACTERISTICS

1.5.1 High Torque Station (See Figure 1-1).

The High Torque Station is used to verify that equipment meets the following requirements:

a. Torque (bidirectional) 30 in. lb. to 2000 ft. lb.
b. Force (tension and compression) 5 lb. to 2000 lb.
c. Cable Tension 30 lbs. to 2000 lbs.

The High Torque Station consists of seven high torque range transducers.

1) 30 - 375 in. lb. for 150 to 375 in. lb. full scale torque applications and 5 to 31.25 lbs. force applications

2) 75 -750 in. lb. for 375 to 750 in. lb. full scale torque applications and 31.25 to 62.5 lbs. force applications

3) 12.5 to 125 ft. lb. for 62.5 to 125 ft. lb. full scale torque applications and 62.5 to 125 lbs. force applications

4) 25 to 250 ft. lb. for 125 to 250 ft. lb. full scale torque applications and 125 to 250 lbs. force applications

5) 50 to 500 ft. lb. for 250 to 500 ft. lb. full scale torque applications and 250 to 500 lbs. force applications

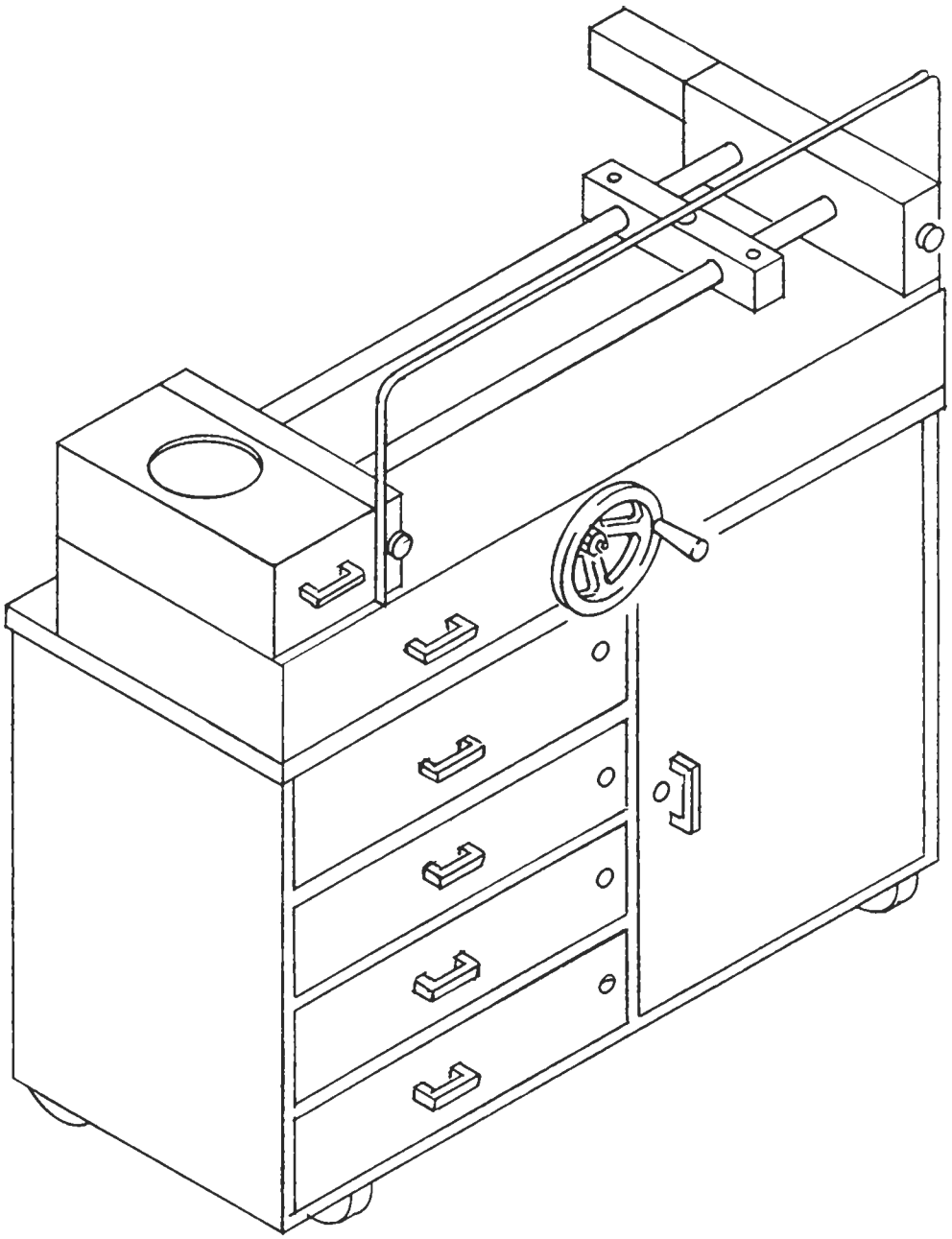


Figure 1-1. High Torque Station

6) 100 to 1000 ft. lb. for 500 to 1000 ft. lb. full scale torque applications and 500 to 1000 lbs. force applications

7) 200 to 2000 ft. lb. for 1000 to 2000 ft. lb. full scale torque applications and 1000 to 2000 lbs. force applications.

1.5.2 Low Torque Station (See Figure 1-2). 2000-0-4

The Low Torque Station is used to verify that equipment meets the following requirement:

Torque (bidirectional) 0.5 in. oz. to 250 ft. lbs.

The Low Torque Station consists of five low torque range transducers:

1) 0.5 to 400 in. oz. for 0.5 to 400 in. oz. full scale torque applications .5 - 400

2) 5 to 50 in. lb. for 25 to 50 in. lb. full scale torque applications

3) 10 to 100 in. lb. for 50 to 100 in. lb. full scale torque applications

4) 20 to 200 in. lb. for 100 to 200 in. lb. full scale torque applications.

5) 375 in. lb., 750 in. lb., 125 ft. lb. and 250 ft. lb. single transducer assemblies can be used on the low torque station. The use of these transducers allows from 30 in. lb. to 250 ft. lb. full scale torque applications.

1.6 PHYSICAL CHARACTERISTICS

See Table 1-1 for physical characteristics and leading particulars of the TFC.

Table 1-1. Physical Characteristics

Item	Characteristic
Low Torque Station (Mechanical Loader)	
Physical Dimensions:	
Width	31 in.
Height	9 in.
Depth	16 in.
Weight	
Loader	65 lbs.
Multiple Torque Transducer	6 lbs. 5 oz.
Computest and Printer Assembly	25 lbs. 5 oz.

Table 1-1. Physical Characteristics (Continued)

Item	Characteristic
High Torque Station (Mechanical Loader)	
Physical Dimensions:	
Width	45 in.
Height	50 in.
Depth	24 in.
Approx. Weight (All components included)	1500 lbs.
Range:	
Low Torque Station - Multiple Torque Transducer	0.5 in. oz. to 200 in. lb. Torque (Bidirectional)
Low Torque Station - Single Transducer	30 in. lb. to 250 ft. lb. Torque (Bidirectional)
High Torque Station	30 in. lb. to 2000 ft. lb. Torque (Bidirectional)
	5.0 lbs. to 2000 lbs. Force (Tension or Compression)
	30 lbs. to 2000 lbs. Cable Tension
Accuracy:	
Low Torque Station - Multiple Torque Transducer	±0.5% indicated value or ±0.2 in. oz., whichever is greater
Low Torque Station - Single Transducer	±0.5% indicated value Torque (Bidirectional)
High Torque Station	±0.5% indicated value Torque (Bidirectional)
	±0.5% indicated value Force (Tension or Compression)
	±0.75% indicated value Cable Tension
Calibration Fixturing (Weights and Moment Arms Combined)	±0.05%

Table 1-1. Physical Characteristics (Continued)

Item	Characteristic
Creep:	0.15% F.S. for each Transducer
Input Torque:	8 ft. lb. maximum
Power Requirements:	115/230 Vrms ±10%, 50/60 Hz
Temperature:	
Storage	-40° to +75°C
Operating	73° ±12°F

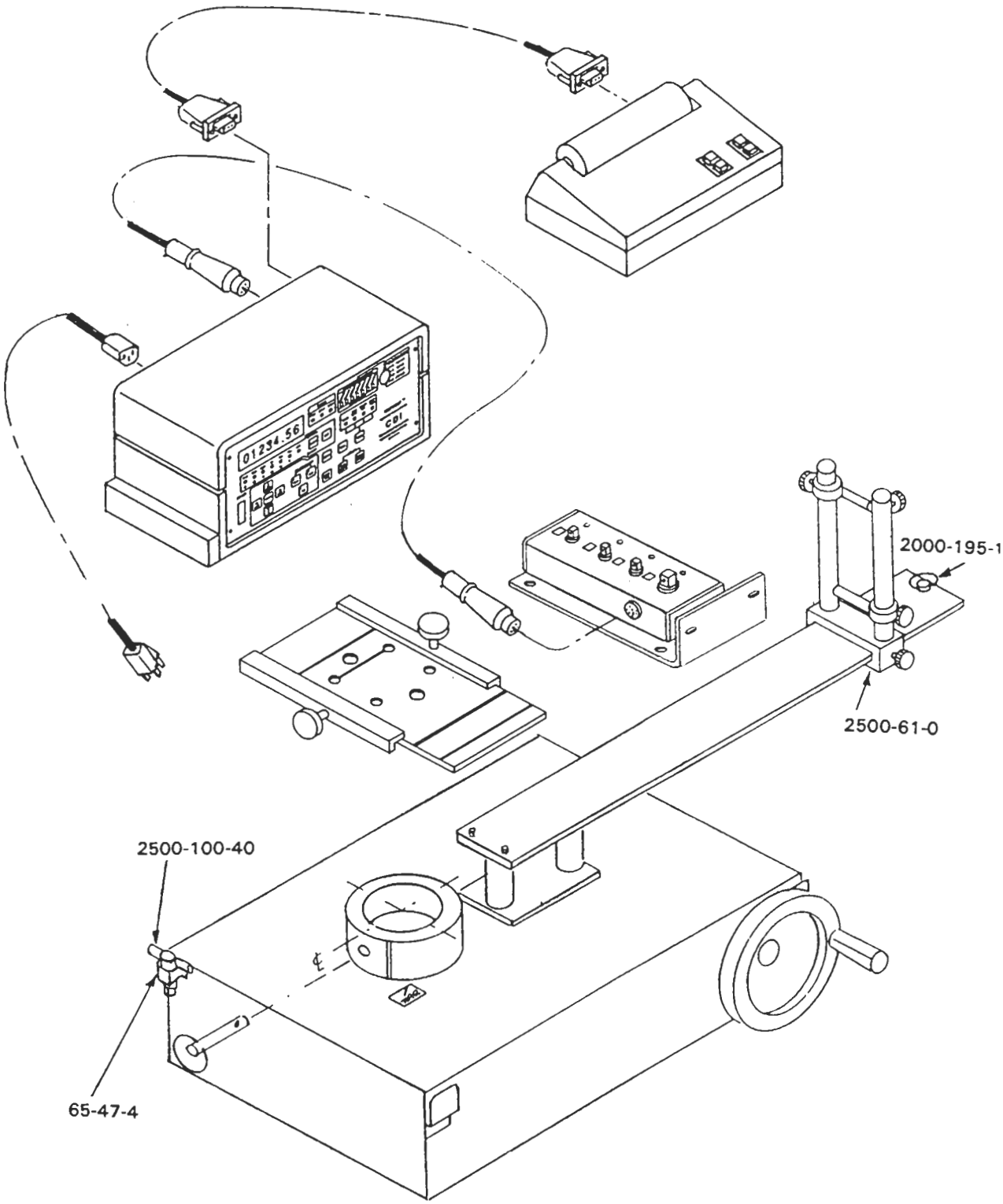


Figure 1-2. Low Torque Station

SECTION II

PREPARATION FOR USE AND INSTALLATION

2.1 INTRODUCTION

This section contains instructions necessary to prepare the TFC for use and installation.

WARNING

The Compression Gage Adapter (P/N 2000- 213-0) has a lock to prevent the adapter from sliding when not in use. Check the adapter prior to handling to make sure lock is engaged. Failure to do this can result in injury to the hand or fingers.

CAUTION

The Digital Indicator and transducers are precision instruments, extreme care should be used in handling them. Permanent damage may result from mishandling.

NOTE

The Transducer Assemblies have been calibrated at CDI to the Digital Indicators. Each Transducer Assembly is calibrated to a specific Digital Indicator and will not, unless recalibrated to another Digital Indicator, be accurate with that Digital Indicator. The set of Transducer Assemblies, and the Digital Indicator to which they have been calibrated have Certificates of Accuracy included.

The 375 in. lb., 750 in. lb., 125 ft. lb., and 250 ft. lb. Transducer Assemblies have been calibrated and certified to both indicators. These Transducer Assemblies may be used with both - during periodic calibration - the High and Low Torque Station Calibrators. All of the above listed Transducer Assemblies must be calibrated to both Digital Indicators to insure accuracy when used with either unit.

2.2 LOW TORQUE STATION

Unpack unit from its shipping containers. The Torque Calibrator will be preassembled.

Hardware for connecting various parts of the unit is shipped in a separate bag. Refer to the table at the end of this section for the hardware, quantity and where it is used.

Place Reaction Slide Assembly (Part # 2500-61-0) on the end of the reaction guide and slide forward. Install Quick Release Pin (Part # 2000-195-1) into the end of the reaction guide.

Attach the Chuck Key Clip (Part # 65-47-4) to the bracket on the left side of the unit. Place the Chuck Key (Part # 2500-100-40) into the holder.

Select the transducer to be used and set up following the instructions in the manual. Plug the transducer cable into the transducer. Next connect the cable to the back of the digital indicator.

Connect the digital indicator power cord to the back of the digital indicator, then to a 115 VAC 60 Hz or 220 VAC 50 Hz. power source. The voltage selector switch must be in the appropriate position (see Table 3-2, index 2).

WARNING

Make sure that the safety shield is positioned on the low torque station prior to use. Do not operate the calibrator unless the safety shield is in place.

2-3 HIGH TORQUE STATION

Unpack the unit from its shipping containers. The Torque Calibrator and the cabinet (2000-1-0 and 2000-100-0) will be pre-assembled.

Hardware for connecting various parts of the unit is shipped in a separate bag. Refer to the table at the end of this section for the hardware, quantity, and where it is used.

Place the reaction pin with Grove Assembly (Part # 2000-173-1) and Reaction Pin Assembly (Part # 2000-173-2) in the slide bar of the loader.

Connect the Torque Indicator Stand (2000-111-0) to the Torque Calibrator (2000-1-0) on the bar at the back of the Torque Calibrator.

The High Torque Calibrators with serial numbers 0001 through 0072 connect to the Digital Indicator through a power receptacle port (see Figure 2-1 Detail A, Figure 3-2 and Table 3-2 index 6) for a power source. Connect these serial numbered calibrators to the Digital Indicators with High Torque Station power cord (Part # 2000-115).

The High Torque Calibrators with serial numbers 0073 and up do not connect to the Digital Indicators for a power source. The Digital Indicators do not have a power receptacle port for power to the High Torque Calibrator (see Figure 3-2, index 6). Connect the power cord (Part # 2000-114) to the back of the calibrator (Figure 2-1 Detail B). Then plug the other end into a 115 VAC 60 Hz or 220 VAC 50 Hz power source. The voltage selector switch on the back of the calibrator must be in the appropriate position.

Select the High Torque Station Transducer and adapters you want to use and set-up per instructions in the manual. Plug the Transducer Assembly into the Transducer Cable on the High Torque Calibrator. Next connect the Single Transducer Cable to the back of the Digital Indicator at the SINGLE TRANSDUCER receptacle (4) then to the Torque Calibrator receptacle on the back of the Torque Calibrator.

NOTE

The slide bar on the High Torque Calibrator has a knob for locking it in place for its different applications. It must be turned to disengage for moving the slide bar.

Connect the Digital Indicator Power Receptacle Cord to the back of the Digital Indicator then to 115 VAC 60 Hz or 220 VAC 50 Hz. power source. The voltage selector switch on the back of the Digital Indicator (Figure 3-2 index 2) must be in the appropriate position.

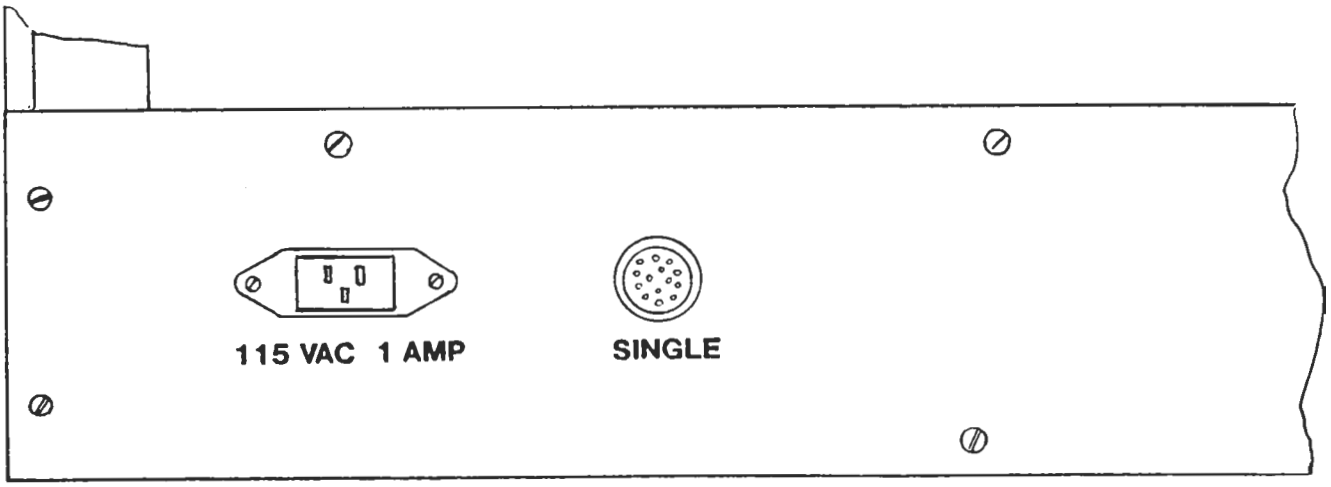
WARNING

Make sure that the safety shield is positioned securely prior to the use of the High Torque Calibrator. Do not operate the calibrator unless safety shield is in place.

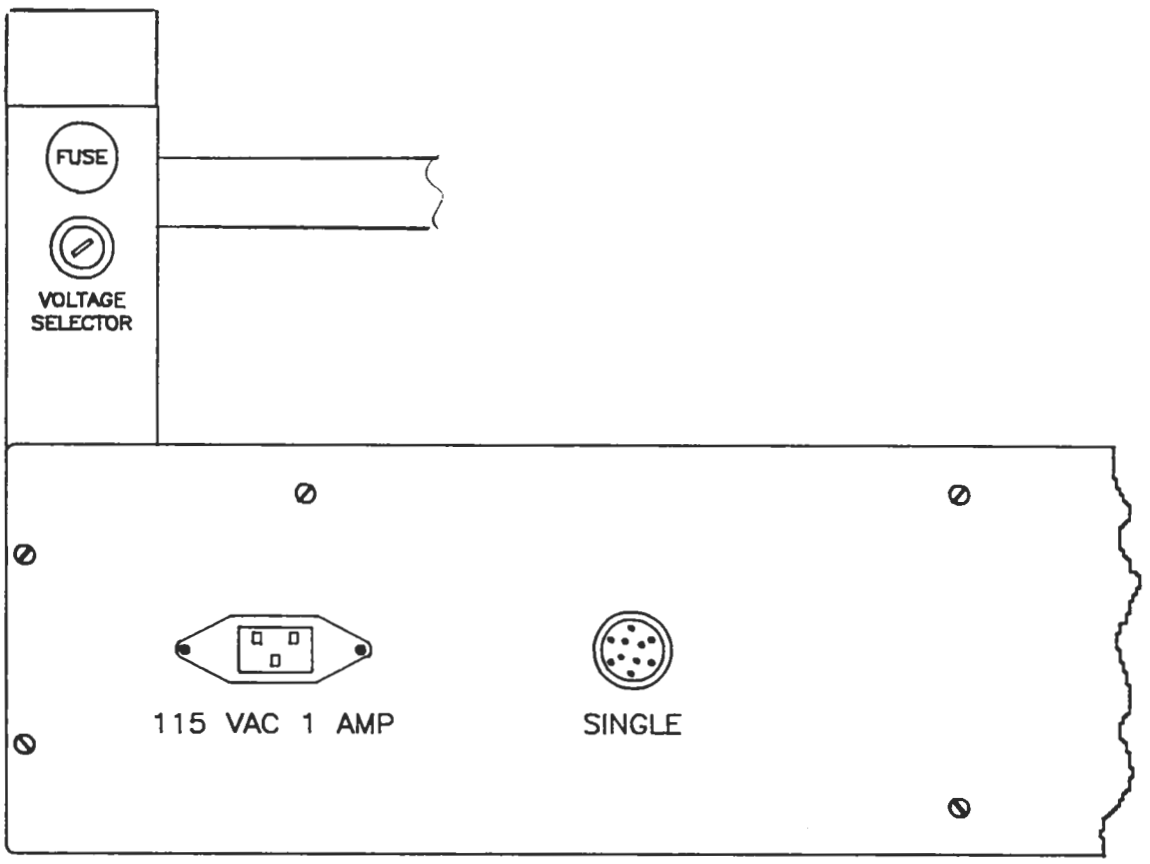
After installation is complete, perform a calibration accuracy check as specified in paragraph 3.4 then calibrate, if required, per Section IV.

NOTE

Prior to performing accuracy check and calibration place level gage on top surface of calibration block. Adjust calibration stand legs until stand is level.



Torque Calibrator Back Panel (Serial No. 0001 - 0072) - Detail A



Torque Calibrator Back Panel (Serial No. 0073 and up) - Detail B

Figure 2-1. Torque Calibrator Back Panel

SECTION III

OPERATING INSTRUCTIONS

3.1 INTRODUCTION

This section lists and describes all controls and indicators on the TFC located on the Computest. See Table 3-1 and Figure 3-1 for front panel controls and indicators and Table 3-2 and Figure 3-2 for back panel controls. This section also provides the proper setup and operating procedures for each unit to be tested.

Table 3-1. Computest Controls and Indicators - Front Panel

Index No.	Control/Indicator	Function
1	POWER button	Used to turn power to the Computest on and off. Digital display (16) will be illuminated when power is on.
2	DIGIT (◁) button	Active digit (blinking) to the left can be selected when in calibration or tolerance modes when pressed.
3	VALUE (△) button	Active digit can be increased when in calibration or tolerance modes when pressed.
4	ENTER button	Enters the data displayed when in calibration or tolerance modes when pressed.
5	VALUE (▽) button	Active digit can be decreased when in calibration or tolerance modes when pressed.
6	DIGIT (▷) button	Active digit (blinking) to the right can be selected when in calibration or tolerance modes when pressed.
7	HIGH TOLERANCE SET button	Sets upper control limit of Computest when pressed.
8	CAL button	Calibration of Computest can be performed when pressed.

Table 3-1. Computest Controls and Indicators Front Panel - (Continued)

Index No.	Control/Indicator	Function
9	LOW TOLERANCE SET button	Sets lower control limit of Computest when pressed.
10	ZERO TARE button	Sets the display to zero (0) when Computest is reading an input torque value and uses this compensated zero point as a reference for all future readings.
11	RECALL button	Recalls last data displayed on digital display (16) when pressed. Button is active only in PEAK HOLD, FIRST PEAK and POWER TOOL modes of operation and does not activate on TRACK mode. A total of 10 memories are available in RECALL from 0 to 9.
12	AUTO CLEAR RESET button	Selects the duration data. Will be displayed on digital display when pressed. Otherwise MANUAL CLEAR RESET button (14) must be used to clear data on display.
13	SEND button	Transmits data from digital display (16) to printer when pressed.
14	MANUAL CLEAR RESET button	Clears current reading from digital display (16). Does not change zero setting.
15	MODE button	Selects desired mode of Computest when pressed. Modes of operation are TRACK, PEAK HOLD, FIRST PEAK (POWER TOOL mode is optional).
16	Digital Display	Shows numerical value of tool being tested. In calibration and tolerance modes gives the instructions and options available.

Table 3-1. Computest Controls and Indicators Front Panel - (Continued)

Index No.	Control/Indicator	Function
17	Unit of Measure indicators	Shows unit of measure being displayed on digital display (16). IN-LB is initially indicated when Computest is turned on. To change unit of measure, press UNIT button (19).
18	SELECT button	Selects TORQUE or FORCE measurement. TORQUE is initially selected when Computest is turned on. To change to FORCE, press SELECT button.
19	UNIT button	Selects desired unit of measurement as indicated by unit of measure indicator (17).
20	RANGE indicator	Indicates if the applied torque or force is within the range of the transducer being used.
21	HIGH TORQUE STATION indicators	Indicates which transducer is being used for the High Torque Station. Picks up signal from transducer cable plugged into SINGLE TRANSDUCER connector on back of Computest.
22	Mode of Operation indicators	Indicates mode Computest is in. TRACK mode will be indicated when computest is turned on. To change mode, press MODE button (15). POWER TOOL mode may be disabled depending on the model configuration. This mode can not be accessed if not included.
23	LOW TORQUE STATION switch	Selects the Low Torque Station transducer to be used for the test instrument (TI) tested.

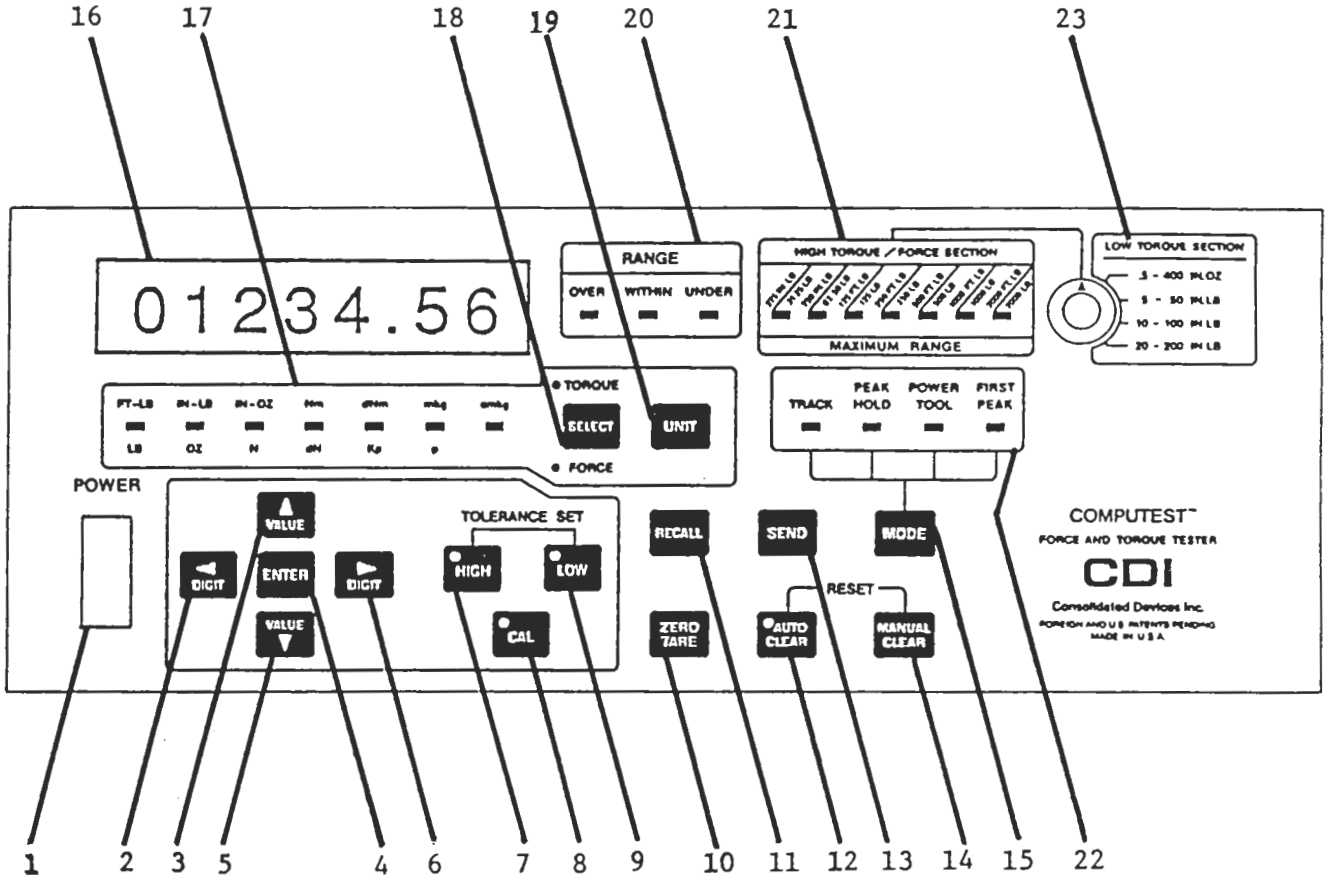


Figure 3-1. Computest Controls and Indicators - Front Panel

Table 3-2. Computest Controls and Indicators - Back Panel

Index No.	Control/Indicator	Function
1	Power Receptacle and FUSE	Used to connect line power cord to Computest. One spare fuse is included. Removable 3.15 AMP fuse is accessible in FUSE box.
2	VOLTAGE SELECTOR	Selects 110 or 220 volt input power being supplied - **MUST** be set the same as the power being supplied.
3	MULTIPLE TRANSDUCER receptacle	Used to connect transducer cable from Low Torque Station.
4	SINGLE TRANSDUCER receptacle	Used to connect transducer cable from High Torque Station.
5	PRINTER PORT	Used to connect printer cable to Computest.
6	AC OUT connector	Used in serial numbers 0001 through serial number 0072 to connect High Torque Station to Digital Indicator as power source. This connector is **NOT** IN USE ON serial numbers 0073 on up.

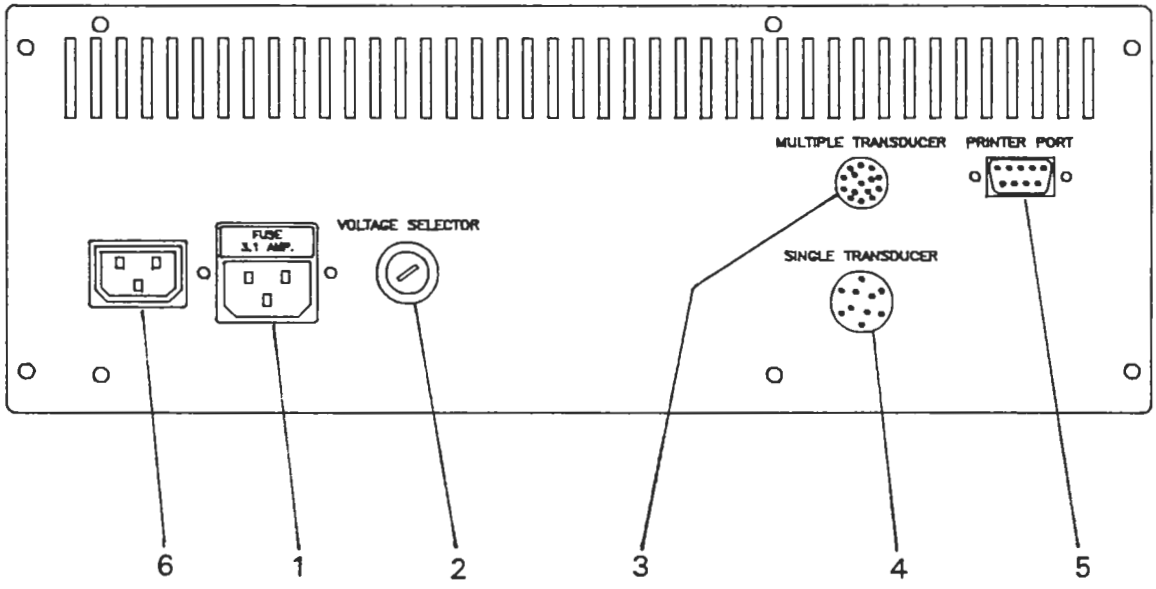


Figure 3-2. Computest Controls and Indicators - Back Panel

3.2 CONTROL LIMITS SETTING

This feature allows the operator to set tolerance limits on the item to be tested into Computest memory. This allows the operator to test a lot of the same items with visual and audio indication of failure of any one item in the lot to meet the accuracy limits. This feature is a separate function from Computest's ability to give a visual and audio signal if the transducer in use is not within the useable range of the tool being tested and/or its ability to signal an overload of a transducer.

NOTE

Initially both testers must be calibrated before testing can be performed. Refer to Section IV for calibration instructions.

3.2.1 Upper Control Limit

Set Upper Control Limit as follows (refer to Figure 3-1):

a. Press HIGH TOLERANCE SET button (7). The yellow light on RANGE indicator (20) will illuminate.

b. Digital display (16) will indicate "ENTER UPPER TOLERANCE LIMIT."

c. Enter the correct upper tolerance limit by using the DIGIT (2) and (6) buttons and the VALUE (3) and (5) buttons as follows:

NOTE

Value displayed on digital display (16) will be blinking during this operation.

1) Pressing DIGIT (◁) button (2) will move decimal point to left.

2) Pressing DIGIT (▷) button (6) will move decimal point to right.

3) Pressing VALUE (△) button (3) will change minus (-) sign to plus (+) sign and increase value.

4) Pressing VALUE (▽) button (5) will change plus (+) sign to minus (-) sign and decrease value.

5) When the correct value is displayed on digital display (16), press ENTER button (4) and value will be entered into Computest memory.

3.2.2 Lower Control Limit

Set Lower Control Limit as follows (refer to Figure 3-1):

a. Press LOW TOLERANCE SET button (9). The yellow light on RANGE indicator (20) will illuminate.

b. Digital display (16) will indicate "ENTER LOWER TOLERANCE LIMIT."

c. Enter the correct lower tolerance limit by using the DIGIT (2) and (6) buttons and the VALUE (3) and (5) buttons as follows:

NOTE

Value displayed on digital display (16) will be blinking during this operation.

1) Pressing DIGIT (◁) button (2) will move decimal point to left.

2) Pressing DIGIT (▷) button (6) will move decimal point to right.

3) Pressing VALUE (△) button (3) will change minus (-) sign to plus (+) sign and increase value.

4) Pressing VALUE (▽) button (5) will change plus (+) sign to minus (-) sign and decrease value.

5) When the correct value is displayed on digital display (16), press ENTER button (4) and value will be entered into Computest memory.

d. The Computest is now ready for use utilizing the UPPER and LOWER control limit feature. A buzzer will sound when the lower control limit set is reached and will continue until the upper control limit is exceeded. When the upper control limit is exceeded, the buzzer sound will change to provide on and off beeps at intervals.

3.3 OPERATION

3.3.1 Low Torque Station

WARNING

Make sure that the safety shield is positioned on the Low Torque Station prior to use. Do not operate the calibrator unless the safety shield is in place.

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

CAUTION

When transducer assemblies are not plugged into the digital indicator or when changing from one single transducer assembly to another, the digital indicator must be turned off.

CAUTION

All Transducer Assemblies, the Drive Plates on the Loaders and Calibration Block must be clean and free of surface imperfections when assembled for use. Care must be used in handling the Transducer Assemblies, Drive Plates and Calibration Block to prevent damage to the splines.

Damage to the splines on the Transducer Assemblies, Drive Plates or Calibration Block can affect the fit of the mating parts.

NOTE

The Transducer Assemblies have been calibrated at CDI to the Digital Indicators. Each Transducer Assembly is calibrated to a specific Digital Indicator and will not, unless recalibrated to another Digital Indicator, be accurate with that Digital Indicator. The set of Transducer Assemblies, and the Digital Indicator to which they have been calibrated have Certificates of Accuracy included.

NOTE (Continued)

The 375 in. lb., 750 in. lb., 125 ft. lb., and 250 ft. lb. Transducer Assemblies have been calibrated and certified to both indicators. These Transducer Assemblies may be used with both — during periodic calibration — the High and Low Torque Station Calibrators. All of the above listed Transducer Assemblies must be calibrated to both Digital Indicators to insure accuracy when used with either unit.

NOTE

Prior to using any transducer for any application it must be exercised to the range being used prior to taking readings. To accomplish this take the tool being used, with the system, apply the highest indicated value of torque or force to the calibrator. Then in a "no load" condition press the ZERO TARE button (10) on the Digital Indicator.

When the direction (clockwise or counter- clockwise) is changed, the transducer must be exercised in the new direction of use, to the range being used, prior to taking readings. Then in a "no load" condition press the ZEROTARE button (10) on the Digital Indicator.

This is required because of hysteresis. Hysteresis is a natural phenomena that occurs in material when torque or force is applied in a direction.

The instructions for operating the Low Torque Station presume that the equipment is within calibration and is providing accurate readings. If at any time during the operation it is suspected that the equipment is not functioning properly, check the accuracy as indicated in paragraph 3.4. If the accuracy is not as specified, calibrate the equipment as indicated in Section IV.

3.3.1.1 Tools Which Can Be Tested on the Low Torque Station

The following tools can be tested on the Low Torque Station:

- Torque Wrenches:
  Most manufacturers; model numbers, types, classes, styles and forms in each category in ranges from .5 in. oz. to 250 ft. lb.
  - Deflecting Beam Indicating Torque Wrenches
  - Dial Indicating Torque Wrenches

- Micrometer Adjustable (Feel Impulse Type) Torque Wrenches
- Screwdriver Type Torque Wrenches
- "T" Handle Type Torque Wrenches
- Preset and other Feel Impulse Specialty Torque Wrenches (Both Limiting and Adjustable)

- Torque Watch Gages

3.3.1.2 Test Procedure for Low Torque Station

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

NOTE

Prior to using any transducer for any application it must be exercised to the range being used prior to taking readings. To accomplish this take the tool being used, with the system, apply the highest indicated value of torque or force to the calibrator. Then in a "no load" condition press the ZERO TARE button (10) on the Digital Indicator.

