

Service and Operating Instructions



System 4 and 5 Digital Torque Tester



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LIST PRICE = \$60.00 U.S.

P/N 10070

Service and Operating Instructions
System 4 and 5
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SECTION 1 PRODUCT DESCRIPTION

1.1 INTRODUCTION

This instruction manual provides installation, operation and calibration instructions for the System 4 and 5 digital torque tester. If additional information concerning special applications, operation or service is required, please contact your local Sturtevant Richmond distributor, sales representative or the factory. **Please read all instructions carefully before using the torque tester.**

1.2 DESCRIPTION

The System 4 and System 5 digital torque testers are microprocessor based torque measuring devices. The primary function of the tester is to act as a N.I.S.T. traceable standard for verification of powered and non-powered torque tool accuracy. The System 4 and 5 are designed for bench or mobile test cart mounting, and are suitable for most indoor laboratory, factory and shop environments.

The torque capacity, units of measure and scaling are automatically set by connecting one of the twelve TT series torque transducers. The transducer is then bolted onto a table or cart that can absorb the reaction torque of the transducer. The operator then attaches the tool to be tested to the drive of the torque transducer, and applies torque. The torque delivered by the tool is then displayed. The operator then compares the actual torque delivered to the tolerance requirements of the tool, and adjusts the tool accordingly.

1.3 SPECIFICATIONS

1.3.1 SYSTEM SPECIFICATIONS

PHYSICAL:

WEIGHT BATTERY MODELS: 6.9 LB. (3.1 kg.)

WEIGHT AC MODELS: 4.3 LB. (2.0 kg.)

TRANSDUCER INTERFACE: MS3102A18-01S AMPHENOL

DISPLAY: 1 X 16 .5" characters, backlit Liquid crystal display (LCD)

KEYBOARD: Membrane switch panel

ENCLOSURE: Aluminum, plastic bezel. Meets MIL-T-28800E, TYPE 5, Class E specification.

ENCLOSURE FINISH: Grey pantone 428, Textured Polane paint

FIG. 1