NOTE

When the direction (clockwise or counter- clockwise) is changed, the transducer must be exercised in the new direction of use, to the range being used, prior to taking readings. Then in a "no load" condition press the ZERO TARE button (10) on the Digital Indicator.

This is required because of hysteresis. Hysteresis is a natural phenomena that occurs in material.

CAUTION

When transducers are not plugged into the digital indicator or when changing from one single transducer to another the digital indicator must be turned off.

a. The low torque station calibrator can be used with either the low torque station and low torque station fixture or single low range transducer assemblies up to 250 ft. lb.

b. For use with the low torque station transducers slide the low torque station transducer into the Low Torque Station Fixture (Part # 2000-500-01). Tighten both thumb screws.

c. Turn the crank handle on the loader until the drive plate reaches a position where one of the 3/8 in. diameter holes is as close as possible to center line of the loader. Secure low torque station fixture to the drive plate with one 3/8 in. x 1.3 Quick Release Pin (Part # 2000-195-13). See Figure 3-3, sheet 1.

d. To align the correct transducer assembly to the test instrument (TI), loosen both thumb screws on the fixture. Slide the low torque station until the square drive of the transducer assembly to be used is centered to the reaction slide. The lines on the fixture are to be used as guides for the alignment of the square drive to the reaction slide. When the transducer assembly is aligned tighten both thumb screws, first the horizontal knob on the left side then the top knob on the right.

e. To use single low range transducer assemblies, align the red orientation mark on the drive plate to the torque label on the calibrator. Place the transducer assembly in the drive plate by aligning the red orientation mark on the transducer assembly to the red orientation mark on the drive plate. Secure with two Quick Release Pins (Part # 2000-195-13). See Figure 3-3, sheet 2 Detail A.

f. Connect the transducer assembly to the digital indicator with the applicable connector cable.

g. Then, with the digital indicator plugged in press POWER button on the front panel. Allow 30 minutes to warm up.

h. After the digital indicator is warmed up, use the SELECTOR switch to select the transducer assembly in use on the low torque station or single transducer. If the low torque station transducer assemblies are selected, a red light on the low torque station transducers will match the transducer selected on the digital indicator.

i. Select the correct unit of measure by pressing the UNIT button on the digital indicator.

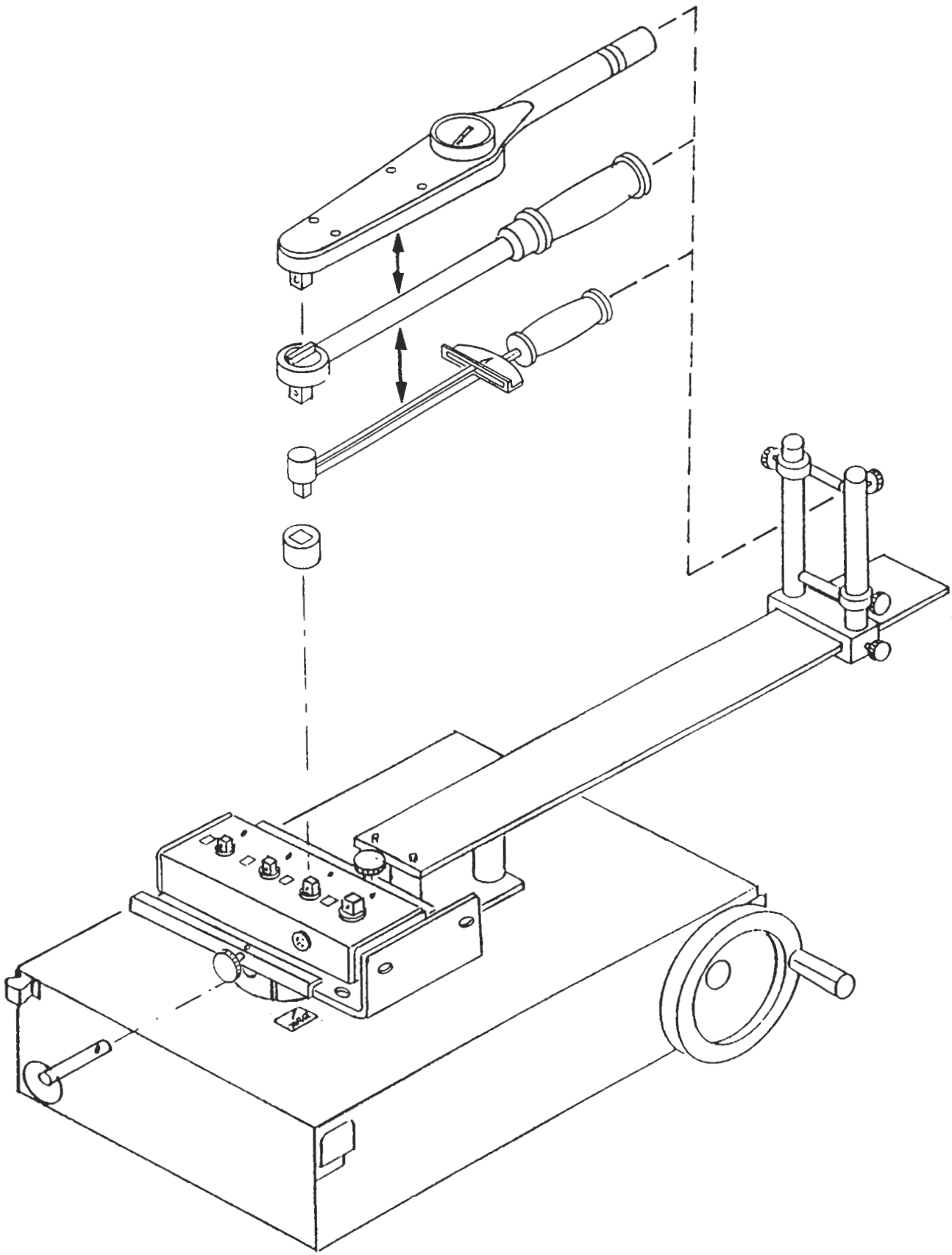
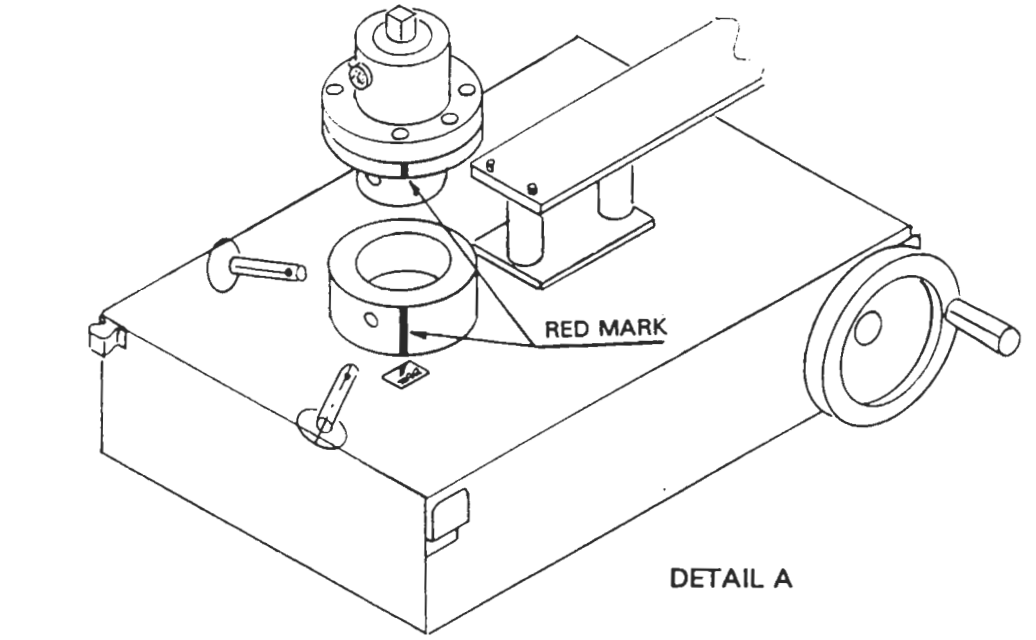
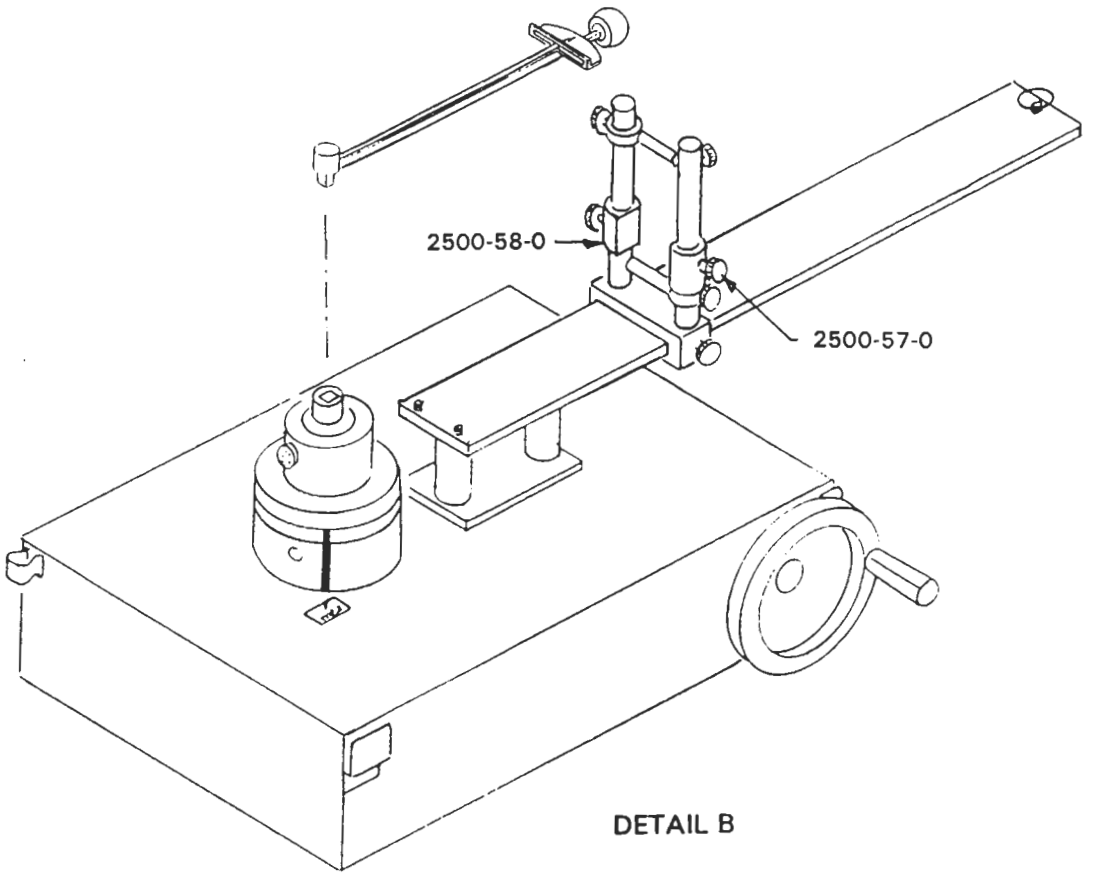


Figure 3-3. Low Torque Station Test Setup (Sheet 1)



DETAIL A



DETAIL B

Figure 3-3. Low Torque Station Test Setup (Sheet 2)

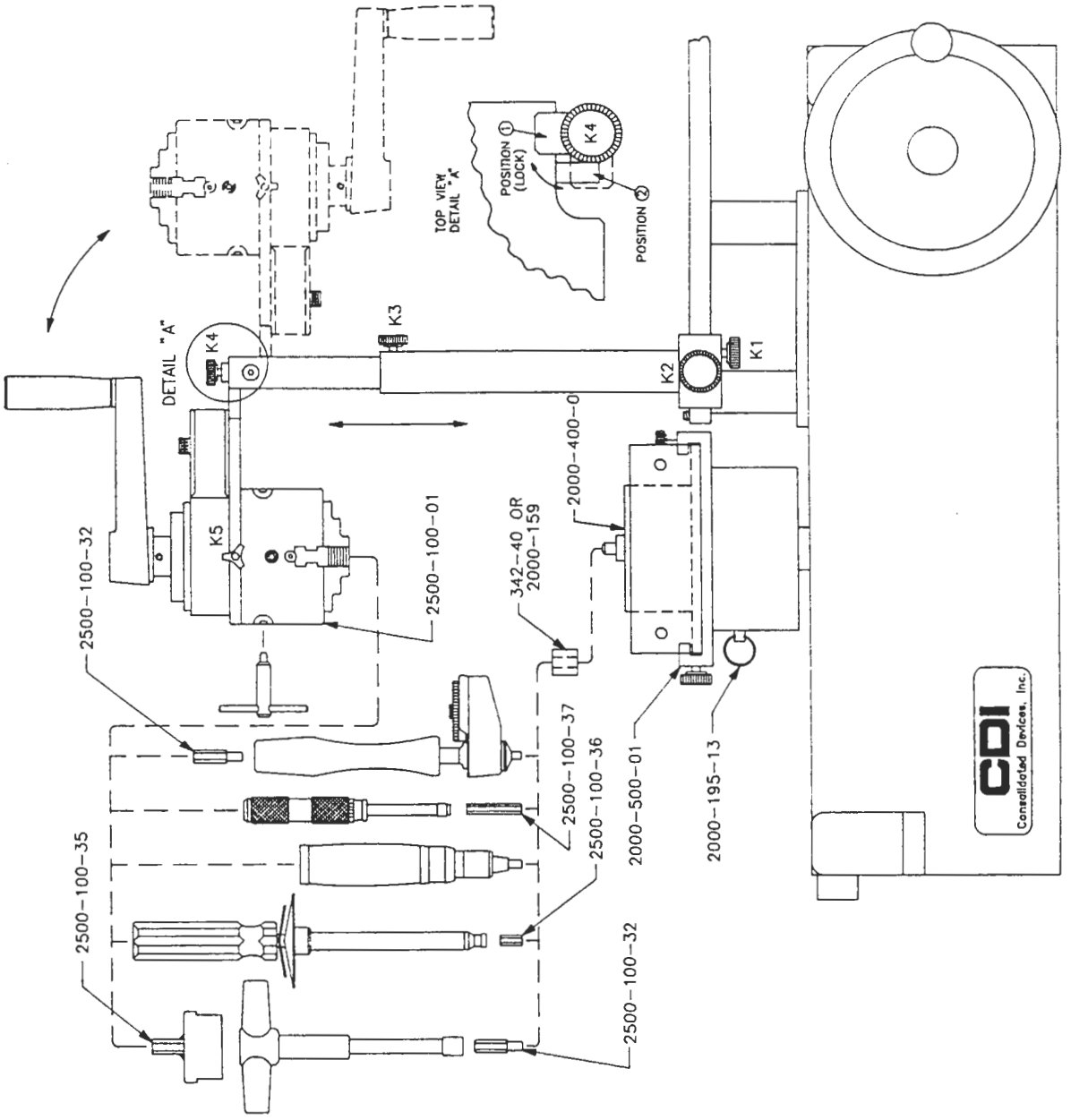


Figure 3-3. Low Torque Station Test Setup (Sheet 3)

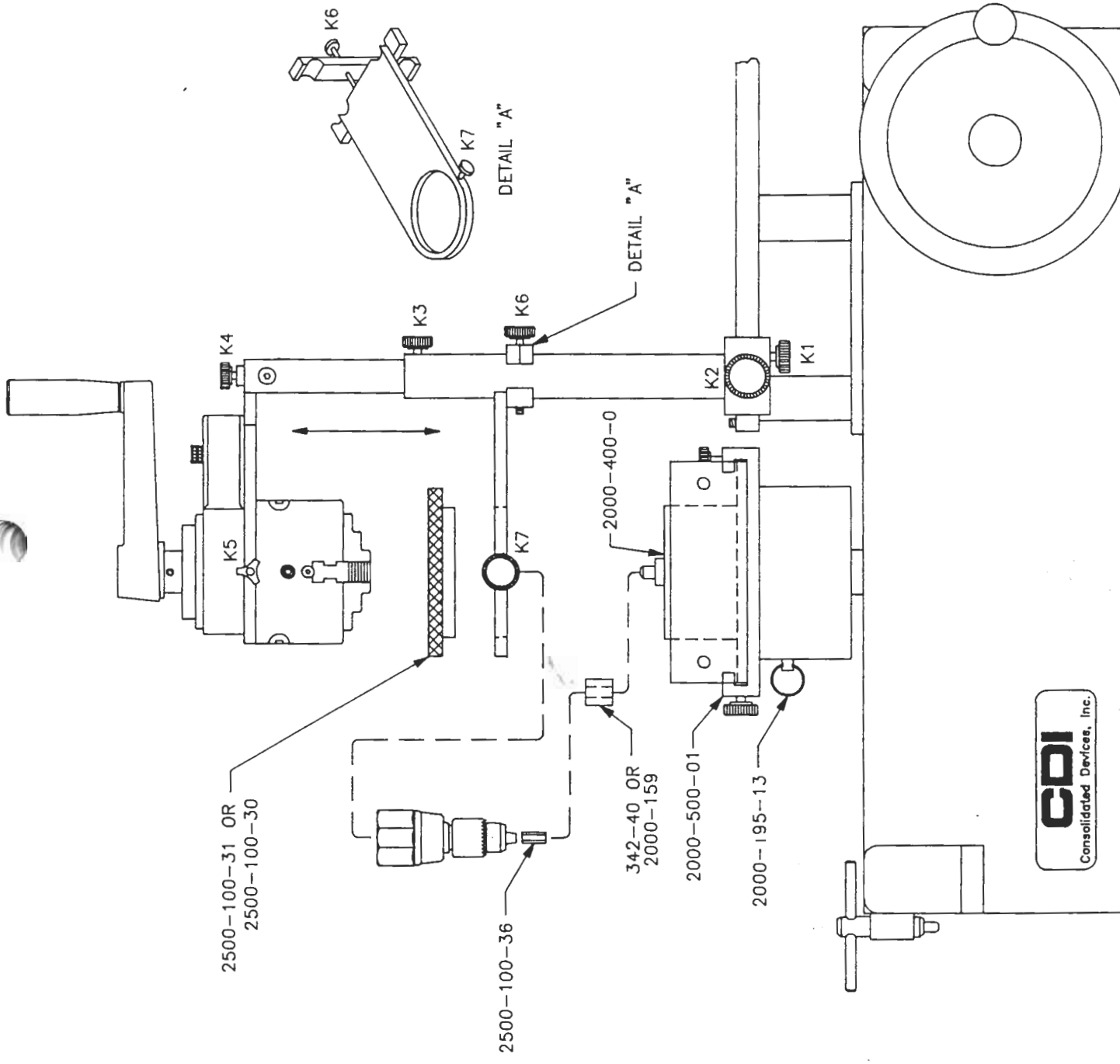


Figure 3-3. Low Torque Station Test Setup (Sheet 4)

3.3.1.2.1 Dial Indicating Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for dial indicating torque wrenches.

b. Place the wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the handle center marks are centered in the reaction pins. See Figure 3-3, sheet 1.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the dial scale indicated reading to the display on the digital indicator. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

d. To print test data, see paragraph 3.5, Printer Operation.

e. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.2 Deflecting Beam Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for deflecting beam torque wrenches.

b. Place the beam wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the pivot point on the handle is in the center of the reaction pins. See Figure 3-3, sheet 1.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the beam wrench scale indicated reading to the display on the digital indicator.

d. To print test data, see paragraph 3.5, Printer Operation.

NOTE

If beam wrench has a ball type handle, attach the flat ring assembly with Slot (Part # 2500-57-0) on the reaction slide assembly reaction pin with a knob. Attach the Flat Ring Assembly (Part # 2500-58-0) on the other reaction pin. Lock both rings after aligning the flat section with the inside of the reaction pins by tightening the thumb screws. Place the beam wrench in the calibrator. See Figure 3-3, sheet 2, Detail B.

Adjust the reaction slide to assure the wrench is level, and the ball handle is centered in the flat ring assemblies.

e. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.3 Micrometer Adjustable Torque Wrenches

a. Select FIRST PEAK Mode for micrometer adjustable or feel impulse torque wrenches.

b. Adjust the wrench to desired test setting.

c. Place the micrometer adjustable wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the handle center marks are centered in the reaction pins. See Figure 3-3, sheet 1.

d. Using the crank handle on the front of the calibrator, apply the load required to actuate the breaking device of the torque wrench. The digital display will indicate the release point of the wrench. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

e. To print test data, see paragraph 3.5, Printer Operation.

f. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.4 Torque Screwdrivers Setup

a. Testing of torque screwdrivers requires the use of Screwdriver Adapter Assembly (Part # 2500-100-01). See Figure 3-3, sheet 3.

b. To use the screwdriver adapter, move the Reaction Slide Assembly (Part # 2500-61-0) left until it stops. Tighten knobs K1 and K2 to lock into position.

c. Place the screwdriver adapter into the pins of the reaction slide adapter. Lock by tightening knob K3 on the reaction pins.

CAUTION

When handling the screwdriver adapter assembly (Part # 2500-100-01) the security stop must be in the lock position "1" and secured by tightening knob K4. See Figure 3-3, sheet 3, Detail A.

CAUTION

When loosening height adjustment screw on the reaction slide assembly, the screwdriver adapter must be supported.

d. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.5 Micrometer Adjustable Torque Screwdrivers

a. Test micrometer adjustable screwdrivers or feel impulse torque screwdrivers by selecting PEAK HOLD Mode.

b. Adjust the screwdriver to correct test setting.

c. Place the screwdriver in the correct square drive adapter on the transducer adapter. See Figure 3-3, sheet 3.

NOTE

In testing of screwdrivers with 5/16 inch or 1/4 inch female hex drives, use Part # 2500-100-32 or 2500-100-36.

d. Hold screwdriver adapter assembly and loosen the height adjustment knob K3 on the reaction slide assembly. Slowly lower the screwdriver adapter to the screwdriver handle. When the jaws of the screwdriver adapter are around the screwdriver handle, tighten knob K3.

CAUTION

Do not let the screwdriver adapter assembly rest on the top of the screwdriver, as this will cause axial loading.

e. Check to assure that the screwdriver is centered to the jaws of the screwdriver adapter. If adjustment is required, slide the reaction slide assembly until satisfactory position is reached and tighten knobs K1 and K2.

f. Tighten the jaws of the screwdriver adapter around the screwdriver to be tested by use of chuck key attach to the calibrator.

g. To use the crank handle of the screwdriver adapter assembly, unlock crank handle knob K5 on top of the screwdriver adapter assembly. Turn screwdriver crank handle to load screwdriver.

h. Crank screwdriver adapter assembly handle to apply load to actuate the breaking device of the torque screwdriver. The digital display will indicate the release point of the screwdriver. If the screwdriver is not within specified accuracy requirements, adjust and calibrate as required.

i. To print data, see paragraph 3.5, Printer Operation.

j. Upon completion of test, disengage the screwdriver by loosening jaws with the chuck key attached to the low torque station calibrator.

k. Disengage the security stop on the screwdriver adapter assembly by loosening knob K4. Then position the security stop in position two (2) (see Figure 3-3, sheet 3, Detail A). No additional adjustment of the screwdriver adapter assembly will be required if the next test screwdriver to be tested is the same type.

l. Testing screwdrivers with 1/4 inch female input on the back of the handle requires that the jaws of the screwdriver adapter assembly are locked around the 5/16 inch hex end of the 1/4 inch square drive to 5/16 inch Adapter (Part # 2500-100-32), not around the handle.

m. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.6 "T" Handle Torque Screwdrivers

a. Test "T" handle feel impulse torque screwdrivers using PEAK HOLD Mode.

b. To test "T" handle feel impulse type screwdrivers use the "T" handle adapter (Part # 2500-100-35. Lock the jaws of the screwdriver adapter around the "T" handle adapter. See Figure 3-3, sheet 3.

c. To use the crank handle of the screwdriver adapter assembly, unlock crank handle knob K5 on top of the screwdriver adapter assembly. Turn screwdriver crank handle to load screwdriver.

d. Crank screwdriver adapter assembly handle to apply load to actuate the breaking device of the torque screwdriver. The digital display will indicate the release point of the screwdriver. If the screwdriver is not within specified accuracy requirements, adjust and calibrate as required.

e. To print data, see paragraph 3.5, Printer Operations.

f. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.7 Dial Indicating Torque Screwdrivers

a. Test dial indicating torque screwdrivers using PEAK HOLD or TRACK Mode.

b. Use the setup procedure as required for holding the micrometer adjustable screwdriver in the screwdriver assembly. See paragraph 3.3.1.2.5.

c. To use the crank handle of the screwdriver adapter assembly, unlock crank handle knob K5 on top of the screwdriver adapter assembly. Turn screwdriver crank handle to load screwdriver.

d. Crank screwdriver adapter assembly handle to apply load close to test point. Lock knob K5 to load with crank handle of low torque calibrator for fine adjustment of load required to desired reading on dial scale. Compare the dial scale indicated reading to the display on the digital indicator. If the screwdriver is not within specified accuracy requirements, adjust and calibrate as required.

e. To print data, see paragraph 3.5, Printer Operation.

f. After torque tests are completed, turn off digital indicator, remove all adapters and remove transducer assembly.

3.3.1.2.8 Torque Watch Gages

a. Test torque watch gages using TRACK Mode.

NOTE

Testing torque watch gages requires the use of Torque Watch Adapter (Part # 2500-100-29) and either the 1-5/8 inch (Part # 2500-100-30) or 2 inch (Part # 2500-100-31) Torque Watch Hex Adapter.

b. Remove screwdriver adapter assembly or flip 180 degrees as shown in Figure 3-3, sheet 3, Detail A.

c. Move the reaction slide assembly left until it stops. Tighten knobs K1 and K2 to lock into position. Loosen the adjustment knob K6 on the torque watch adapter. Turn the back of the adapter 180 degrees. Position the back of the adapter through the reaction slide assembly reaction pins. Turn back 180 degrees. Tighten knob K6 to lock onto reaction pins.

d. Place the torque watch in the drive adapter on the transducer. Lower the torque watch adapter so it is aligned with the hex handle of the torque watch.

e. Align the correct Torque Watch Hex Adapter, 1-5/8 inch (Part # 2500-100-30) or 2 inch (Part # 2500-100-31) with the hex flats on the torque watch and set in the adapter.

f. Apply load by turning the torque watch adapter to desired testing point. Lock in position by tightening knob K7 on torque watch hex adapter. Compare the setting on dial indicator to the digital indicator display. If the torque watch gage is not within specified accuracy requirements, adjust and calibrate as required.

g. To print test data see paragraph 3.5, Printer Operation.

h. After torque watch tests are completed, turn off digital indicator, remove all adapters, and remove transducer assembly.

3.3.2 High Torque Station

WARNING

Make sure that the safety shield is positioned securely prior to the use of the High Torque Calibrator. Do not operate the calibrator unless safety shield is in place.

CAUTION

The High Torque Calibrator has an automatic locking mechanism as a precaution against "Over-Torquing" the transducer. When the Digital Indicator is connected to the High Torque Calibrator and powered, the mechanism is automatically activated as part of the pre-test cycle. During this test cycle the operator should test the operation of this mechanism by trying to rotate the hand crank during the lock-up stage of the pretest. The operator can tell when the mechanism is locked by listening for a click upon start up. Care should be taken not to rotate the hand crank too hard as the lock up mechanism is very sensitive and can be damaged. The hand crank should lock in one direction for just a few seconds, then the other direction, then be released. If the operator finds that the handle turns in both directions, then the system should not be used.

As an added precaution against damage to a transducer from "Over-Torquing" a buzzer will sound and the Digital Display will show "OVER-LOAD". If the Digital Indicator is signaling, stop applying the load.

NOTE

The High Torque Station requires connection between the Digital Indicator and High Torque Calibrator. Due to the delay in relay switching wait 20 seconds between switching the POWER button on then off then on again.

The instructions for operating the High Torque Station presume that the equipment is within calibration and is providing accurate readings. If at any time during the operation it is suspected that the equipment is not functioning properly, check the accuracy as indicated in paragraph 3.4.2 If the accuracy is not as specified, calibrate the equipment as indicated in Section IV. If the accuracy is not within the specification listed in the tolerance chart, calibrate the equipment as indicated in Section IV.

3.3.2.1 Setup for 375 In. Lb, 750 In. Lb, 125 In. Lb. and 250 Ft. Lb. Transducer Assemblies

Set up the High Torque Station as shown in Figure 3-4 and follow the instructions in paragraph 3.3.2.3 for tools listed in paragraph 3.3.2.2.

3.3.2.2 Test Instruments (TI) Which Can Be Tested On The High Torque Station (375 In. Lb, 750 In. Lb, 125 In. Lb. and 250 Ft. Lb.) Transducer Assemblies

The following tools can be tested on the High Torque Station:

- Torque Wrenches:
  Most manufacturers; model numbers, types, classes, styles and forms in each category in ranges from 30 in. lb. to 250 ft. lb.
  - Deflecting Beam Indicating Torque Wrenches
  - Dial Indicating Torque Wrenches
  - Micrometer Adjustable (Feel Impulse Type) Torque Wrenches
  - Preset and other Feel Impulse Specialty Torque Wrenches

NOTE

Torque screwdrivers and "T" handle type torque wrenches, torque watch gages and low range torque specialty wrenches are to be tested on the low torque calibrator.

- Force Gages:
  Within 30 in. lb. to 250 ft. lb. range. Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number force gages could be tested on the system if adapters and/or fixtures are approved by CDI.
  - Chatillon DPP and DPPH Series Force Gages
  - Hunter L and D Series Force Gages
- Cable Tensiometer:
  Within 30 in. lb. to 250 ft. lb. range. Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number cable tensiometers could be tested on the system if adapters and/or fixtures are approved by CDI.
- Pacific Scientific C5, C6, C7, C8, C9, T5-2000 Series, T5-500 Series, T6-8000 Series and 401 Series Cable Tensiometer

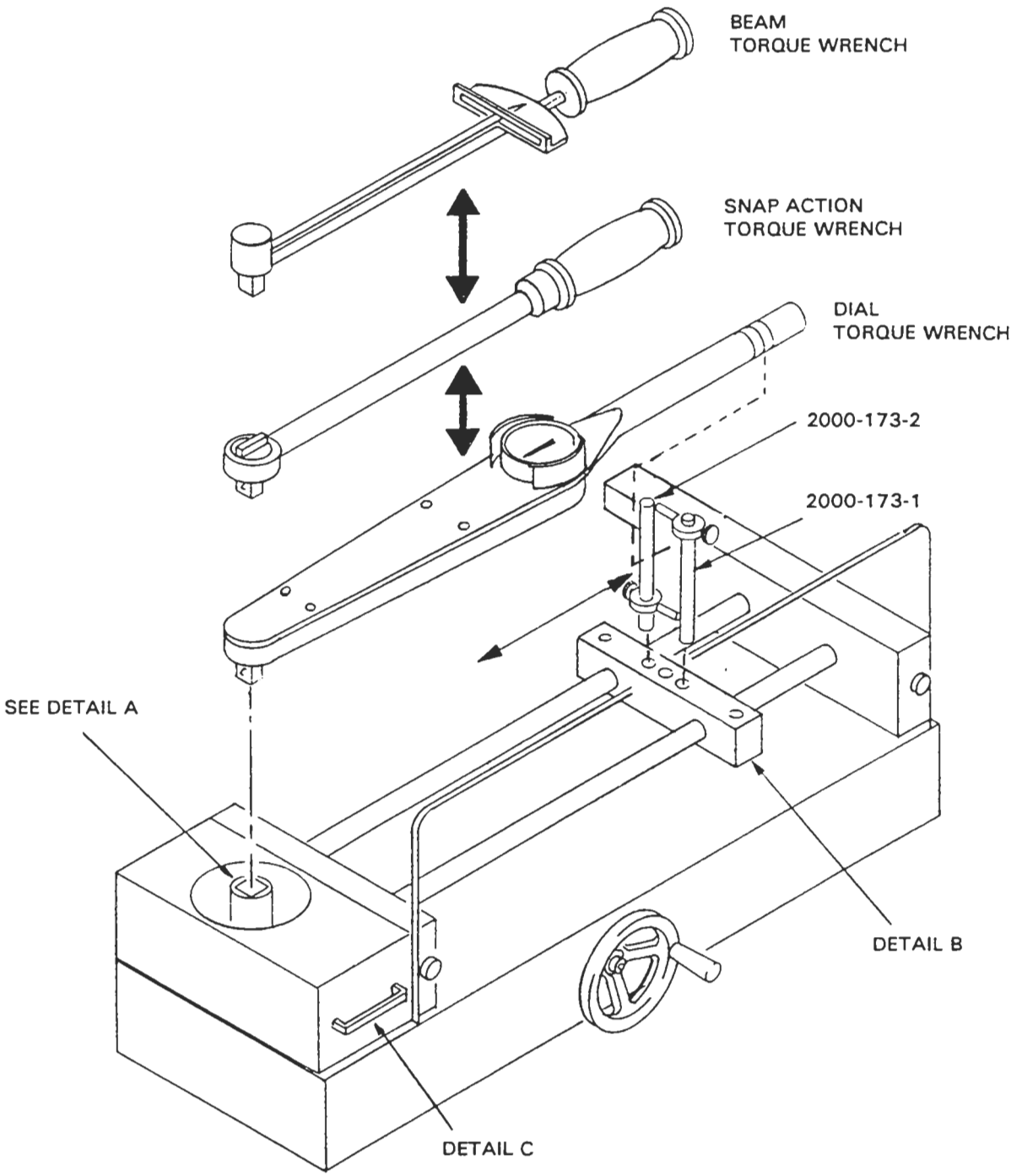


Figure 3-4. High Torque Station Test Setup for 375 In. Lb, 750 In. Lb, 125 Ft. Lb. and 250 Ft. Lb. Transducers (Sheet 1)

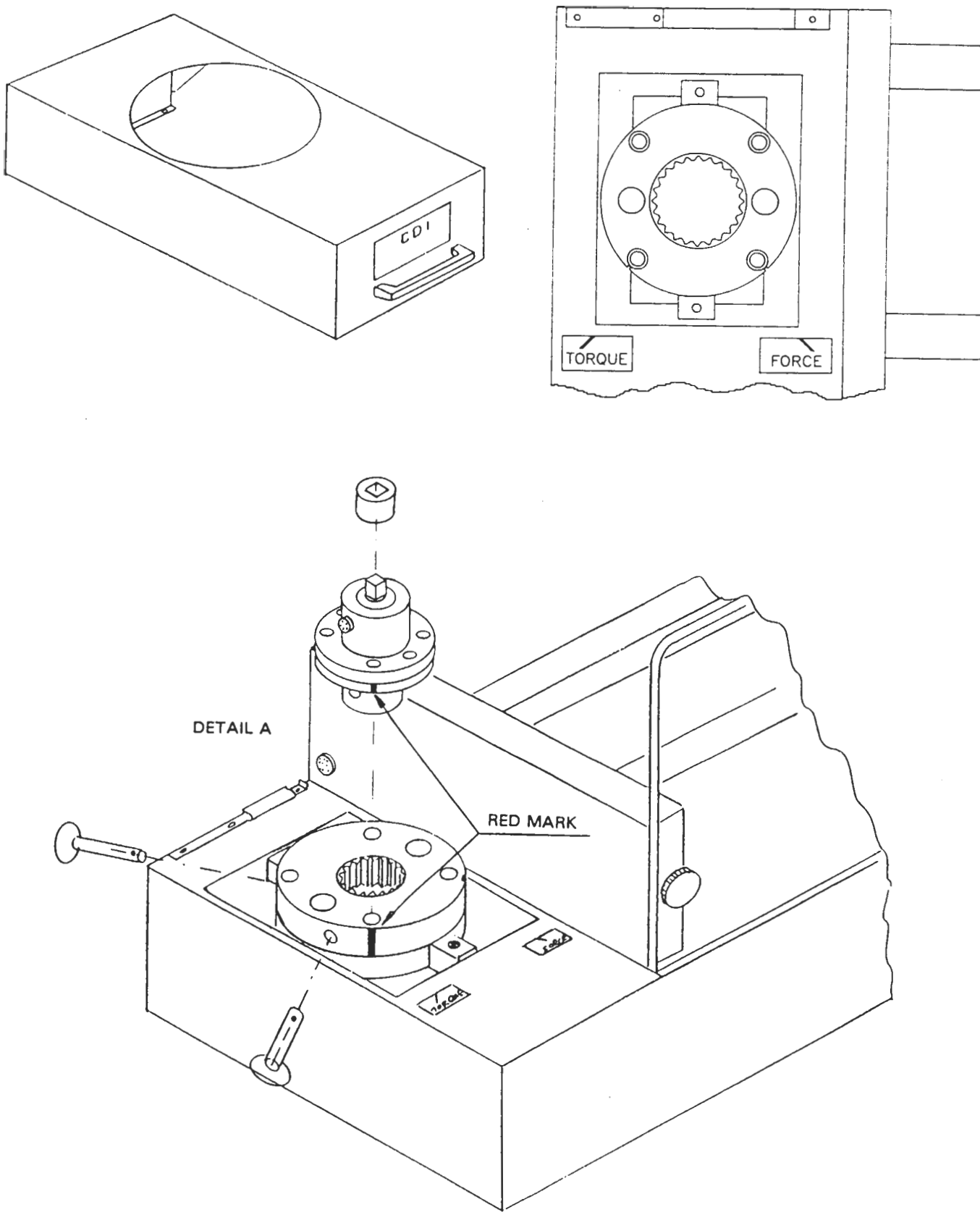


Figure 3-4. High Torque Station Test Setup for 375 In. Lb, 750 In. Lb, 125 Ft. Lb. and 250 Ft. Lb. Transducers (Sheet 2)

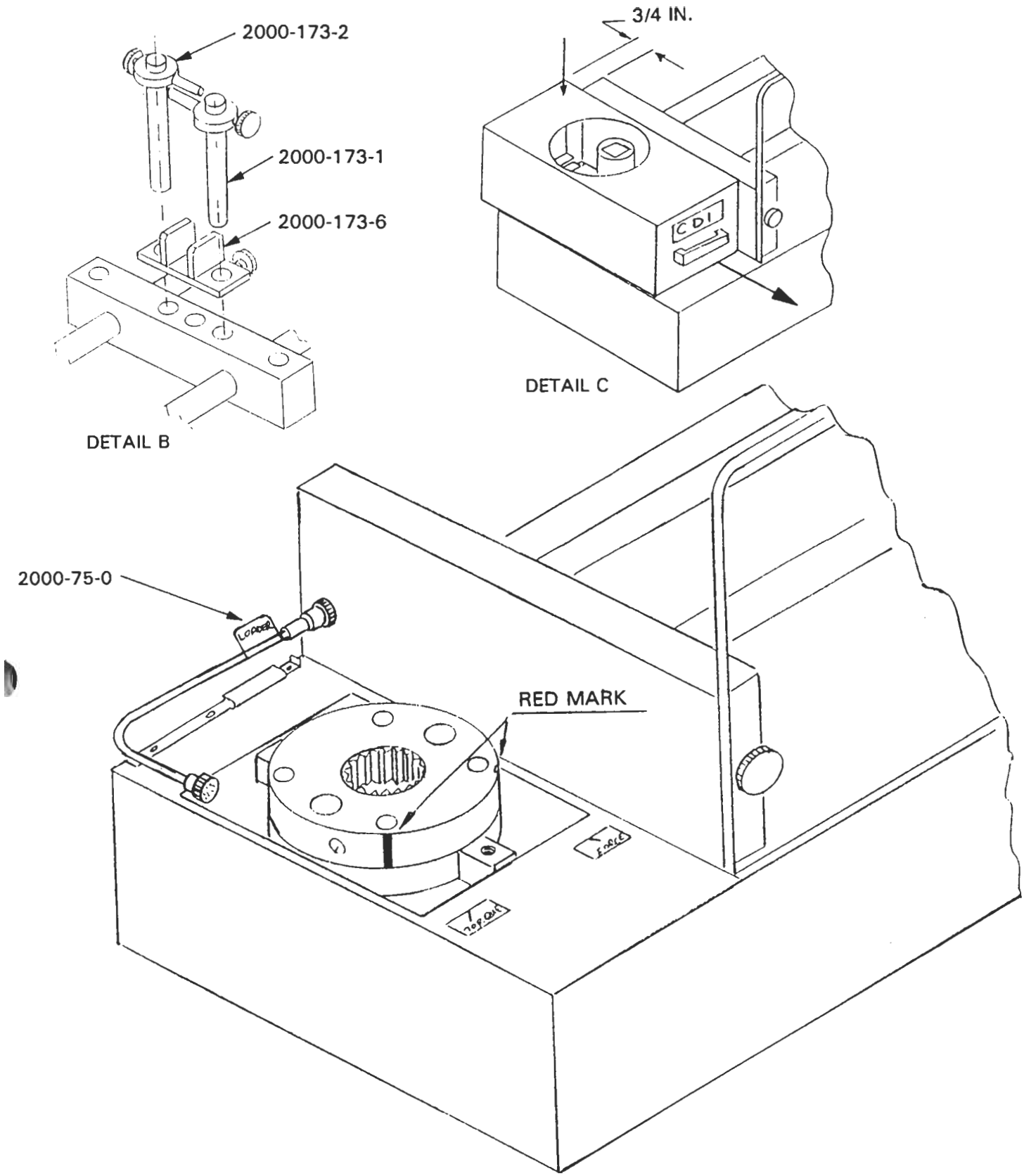


Figure 3-4. High Torque Station Test Setup for 375 In. Lb, 750 In. Lb, 125 Ft. Lb. and 250 Ft. Lb. Transducers (Sheet 3)

3.3.2.3 Test Procedure for High Torque Station

CAUTION

All Transducer Assemblies, the Drive Plates on the Loaders and Calibration Block must be clean and free of surface imperfections when assembled for use. Care must be used in handling the Transducer Assemblies, Drive Plates and Calibration Block to prevent damage to the splines which can affect the fit of mating parts.

NOTE

Before using the High Torque Station make sure that the loading mechanism is at the middle position. The mechanism is at the middle position when the torque and force lines on the drive plate are aligned with the force and torque labels on the calibrator. See Figure 3-4, sheet 3, Detail B.

a. Select the appropriate transducer assembly for the test instrument (TI) and install it as follows:

1) Position the transducer assembly on the drive plate by aligning the red orientation mark on the transducer assembly with the torque orientation mark on the drive plate of the calibrator. See Figure 3-4, sheet 3.

2) Secure the transducer assembly with two Quick Release Pins (Part # 2000-195-12). Both quick release pins must be fully engaged.

3) Connect the transducer assembly to calibrator with the transducer cable. See Figure 3-4, sheet 3.

4) Place transducer cover over transducer assembly. Slide slightly toward back to engage holder bracket. Bring forward to lock in holder bracket. See Figure 3-4, sheet 3, Detail C.

CAUTION

When transducers are not plugged into the digital indicator or when changing from one single transducer to another the digital indicator must be turned off.

b. With the Computest powered (input voltage applied to back panel connector) press the POWER button on the front of the Computest. Allow 30 minutes for the Computest to warm-up and stabilize.

CAUTION

If the transducer assembly in use and the Digital Indicator do not correspond (Table 3-1, index 21 and Figure 3-1) the over-torque protection feature of the system will not operate. This may result in permanent damage to the transducer.

3.3.2.3.1 Dial Indicating Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for dial indicating torque wrenches.

b. Place the wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the handle center marks are centered to reaction pins.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the dial scale indicated reading to the reading on the digital indicator. If the torque wrench is not within specified accuracy requiremetns, recalibrate.

d. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.3.2 Deflecting Beam Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for deflecting beam torque wrenches.

b. Place the beam wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the pivot point on the handle is in the center of the reaction pins.

NOTE

If beam wrench has a ball type handle, remove both reaction pins from slide bar. Line up Beam Wrench Reaction Adapter (Part # 2000-173-6) to the holes in the reaction slide. Place reaction pins through ball wrench reaction adapter and into holes in reaction slide. Place beam wrench on calibrator. Adjust the reaction slide to assure that the wrench is level, and the ball handle is centered in the beam wrench adapter. See Figure 3-4, sheet 3, Detail B.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the beam wrench scale indicated reading to the reading on the digital indicator.

d. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.3.3 Micrometer Adjustable Torque Wrenches

a. Select FIRST PEAK Mode for micrometer adjustable or feel impulse torque wrenches. Adjust the wrench to the desired test setting.

b. Place the micrometer adjustable torque wrench on the calibrator. Adjust the reaction slide to assure the wrench is level, and handle center is centered in reaction pins.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the breaking device of the torque wrench. The digital display will indicate the release point of the torque wrench. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

d. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.4 Setup for 500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb. Transducer Assemblies

Set up the High Torque Station as shown in Figure 3-5 and follow the instructions in paragraph 3.3.2.6 for tools listed in paragraph 3.3.2.5.

3.3.2.4.1 Extension Fixture for Wrenches up to 80 Inch

a. Slide the reaction slide of the TFC-High Torque Station Loader to the end of the slide bars (see Figure 3-5, sheet 3). Lock the reaction slide lock knob.

b. Place the two pins at the bottom of the extension fixture (Part # 2000-550-01) into the two corresponding holes in the slide bar of the TFC-High Torque Station Loader. See Figure, 3-5 sheet 3.

c. Place the test instrument (TI) on the loader. Adjust the reaction assembly slide bar as close as possible to the center of the handle. Lock the slide bar in place by tightening the knob.

d. Adjust the test instrument (TI) to level height, move height adjustment ring to hold test instrument (TI) and lock in place by tightening knob on height adjustment ring.

3.3.2.5 Test Instruments (TI) Which Can Be Tested On The High Torque Station (500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb.) Transducer Assemblies

The following test instruments can be tested on the High Torque Station:

- Torque Wrenches:
  Most manufacturers; model numbers, types, classes, styles and forms in each category in ranges from 50 ft. lb. to 2000 ft. lb.

- Deflecting Beam Indicating Torque Wrenches
- Dial Indicating Torque Wrenches
- Micrometer Adjustable (Feel Impulse Type) Torque Wrenches
- Preset Feel Impulse Type Torque Wrenches

- Torque Multipliers
  Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand names and model numbers could be tested on this system if adapters and/or fixtures are approved by CDI.
  - CDI Model DPT 1200 Torque Multiplier
  - Power-Dyne Model DP-1201 Torque Multiplier
  - Sweeney Model 102E Torque Multiplier
- Force Gages:
  Within 50 ft. lb. to 2000 ft. lb. range. Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number force gages could be tested on the system if adapters and/or fixtures are approved by CDI.
  - Chatillon DPP and DPPH Series Force Gages
  - Hunter L and D Series Force Gages
- Cable Tensiometer:
  Within 50 ft. lb. to 2000 ft. lb. range. Those listed require special adapters and/or fixtures to test that are included in the series 2000 TFC. Other brand name and model number cable tensiometers could be tested on the system if adapters and/or fixtures are approved by CDI.
- Pacific Scientific C5, C6, C7, C8, C9, T5-2000 Series, T5-500 Series, T6-8000 Series and 401 Series Cable Tensiometer

3.3.2.6 Test Procedure for High Torque Station

a. Select the appropriate transducer assembly for the test instrument (TI) and install it as shown in Figure 3-5, sheet 2, as follows:

CAUTION

When transducer assemblies are not plugged into the digital indicator or when changing from one single transducer assembly to another, the digital indicator must be turned off or damage to the transducer could occur.

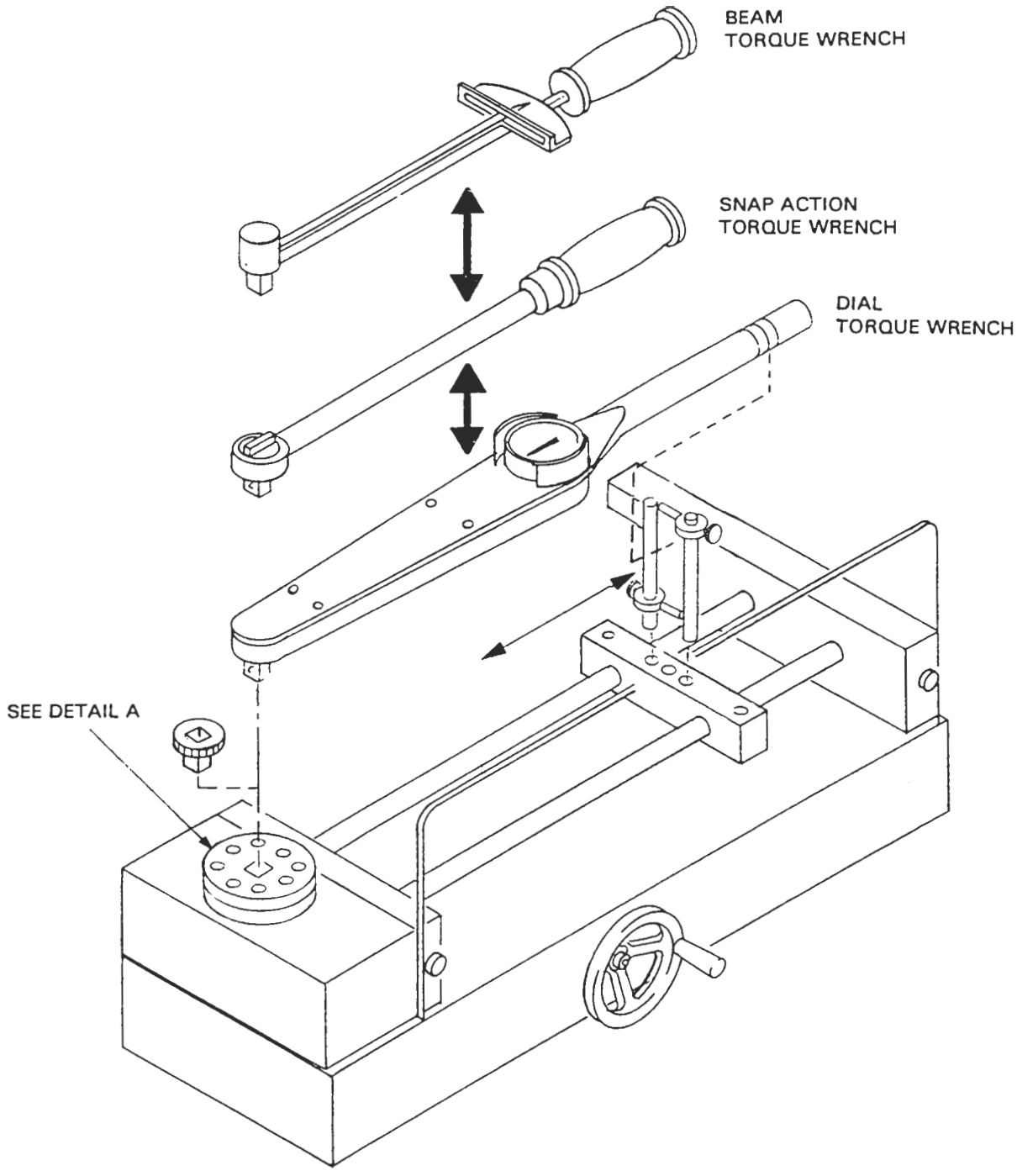
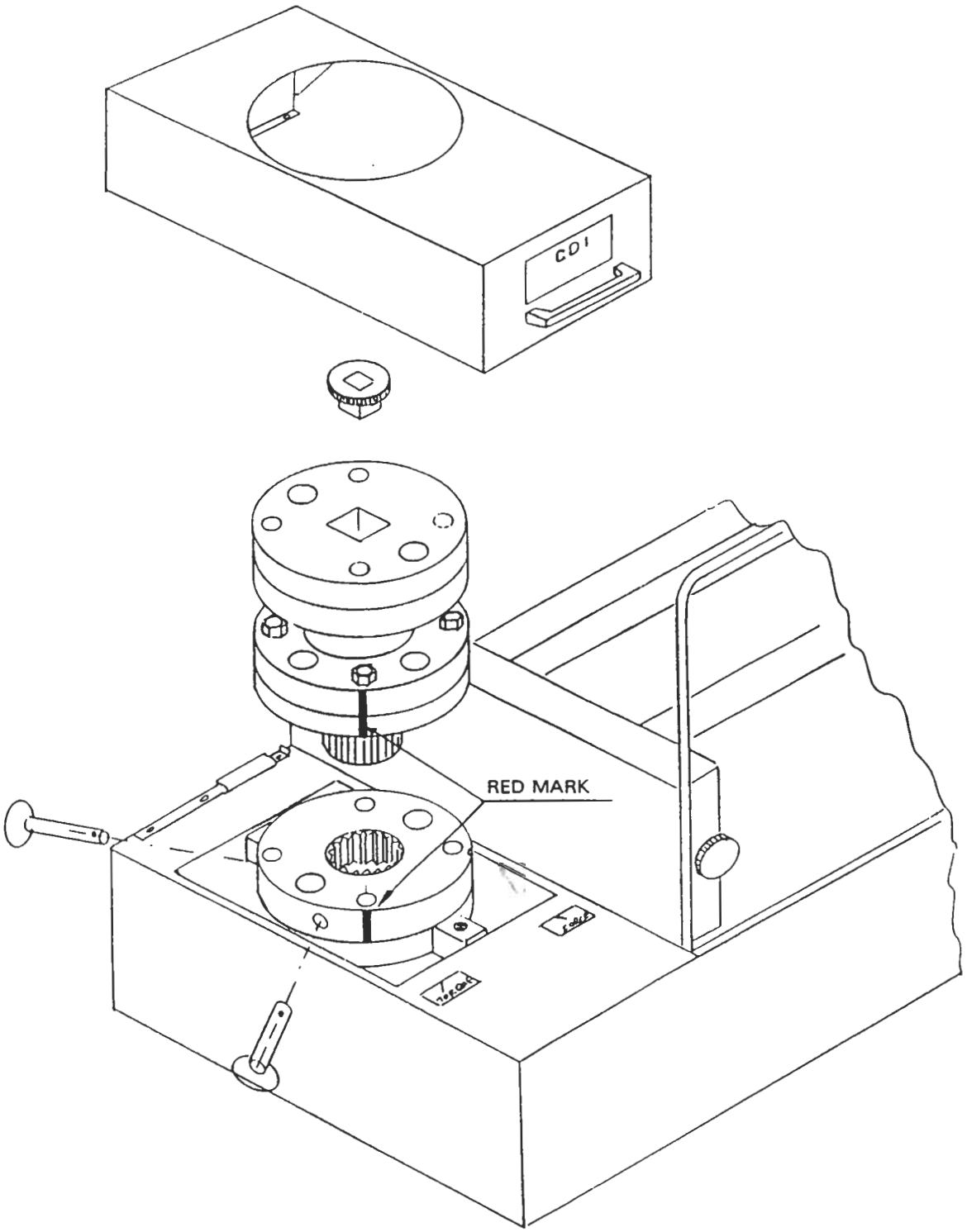
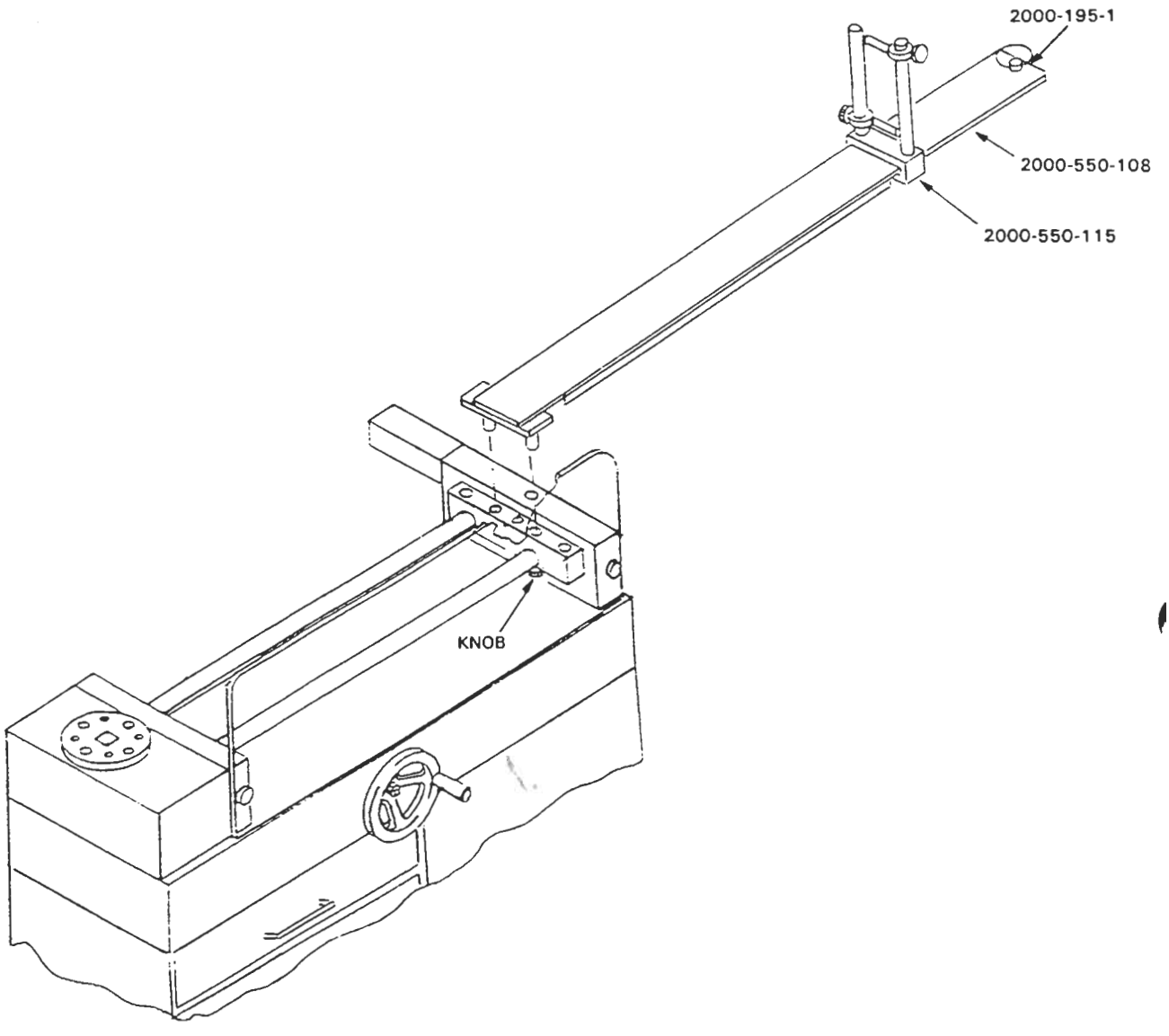


Figure 3-5. High Torque Station Test Setup for 500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb. Transducers (Sheet 1)



DETAIL A

Figure 3-5. High Torque Station Test Setup for 500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb. Transducers (Sheet 2)



EXTENSION FIXTURE

Figure 3-5. High Torque Station Test Setup for 500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb. Transducers (Sheet 3)

CAUTION

All Transducer Assemblies, the Drive Plates on the Loaders and Calibration Block must be clean and free of surface imperfections when assembled for use. Care must be used in handling the Transducer Assemblies, Drive Plates and Calibration Block to prevent damage to the splines which can affect the fit of mating parts.

1) Position the transducer assembly on the drive plate by aligning the red orientation mark on the transducer assembly with the torque orientation mark on the drive plate of the calibrator. See Figure 3-5, sheet 2.

2) Secure the transducer assembly to the drive plate with two Quick Release Pins (Part # 2000-195-12). Both quick release pins must be fully engaged.

3) Connect the transducer assembly to the calibrator with the transducer cable. See Figure 3-4, sheet 3.

4) Place transducer cover over transducer assembly. Slide slightly towards the back to engage holder bracket. See Figure 3-4, sheet 3, Detail C. Bring forward to lock to holder bracket.

b. With the Computest powered (input voltage applied to back panel connector) press the POWER button on the front of the Computest. Allow 30 minutes for the Computest to warm-up and stabilize.

CAUTION

If the transducer assembly in use and the Digital Indicator do not correspond (Table 3-1, index 21 and Figure 3-1) the over-torque protection feature of the system will not operate. This may result in permanent damage to the transducer.

3.3.2.6.1 Dial Indicating Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for dial indicating torque wrenches.

b. Place the wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the handle center marks are centered to reaction pins.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the dial scale indicated reading to the reading on

the digital indicator. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

d. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.6.2 Deflecting Beam Torque Wrenches

a. Select PEAK HOLD or TRACK Mode for deflecting beam torque wrenches.

b. Place the beam wrench on the calibrator. Adjust the reaction slide to assure the wrench is level and the pivot point on the handle is in the center of the reaction pins.

NOTE

If beam wrench has a ball type handle, remove both reaction pins from slide bar. Line up Beam Wrench Reaction Adapter (Part # 2000-173-6) to the holes in the reaction slide. Place reaction pins through ball wrench reaction adapter and into holes in reaction slide. Place beam wrench on calibrator. Adjust the reaction slide to assure that the wrench is level, and the ball handle is centered in the beam wrench adapter.

c. Using the crank handle on the front of the calibrator, apply the load required to actuate the torque wrench. Compare the beam wrench scale indicated reading to the reading on the digital indicator. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

d. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.6.3 Micrometer Adjustable Torque Wrenches

a. Select FIRST PEAK Mode for micrometer adjustable or feel impulse torque wrenches.

b. Adjust the wrench to the desired test setting.

c. Place the micrometer adjustable torque wrench on the calibrator. Adjust the reaction slide to assure the wrench is level, and handle center is centered to reaction pins.

d. Using the cranck handle on the front of the calibator, apply the load required to actuate the breaking device of the torque wrench. The digital display will indicate the release point of the torque wrench. If the torque wrench is not within specified accuracy requirements, adjust and calibrate as required.

e. To print test data, see paragraph 3.5, Printer Operation.

3.3.2.7 Torque Multiplier Test

Set up the High Torque Station as shown in Figure 3-6 and follow instructions below for torque multipliers. For Sweeney Torque Multiplier start with step a. (Figure 3-6, sheet 1) For CDI or Power-Dyne go to step b. (Figure 3-6, sheet 3).

a. Sweeney Torque Multipliers

1) Set up torque multiplier as follows:

A. Position 2000 ft. lb. transducer assembly with orientation mark aligned with torque orientation label on High Torque Station as shown in Figure 3-6, sheet 2. Secure with two quick release pins (Part #2000-195-12). Both quick release pins must be fully engaged.

CAUTION

All Transducer Assemblies, the Drive Plates on the Loaders and Calibration Block must be clean and free of surface imperfections when assembled for use. Care must be used in handling the Transducers, Drive Plates and Calibration Block to prevent damage to the splines which can affect the fit of mating parts.

B. Plug the transducer cable on the High Torque Station into the transducer assembly.

C. Place the transducer cover over the transducer assembly. Slide back approximately 3/4 inch to engage holder bracket. Bring cover forward to lock into holder bracket.

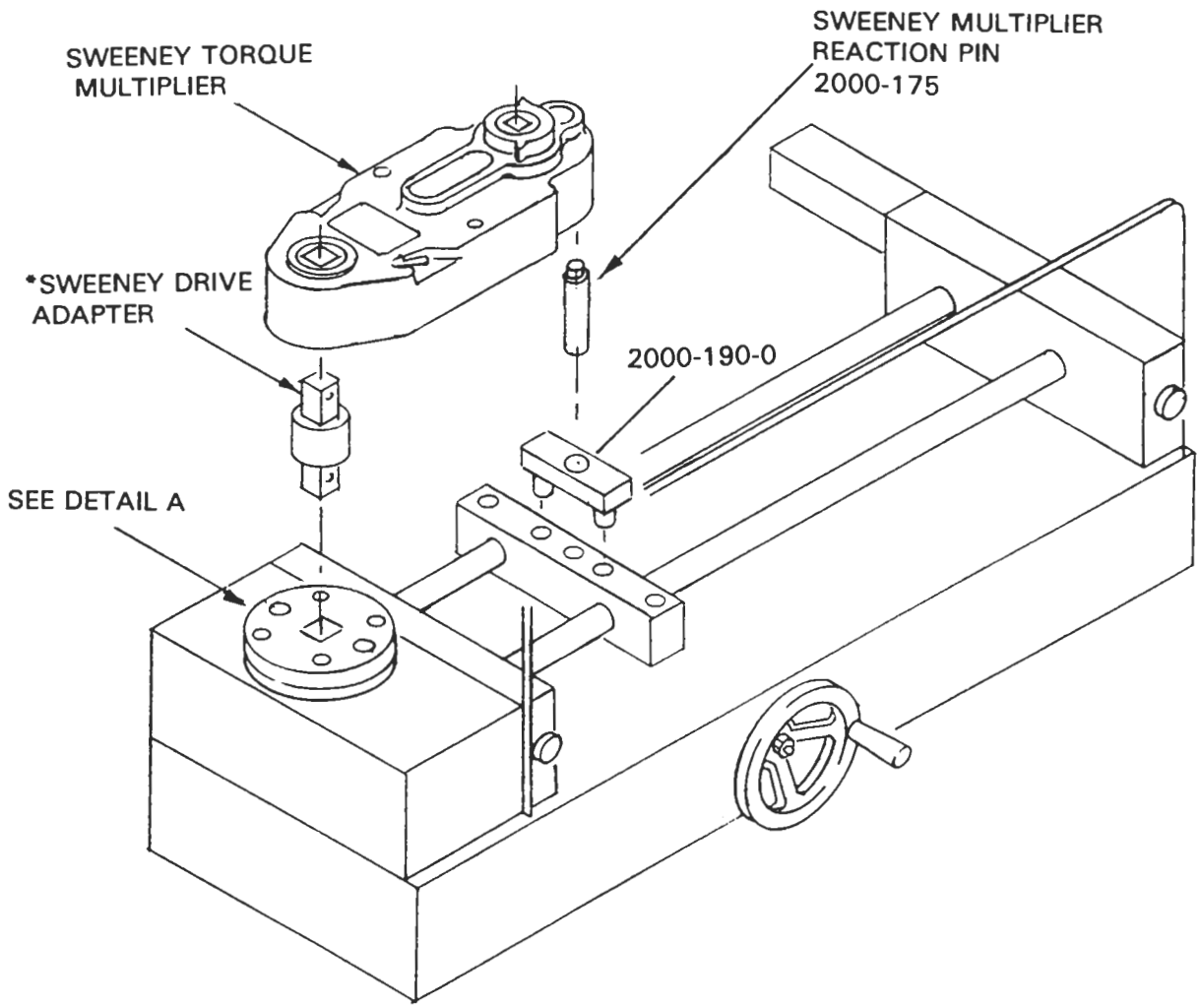
CAUTION

When transducer assemblies are not plugged into the Digital Indicator or when changing from one transducer assembly to another the Digital Indicator must be turned off.

D. With the Computest powered (input voltage applied to back panel connector) press the POWER button on the front of the Computest. Allow 30 minutes for the Computest to warm-up and stabilize.

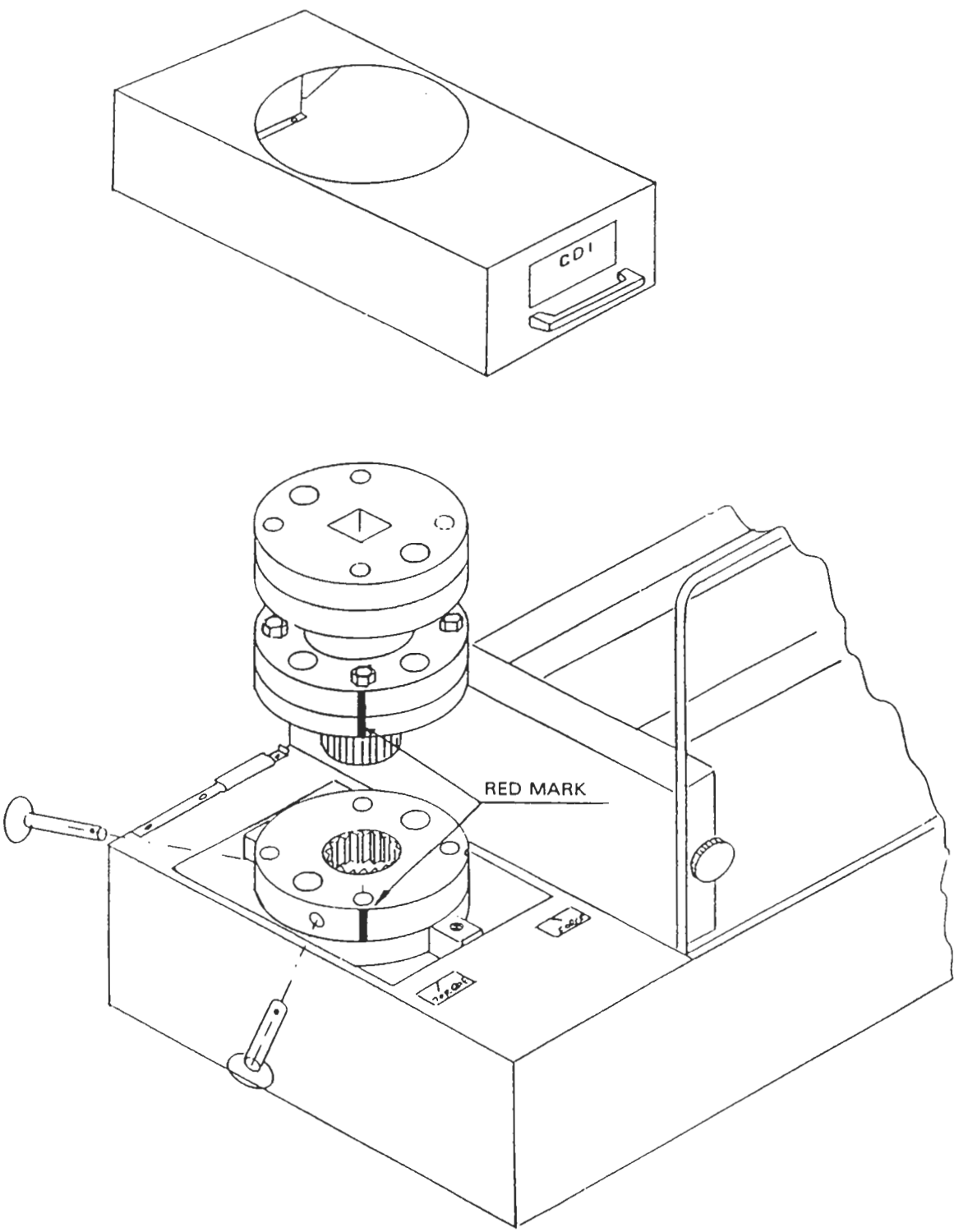
E. Make sure the proper transducer indicator on the Computest (Figure 3-1, index 21) is illuminated. It must match the 2000 ft. lb. transducer assembly installed.

F. Select the track mode by pressing the MODE button (index 15) on the Computest.



*SUPPLIED WITH MULTIPLIER BY SWEENEY

Figure 3-6. Torque Multiplier Test Setup (Sheet 1)



DETAIL A

Figure 3-6. Torque Multiplier Test Setup (Sheet 2)

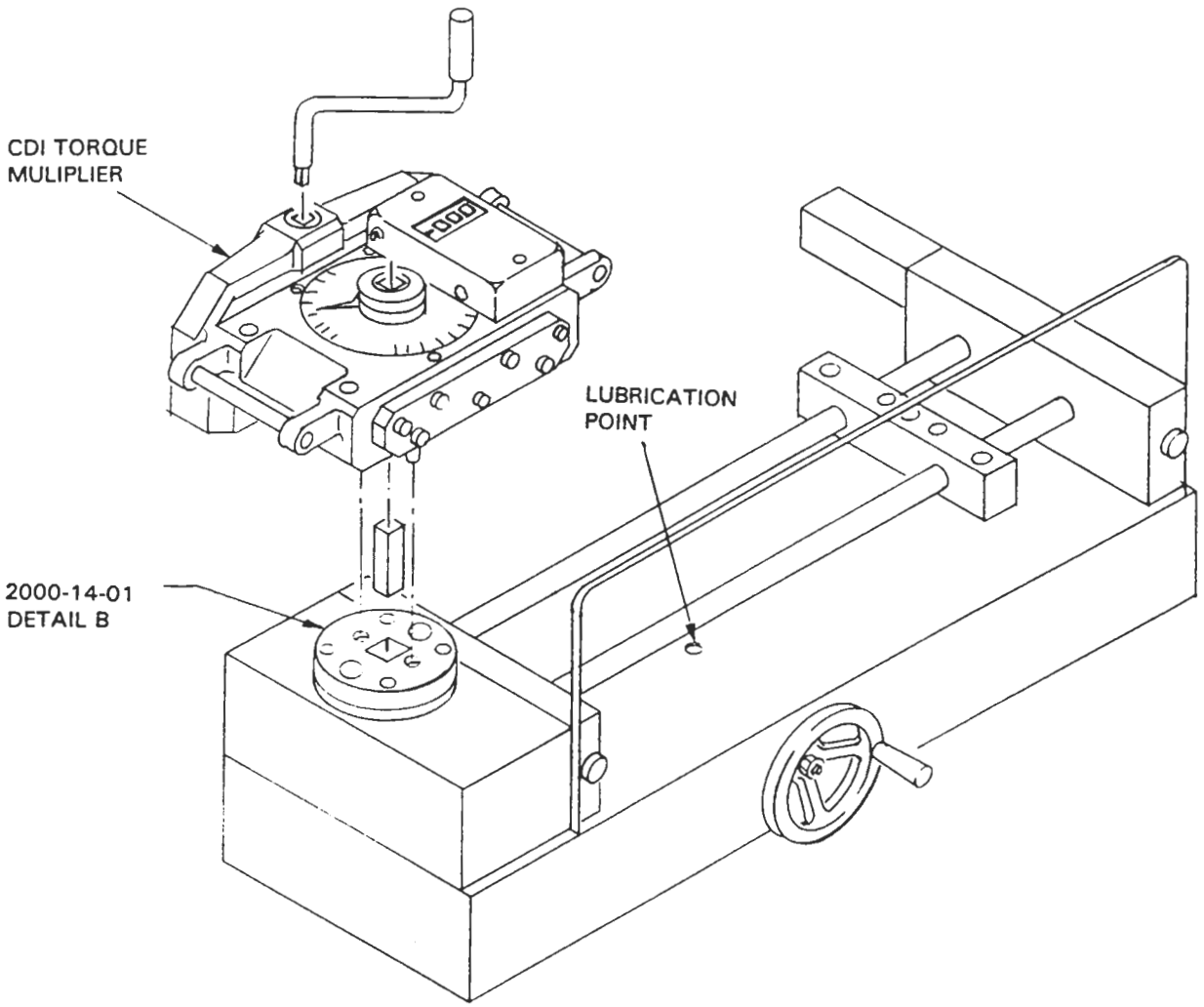
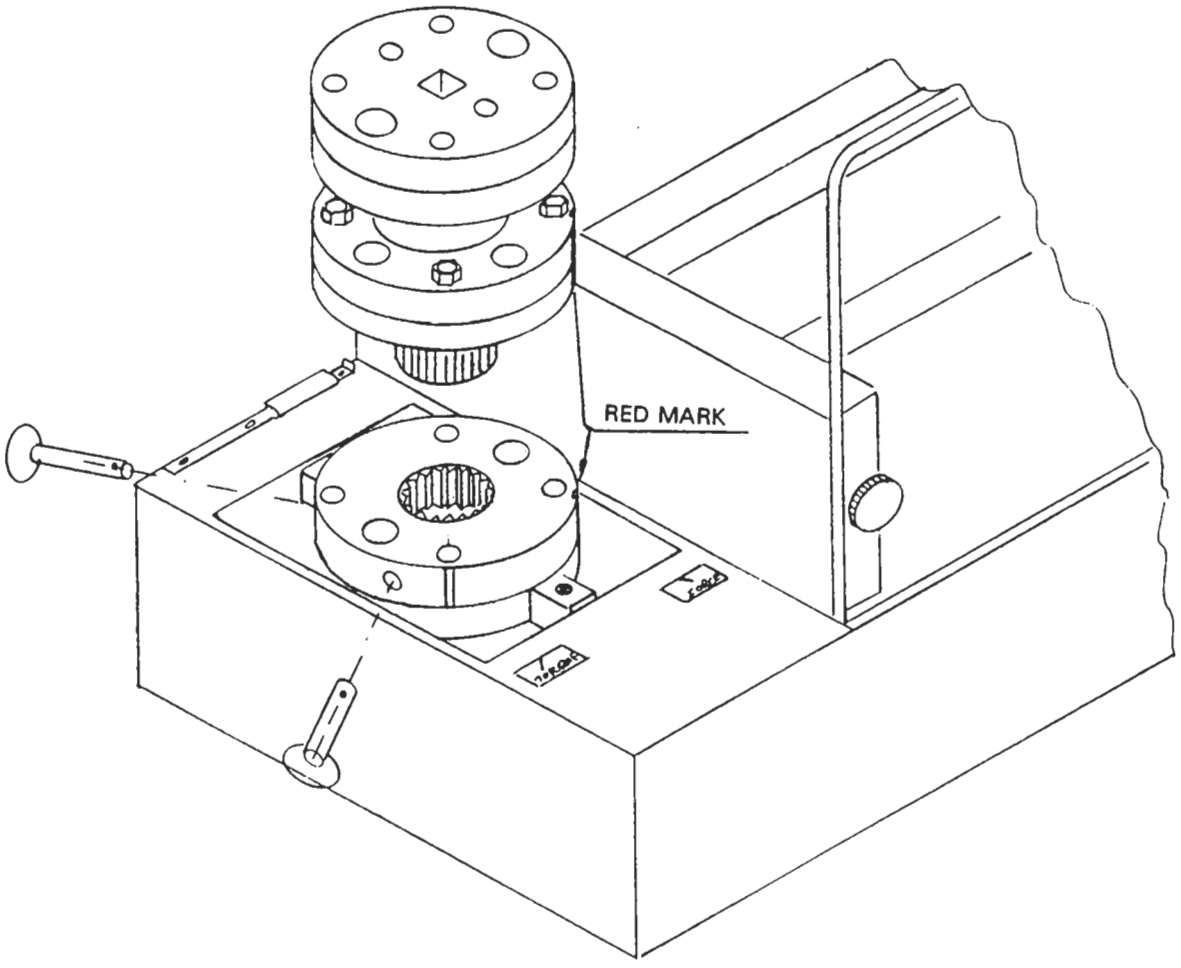


Figure 3-6. Torque Multiplier Test Setup (Sheet 3)



DETAIL B

Figure 3-6. Torque Multiplier Test Setup (Sheet 4)

G. Make sure the correct unit of measure, ft. lb., has been selected (index 19) and that TORQUE has been selected (index 18).

H. Engage the Sweeney drive adapter into the top of the transducer assembly. Place the reaction pin adapter (Part # 2000-190-0) into the High Torque Station slide bar as shown in Figure 3-6, sheet 1. Place the reaction pin (Part # 2000-175-0) into the center of the reaction pin adapter. Place the sweeney torque multiplier onto the drive adpater and reaction pin. The reaction pin must fit into the smaller slot on the end of the sweeney multiplier.

CAUTION

Smaller of slots at end **MUST** be where reaction pin is engaged or damage could result.

I. Using an appropriate torque wrench, apply force to the Sweeney multiplier and compare the reading on the digital display (index 16) with the reading (setting) on the torque wrench (multiplied by the multiplier rate) to determine if multiplier is within specified tolerance.

J. To print data, see paragraph 3.5, Printer Operation.

b. CDI or Power-Dyne Multiplier

1) Set up torque multiplier as follows:

A. Position 2000 ft. lb. transducer assembly with the orientation mark aligned with the FORCE label on the High Torque Station. Secure with two quick release pins (Part #2000-195-12). Both quick release pins must be fully engaged.

B. Connect the transducer cable on the High Torque Calibrator into the transducer assembly.

C. Place the transducer cover over the transducer assembly and slide back approximately 3/4 inch to engage the holder bracket. Slide forward to secure cover in the holder bracket.

D. Make sure the proper transducer indicator on the Computest (Figure 3-1, index 21) is illuminated. It must match the 2000 ft. lb. transducer assembly in use.

E. Select the track mode by pressing the MODE button (index 15) on the Computest.

F. Make sure the correct unit of measure, ft. lb., has been selected (index 19) and that TORQUE has been selected (index 18).

G. Place 3/4 inch drive supplied with multiplier through plate and center of the transducer and into the 3/4 inch drive adapter on the transducer adapter assembly. Position the reaction pins on the torque multiplier into the drive plate adapter holes.

NOTE

In the test set up for the CDI and Power-Dyne Torque Multipliers the Digital Indicator will show reverse polarity for CW (–) readings and CCW (+) readings.

H. Using the input crank handle supplied with the multiplier, apply the load desired to the multiplier and compare the readings on the digital display of the torque multiplier to the digital display of the Computest (index 16) to determine if the multiplier is within specified tolerance.

I. To print data, see section 3.5, Printer Operation.

3.3.2.8 Cable Tensiometer Test

Set up the High Torque Station as shown in Figure 3-7 and follow instructions below for all cable tensiometers.

a. Set up the tester for the test instrument (TI) by first referring to Table 3-3 and selecting the appropriate set up number.

b. Install the appropriate transducer as shown in Figure 3-7, sheet 6 and 7. Make sure the orientation mark is aligned with the FORCE label. Secure with two quick release pins (Part # 2000-195-12).

c. Plug the transducer cable on the High Torque Calibrator into the transducer.

d. Close the transducer cover by placing transducer cover over transducer assembly, and make sure the clear safety shield is in place on the High Torque Station.

WARNING

Make sure that the safety shield is positioned securely prior to use of the High Torque Calibrator. Do not operate the calibrator unless the safety shield is in place.

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

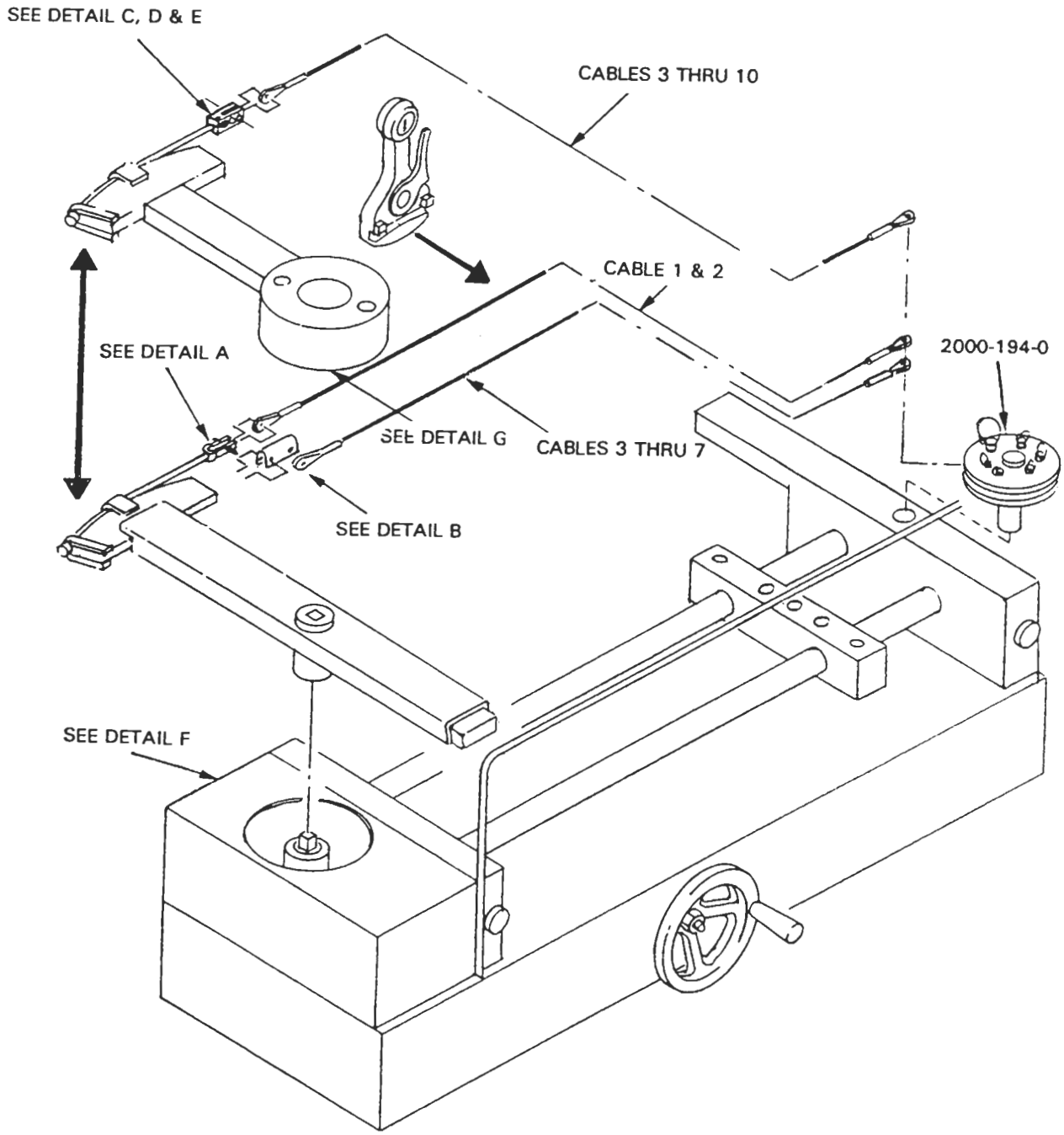


Figure 3-7. Cable Tensiometer Test Setup (Sheet 1)

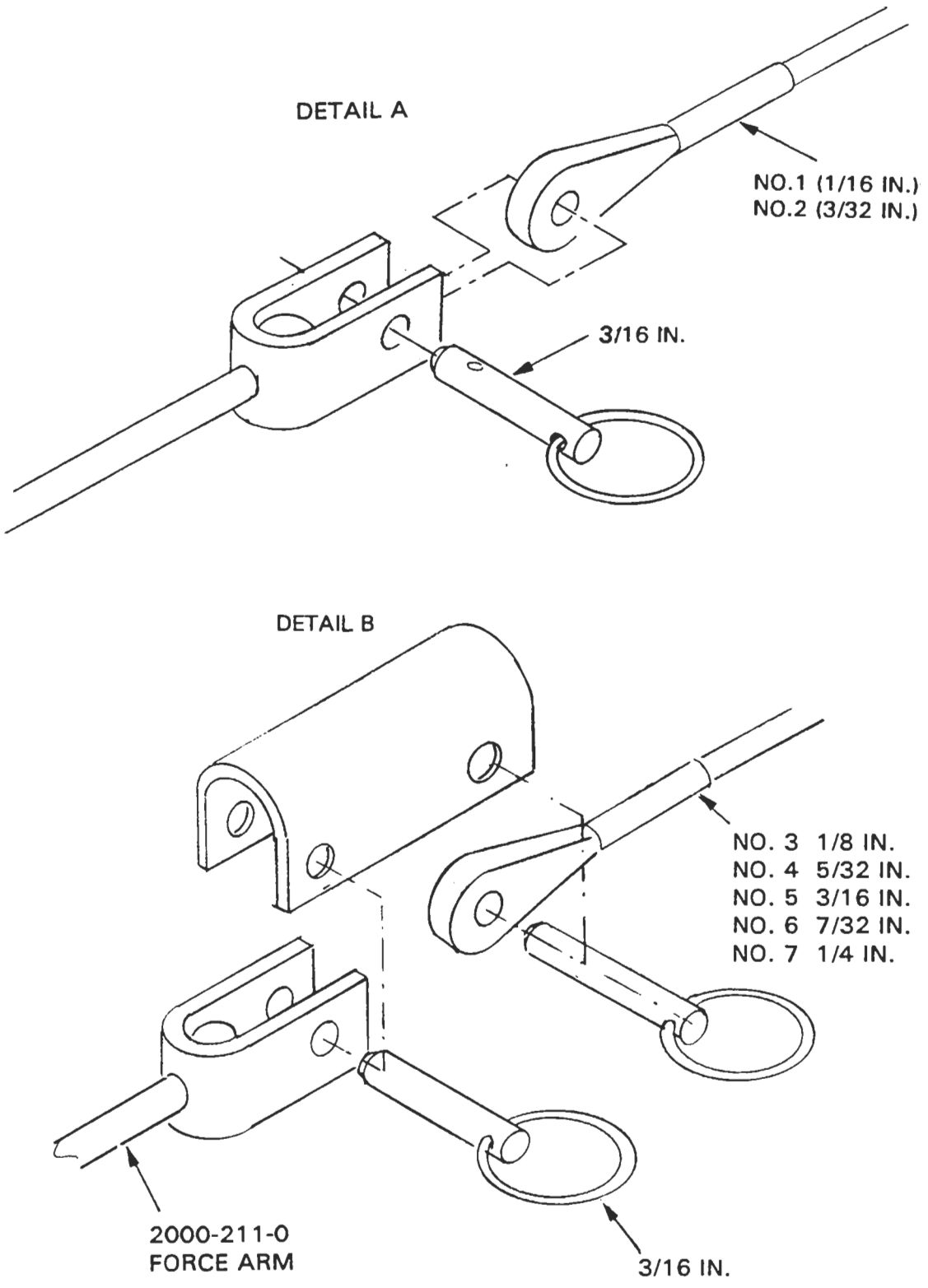


Figure 3-7. Cable Tensiometer Test Setup (Sheet 2)

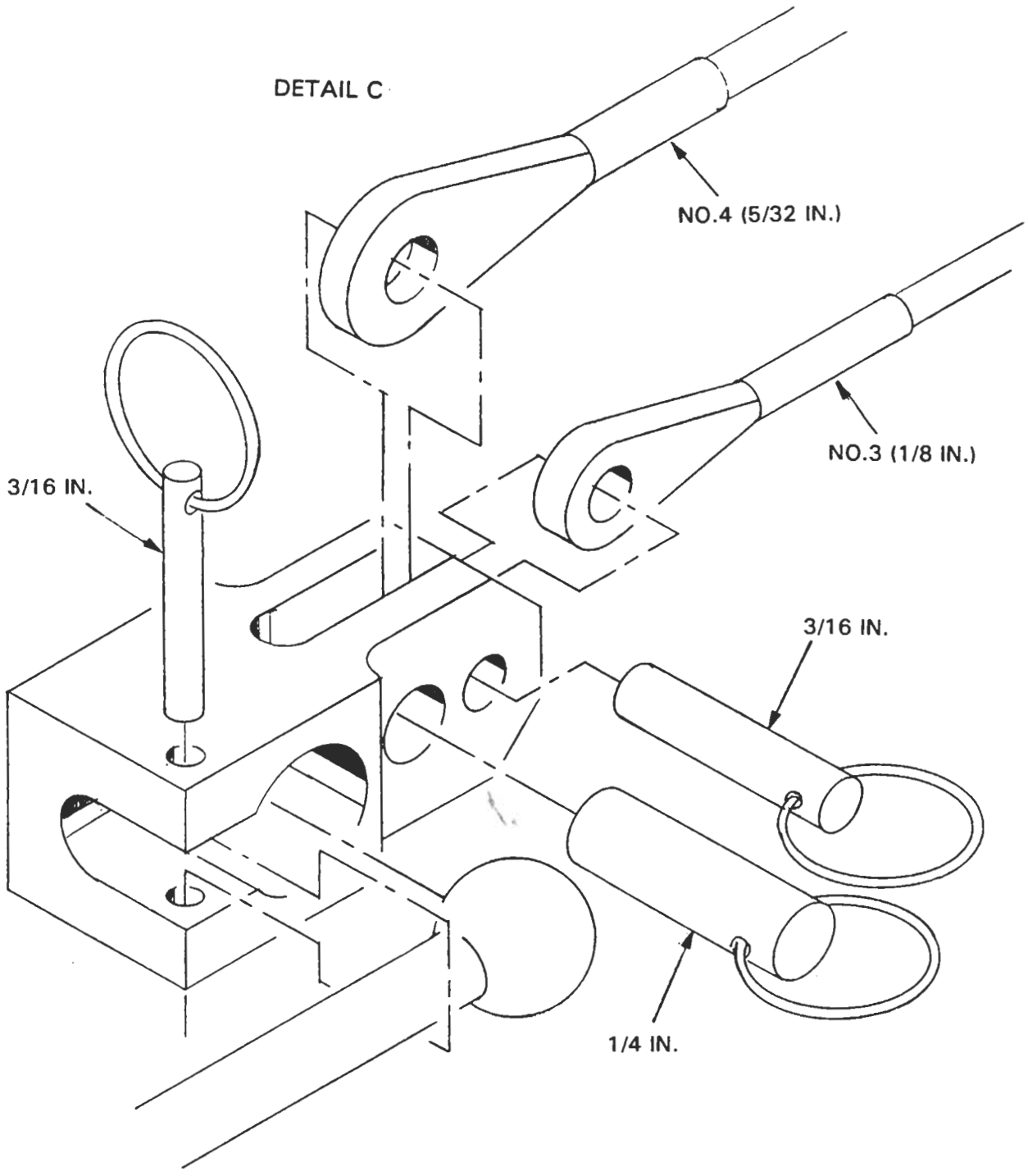
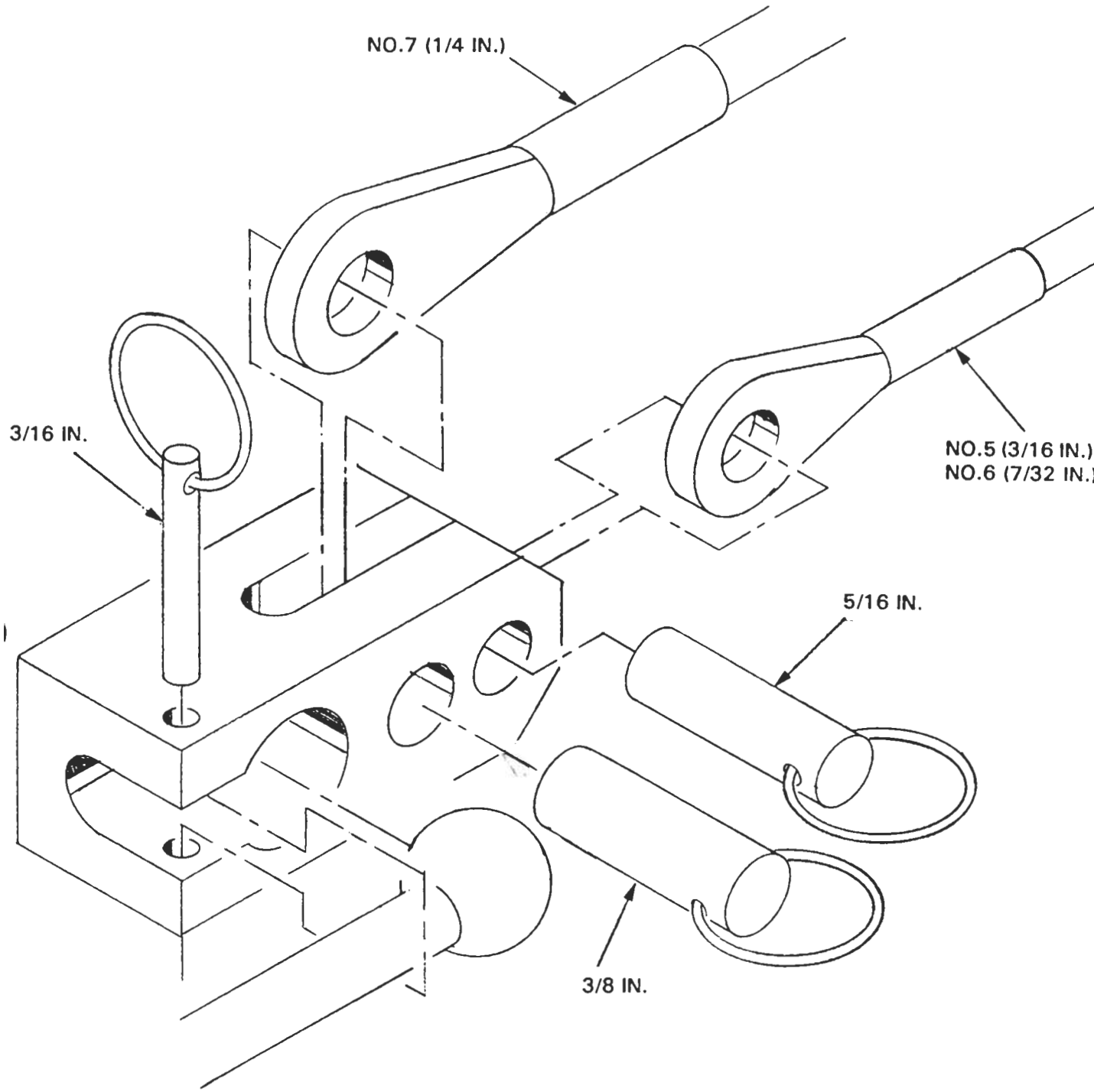


Figure 3-7. Cable Tensiometer Test Setup (Sheet 3)



DETAIL D

Figure 3-7. Cable Tensiometer Test Setup (Sheet 4)

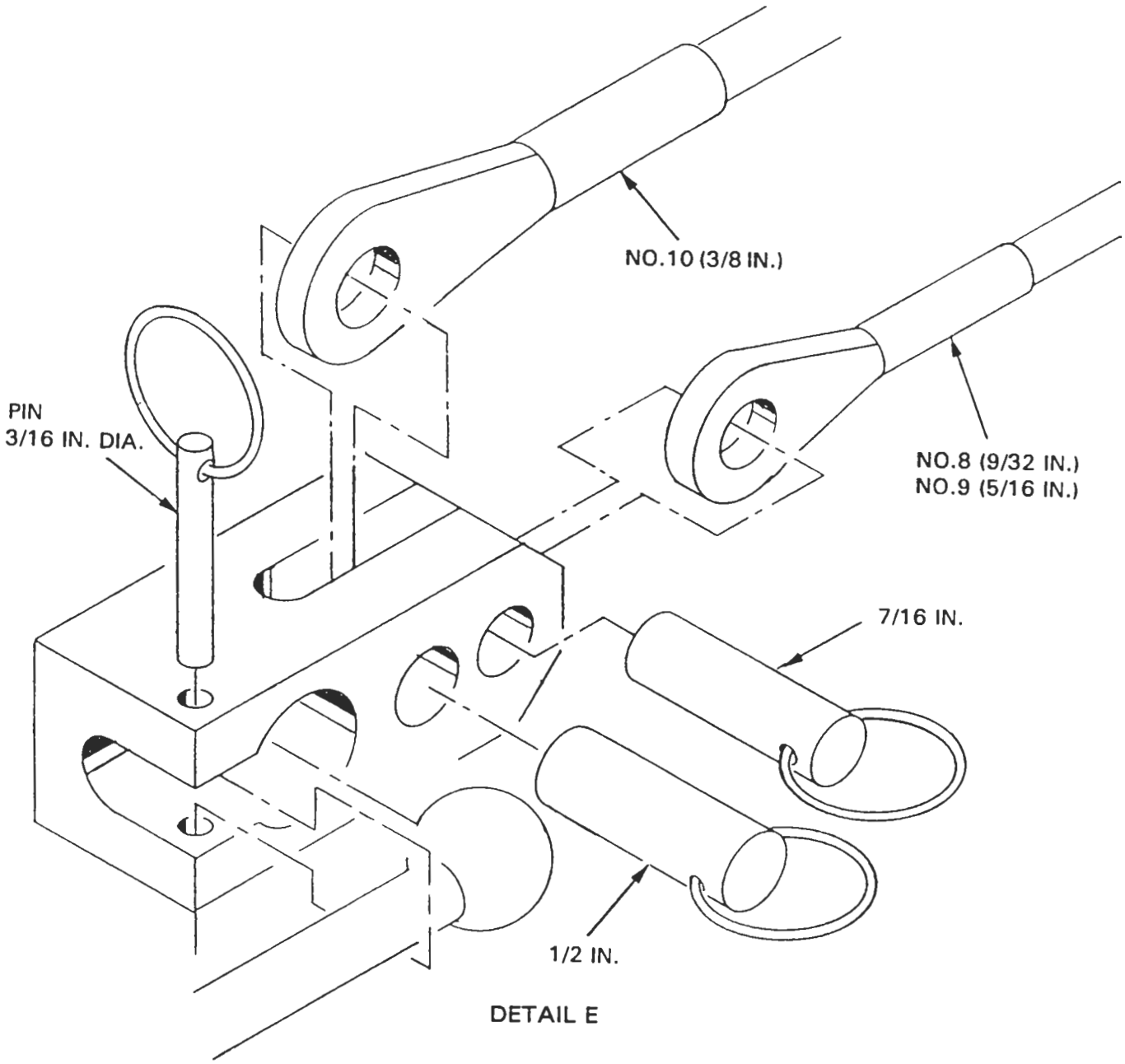


Figure 3-7. Cable Tensiometer Test Setup (Sheet 5)

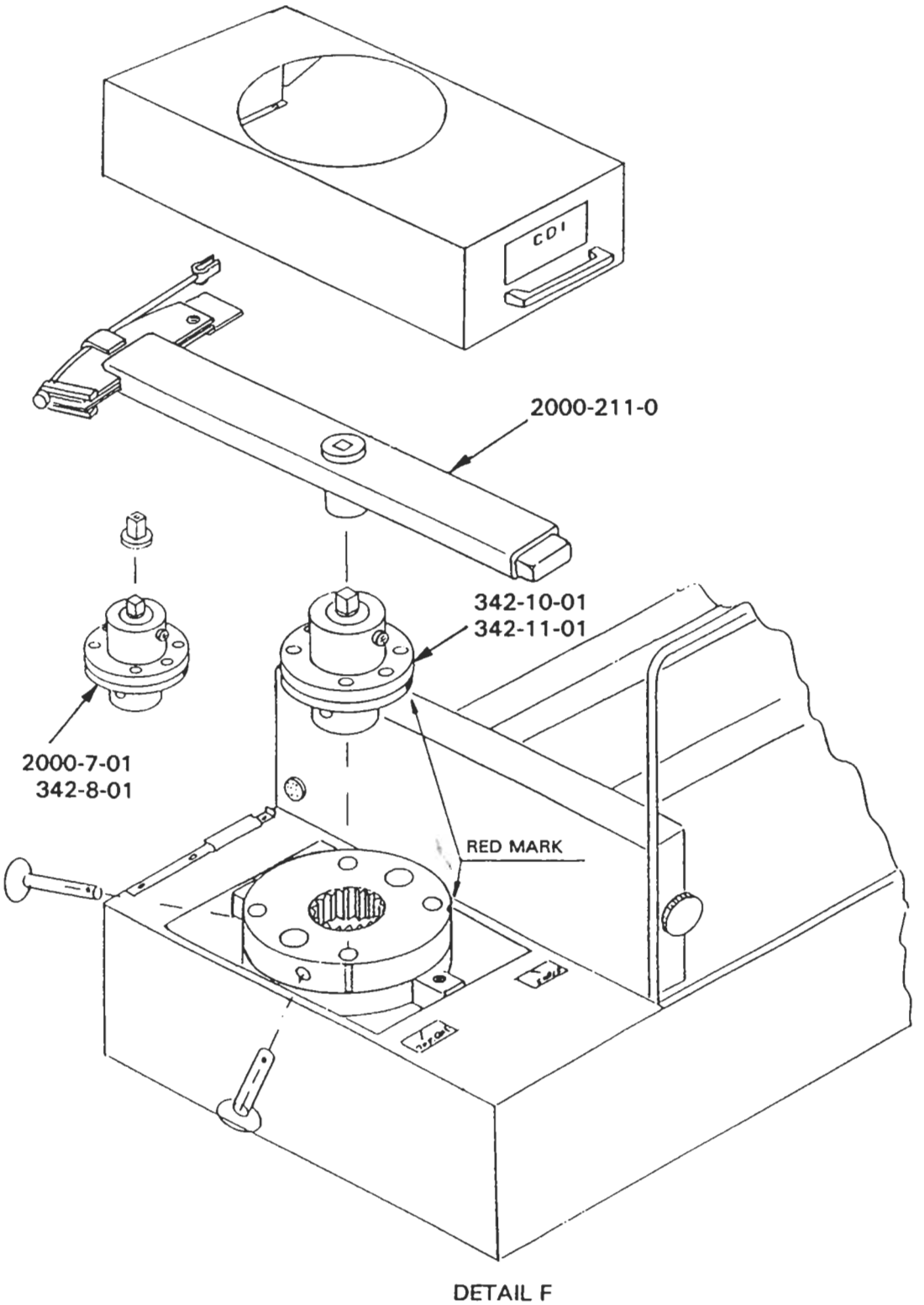


Figure 3-7. Cable Tensiometer Test Setup (Sheet 6)

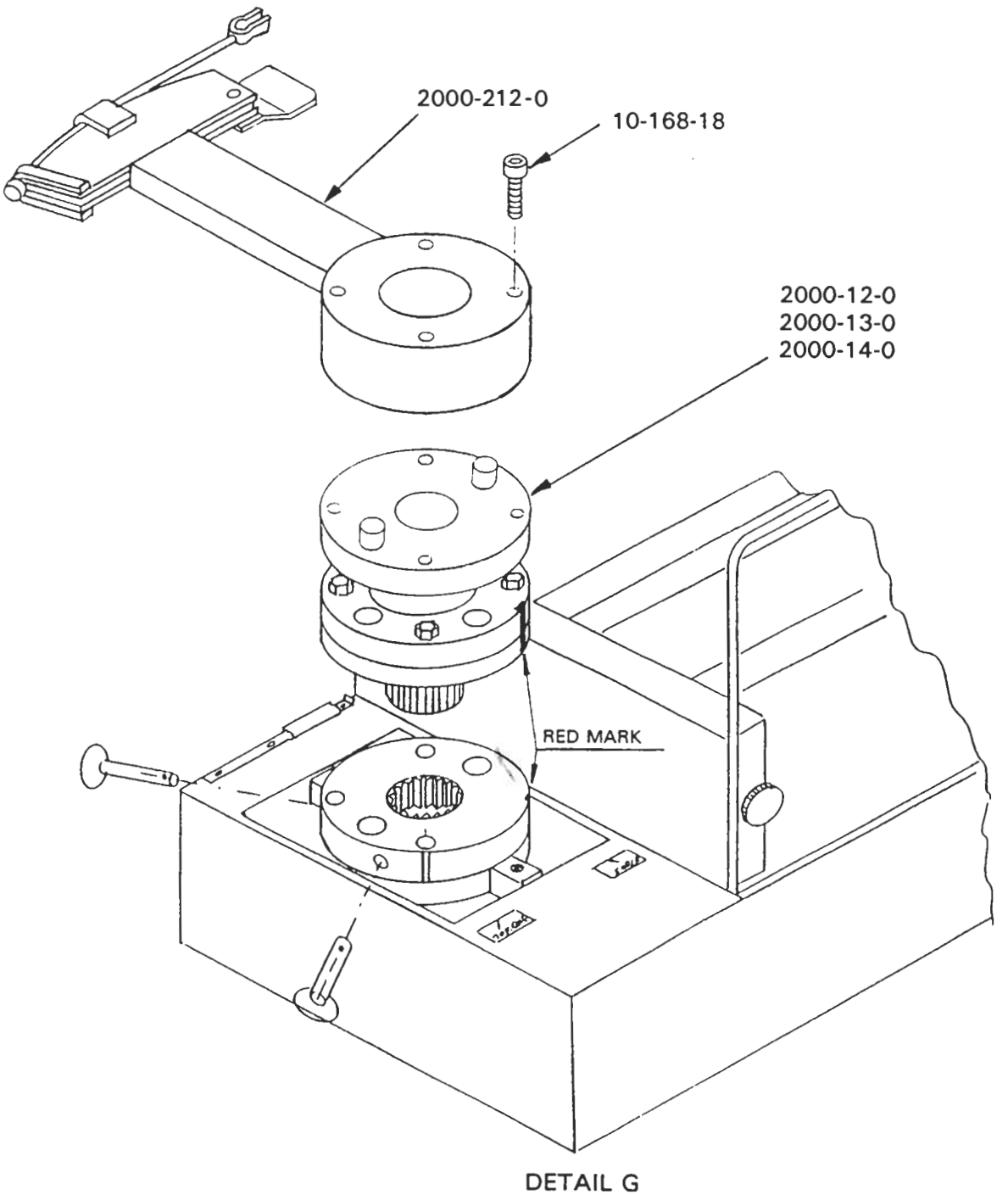


Figure 3-7. Cable Tensiometer Test Setup (Sheet 7)

e. With the Computest powered (input voltage applied to back panel connector) press the POWER button on the front of the Computest. Allow 30 minutes for the Computest to warm-up and stabilize.

f. Make sure the proper indicator on the HIGH TORQUE STATION indicator (Figure 3-1, index 21) is illuminated. It should agree with the transducer that is installed.

g. Select the TRACK mode by pressing MODE button (15).

h. Make sure the correct unit of measurement has been selected and that FORCE has been selected. If required, change the unit of measurement by pressing the UNIT button (19) and select FORCE by pressing the SELECT button (18).

i. Install force arm per Table 3-3 and as shown in Figure 3-7, sheets 6 and 7. For setup B, the transducer assembly top drive plate must be removed for installation of force arm Part # 2000-212-0. Set the top drive plate and four screws aside and attach the force arm with four 3/8-16 x 3 inch socket head cap screws, Part # 10-168-18, as shown.

WARNING

Make sure that proper size quick release pin is used. Diameter must match hole in universal cable reaction adapter and eyelet of cable being tested. Failure to comply may result in equipment failure and/or personal injury.

j. Select appropriate cable per Table 3-3 and attach to force arm as shown in Figure 3-7 Sheet 1.

k. Install universal cable reaction adapter (Part # 2000-194-0) on High Torque Station by sliding into hole on end side rail as shown in Figure 3-7, sheet 1. Attach end of cable to universal cable reaction adapter using a quick release pin as specified in Table 3-3.

l. Apply a load to the cable and engage tensiometer as close as possible to the midpoint of the cable. Compare the reading on the display (16) to the tensiometer after engagement to determine if the gage is within specification limits. The reading on the display (16) will change when the tensiometer is engaged due to the additional load. The reading on the display (16) after engagement is the true cable tension for determination of accuracy of the tensiometer.

Table 3-3. Cable Tensiometer Test Setup

SETUP NO.(1)	CABLE (2) PART NO.	DIA(IN.)	TRANSDUCER PART NO.	TRANSDUCER FORCE RANGE(LB)	QUICK RELEASE PIN DIA. (IN.)
1A	2000-200-1	1/16	342-10-01	12.5-125	3/16
2A	2000-200-2	3/32	342-11-01	25-250	3/16
3B	2000-200-3	1/8	2000-12-01	50-500	3/16
4B	2000-200-4	5/32	2000-13-01	100-1000	1/4
5B	2000-200-5	3/16	2000-13-01	100-1000	5/16
6B	2000-200-6	7/32	2000-13-01	100-1000	5/16
7B	2000-200-7	1/4	2000-14-01	200-2000	3/8
8B	2000-200-8	9/32	2000-14-01	200-2000	7/16
9B	2000-200-9	5/16	2000-14-01	200-2000	7/16
10B	2000-200-10	3/8	2000-14-01	200-2000	1/2

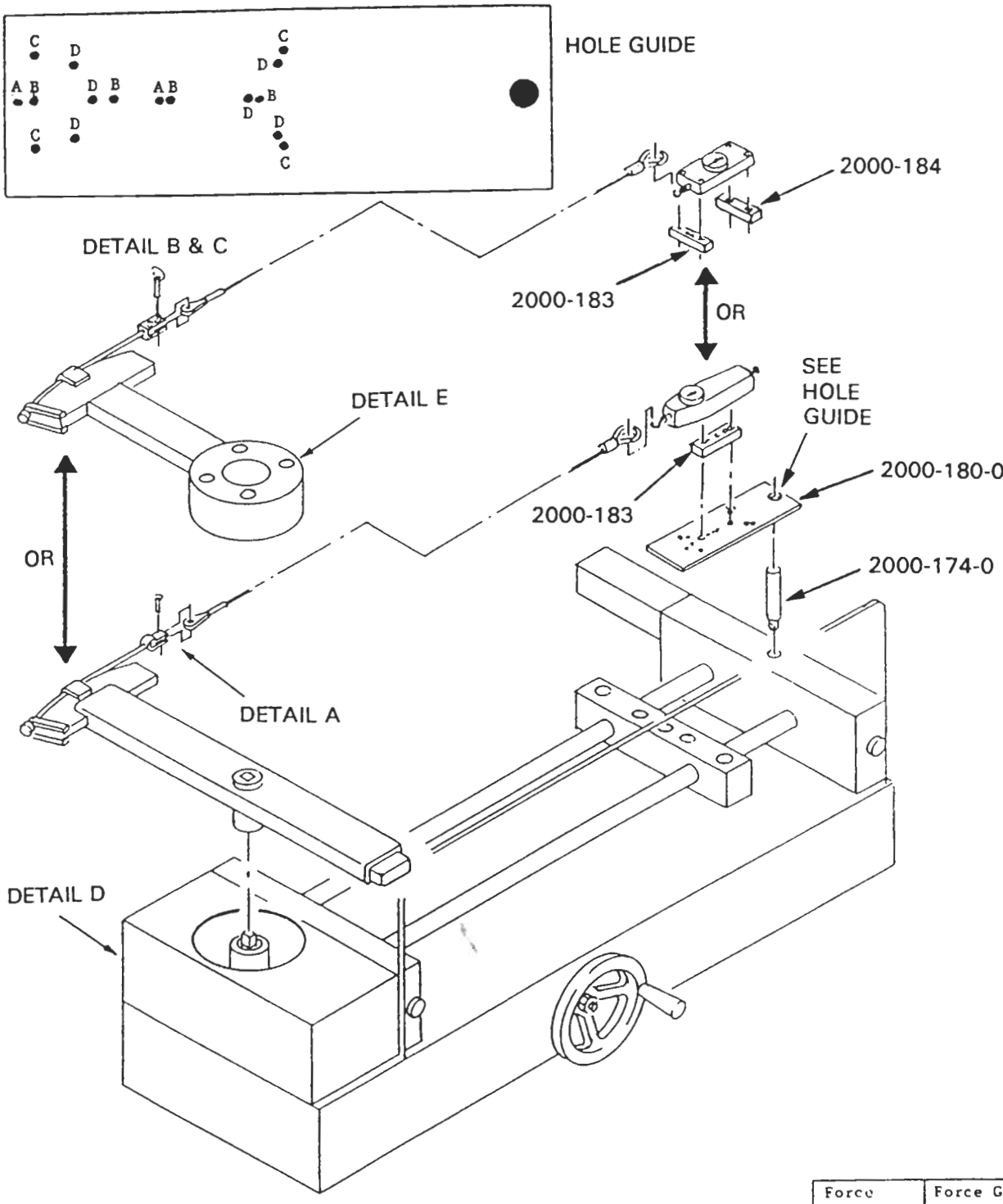
NOTES:
1. Set-up A requires 2000-211-0 Force Arm and set-up B requires 2000-212-0 Force Arm.
2. Cables -1 through -4 are 32.5 inches long and cables -5 through -10 are 32.0 inches long.
3. Table 3-3 indicates test set-up required for each cable to its maximum allowable load. When testing a larger cable at a range lower than shown in table 3-3 is required, the cable can be tested using set-up A as long as the test load does not exceed the range of the transducer used.
4. To allow testing cables from 1/8 inch diameter to 1/4 inch diameter in low force ranges which requires setup "A" (2000-211-0 force arm) use cable adapter (Part # 2000-197) as shown in Figure 3-7, sheet 2, Detail B.
5. No cable should be tested past its maximum allowable working load.

m. After completion of test, if next test instrument (TI) is within the same range, repeat step l. Otherwise repeat steps b through l for test instruments that are not within the same range. When all tests have been completed, remove cable, force arm and universal reaction adapter. After use of force arm, Part # 2000-212-0, the transducer top drive plate must be placed back on the transducer assembly with four 3/8-16 socket head cap screws (Part # 10-168-17).

3.3.2.9 Force Gage Test

Set up the High Torque Station as shown in Figure 3-8 for tension tests and Figure 3-9 for compression tests. Follow instructions below for all force gages; both tension and compression.

a. For tension force test set up the High Torque Station as shown in Figure 3-8 and follow instructions below.



Force Cable				Force Arm		
Part No.	Range Max.	Dia. (In.)	Length (In.)	Part No.	Range	Radius
2000-201-1	100 Lb.	1/16	16	2000-211-0	250 Lb.	12 In.
2000-201-2	250 Lb.	1/8	16	2000-211-0	250 Lb.	12 In.
2000-201-3	500 Lb.	5/32	16	2000-212-0	2000 Lb.	12 In.
2000-201-4	2000 Lb.	3/8	16	2000-212-0	2000 Lb.	12 In.

Force Gage Model	Force Gage Spacer Part No.
Hunter L	2000-183
Hunter D	N/A
Chatillon DPP	2000-183
Chatillon DPPH	2000-183 & 2000-184

Figure 3-8. Force Test Setup for Tension (Sheet 1)

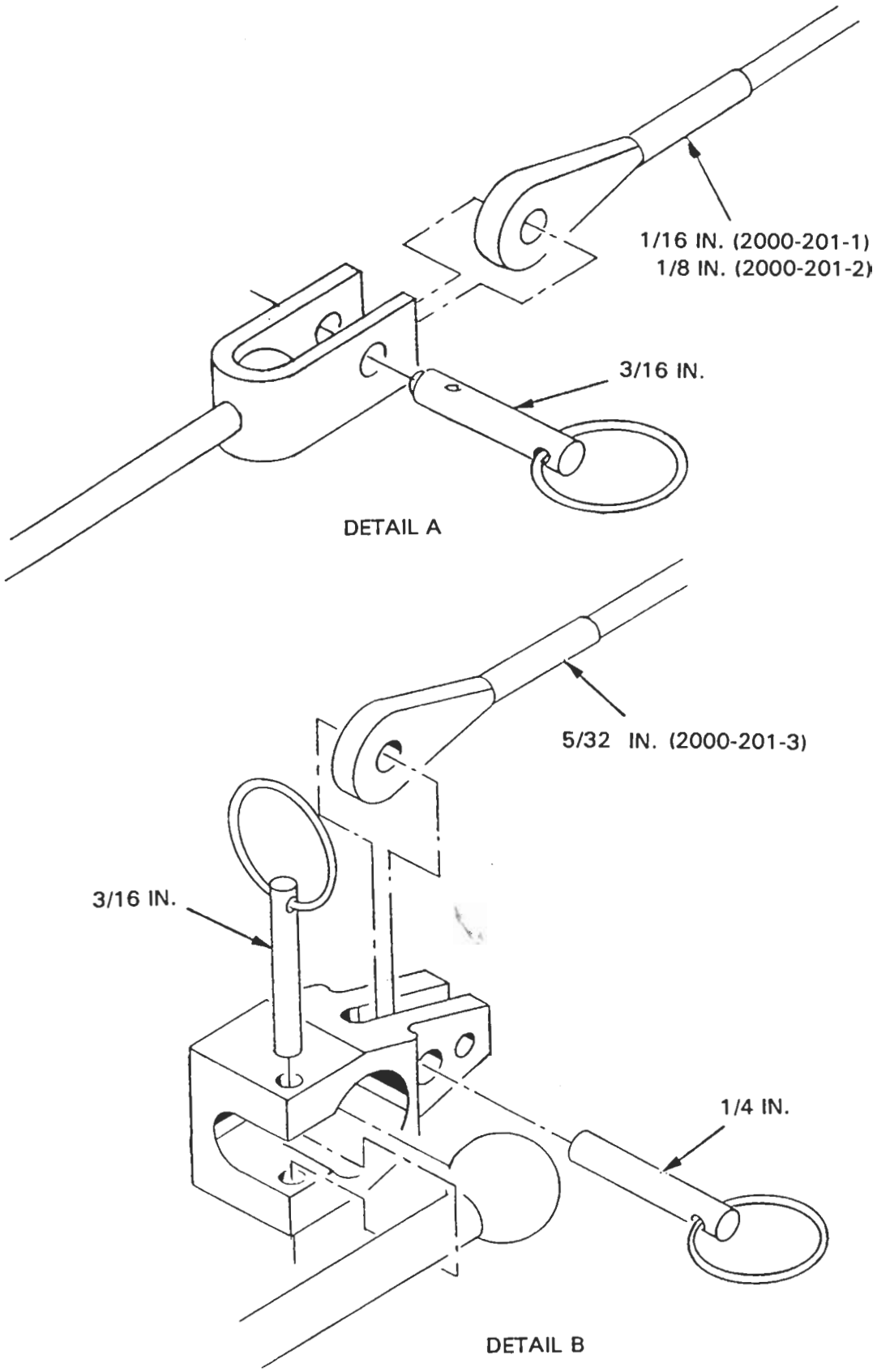


Figure 3-8. Force Test Setup for Tension (Sheet 2)

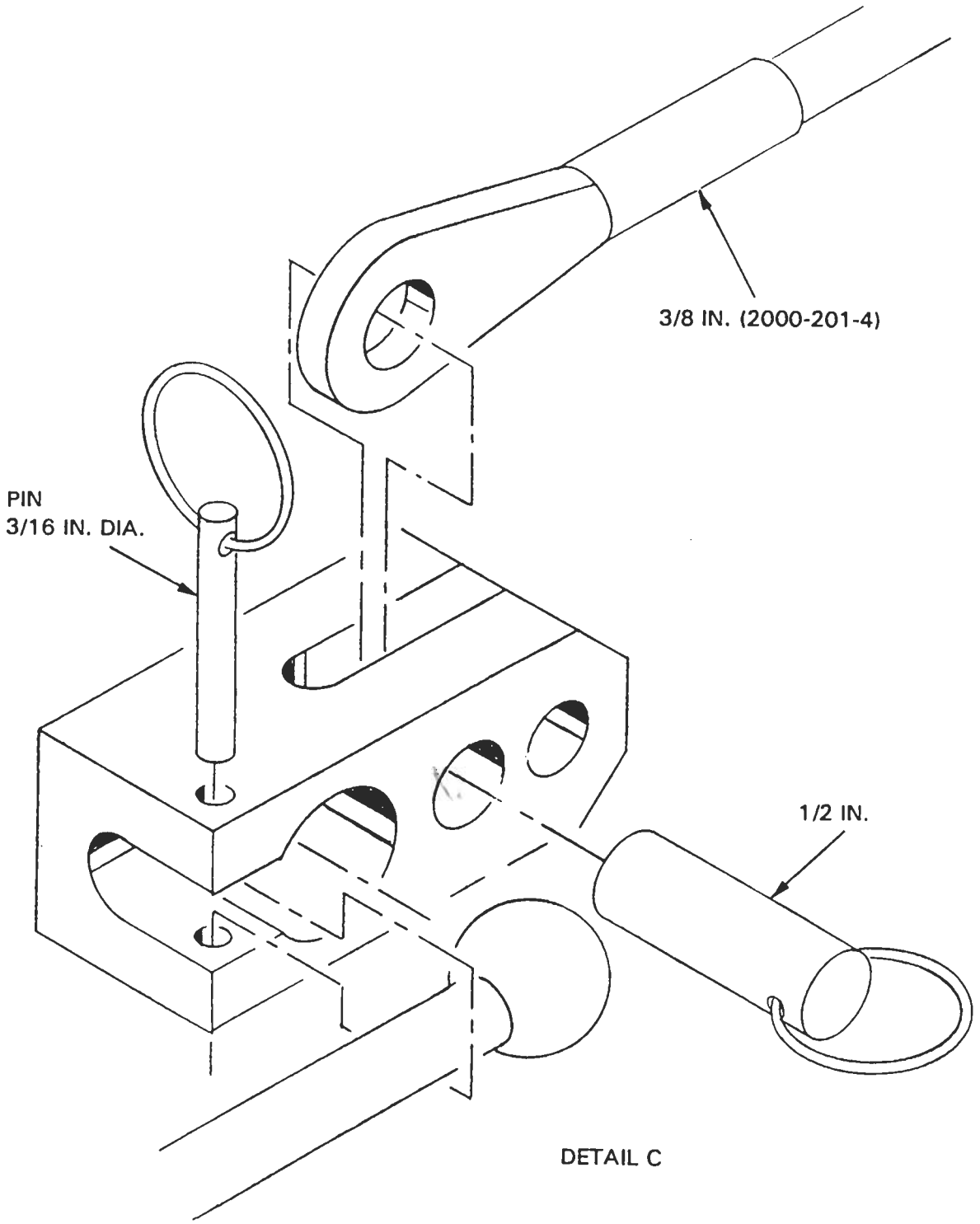


Figure 3-8. Force Test Setup for Tension (Sheet 3)

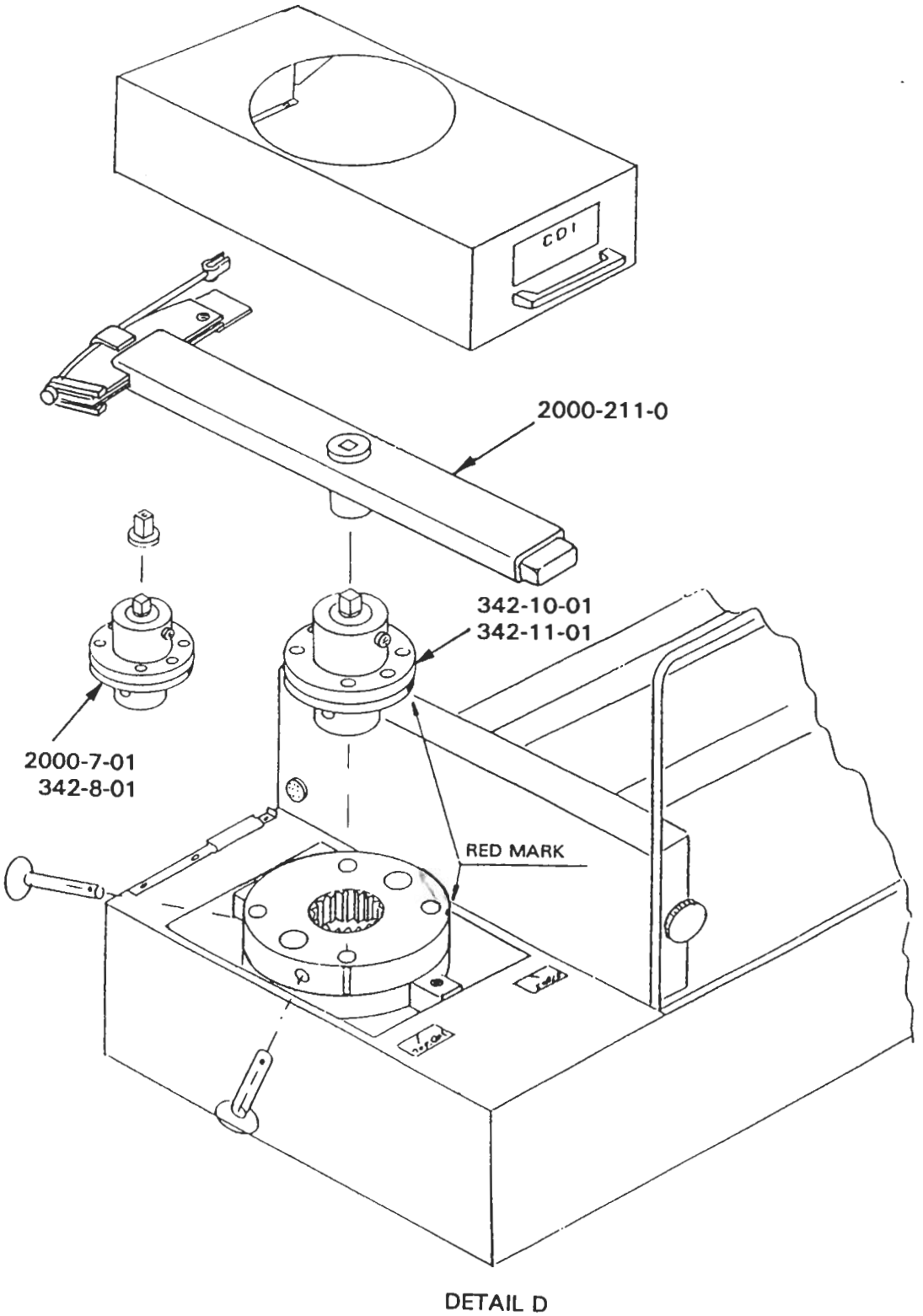


Figure 3-8. Force Test Setup for Tension (Sheet 4)

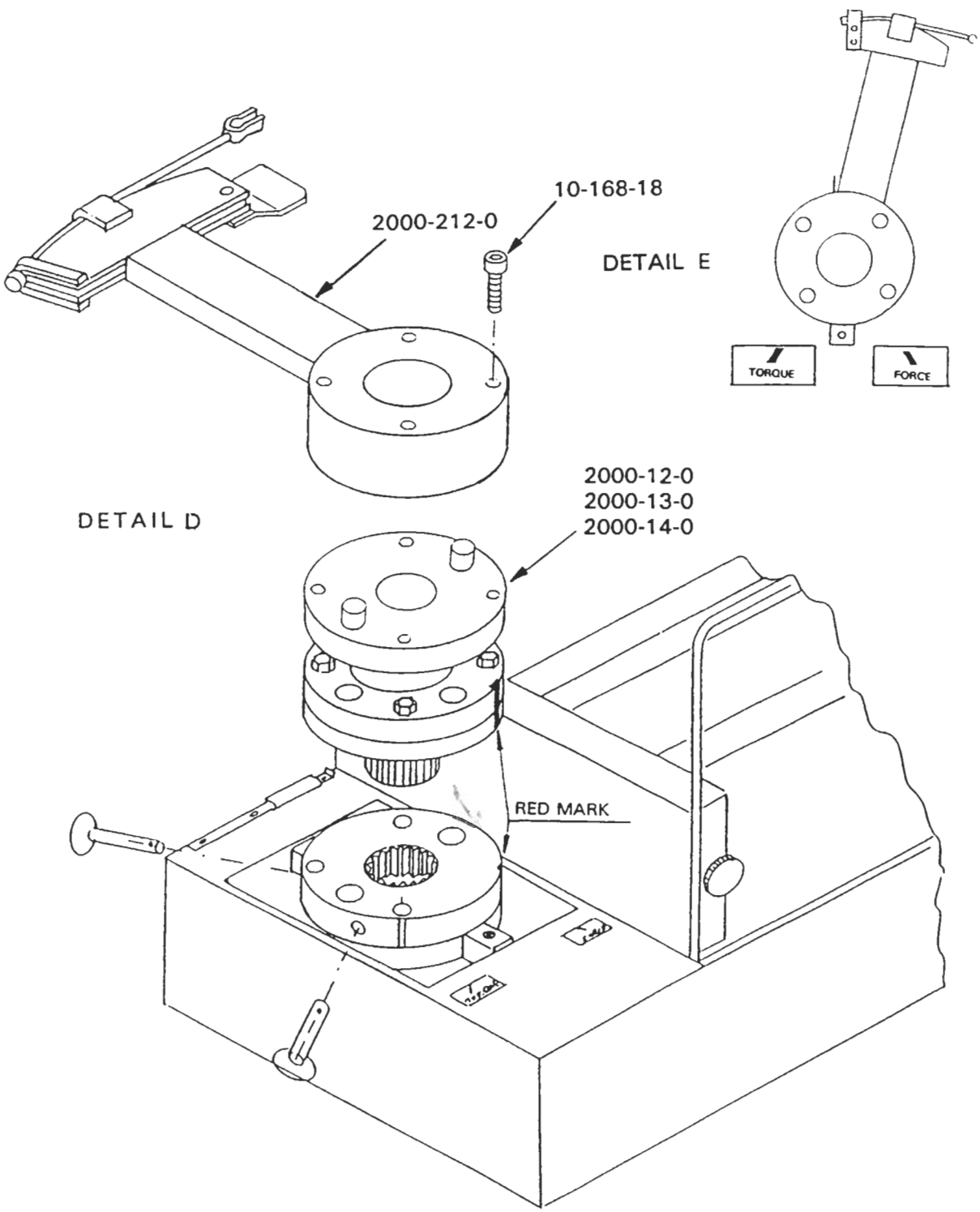


Figure 3-8. Force Test Setup for Tension (Sheet 5)

1) Install the appropriate transducer assembly shown in Figure 3-8, sheets 4 and 5. Make sure the orientation mark is aligned with the FORCE label.

2) Plug the transducer cable on the High Torque Calibrator into the transducer.

WARNING

Make sure that the safety shield is positioned securely prior to use of the High Torque Calibrator. Do not operate the calibrator unless the safety shield is in place.

3) Close the transducer cover by placing transducer cover over transducer assembly and make sure the clear safety shield is in place on the High Torque Station.

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

4) With the Computest powered (input voltage applied to back panel connector) press the POWER button on the front of the Computest. Allow 30 minutes for the Computest to warm up and stabilize.

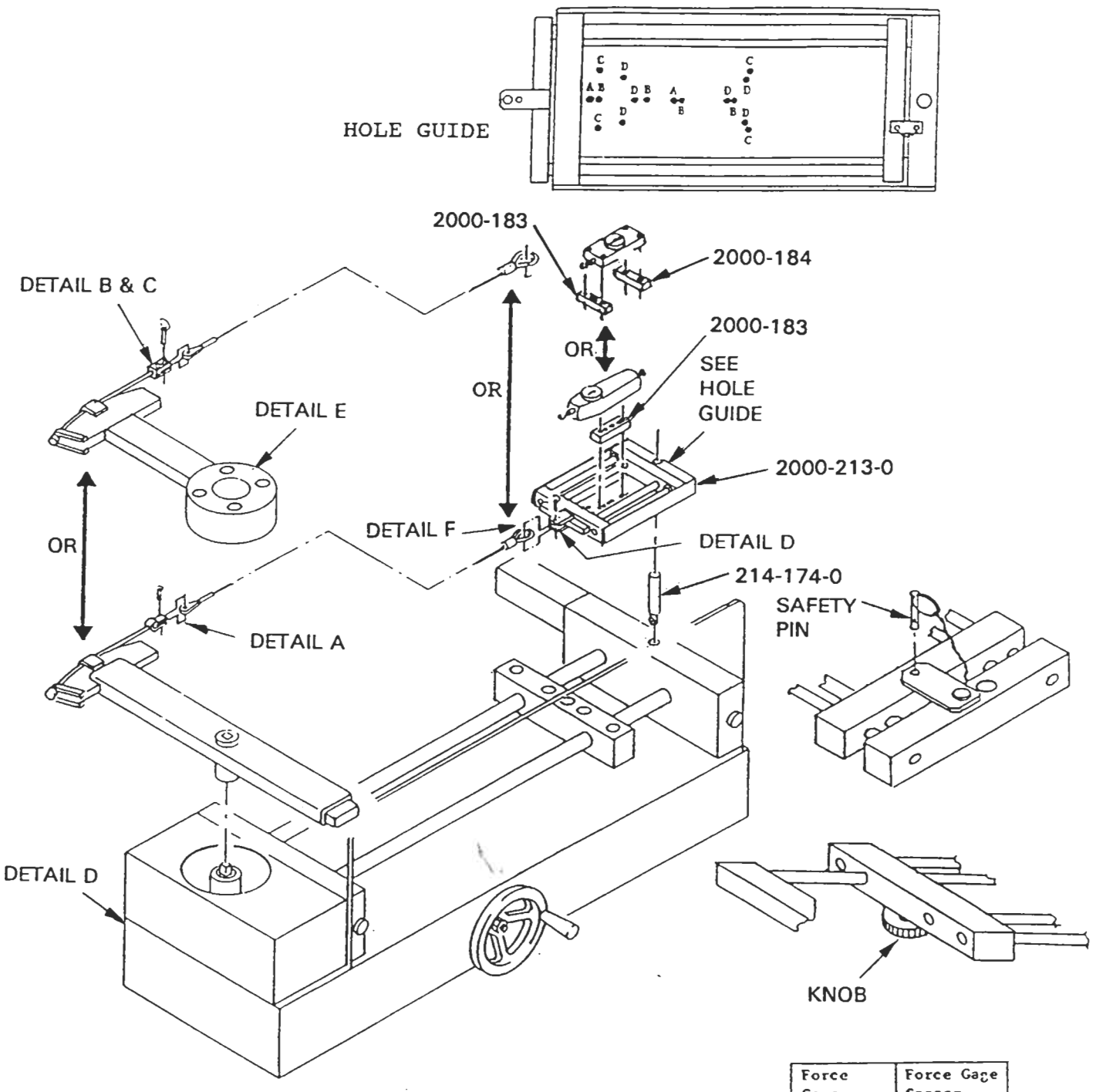
5) Make sure the proper indicator on the HIGH TORQUE STATION indicator (21) is illuminated. It should agree with the transducer that is installed.

6) Select the track mode by pressing MODE button (15).

7) Make sure the correct measurement has been selected and that FORCE has been selected. If required, change the measurement by pressing the UNIT button (19) and select FORCE by pressing the SELECT button (18).

8) Install appropriate force arm as shown in Figure 3-8, sheets 4 and 5. To use force arm for setup Detail D, the transducer assembly top drive plate must be removed for installation of force arm Part # 2000-212-0. Set the top drive plate and four screws aside and attach the force arm with four 3/8-16 x 3 inch long socket head cap screws (Part # 10-168-18) as shown. Align the orientation mark on the force arm with the orientation mark on the transducer assembly.

9) Using the appropriate spacer(s) (Figure 3-8, sheet 1, Table) and following the hole guide diagram (Figure 3-8, sheet 1), mount the test instrument (TI) on the force gage support (Part # 2000-180-0) and secure.



Force Cable				Force Arm		
Part No.	Range Max.	Dia. (In.)	Length (In.)	Part No.	Range	Radius
2000-201-1	100 Lb.	1/16	16	2000-211-0	250 Lb.	12 In.
2000-201-2	250 Lb.	1/8	16	2000-211-0	250 Lb.	12 In.
2000-201-3	500 Lb.	5/32	16	2000-212-0	2000 Lb.	12 In.
2000-201-4	2000 Lb.	3/8	16	2000-212-0	2000 Lb.	12 In.

Force Gage Model	Force Gage Spacer Part No.
Hunter L	2000-183
Hunter D	N/A
Chatillon DPP	2000-183
Chatillon DPPII	2000-183 & 2000-184

Figure 3-9. Force Test Setup for Compression (Sheet 1)

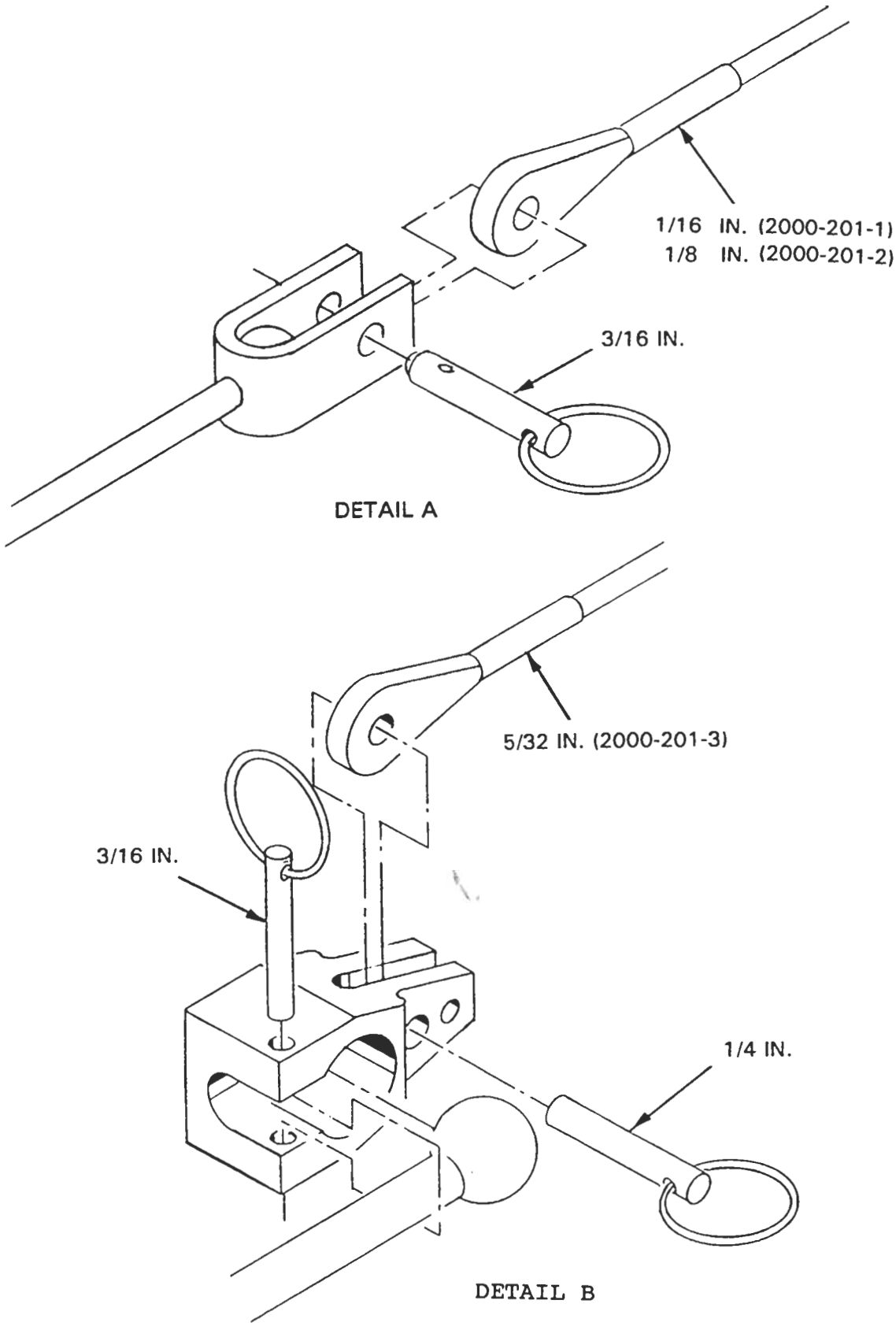


Figure 3-9. Force Test Setup for Compression (Sheet 2)

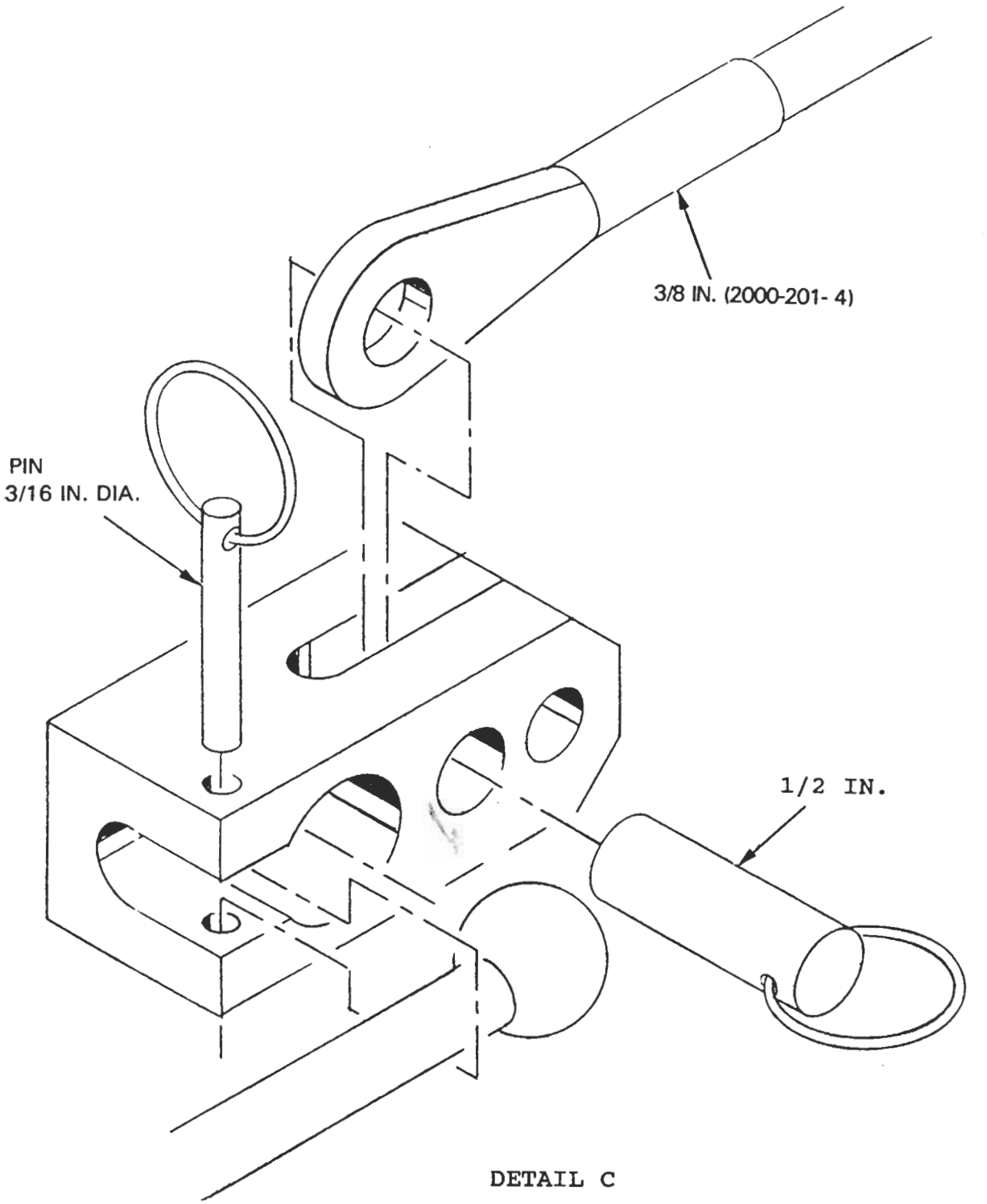


Figure 3-9. Force Test Setup for Compression (Sheet 3)

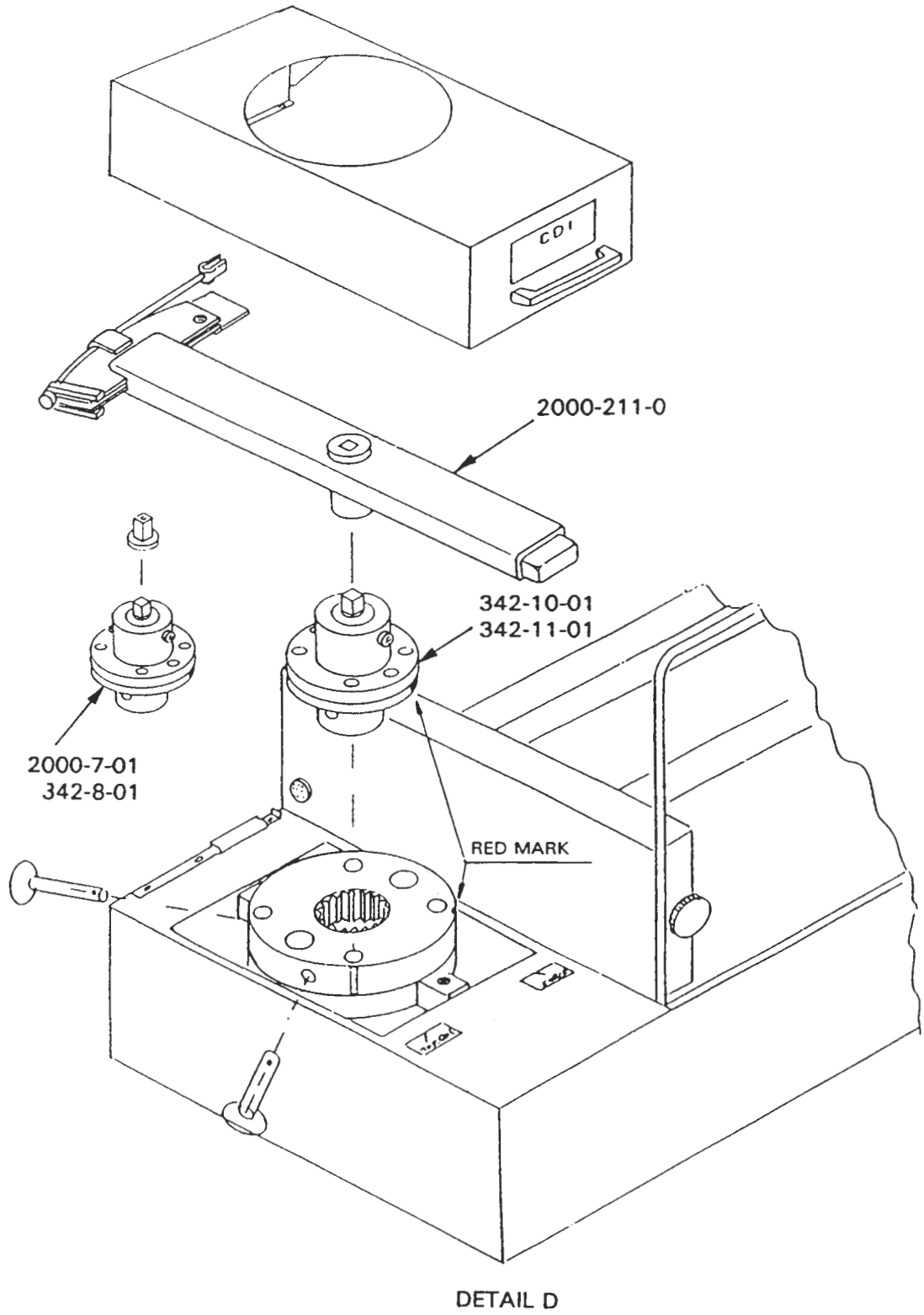


Figure 3-9. Force Test Setup for Compression (Sheet 4)

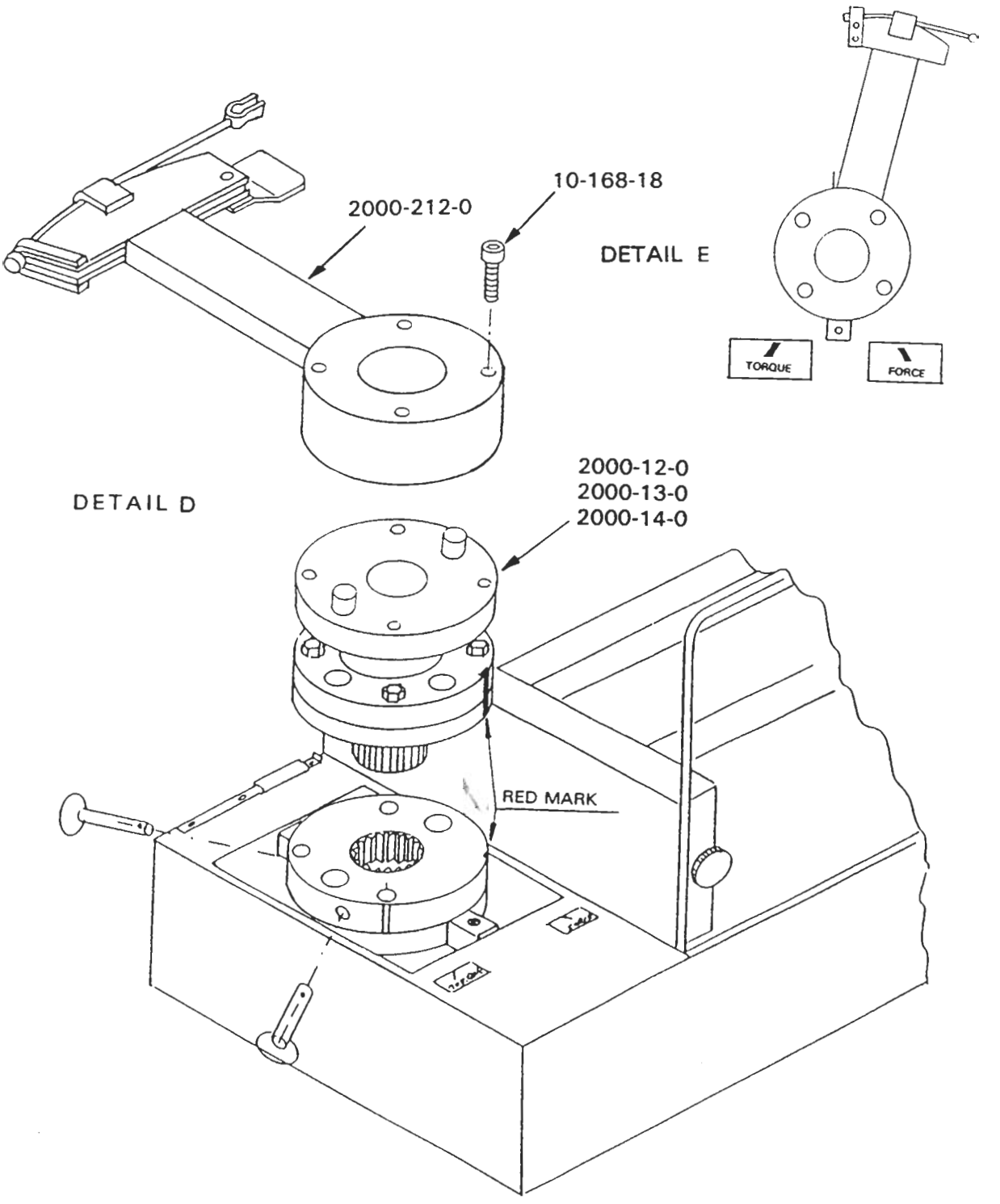
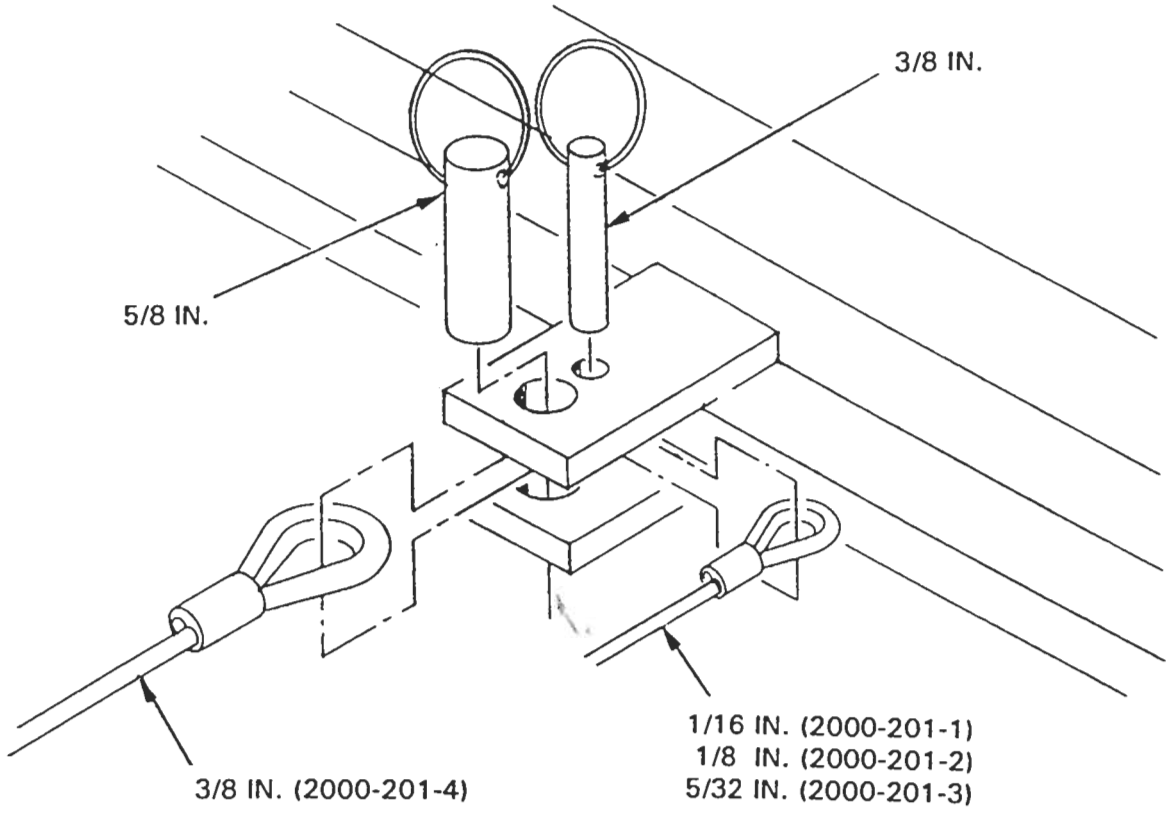


Figure 3-9. Force Test Setup for Compression (Sheet 5)



DETAIL F

Figure 3-9. Force Test Setup for Compression (Sheet 6)

10) Engage the force gage support assembly with the reaction pin.

11) Attach end of cable to hook of tool to be tested.

12) Observing the tested tool's display, operate crank on front of tester to straighten the cable to the point where the unit under test still shows no load (zero). When the indicator on the tested unit starts moving, showing initial load, stop, back up to get it back to "0" (zero) and at that point ZERO TARE digital indicator of TFC unit. Proceed with the active testing.

13) Operate crank on front of tester to apply force to tool being tested and compare digital display (16) with indication on tool being tested to determine if the tool is within specification. Refer to paragraph 3.5 if data is to be printed.

14) After testing is complete, if next tool is within the same range, repeat steps 9 through 13. Otherwise repeat steps 1 through 13 for tools that are not within the same range.

WARNING

The Compression Gage Adapter (P/N 2000-213-0) has a lock to prevent the adapter from sliding when not in use. Check the adapter prior to handling to make sure lock is engaged. Failure to do this can result in injury to the hand or fingers.

b. For compression force test set up the High Torque Station as shown in Figure 3-9 and follow instructions below.

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

1) Install the appropriate transducer for the tool to be tested (see Figure 3-9 for range of transducer). Make sure the transducer adapter is oriented so the mark aligns with FORCE.

2) Plug the transducer cable on the transducer High Torque Calibrator into the transducer.

3) Close the transducer cover by placing transducer cover over the transducer assembly, and make sure the clear shield is in place on the High Torque Station.

4) Make sure the proper indicator on the HIGH TORQUE STATION indicator (21) is illuminated. It should agree with the transducer that is installed.

5) Select the track mode by pressing MODE button (15).

6) Make sure the correct measurement has been selected and that FORCE has been selected. If required, change the measurement by pressing the UNIT button (19) and select FORCE by pressing the SELECT button (18).

7) Install appropriate force arm as shown in Figure 3-9, sheets 4 and 5. To use force arm Part # 2000-212-0, remove the transducer assembly top drive plate. Set the top plate and screws aside. Attach the force arm to the transducer with four 3/8-16 x 3 inch long socket head cap screws (Part # 10-168-18). Align the transducer and force arm to FORCE orientation marks on the drive plate.

8) Using the appropriate spacer(s) (Figure 3-9, sheet 1, Table) mount the test instrument (TI) on the compression gage adapter (Part # 2000-213-0) and secure.

9) Engage the force gage support assembly with the reaction pin.

10) Attach end of cable to support assembly making sure the setup is as shown in Figure 3-9.

11) Observing the tested tool's display, operate crank on front of tester to straighten the cable to the point where the unit under test still shows no load (zero). When the indicator on the tested unit starts moving, showing initial load, stop, back up to get it back to "0" (zero) and at that point ZERO TARE digital indicator of TFC unit. Proceed with the active testing.

NOTE

Compression gage adapter must be supported at the free end by the slide bar and leveled with level adjust knob as shown in Figure 3-9, sheet 1.

12) Operate crank on front of tester to apply force to tool being tested and compare digital display (16) with indication on tool being tested to determine if the tool is within specification. Refer to paragraph 3.5 if data is to be printed.

13) After testing is complete, if next tool is within the same range, repeat steps 8 through 12. Otherwise repeat steps 1 through 12 for tools that are not within the same range.

3.4 ACCURACY CHECK PROCEDURE

3.4.1 Low Torque Station Multiple Transducer

Check the accuracy of the Low Torque Station Transducers as follows:

CAUTION

Torque Transducers are sensitive measuring instruments "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

a. Refer to Table 3-4 to determine which calibration arm, hanger and weights are to be used in the setup as shown in Figure 3-10.

b. Connect the Low Torque Station cable to the Multiple Torque Transducer then to the back of the Computest at the MULTIPLE TRANSDUCER port. (See Figure 3-2, index 3).

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

c. With the Computest powered (input voltage applied to the back panel connector) press the POWER button (Figure 3-1, index 1) on the front panel of Computest. Allow 30 minutes for Computest to warm up, go through self-test and stabilize prior to use.

d. Set LOW TORQUE SECTION switch (23) on front panel to the transducer to be tested. The transducer in use on the Multiple Torque Transducer will light up to match the one selected on the Computest front panel.

e. Select track mode by pressing MODE button (15).

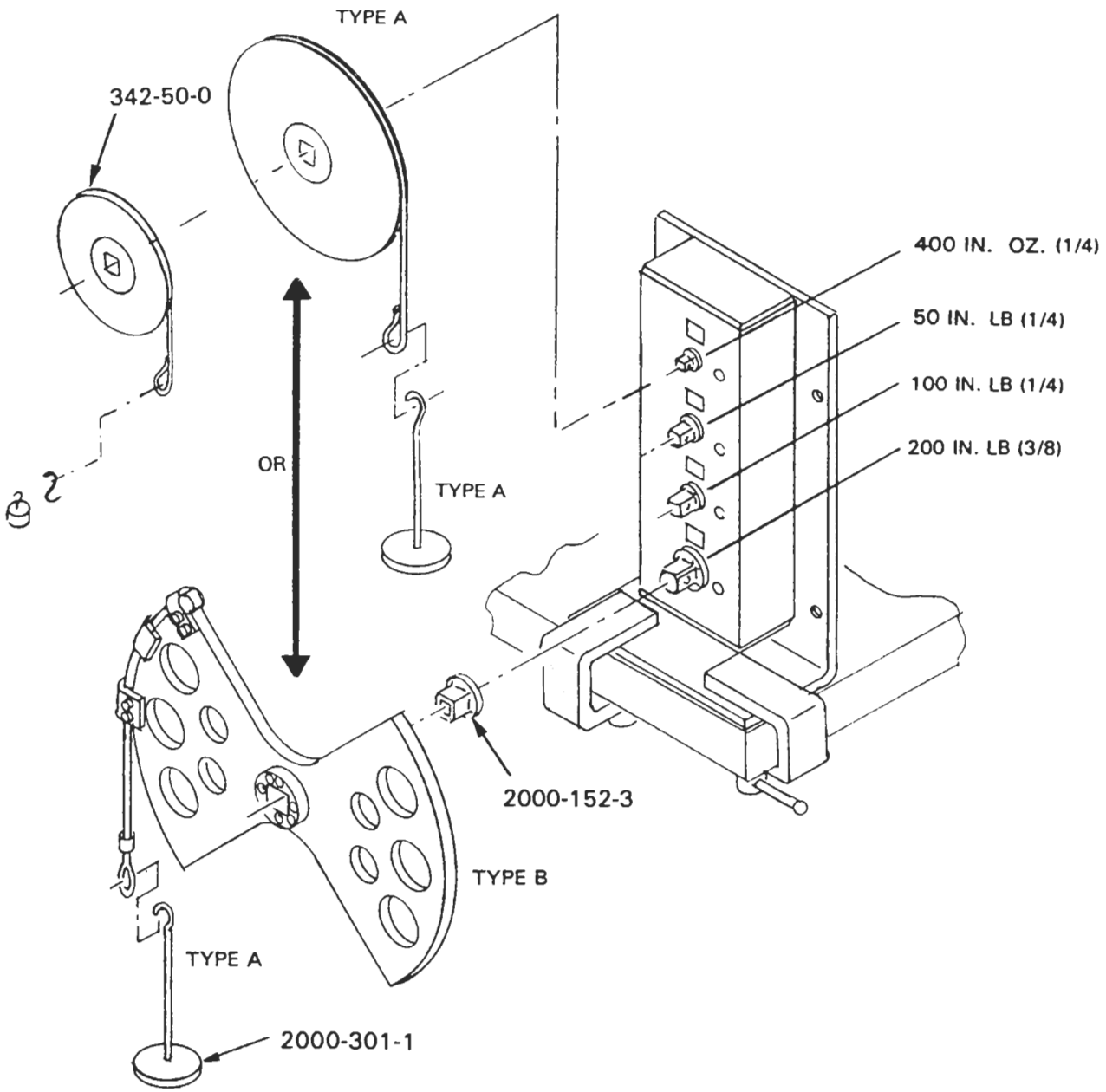


Figure 3-10. Low Torque Station Accuracy Check Setup

f. Select the correct unit of measure for the transducer being checked by pressing the UNIT select button (19).

g. Select torque by pressing the SELECT button (18).

h. Refer to Table 3-4 and attach adpaters (if required), calibration arms and hanger to the transducer.

i. Apply maximum weight required, three (3) times, on hanger for the highest torque range of the transducer being checked. This is necessary to exercise the transducer for maximum accuracy.

j. Remove all weights and hanger. Press ZERO TARE button (10) on Computest front panel.

k. Then place the hanger and applicable weights as they are listed in Table 3-4 at each accuracy check point for the transducer. Check the value indicated at each check point against Table 3-5.

l. Remove calibration arm and hanger and place them on the transducer in the opposite direction. Repeat steps i through k for the opposite direction.

m. If the transducer at any check point, in either direction, does not meet the accuracy specified in Table 3-5, recalibrate per Section IV.

3.4.2 Low Torque Station Single Range Transducers to 250 ft. lb.

a. To check accuracy of Low Torque Station Digital Indicator, see Section 3.4.3.

NOTE

The 375 in. lb., 750 in. lb., 125 ft. lb., and 250 ft. lb. transducer assemblies must be checked for accuracy and, if required, calibrated to the low torque station digital display (Computest).

b. Check the accuracy of the 375 in. lb., 750 in. lb., 125 ft. lb. and 250 ft. lb. to the Low Torque Station Digital Indicator.

Table 3-4. Calibration Arm And Weight Matrix

NOTES: 1. Unless otherwise noted all weights shown are in pounds (lbs).
2. To check 0.5 to 20 in. oz. accuracy on the 25 in. lb. transducer assembly, use 2.5 inch calibration arm, (Part # 342-50-0) a 0.2 oz. hanger weight and oz. weights. The transducer assembly can not be calibrated at these points.

TRANSDUCER RANGE	TRANSDUCER POINTS (IN. OZ.)	OZ. WEIGHT AND QUANTITY				TOTAL WEIGHT (OZ.)
		0.2	2	4	8	
25 in. lb.	* 0.5 in. oz.	1				0.2
(400 in. oz.)	* 5.0 in. oz.		1			2.0
	*10.0 in. oz.			1		4.0
	*20.0 in. oz.				1	8.0

TRANSDUCER RANGE	TRANSDUCER POINTS	ARM TYPE	HANGER TYPE	WEIGHT AND QUANTITY								TOTAL WEIGHT
				1/4	1/2	1	2	5	10	20	50	
25 in. lb.	2.5 in. lb.	A	A									0.50
(400 in. oz.)	10 in. lb.	A	A		1	1						2.00
	* 15 in. lb.	A	A		1	2						3.00
	20 in. lb.	A	A		1	3						4.00
	25 in. lb.	A	A		1	4						5.00
50 in. lb.	5 in. lb.	A	A		1							1.00
	20 in. lb.	A	A		1	1	1					4.00
	* 30 in. lb.	A	A		1	1	2					6.00
	40 in. lb.	A	A		1	1	3					8.00
	50 in. lb.	A	A		1	1	4					10.00
100 in. lb.	10 in. lb.	A	A		1	1						2.00
	40 in. lb.	A	A		1	2		1				8.00
	* 60 in. lb.	A	A		1	2	2	1				12.00
	80 in. lb.	A	A		1	2	4	1				16.00
	100 in. lb.	A	A		1	4	5	1				20.00

Table 3-4. Calibration Arm And Weight Matrix (Continued)

TRANSDUCER RANGE	TRANSDUCER POINTS	ARM TYPE	HANGER TYPE	WEIGHT AND QUANTITY								TOTAL WEIGHT
				1/4	1/2	1	2	5	10	20	50	
200 in. lb.	20 in. lb.	B	A		1	1						2.00
	80 in. lb.	B	A		1	2		1				8.00
	*120 in. lb.	B	A		1	2	2	1				12.00
	160 in. lb.	B	A		1	2	4	1				16.00
	200 in. lb.	B	A		1	4	5	1				20.00
375 in. lb.	37.5 in. lb.	B	A	1		1	1					3.75
	150 in. lb.	B	A	2		2	1	2				15.00
	*225 in. lb.	B	A	2	1	2	2	3				22.50
	300 in. lb.	B	A	2	2	2	3	4				30.00
	375 in. lb.	B	A	2	3	2	4	5				37.50
750 in. lb.	75 in. lb.	B	B									7.50
	300 in. lb.	B	B		1		1	2	1			30.00
	*450 in. lb.	B	B		1		1	3	2			45.00
	600 in. lb.	B	B		1		1	2	4			60.00
	750 in. lb.	B	B		1		1	5	4			75.00
125 ft. lb.	12.5 ft. lb.	B	C									15.00
	50 ft. lb.	B	C					1		2		60.00
	* 75 ft. lb.	B	C					1	1	3		90.00
	100 ft. lb.	B	C					1	2	4		120.00
	125 ft. lb.	B	C					1	3	5		150.00
250 ft. lb.	25 ft. lb.	B	C					3				30.00
	100 ft. lb.	B	C					1			2	120.00
	*150 ft. lb.	B	C					1	2	2	2	180.00
	200 ft. lb.	B	C					1	2		4	240.00
	250 ft. lb.	B	C					1		4	4	300.00

Table 3-4. Calibration Arm And Weight Matrix (Continued)

TRANSDUCER RANGE	TRANSDUCER POINTS	ARM TYPE	HANGER TYPE	WEIGHT AND QUANTITY								TOTAL WEIGHT
				1/4	1/2	1	2	5	10	20	50	
500 ft. lb.	50 ft. lb.	C	C									15.00
	200 ft. lb.	C	C					1		2		60.00
	* 300 ft. lb.	C	C					1	1	3		90.00
	400 ft. lb.	C	C					1	2	4		120.00
	500 ft. lb.	C	C					1	3	5		150.00
1000 ft. lb.	100 ft. lb.	C	C					3				30.00
	400 ft. lb.	C	C					1			2	120.00
	* 600 ft. lb.	C	C					1	2	2	2	180.00
	800 ft. lb.	C	C					1	2		4	240.00
	1000 ft. lb.	C	C					1		4	4	300.00
2000 ft. lb.	200 ft. lb.	C	D					2				60.00
	800 ft. lb.	C	D					2		4	2	240.00
	*1200 ft. lb.	C	D					2		5	4	360.00
	1600 ft. lb.	C	D					2	2	5	6	480.00
	2000 ft. lb.	C	D					2	4	5	8	600.00

NOTES: 1. Calibration Arm A has a 5 inch effective radius (P/N 2000-151-0)
Calibration Arm B has a 10 inch effective radius (P/N 2000-152-0)
Calibration Arm C has a 40 inch effective radius (P/N 2000-154-0)

2. Hanger A weighs 0.5 lb (P/N 2000-301-1)
Hanger B weighs 7.5 lb (P/N 2000-304)
Hanger C weighs 15 lb (P/N 2000-302)
Hanger D weighs 50 lb (P/N 2000-303)

3. *This is an accuracy check point only. Calibrate transducers on the other four transducer points only.

Table 3-5. Accuracy Limits

REQUIREMENT: .5% OF INDICATED VALUE CLOCKWISE & COUNTER-CLOCKWISE				
TRANSDUCER	% OF SCALE	TRANSDUCER POINT	TOLERANCE MINIMUM	TOLERANCE MAXIMUM
25 in. lb.	10	2.5	2.488	2.51
	40	10	9.95	10.05
	60	15	14.93	15.08
	80	20	19.90	20.10
	100	25	24.88	25.13
50 in. lb.	10	5	4.975	5.03
	40	20	19.90	20.10
	60	30	29.85	30.15
	80	40	39.80	40.20
	100	50	49.75	50.25
100 in. lb.	10	10	9.95	10.05
	40	40	39.80	40.20
	60	60	59.70	60.30
	80	80	79.60	80.40
	100	100	99.50	100.50
200 in. lb.	10	20	19.90	20.10
	40	80	79.60	80.40
	60	120	119.40	120.60
	80	160	159.20	160.80
	100	200	199.00	201.00

Table 3-5. Accuracy Limits (Continued)

TRANSDUCER	% OF SCALE	TRANSDUCER POINT	TOLERANCE MINIMUM	TOLERANCE MAXIMUM
375 in. lb.	10	37.50	37.31	37.69
	40	150	149.25	150.75
	60	225	223.88	226.13
	80	300	298.50	301.50
	100	375	373.13	376.88
750 in. lb.	10	75	74.63	75.38
	40	300	298.50	301.50
	60	450	447.75	452.25
	80	600	597.00	603.00
	100	750	746.25	753.75
125 ft. lb.	10	12.50	12.44	12.56
	40	50	49.75	50.25
	60	75	74.63	75.38
	80	100	99.50	100.50
	100	125	124.38	125.63
250 ft. lb.	10	25	24.88	25.13
	40	100	99.50	100.50
	60	150	149.25	150.75
	80	200	199.00	201.00
	100	250	248.75	251.25

Table 3-5. Accuracy Limits (Continued)

TRANSDUCER	% OF SCALE	TRANSDUCER POINT	TOLERANCE MINIMUM	TOLERANCE MAXIMUM
500 ft. lb.	10	50	49.75	50.25
	40	200	199.00	201.00
	60	300	298.50	301.50
	80	400	398.00	402.00
	100	500	497.50	502.50
1000 ft. lb.	10	100	99.50	100.50
	40	400	398.00	402.00
	60	600	597.00	603.00
	80	800	796.00	804.00
	100	1000	995.00	1005.00
2000 ft. lb.	10	200	199.00	201.00
	40	800	796.00	804.00
	60	1200	1194.00	1206.00
	80	1600	1592.00	1608.00
	100	2000	1990.00	2010.00

3.4.3 High Torque Station

Check the accuracy of the High Torque Station Transducers as follows:

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

a. Mount the transducer assembly in the calibration block assembly by aligning the white orientation marks. Secure wtih two quick release pins (Part # 2000-195-12). Refer to Table 3-4 to determine which calibration arm, hanger and weights are to be used in setup as shown in Figure 3-11 or 3-12.

WARNING

Both of the quick release pins must be fully engaged when the calibration block assembly is used. Failure to do so may result in personal injury.

WARNING

The calibration/accuracy stand, fixtures and arms must be set up and used as illustrated in figures 3-11 and 3-12. Failure to set up and use the equipment as illustrated will cause either an out-of-balance distribution of weight and/ or unsafe support of the weight. Personal injury may result from the improper setup and/or use of this equipment.

b. Plug the single transducer cable into the transducer then into the back of Computest at the SINGLE TRANSDUCER port. (Figure 3-2, index 4).

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

c. With the Computest powered (input voltage applied to the back panel connector) press the POWER button (Figure 3-1, index 1) on the front panel of Computest. Allow 30 minutes for Computest to warm up, go through self-test and stabilize prior to use.

d. HIGH TORQUE/FORCE SECTION light (21) that matches the transducer being used will be lit on the front panel of Computest.

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

e. Select track mode by pressing MODE button (15).

f. Select the correct unit of measure for the transducer being checked by pressing the UNIT select button (19).

g. Select torque by pressing the SELECT button (18).

WARNING

Both of the quick release pins must be fully engaged to hold the transducer assembly on the calibration block assembly prior to placing calibration arms, hangers and weights on transducer assembly. Failure to do so may result in personal injury.

h. Refer to Table 3-4 and attach adapters (if required), calibration arm and hanger to the transducer.

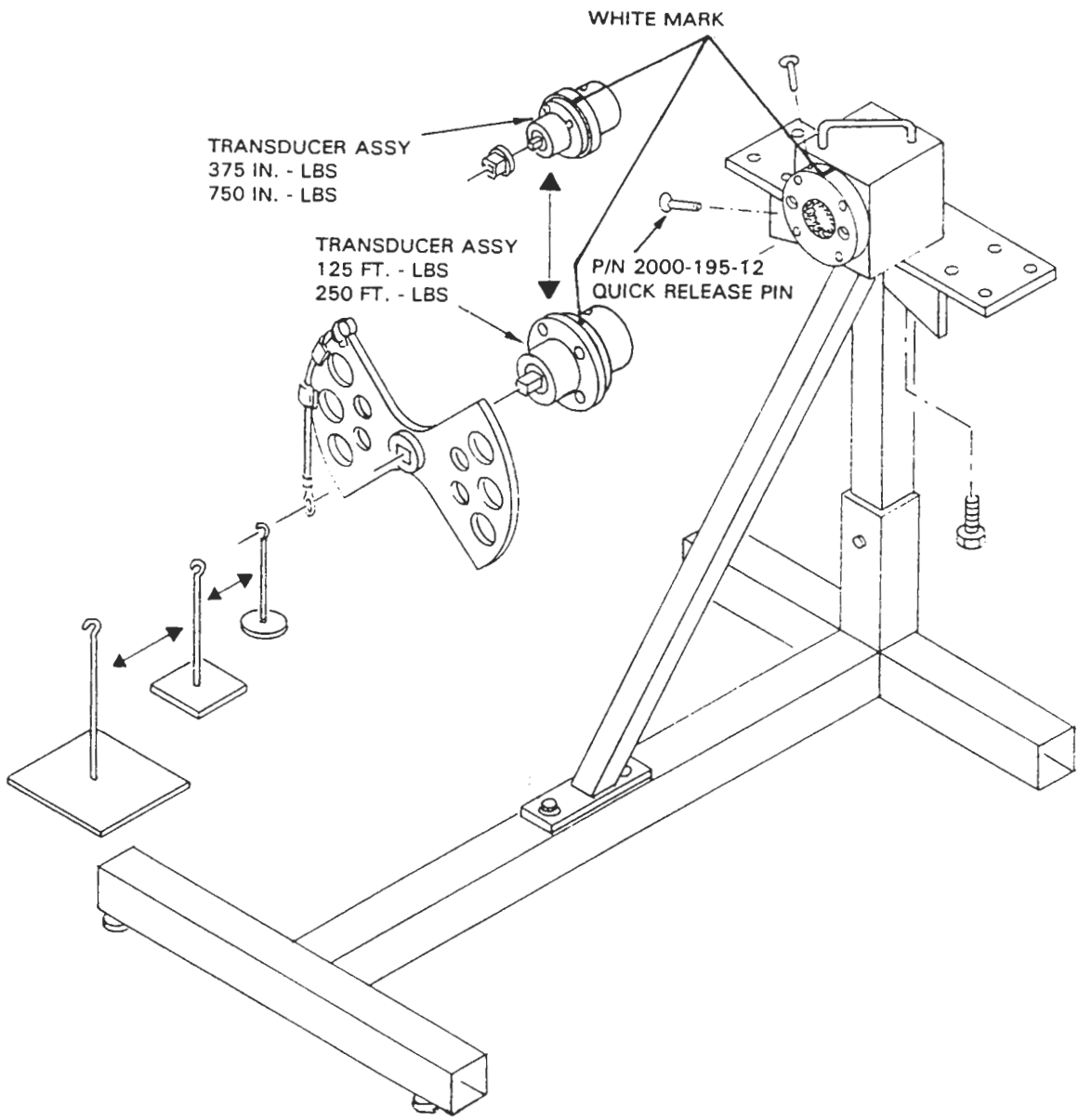


Figure 3-11. High Torque Station Accuracy Check Setup for 375 In. Lb, 750-In. Lb, 125 Ft. Lb. and 250 Ft. Lb. Transducers

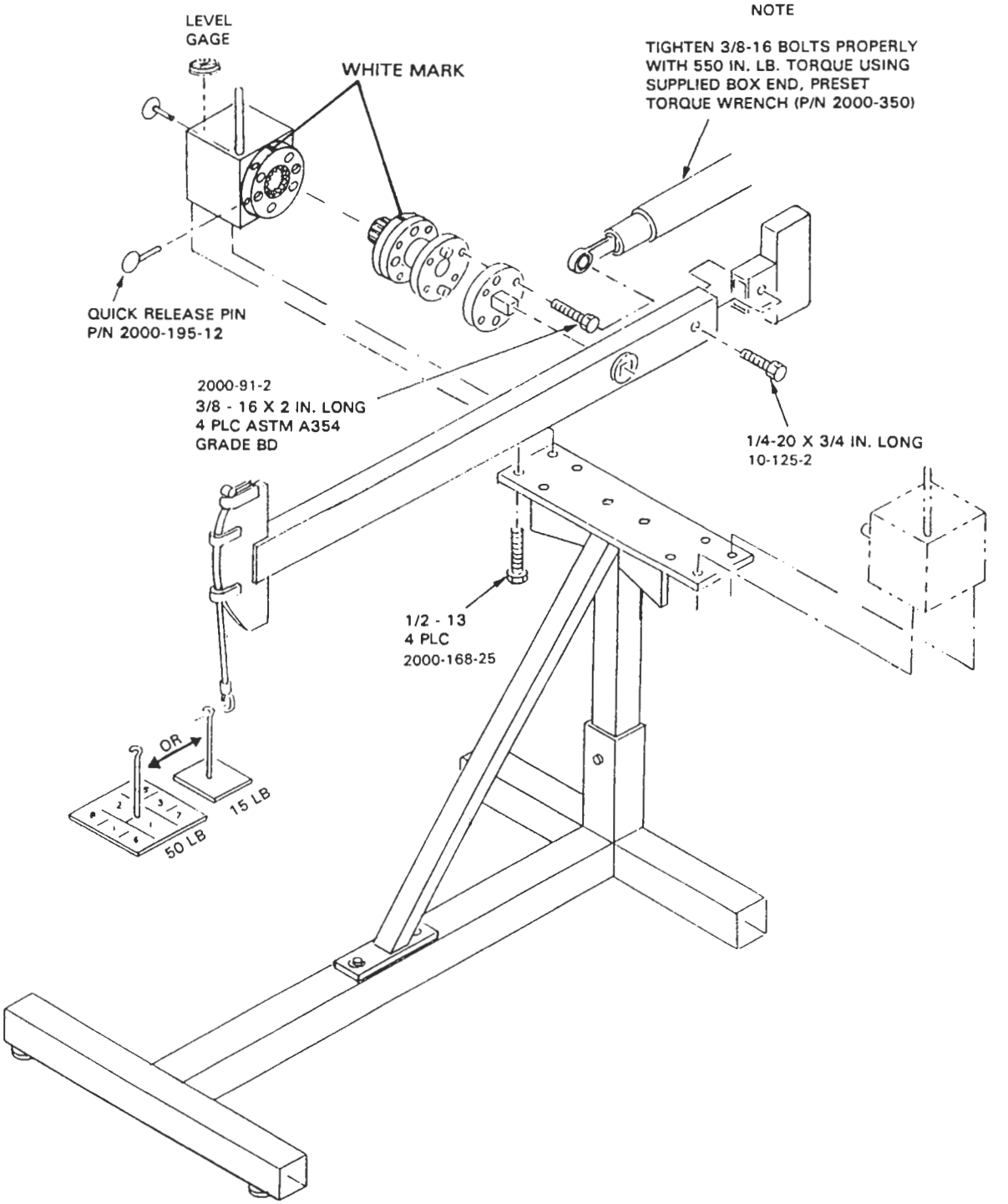


Figure 3-12. High Torque Station Accuracy Check Setup for 500 Ft. Lb, 1000 Ft. Lb. and 2000 Ft. Lb. Transducers

i. Apply maximum weight required, three (3) times, on hanger in the direction being checked for the highest torque range of the transducer being tested. This is necessary to exercise the transducer for maximum accuracy.

j. Remove all weights and hanger. Press ZERO TARE button (10) on Computest front panel.

k. Then place the hanger and applicable weights as they are listed in Table 3-5 at each accuracy check point for the transducer. Check the value indicated at each check point against Table 3-5.

l. Remove calibration arm and hanger. Place them on the transducer in the opposite direction. Repeat steps i through k for the opposite direction.

m. If the transducer at any check point in either direction does not meet the accuracy specified in Table 3-5, calibrate per Section IV.

3.5 PRINTER OPERATION

Operate the printer as follows:

a. Make sure that the Printer Connector cable is connected to the PRINTER PORT (Figure 3-2, index 5) in back of the Computest and to the CABLE PORT on the printer.

b. To print data displayed on the Computest digital display (Figure 3-1, index 16) press the SEND button (index 13) on the Computest.

c. If the data most recently obtained has cleared off the digital display (16), press the RECALL button (11) on the Computest front panel and the data will reappear. Then press the SEND button (13) to print data.

For a detailed operation of the printer, see Brother M-1109 Impact Dot Matrix Printer manual.

SECTION IV

CALIBRATION

4.1 INTRODUCTION

The calibration of the High and Low Torque Station Transducers is described in the following procedure. Calibration is only necessary if a Transducer fails the accuracy check procedure in paragraph 3.4.

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

NOTE

If a transducer is to be calibrated, a code must be used to enter the new calibration data into Computest. This feature is to prevent tampering with stored calibration data by unauthorized persons or the inadvertent entry or changing of calibration data. If any transducer requires calibration, notify the authorized person and request that the transducer be calibrated.

4.2 CALIBRATION PROCEDURE

4.2.1 Low Torque Station Multiple Transducers

Set up the Multiple Transducer as shown in Figure 3-10 and follow the procedure below:

a. Refer to Table 3-4 to determine which calibration arm, hanger and weights are to be used in the setup as shown in Figure 3-10. Attach the Low Torque Multiple Transducer to a sturdy anchored table top or calibration stand (P/N 2000-250-0).

WARNING

The calibration/accuracy stand, fixtures and arms must be set up and used as illustrated in figures 3-11 and 3-12. Failure to set up and use the equipment as illustrated will cause either an out-of-balance distribution of weight and/or unsafe support of the weight. Personal injury may result from the improper setup and/or use of this equipment.

b. Connect the Low Torque Station cable to the Multiple Transducer then to the back of Computest at the MULTIPLE TRANSDUCER port. (Figure 3-2, index 3).

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

c. With the Computest powered (input voltage applied to the back panel connector) press the POWER button (Figure 3-1, index 1) on the front panel of the Computest. Allow 30 minutes for the Computest to warm up, go through self-test and stabilize prior to use.

d. Set LOW TORQUE SECTION switch (23) on the front panel to the transducer to be calibrated. The transducer in use on the Multiple Torque Transducer will light up to match the one selected on the Computest front panel.

e. Select the track mode by pressing MODE button (15).

f. Select the correct unit of measure for the transducer being checked by pressing the UNIT select button (19).

g. Select torque by pressing the SELECT button (18).

h. Refer to Table 3-4 and attach adapters (if required), calibration arm and hanger to the transducer.

i. Apply maximum weight required, three (3) times, on hanger in the direction being checked, for the highest torque range of the transducer. This is necessary to exercise the transducer for maximum accuracy.

j. Remove all weights and the hanger. Press the ZERO TARE button (10) on Computest front panel.

k. Press CAL button (8) on Computest front panel. The display will show "CALIBRATION HAS BEEN SELECTED. ENTER YOUR PASS CODE".

l. To enter your pass code, press the VALUE button (3) and the display will show "CODE 1000". Next press either VALUE button (3) or (5) to change the first digit to the correct number (the one that corresponds to your code number). Move to the second digit by pressing the DIGIT button (6) and repeat the same procedure for changing the value of the second digit. Continue until the correct 4-digit number is on the display. When the number on the display matches your code number, press the ENTER button (4).

m. If the code entered is correct, the display will show "PASS CODE OK. SELECT ANY OPTION BY PRESSING UP OR DOWN BUTTON". (VALUE button (3) or (5)). If an incorrect code is entered the display will show "SORRY WRONG PASS CODE RETURNING TO MEASURING MODE". To try again repeat steps k. and l.

NOTE

When "ERASE" is selected, new calibration data can be entered into Computest. The new data entered will <u>not</u>, however, be stored into memory replacing the old data unless "step t" is followed.

n. Press the VALUE button (3) until "ERASE" shows on the display. To clear old calibration data, press ENTER button (4). The display will show "ALL CALIBRATION DATA FOR CURRENT TRANSDUCER ERASED".

o. Attach correct hanger and weights (refer to Table 3-4) for lowest calibration point shown on the chart.

NOTE

There are only 4 points in each direction, do not calibrate on the * point. This point is for accuracy check only.

NOTE

Always allow hanger to come to equilibrium prior to proceeding to the next step.

p. After the old data has been erased, press the VALUE button (3) until "ADD DATA" appears on the display.

q. After hanger reaches equilibrium, press ENTER button (4). The display will show "CALIBRATION POINT HAS BEEN ENTERED ADD ADDITIONAL DATA".

r. Enter the correct data for the applied load per Table 3-4 by pressing the VALUE button (3). The display will show "+...." with the first "." blinking (active digit). If calibrating in the clockwise direction, change the first active digit by pressing the VALUE

button (3) until the correct numerical value shows on the active digit. If the numerical value is more than one digit, press the DIGIT button (6) to move to the desired digit and then press the VALUE button (3) to change that digit to the correct numerical value. Continue until the correct value shows on the display.

If the correct value for the applied load includes a decimal point, it must be shown with the decimal point in the correct location. To show the decimal point, press the DIGIT button (6) twice. This will move the active digit 2 places and place a decimal point between the last numerical value added and the active digit blinking.

If calibrating in the counterclockwise direction, the "+" showing on the display must be changed to a "-". This is done by pressing the DIGIT button (2) until the "+" becomes the active digit (blinks). Then press the VALUE button (3) once and the "+" will change to a "-".

When the correct direction of calibration and numerical value for the load applied shows on the display, press the ENTER button (4) on the Computest. The display will show "OK CALIBRATION POINT HAS BEEN ADDED".

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

s. After data has been entered for the first calibration point, the display will show "ADD DATA" again. Repeat steps o. through r. for each calibration point shown in Table 3-4.

NOTE

If steps s. and t. are not followed, calibration data will not be stored in Computest memory.

t. When four calibration points have been entered for one direction, press the VALUE button (3) until "SAVE" appears on the display. Press the ENTER button (4) and data will be stored in Computest.

u. Exit calibration after calibrating one side by pressing the VALUE button (3) until "RESUME" appears on the display. Then press the ENTER button (4) and Computest will return to track mode.

v. Remove calibration arm and hanger. Place them on the transducer in the opposite direction. Repeat steps i. through u, except step "n", as this will "erase" all calibration data entered in the other direction.

w. To assure calibration procedure was performed correctly, always follow calibration with an accuracy check per paragraph 3.4.

4.2.2 Low Torque Single Range Transducers 375 In. Lb., 750 In. Lb., 125 Ft. Lb. and 250 Ft. Lb.

To calibrate to the Low Torque Station Indicator see Section 4.2.3.

4.2.3 High Torque Station

Set up the High Torque Station transducers as shown in Figure 3-11 or 3-12 and follow the procedure below:

CAUTION

Torque Transducers are sensitive measuring instruments. "Over-Torquing" past the useable range of the transducer may result in permanent damage to the transducer. Always load the transducer slowly and DO NOT exceed the useable range in any application.

A buzzer will sound and the Digital Display will show "OVER-LOAD" when the transducer is "Over-Torqued". If the Digital Indicator is signaling, stop applying the load.

NOTE

Figure 3-11 is for the 375 in. lb, 750 in. lb, 125 in. lb. and 250 ft. lb. transducers. Figure 3-12 is for the 500 ft. lb, 1000 ft. lb. and 2000 ft. lb. transducers.

a. Mount transducer assembly in the calibration block assembly by aligning the white orientation marks. Secure with two quick release pins (Part # 2000-195-12).

WARNING

The calibration/accuracy stand, fixtures and arms must be set up and used as illustrated in figures 3-11 and 3-12. Failure to set up and use the equipment as illustrated will cause either an out-of-balance distribution of weight and/ or unsafe support of the weight. Personal injury may result from the improper setup and/or use of this equipment.

b. Plug the Single Transducer cable into the transducer then into the back of Computest at the SINGLE TRANSDUCER port. (Figure 3-2, index 4).

CAUTION

When transducers are not plugged into the Digital Indicator or when changing from one single transducer to another the Digital Indicator must be turned off.

c. With the Computest powered (input voltage applied to the back panel connector) press the POWER button (Figure 3-1, index 1) on the front panel of Computest. Allow 30 minutes for Computest to warm up, go through self test and stabilize prior to use.

d. HIGH TORQUE FORCE SECTION light (21) that matches the transducer being calibrated will be lit on the front panel of Computest.

e. Next select track mode by pressing the MODE button (15).

f. Select the correct unit of measure for the transducer being calibrated by pressing the UNIT Select button (19).

g. Select torque by pressing the SELECT button (18).

WARNING

Both of the quick release pins must be fully engaged when the calibration block assembly is used. Failure to do so may result in personal injury.

h. Refer to Table 3-4 and attach adapters (if required), calibration arm and hanger to the transducer.

i. Apply maximum weight required, three (3) times, on hanger in the direction being checked, for the highest torque range of the transducer. This is necessary to exercise the transducer for maximum accuracy.

j. Remove all weights and the hanger. Press the ZERO TARE button (10) on Computest front panel.

k. Press CAL button (8) on Computest front panel. The display will show "CALIBRATION HAS BEEN SELECTED. ENTER YOUR PASS CODE".

l. To enter your pass code, press the VALUE button (3) and the display will show "CODE 1000". Next press either VALUE button (3) or (5) to change the first digit to the correct number (the one that corresponds to your code number). Move to the second digit by pressing the DIGIT button (6) and repeat the same procedure for changing the value of the second digit. Continue until the correct 4-digit number is on the display. When the number on the display matches your code number, press the ENTER button (4).

m. If the code entered is correct, the display will show "PASS CODE OK. SELECT ANY OPTION BY PRESSING UP OR DOWN BUTTON". (VALUE button (3) or (5)). If an incorrect code is entered the display will show "SORRY WRONG PASS CODE RETURNING TO MEASURING MODE". To try again repeat steps k. and l.

NOTE

When "ERASE" is selected, new calibration data can be entered into Computest. The new data entered will not, however, be stored into memory replacing the old data unless "step t" is followed.

n. Press the VALUE button (3) until "ERASE" shows on the display. To clear old calibration data, press ENTER button (4). The display will show "ALL CALIBRATION DATA FOR CURRENT TRANSDUCER ERASED".

o. Attach correct calibration arm, hanger and weights (refer to Table 3-4) for lowest calibration point shown on the chart.

NOTE

There are only 4 points in each direction, do not calibrate on the * point. This point is for accuracy check only.

NOTE

Always allow hanger to come to equilibrium prior to proceeding to the next step.

p. After the old data has been erased, press the VALUE button (3) until "ADD DATA" appears on the display.

q. After hanger reaches equilibrium, press ENTER button (4). The display will show "CALIBRATION POINT HAS BEEN ENTERED ADD ADDITIONAL DATA".

r. Enter the correct data for the applied load per Table 3-4 by pressing the VALUE button (3). The display will show "+...." with the first "." blinking (active digit). If calibrating in the clockwise direction, change the first active digit by pressing the VALUE button (3) until the correct numerical value shows on the active digit. If the numerical value is more than one digit, press the DIGIT button (6) to move to the desired digit and then press the VALUE button (3) to change that digit to the correct numerical value. Continue until the correct value shows on the display.

If the correct value for the applied load includes a decimal point, it must be shown with the decimal point in the correct location. To show the decimal point, press the DIGIT button (6) twice. This will move the active digit 2 places and place a decimal point between the last numerical value added and the active digit blinking.

If calibrating in the counterclockwise direction, the "+" showing on the display must be changed to a "-". This is done by pressing the DIGIT button (2) until the "+" becomes the active digit (blinks). Then press the VALUE button (3) once and the "+" will change to a "-". When the correct direction of calibration and numerical value for the load applied shows on the display, press the ENTER button (4) on the Computest. The display will show "OK CALIBRATION POINT HAS BEEN ADDED".

NOTE

If steps s. and t. are not followed, calibration data will not be stored in Computest memory.

s. After data has been entered for the first calibration point, the display will show "ADD DATA" again. Repeat steps o. through r. for each calibration point shown in Table 3-4.

t. When four calibration points have been entered for one direction, press the VALUE button (3) until "SAVE" appears on the display. Press the ENTER button (4) and data will be stored in Computest.

u. Exit calibration after calibrating one side by pressing the VALUE button (3) until "RESUME" appears on the display. Then press the ENTER button (4) and Computest will return to track mode.

v. Remove calibration arm and hanger. Place them on the transducer in the opposite direction. Repeat steps i. through u, except step "n", as this will "erase" all calibration data entered in the other direction.

w. To assure calibration procedure was performed correctly, always follow calibration with an accuracy check per paragraph 3.4.

SECTION V

MAINTENANCE INSTRUCTIONS

5.1 CLEANING

Wipe all equipment periodically with a dry clean, lint-free cloth. Do Not Use any abrasive or corrosive materials to clean any components.

5.2 LUBRICATION

Lubricate the crank gear train using MOBILUX EP 023 grease or equivalent. Recommended lubrication is every 3 months or as required. See Figure 3-6, sheet 2 for lubrication point.

Apply a thin light general purpose oil on all black oxide parts to prevent corrosion.

The screwdriver adapter assembly Part # 2500-100-01 requires lubrication with a thin light general purpose oil to prevent corrosion.

5.3 TROUBLESHOOTING

Refer to Table 5-1 if any troubleshooting is required on the TFC. See Figure 5-1 for the Computest circuit board layout of components.

5.4 INSPECTION

Determine that all equipment is operational by visually inspecting for worn, broken, cracked or damaged parts. Replace equipment not found to be in satisfactory condition.

Table 5-1. Troubleshooting

Problem	Probable Cause	Remedy
Computest does not operate	Power is not supplied	Plug the power cord into the outlet Check the fuse Make sure all connections are correct and tight.
*xx**** appears on the display	Noise from the relay	Turn Computest off, wait 20 seconds Then turn it on again.

Table 5-1. Troubleshooting (Continued)

Problem	Probable Cause	Remedy
Printer does not print	Power is not supplied	Turn power switch on.
Printer does not print when data is transmitted	Printer cable not making contact	Check printer cable from printer to printer port of Computest
OVER RANGE or NO INPUT appears on display	Transducer cable not making good contact	Check the transducer cable.
Overload appears more on one side than on the other side	Load cell has too much of an overload	Replace load cell.
During self test procedure, input handle does not lock in one direction and ratchet in the opposite direction	Mechanical loader's power cord is disconnected, or damaged.	Connect the power cord into the rear of the mechanical loader.
	Bad connection between digital indicator and mechanical loader	Make sure that round connector is plugged correctly into mechanical loader
		Install new cable.
Input torque (wheel) exceeds specifications in Table 1-1. Noise from the internal mechanical loader's mechanism.	Insufficient lubrication on lead screw/nut joint.	Relubricate lead screw/nut joint per paragraph 5.2.
During torque/force measurement, input handle suddenly stops.	Measurement started at the point where internal mechanism was not aligned properly in central position, and has reached the end of its travel.	Prior to the start of the test, the internal mechanism must be properly aligned in the central position as described in the NOTE directly below paragraph 3.3.2.3.

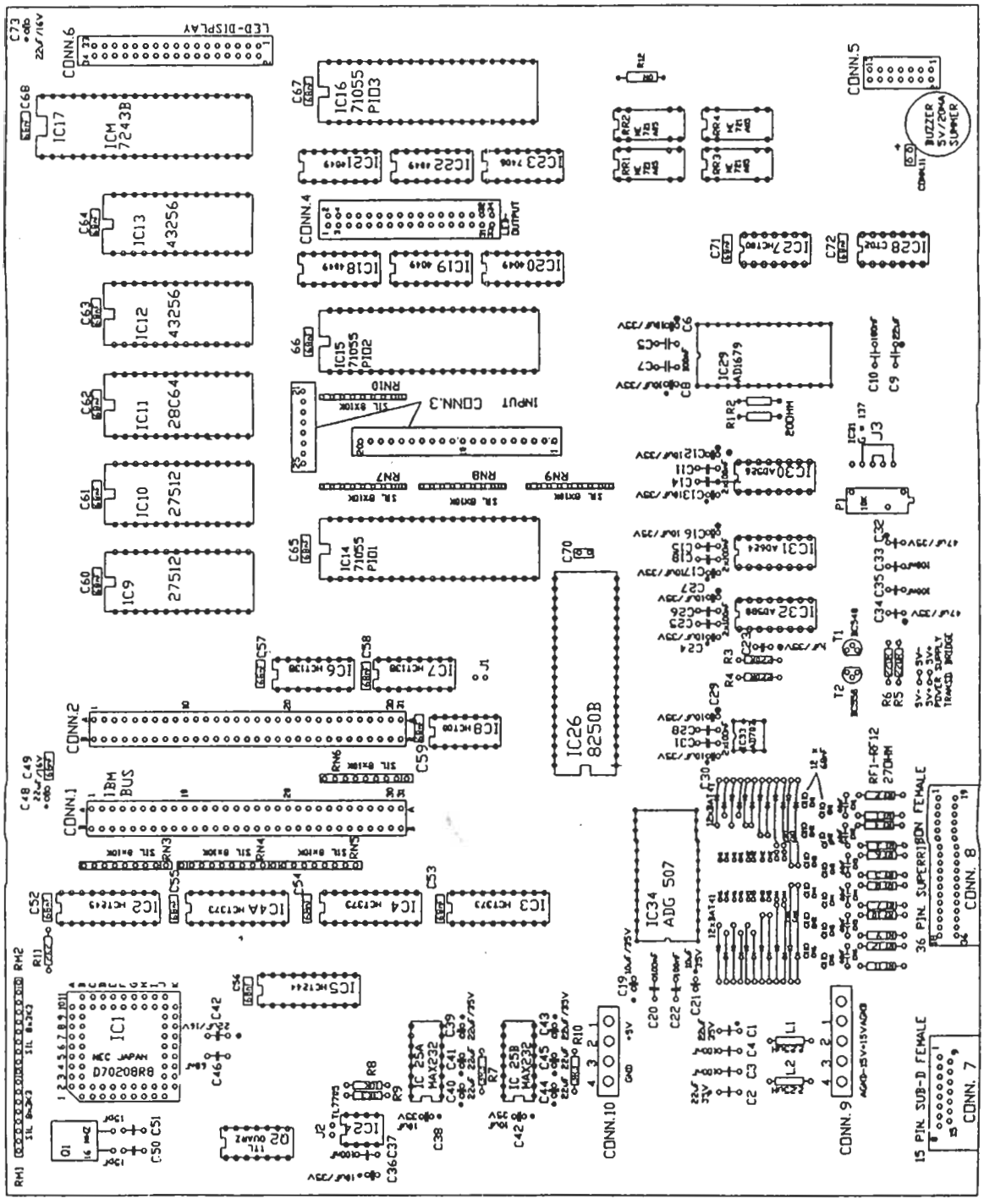


Figure 5-1. COMPUTEST Circuit Board Component Location

Pos	Component Des.	Description
1	IC1	UPD70208R-8
2	IC2	SN74HCT245
3	IC3, IC4, IC4A	SN74HCT373
4	IC5	SN74HCT244
5	IC6, IC7	SN74HCT138
6	IC8, IC27	SN74HCT00
7	IC28	SN74HCT02
8	IC23	SN7406
9	IC9, IC10	27C256-20
10	IC11	D28C64C-20
11	IC12, IC13	43256
12	IC14, IC15, IC16	UPD71055
13	IC17	ICM7243BIPL
14	IC18,19,20,21,22	TC4049BP
15	IC24	TL7705
16	IC25A, IC25B	MAX232
17	IC26	8250B
18	IC29	AD1679KD
19	IC30	AD526CD
20	IC31	AD624KD
21	IC32	AD588BD
22	IC33	AD707BQ
23	IC34	AD507ABQ
24	T2	BC588C
25	T1	BC548C
26	RR1,2,3,4	HE721A05-10
27	N1-N24	BAT41
28	Q1	HC18-U 16.0 MHZ
29	Q2	1.8432 TTL
30	L1, L2	2.5A/2.25 uH
31	R1, R2	20R
32	R11	2K2
33	R8	10K
34	R7, R9, R10	3K3
35	R3, R4, R5, R6	220R
36	R12	OR
37	RF1, RF2-RF12	27R
38	RN8-RN10	Sil 8x10K
39	RN1, RN2	Sil 8x3K3
40	C32, C34	47uF/35V Tantal
41	C39-C41, C43-C45 C1, C2, C9	22uF/35V Tantal
42	C42, C48, C73	22uF/16V Tantal
43	C6, C8, C12, C13, C16, C17, C21, C24, C27, C29, C30, C36, C38, C42	10uF/35V Tantal
44	CF1-CF6, CG1.1-CG6.2 C46, C49, C52-C68 C70, C71, C72	68nF/63V Ceram.
45	C23	1uF/35V Tantal
46	C3, C4, C5, C7, C11, C14, C15, C18, C20, C22, C25, C26, C28, C31, C33, C35, C37	Capacitor
47	C50, C51	Capacitor
48	CONN.1, CONN.2	31 Pin AB Plug
49	CONN.3	Sil 28 Pin
50	CONN.4, CONN.6	Dil 34 Pin
51	CONN.7	Sub-D 15 Pin Female
52	CONN.8	Superribon 36 Pin
53	CONN.9	5 Pin Conn.
54	CONN.10	4 Pin Conn.
55	CONN.11	Sil 2 Pin
56	P1	Pot 10K Cermit-Trim.
57	J1, J2	Sil 2 Pin. Jumper
58	J3	Sil 5 Pin. Jumper
59	BUZZER	Buzzer Meb/6
60	BARE BOARD	Computest 02/9385
61		IC-Socket 68 Pin PGA
62		IC-Socket 40 Pin
63		IC-Socket 28 Pin
64		IC-Socket 20 Pin
65		IC-Socket 16 Pin
66		IC-Socket 14 Pin
67		IC-Socket 8 Pin

SECTION VI

ILLUSTRATED PARTS BREAKDOWN

6.1 INTRODUCTION

The Illustrated Parts Breakdown lists and describes the parts necessary for equipment support and is used for requisitioning and identifying parts.

6.2 FIGURE & INDEX NUMBER COLUMN

This column lists the figure and index numbers relating to figures within the text and help in identifying parts used for requisitioning.

6.3 PART NUMBER COLUMN

This column lists the prime contractor part number, or government standard part number, or other vendor part number, if applicable.

6.4 DESCRIPTION COLUMN

This column lists the item name, dimensions and other descriptive information, where applicable.

6.5 QTY COLUMN

This column lists the quantity of parts used for that specific figure. The term REF indicates that item has been previously listed or is listed for reference purposes only.

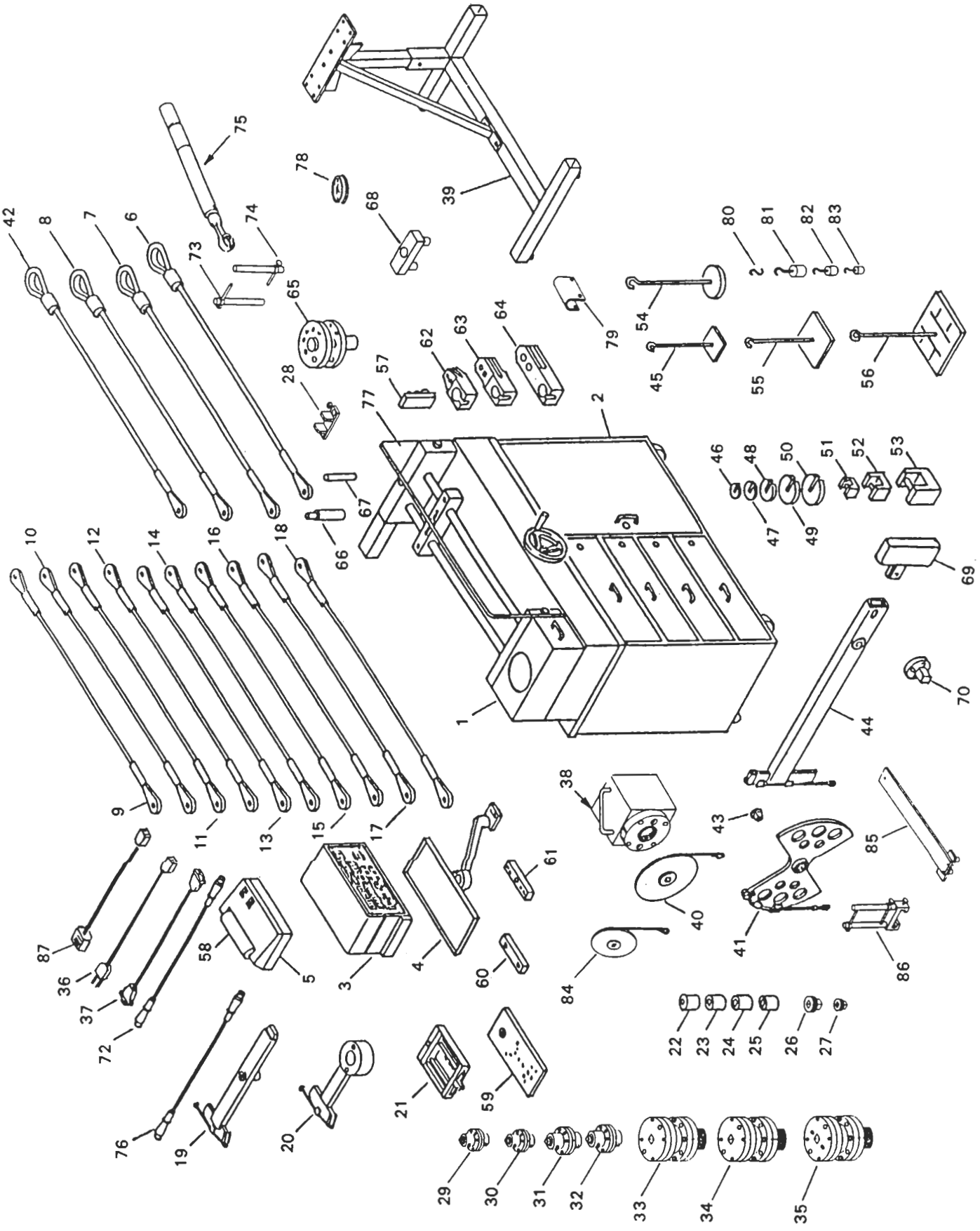


Figure 6-1. TFC High Torque Station

Fig. & Index Number	Part Number	Description	Qty
6-1-	2000-0-3	TFC-HIGH TORQUE STATION	REF
1	2000-1-0	. TORQUE CALIBRATOR	1
2	2000-100-0	. STORAGE CABINET	1
3	2000-110-0	. TORQUE INDICATOR	1
4	2000-111-0	. TORQUE INDICATOR STAND	1
5	2000-112-1	. PRINTER	1
6	2000-201-1	. CABLE, Force range 5-100 lb	1
7	2000-201-2	. CABLE, Force range 100-250 lb	1
8	2000-201-3	. CABLE, Force range 250-500 lb.	1
9	2000-200-1	. CABLE, Tension 1/16 in. dia.	1
10	2000-200-2	. CABLE, Tension 3/32 in. dia.	1
11	2000-200-3	. CABLE, Tension 1/8 in. dia.	1
12	2000-200-4	. CABLE, Tension 5/32 in. dia.	1
13	2000-200-5	. CABLE, Tension 3/16 in. dia.	1
14	2000-200-6	. CABLE, Tension 7/32 in. dia.	1
15	2000-200-7	. CABLE, Tension 1/4 in. dia.	1
16	2000-200-8	. CABLE, Tension 9/32 in. dia.	1
17	2000-200-9	. CABLE, Tension 5/16 in. dia.	1
18	2000-200-10	. CABLE, Tension 3/8 in. dia.	1
19	2000-211-0	. ARM, Force 5-250 lb.	1
20	2000-212-0	. ARM, Force 250-2000 lb.	1
21	2000-213-0	. COMPRESSION GAGE ADAPTER	1
22	342-41-1	. DRIVE ADAPTER 1/4 IN. SQ. TO 3/8 IN. SQ.	1
23	342-41-2	. DRIVE ADAPTER 3/8 IN. SQ. TO 3/8 IN. SQ.	1
24	65-26-2	. DRIVE ADAPTER 3/8 IN. SQ. TO 1/2 IN. SQ.	1
25	65-26-3	. DRIVE ADAPTER 1/2 IN. SQ. TO 1/2 IN. SQ.	1
26	2000-226-2	. ADAPTER 1 IN. - 3/4 IN. SQ DRIVE	1
27	2000-226-3	. ADAPTER 3/4 IN - 1/2 IN. SQ DRIVE	1
28	2000-173-0	. REACTION - BALL TYPE BEAM WRENCH	1
29	2000-7-01	. TORQUE TRANSDUCER ASSY 375 IN. LB.	1
	2000-7-0	. . TRANSDUCER 375 IN.	1
	2000-225-5	. . SMALL TRANSDUCER ADAPTER	1
	10-168-19	. . SOCKET HEAD CAP SCREW 1/4-20, 1/2 IN. LG.	4
30	342-8-01	. TORQUE TRANSDUCER ASSY 750 IN. LB.	1
	342-8-0	. . TRANSDUCER 750 IN. LB.	1
	2000-225-5	. . SMALL TRANSDUCER ADAPTER	1
	10-168-19	. . SOCKET HEAD CAP SCREW 1/4-20, 1/2 IN. LG.	4
31	342-10-01	. TORQUE TRANSDUCER ASSY 125 FT. LB.	1
	342-10-0	. . TRANSDUCER 125 FT. LB.	1
	2000-225-4	. . SMALL TRANSDUCER ADAPTER	1
	10-168-24	. . SOCKET HEAD CAP SCREW 3/8-16, 1/2 IN. LG.	4

Fig. & Index Number	Part Number	Description	Qty
6-1-			
32	342-11-01	. TORQUE TRANSDUCER ASSY 250 FT. LB.	1
	342-11-0	. . TRANSDUCER 250 FT. LB.	1
	2000-225-4	. . SMALL TRANSDUCER ADAPTER	1
	10-168-01	. . SOCKET HEAD CAP SCREW 3/8-16, 1/2 IN. LG.	4
33	2000-12-01	. TORQUE TRANSDUCER ASSY 500 FT. LB.	1
	2000-12-0	. . TRANDUCER 500 FT. LB.	1
	2000-225-3	. . TRANSDUCER ADAPTER	1
	2000-91-1	. . HEX HEAD SCREW 3/8-16, 1-1/2 IN. LG.	4
34	2000-13-01	. TORQUE TRANSDUCER ASSY 1000 FT. LB.	1
	2000-13-0	. . TRANSDUCER 1000 FT. LB.	1
	2000-225-3	. . TRANSDUCER ADAPTER	1
	2000-91-1	. . HEX HEAD SCREW 3/8-16, 1-1/2 IN. LG.	4
35	2000-14-01	. TORQUE TRANSDUCER ASSY 2000 FT. LB.	1
	2000-14-0	. . TRANSDUCER 2000 FT. LB.	1
	2000-227-2	. . 2000 FT.LB. TRANSDUCER ADAPTER	1
	2000-91-1	. . HEX HEAD SCREW 3/8-16, 1-1/2 IN. LG.	4
36	2000-114	. POWER CORD	
		for Serial # 001 through 0072	1
		for Serial # 0073 and up	2
37	2000-50	. CABLE ASSEMBLY, Printer	1
38	2000-150-01	. BLOCK CALIBRATION ASSY	1
39	2000-250-0	. CALIBRATION STAND	1
40	2000-151-0	. CALIBRATION ARM 5 IN.	1
41	2000-152-0	. CALIBRATION ARM 10 IN.	1
42	2000-201-4	. CABLE, Force range 500-2000 lb.	1
43	2000-152-3	. CALIBRATION ARM ADAPTER 3/8 IN.	1
44	2000-154-0	. CALIBRATION ARM 40 .	1
45	2000-304-0	. TRAY 7.5 LB.	1
46	2000-300-1	. WEIGHT 1/4 LB.	2
47	2000-300-2	. WEIGHT 1/2 LB.	3
48	2000-300-3	. WEIGHT 1 LB.	4
49	2000-300-4	. WEIGHT 2 LB.	5
50	2000-300-5	. WEIGHT 5 LB.	5
51	2000-300-6	. WEIGHT 10 LB.	4
52	2000-300-7	. WEIGHT 20 LB.	5
53	2000-300-8	. WEIGHT 50 LB.	8
54	2000-301	. HANGER 1/2 LB.	1
55	2000-302-0	. TRAY 15 LB.	1
56	2000-303-0	. TRAY 50 LB.	1
57	2000-230-0	. DUMMY SOCKETS	1

Fig. & Index Number	Part Number	Description	Qty
6-1			
58	2000-113	. PAPER, Printer	6
59	2000-180-0	. FORCE GAGE SUPPORT	1
60	2000-184	. FORCE GAGE SPACER #2 (DPPH SERIES)	1
61	2000-183	. FORCE GAGE SPACER #1 (L, DPPH, DPP SERIES)	1
62	2000-191	. CABLE ADAPTER #1	1
63	2000-192	. CABLE ADAPTER #2	1
64	2000-193	. CABLE ADAPTER #3	1
65	2000-194-0	. CABLE ADAPTER REACTION, Universal	1
66	2000-175	. REACTION PIN, Sweeney multiplier	1
67	2000-174-0	. REACTION PIN, Force	1
68	2000-190-0	. REACTION PIN ADAPTER, Sweeney multiplier	1
69	2000-176-0	. COUNTER WEIGHT	1
70	2000-221-0	. ADAPTER 1-1/4 IN. SQ.	1
71	Not Used		
72	2000-116	. CALIBRATION CABLE, Single transducer	1
73	2000-173-2	. PIN, Reaction assy	1
74	2000-173-1	. PIN, Reaction with groove assy	1
75	2000-350	. TORQUE WRENCH, Preset to 550 in. Lb.	1
76	2000-117	. CABLE, Computest to mechanical loader	1
77	2000-56-0	. PROTECTIVE SHIELD ASSEMBLY	1
78	2000-251	. LEVEL GAGE, Calibration stand	1
79	2000-179	. CABLE, Adapter	1
80	2000-310-1	. WEIGHT, 0.2 oz. (hook)	1
81	2000-310-2	. WEIGHT, 2 oz.	1
82	2000-310-3	. WEIGHT, 4 oz.	1
83	2000-310-4	. WEIGHT, 8 oz.	1
84	342-50-0	. CALIBRATION DISK ASSY, 2.5 in. radius	1
85	2000-550-108	. EXTENSION FIXTURE	1
86	2000-550-115	. REACTION SLIDE ASSY	1
87	2000-115	. POWER CORD, Torque Calibrator (For Serial # 001 through 0072 only)	1

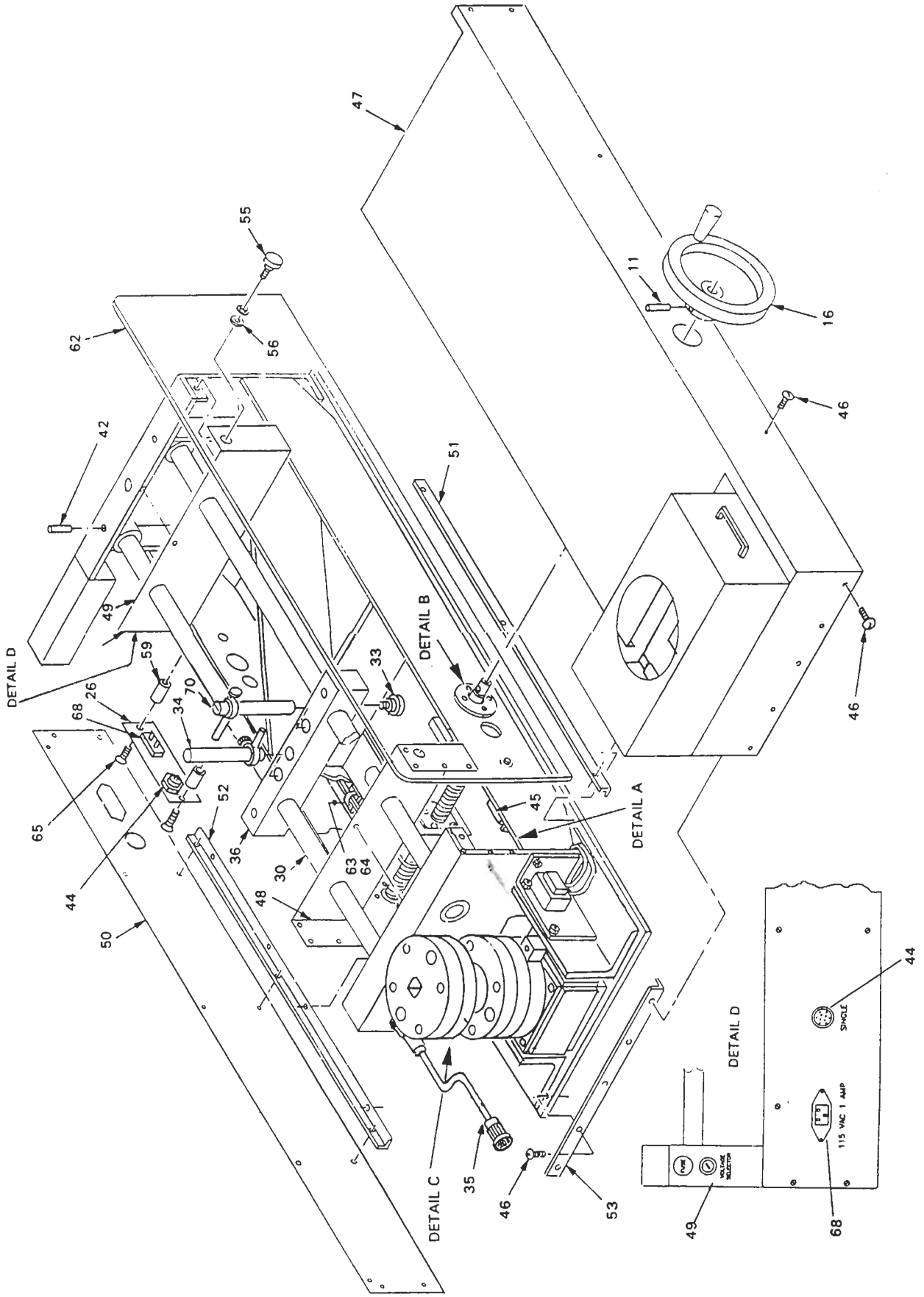
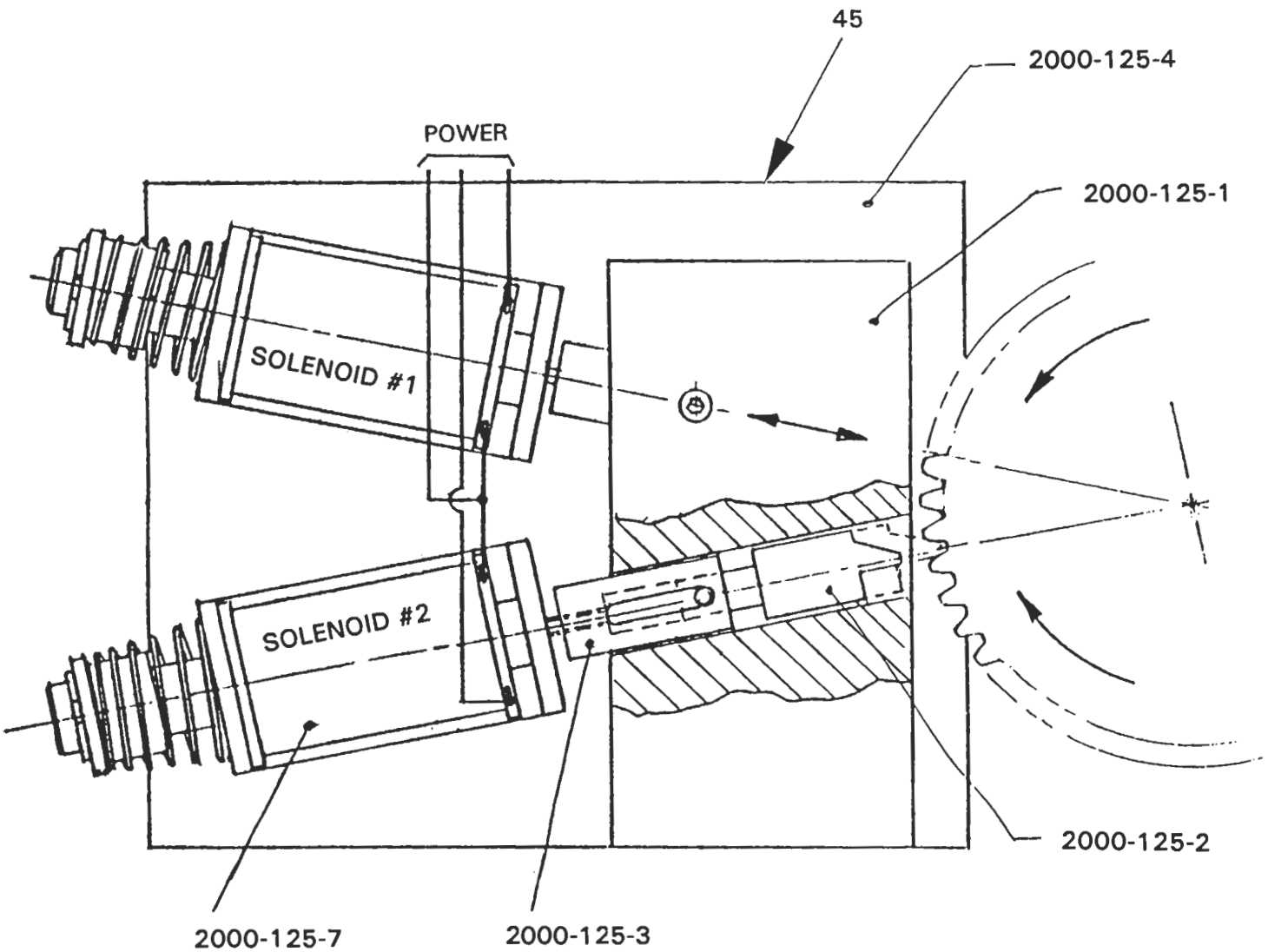
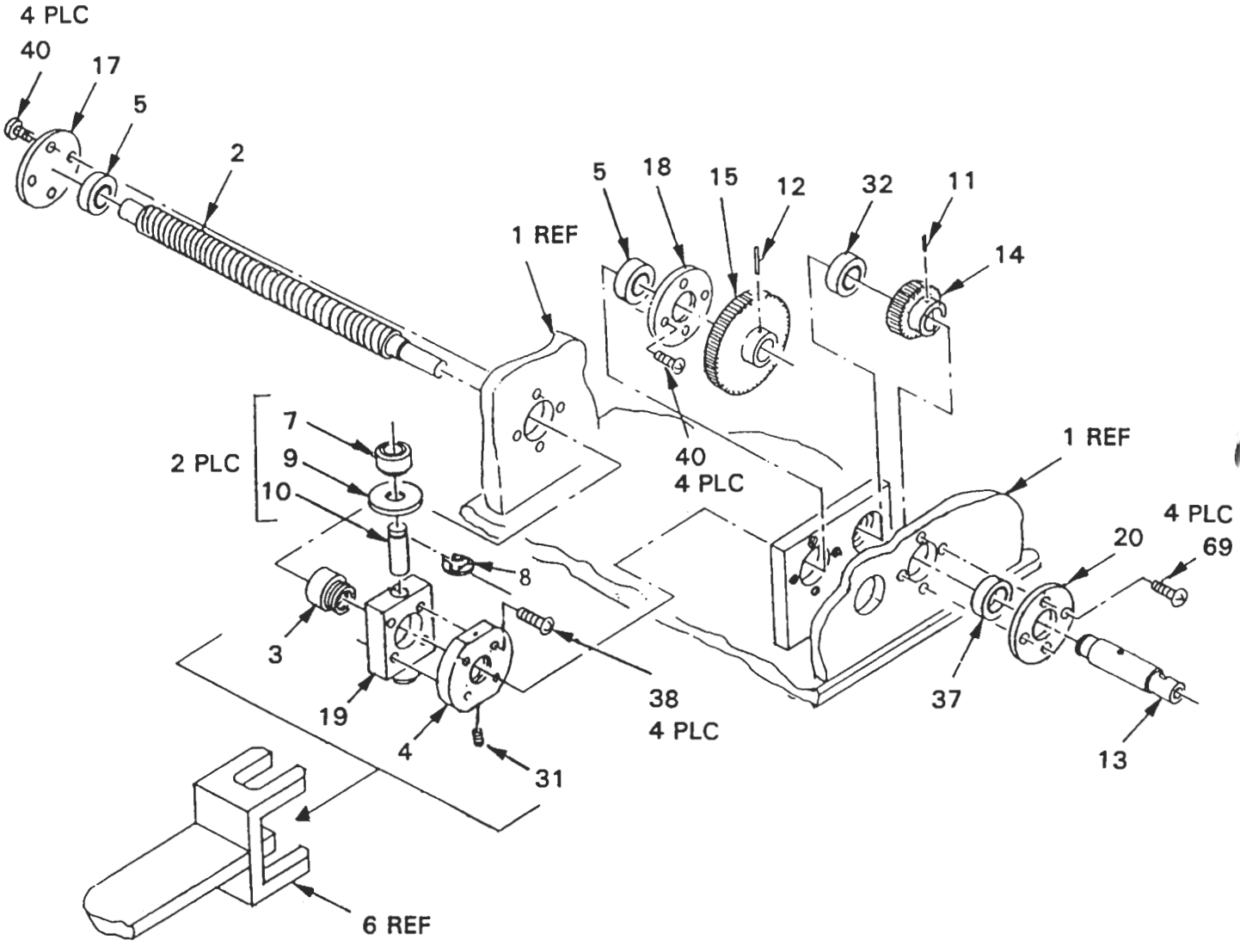


Figure 6-2. Torque Calibrator (Sheet 1)



DETAIL A

Figure 6-2. Torque Calibrator (Sheet 2)



DETAIL B

Figure 6-2. Torque Calibrator (Sheet 3)

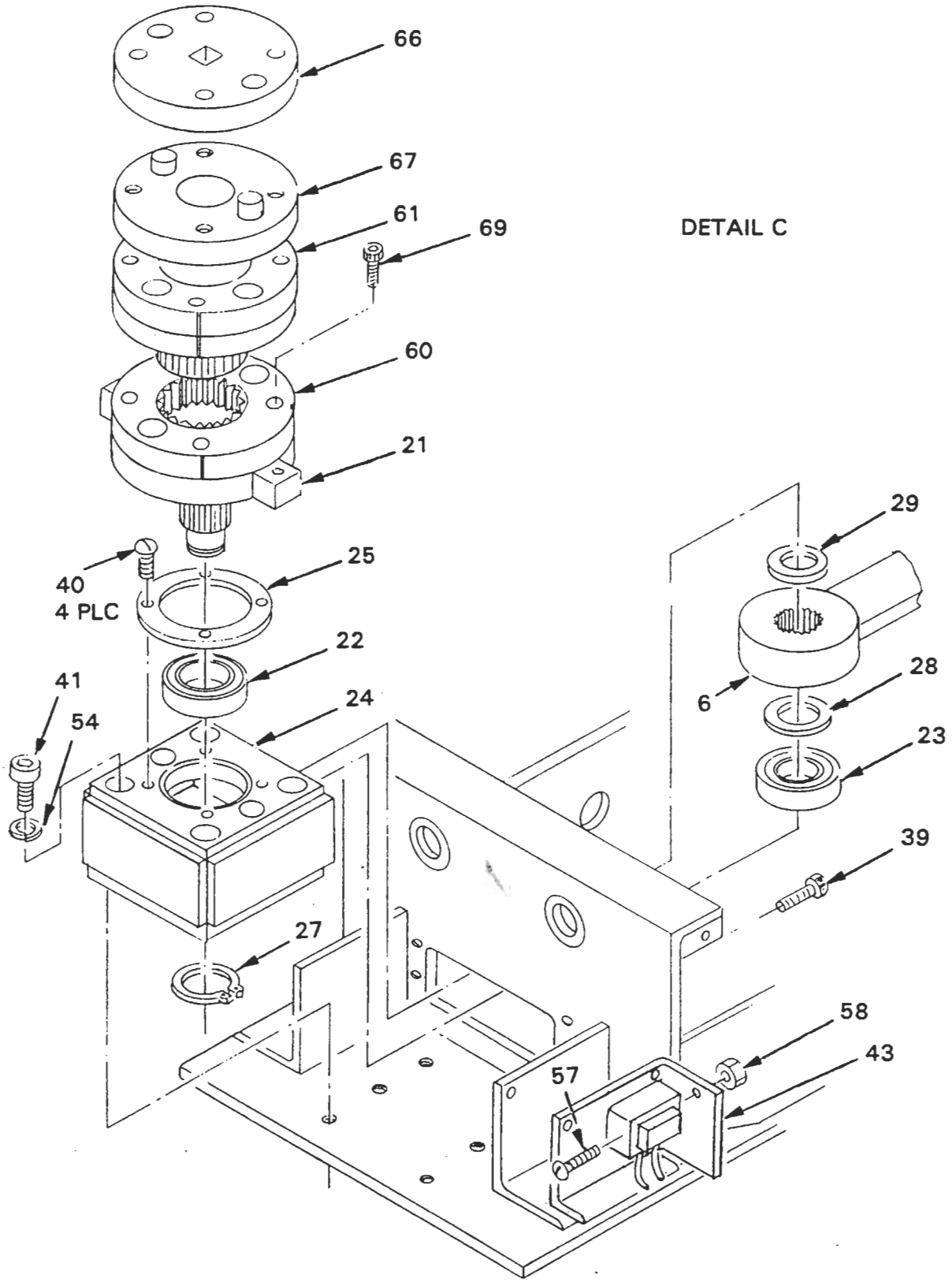
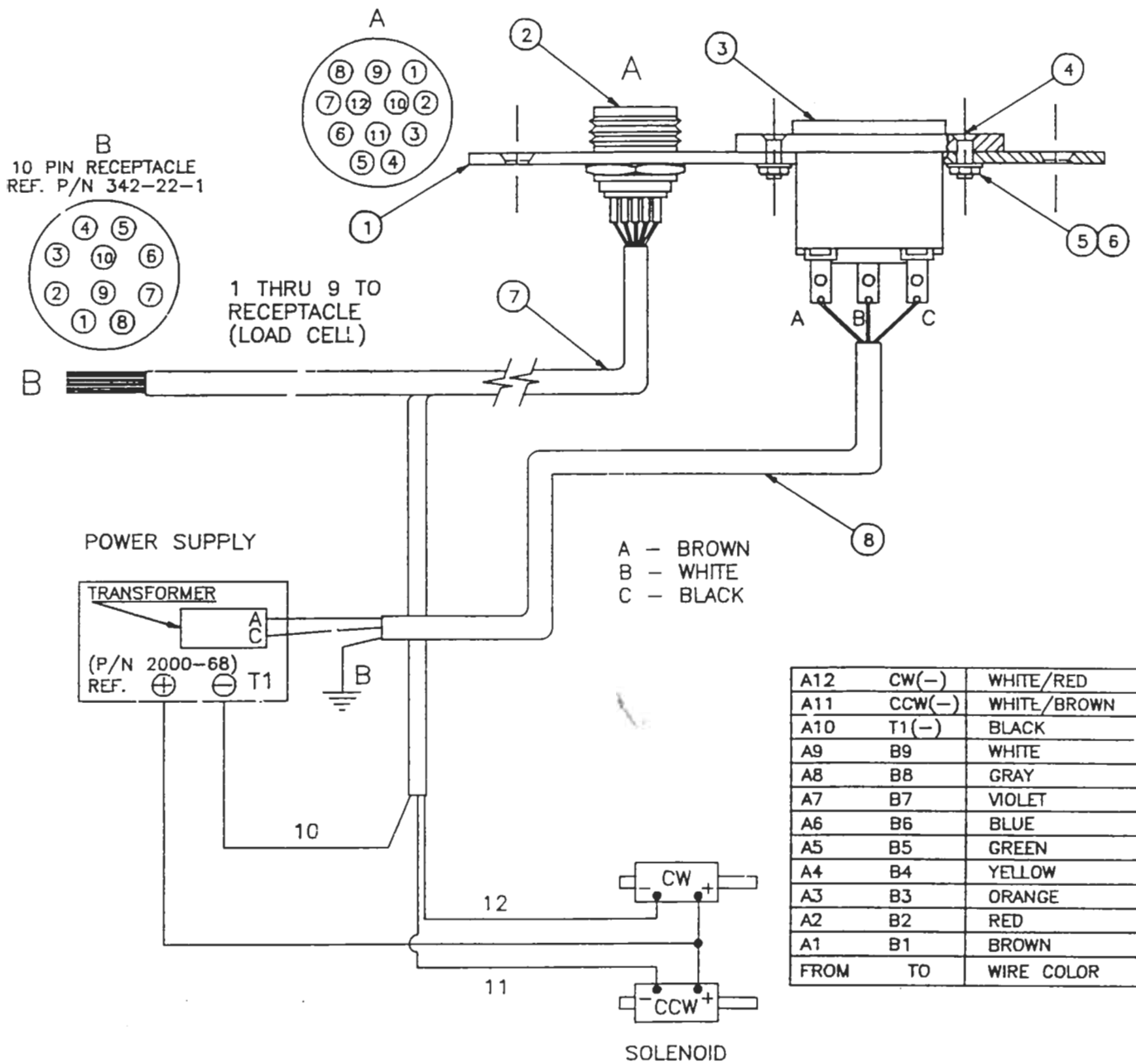


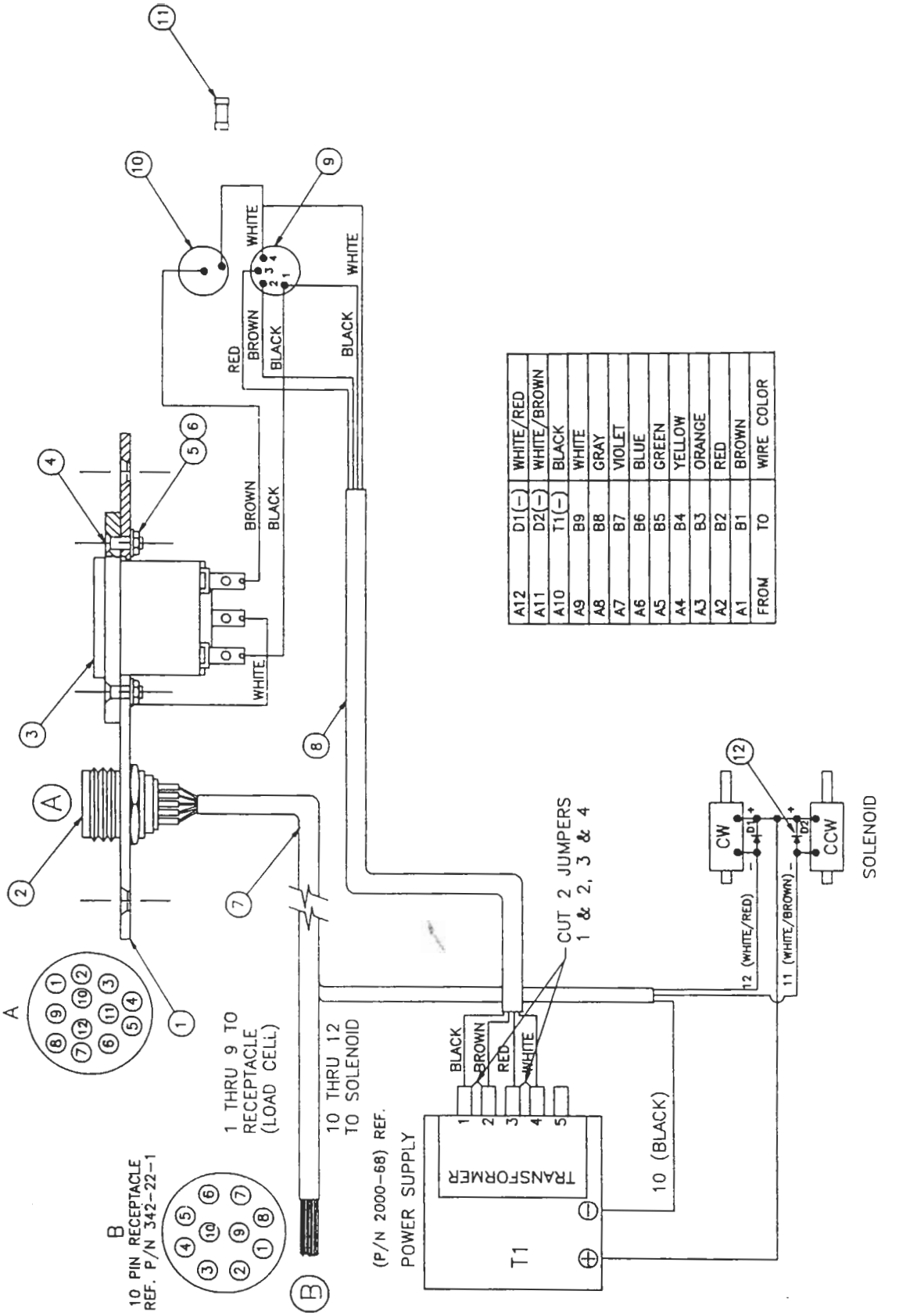
Figure 6-2. Torque Calibrator (Sheet 4)



A12	CW(–)	WHITE/RED
A11	CCW(–)	WHITE/BROWN
A10	T1(–)	BLACK
A9	B9	WHITE
A8	B8	GRAY
A7	B7	VIOLET
A6	B6	BLUE
A5	B5	GREEN
A4	B4	YELLOW
A3	B3	ORANGE
A2	B2	RED
A1	B1	BROWN
FROM	TO	WIRE COLOR

MECHANICAL LOADER WIRING SERIAL # 001 - 0072

Figure 6-2. Torque Calibrator (Sheet 5)



MECHANICAL LOADER WIRING SERIAL # 0073 AND UP

Figure 6-2. Torque Calibrator (Sheet 6)

Fig. & Index Number	Part Number	Description	Qty
6-2-	2000-1-0	TORQUE CALIBRATOR	REF
1	2000-52-0	. PLATE BEARING SUPPORT ASSY	1
2	2000-20	. ACME SCREW 3/4-6 x 12	1
3	2000-21	. ACME SCREW NUT	1
4	2000-22	. FLANGE MOUNTING, Modified	1
5	2000-49	. BEARING, Single row angular contact	2
6	2000-61-0	. LOADING ARM WELDED ASSY	1
7	2000-106	. BEARING, Torrington 6NBF817YJ	2
8	2000-45	. "E" RING, Waldes 5144-3T	2
9	2000-38	. SPACER	2
10	2000-16	. PIVOT PIN	2
11	10-107-23	. SPRING PIN 1/8-1.0 IN. LG.	1
12	10-107-24	. SPRING PIN 1/8-3/4 IN. LG.	1
13	2000-17	. INPUT SHAFT	1
14	2000-18	. SPUR GEAR MODIFIED, 1-1/2 P. DIA.	1
15	2000-19	. SPUR GEAR MODIFIED, 3.0 P. DIA.	1
16	2000-28	. HANDLE MODIFIED	1
17	2000-63	. BEARING COVER	1
18	2000-64	. BEARING PLATE	1
19	2000-25	. FLANGE ADAPTER	1
20	2000-15	. BEARING COVER, Input shaft	1
21	2000-55	. DRIVE PLATE AND SHAFT ASSY	1
22	2000-62-3	. BEARING, Fafnir 309W	1
23	2000-62-4	. BEARING, Fafnir 307W	1
24	2000-34-0	. BEARING SUPPORT ASSY, Drive shaft	1
25	2000-29	. BEARING COVER, Drive shaft	1
26	2000-66	. RECEPTACLE HOLDER	1
27	2000-96-6	. RETAINING RING 5160-137	1
28	2000-26-2	. THRUST WASHER	3
29	2000-26-1	. THRUST WASHER	1
30	2000-48	. SLIDE SHAFT	2
31	10-101-114	. SOCKET SET SCREW	1
32	2000-62-5	. BEARING	1
33	2000-46-1	. KNOB	1
34	2000-173-2	. PIN REACTION ASSY	1
35	2000-75-0	. TRANSDUCER CABLE	1
36	2000-30	. REACTION POST	1
37	2000-62-1	. BEARING, Fafnir S 5K	2
38	10-195-1	. SOCKET CAP SCREW 1/4-20	4
39	Not Used		
40	10-225-7	. SCREW, Button hd. 1/4-20	12

Fig. & Index Number	Part Number	Description	Qty
6-2-			
41	10-168-20	. SOCKET CAP SCREW 3/8-16	6
42	10-107-25	. SPRING PIN 3/8	2
43	2000-68	. POWER SUPPLY	1
44	342-22-2	. RECEPTACLE ASSY, 12 Pins	1
45	2000-125-0	. SOLENOID SUPPORT ASSY	1
46	10-225-9	. SCREW, HEX BUTTON HEAD 8-32	38
47	2000-89	. MAIN CHASSIS	1
48	2000-90	. COVER LEFT	1
49	2000-91	. COVER RIGHT	1
50	2000-92	. REAR COVER	1
51	2000-93	. FRONT ANGLE	1
52	2000-94	. REAR ANGLE	1
53	2000-95	. SIDE ANGLE	1
54	10-137-1	. LOCK WASHER	1
55	2000-46-2	. KNOB	2
56	2000-56-2	. "O" RING	2
57	10-125-12	. SCREW 8-32	2
58	10-138-14	. HEX NUT 8-32	2
59	2000-104	. SPACER	2
60	2000-225-2	. DRIVE PLATE ADAPTER	1
61	2000-225-3	. TRANSDUCER ADAPTER	1
62	2000-56-1	. COVER PROTECTIVE	1
63	44-8	. CABLE TIE	6
64	44-9	. MOUNTING DEVICE	6
65	10-128-114	. SCREW 8-32, Flat head	2
66	2000-219-2	. DRIVE ADAPTER FLANGE	1
67	2000-13-0	. TRANSDUCER	1
68	2000-110-41	. RECEPTACLE, Solenoid power supply	1
69	10-225-11	. SCREW, BUTTON HEAD, 10-24	8
70	2000-173-1	. PIN, REACTION WITH GROOVE ASSY	1

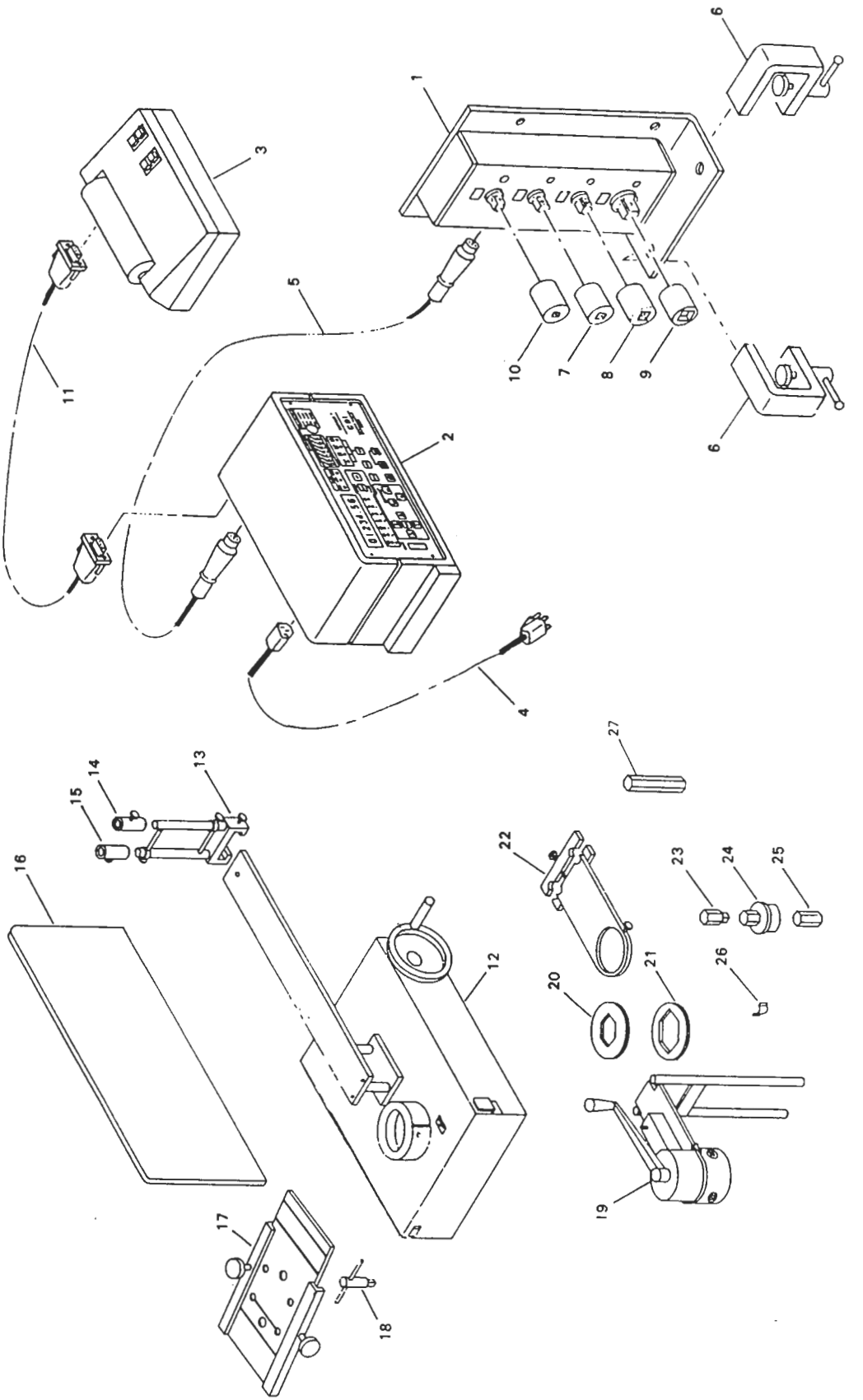


Figure 6-3. TFC-Low Torque Station

Fig. & Index Number	Part Number	Description	Qty
6-3-	2000-0-4	TFC-LOW TORQUE STATION	REF
1	2000-400-0	. MULTIPLE TRANSDUCER ASSY	1
2	2000-110	. TORQUE INDICATOR	1
3	2000-112	. PRINTER	1
4	2000-114	. POWER CORD, Digital indicator	1
5	2000-51	. CABLE ASSY	1
6	2000-231	. CLAMP	2
7	342-40	. ADAPTER 1/4 IN. SQ. - 1/4 IN. SQ.	1
8	2000-159	. ADAPTER 1/4 IN. SQ. - 1/4 IN. HEX.	1
9	342-41-1	. ADAPTER 1/4 IN. SQ.- 3/8 IN. SQ.	1
10	342-41-2	. ADAPTER 3/8 IN. SQ. - 3/8 IN. SQ.	1
11	2000-50	. CABLE ASSY	1
12	2500-1-01	. LOW TORQUE STATION MECH LOADER	1
13	2500-61-0	. REACTION SLIDE ASSY.	1
14	2500-58-0	. RING FLAT WITH SLOT ASSY	1
15	2500-57-0	. RING FLAT ASSY	1
16	2500-56	. PROTECTIVE SHIELD.	1
17	2000-500-01	. FIXTURE LOW TORQUE STATION ASSY.	1
18	2500-100-40	. CHUCK KEY.	1
19	2500-100-01	. TORQUE SCREWDRIVER ADAPTER ASSY.	1
20	2500-100-30	. TORQUE WATCH HEX ADAPTER 1-5/8 IN. HEX	1
21	2500-100-31	. TORQUE WATCH HEX ADAPTER 2 IN. HEX.	1
22	2500-100-29	. TORQUE WATCH HOLDER.	1
23	2500-100-32	. ADAPTER 1/4 SQ TO 5/16 HEX	1
24	2500-100-35	. T-HANDLE ADAPTER	1
25	2500-100-36	. ADAPTER 1/4 IN. HEX.	1
26	65-47-4	. CHUCK KEY CLIP	1
27	2500-100-37	. ADAPTER 1/4 IN. HEX 2 IN. LG.	1

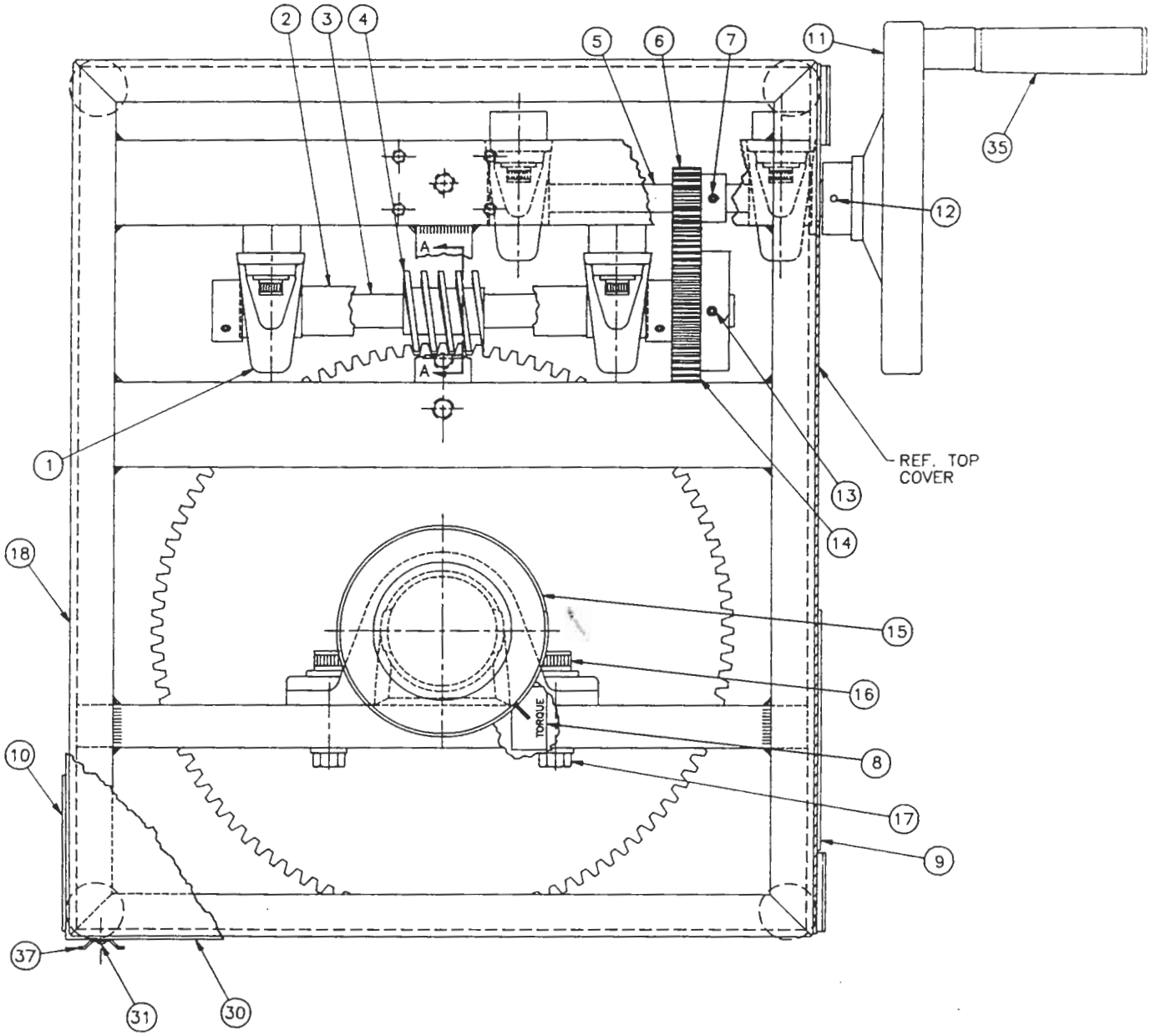


Figure 6-4. Low Torque Station Mechanical Loader (Sheet 1)

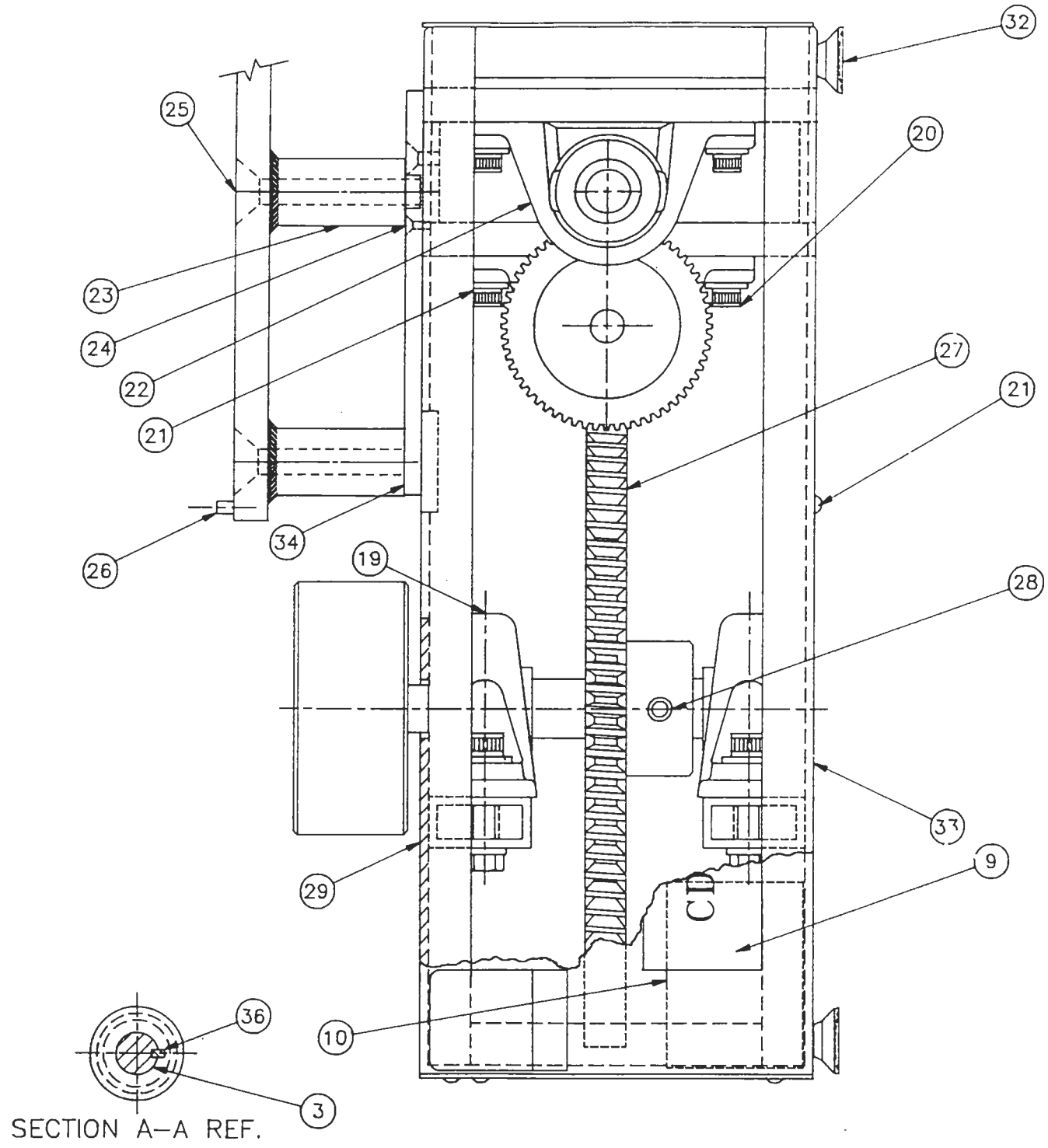


Figure 6-4. Low Torque Station Mechanical Loader (Sheet 2)

Fig. & Index Number	Part Number	Description	Qty
6-4-	2500-1-01	LOW TORQUE STATION MECHANICAL LOADER	REF
1	2500-10AP-2	. PILLOW BLOCK (5/8 BORE)	2
2	2500-18	. SPACER	2
3	2500-15	. SHAFT (5/8)	1
4	2500-9AP	. WORM	1
5	2500-16	. SHAFT (1/2)	1
6	2500-31	. SPUR GEAR (P.D. 1.000)	1
7	10-107-6	. SPRING PIN (3/16 X 3/4)	1
8	2000-164-1	. LABEL - TORQUE	1
9	2000-157	. LABEL - CDI	1
10	2000-165-2	. LABEL, Low torque station	1
11	2000-28-1	. HAND WHEEL (MODIFIED)	1
12	10-107-23	. SPRING PIN (1/8 DIA. X 1.00)	1
13	10-107-14	. SPRING PIN (3/16 X 1-5/8)	1
14	2500-30-0	. SPUR GEAR (P.D. 3000)	1
15	2500-45-0	. TRANSDUCER, Drive plate ass'y	1
16	10-168-20	. SOC. HD. CAP SCREW 3/8 X 1-3/4	4
17	10-138-9	. HEX NUT	4
18	2500-36-0	. FRAME ASSEMBLY	1
19	2500-10AP-3	. PILLOW BLOCK (7/8 BORE)	2
20	10-168-17	. SOC. HD. CAP SCREW 3/8 X 7/8	8
21	10-104-17	. WASHER	16
22	2500-10AP-1	. PILLOW BLOCK (1/2 BORE)	2
23	2500-28	. REACTION FIXTURE	1
24	10-128-3	. HX. SOC. FLT. HD. SCREW 1/4-20 X 3/4	5
25	10-128-19	. HX. SOC. FLT. HD. SCREW 38-16 X 3-1/2	2
26	10-107-6	. SPRING PIN	1
27	2500-38	. WORM GEAR (MODIFIED)	1
28	10-107-31	. SPRING PIN (3/8 DIA. X 2)	1
29	2500-32	. COVER, Top	1
30	2500-33	. COVER, End	2
31	10-225-9	. HX. BUT. HD. SCREW 8-32 X 5/16	12
32	2500-17AP	. SUCTION PAD	4
33	2500-34	. COVER, Bottom	1
34	2500-11	. PLATE REST	1
35	2000-28B-2	. HANDLE	1
36	2500-29	. KEY	1
37	2500-100-42	. CHUCK KEY CLIP HOLDER	1

Hardware List

Description	Qty	Use
Hex head screw 1/4-20, 3/4 in. long P/N 10-125-2	1	Secure counter weight (P/N 2000-176-0) to calibration arm (P/N 2000-154-0)
Socket head cap screw 3/8-16, 3 in. long P/N 10-168-16	4	Secure force arm (P/N 2000-212-0) to transducers 500 Ft. Lb., 1000 Ft. Lb., and 2000 Ft. Lb.
Hex head screw 3/8-16, 1-3/4 in. long ASTM A354, Grade BD P/N 2000-91-2	4	Secure adapter 1-1/4 in. sq. (P/N 2000-221-0) to transducers 500 Ft. Lb., 1000 Ft. Lb. and 2000 Ft. Lb.
Socket head cap screw 1/2-13, 1-3/4 in. long P/N 10-168-25	4	Secure calibration block ((P/N 2000-150-0) to calibration stand (P/N(P/N 2000-250-0)
Quick release pin 3/16 x 1.00 P/N 2000-195-1	5	For cable tensiometer setup (1/16, 3/32 and 1/8 dia. cables) For force cable setup (1/16 and 1/8 dia. cables) and as a security stop on Extension Fixture P/N 2000-550-108 as well as on Low Torque Station Mechanical Loader P/N 2500-1-01
Quick release pin 3/16 x 1.30 P/N 2000-195-2	3	Secure adapter no. 1, no. 2 and no. 3 to the force arm (P/N 2000-212-0)
Quick release pin 1/4 x 1.00 P/N 2000-195-3	2	For cable tensiometer setup (5/32 dia.) For force cable setup (5/32 dia.)
Quick release pin 5/16 x 1.00 P/N 2000-195-4	2	For cable tensiometer setup (3/16 and 7/32 dia. cables)

Hardware List (Continued)

Description	Qty	Use
Quick release pin 3/8 x 1.50 P/N 2000-195-5	1	To engage force cables 1/16, 1/8 and 5/32 dia. with compression gage adapter (P/N 2000-213-0)
Quick release pin 3/8 x 1.00 P/N 2000-195-6	2	For cable tensiometer setup (1/4 dia.)
Quick release pin 7/16 x 1.00 P/N 2000-195-7	1	For cable tensiometer setup (9/32 and 5/16 dia. cables)
Quick release pin 1/2 x 100 P/N 2000-195-8	1	For cable tensiometer setup (3/8 dia. cable)
Quick release pin 1/2 x 1.30 P/N 2000-195-9	1	To engage cable tensiometer (3/8 dia.) or force cable (3/8 dia.) with cable adapter no. 3
Quick release pin 5/8 x 1.50 P/N 2000-195-10	1	To engage force cable (3/8 dia.) with compression gage adapter (P/N 2000-213-0)
Quick release pin 7/16 x 1.50 P/N 2000-195-11	1	To engage cable tensiometer (9/32 and 5/16 dia.) with cable adapter no. 3
Quick release pin 3/8 x 2.00 in. long P/N 2000-195-12	4	To secure transducer assemblies on drive plate on High Torque Station Mechanical Loader and calibration block
Quick release pin 3/8 x 1.30 in. long P/N 2000-195-13	1	To secure transducer assemblies on drive plate on Low Torque Station Mechanical Loader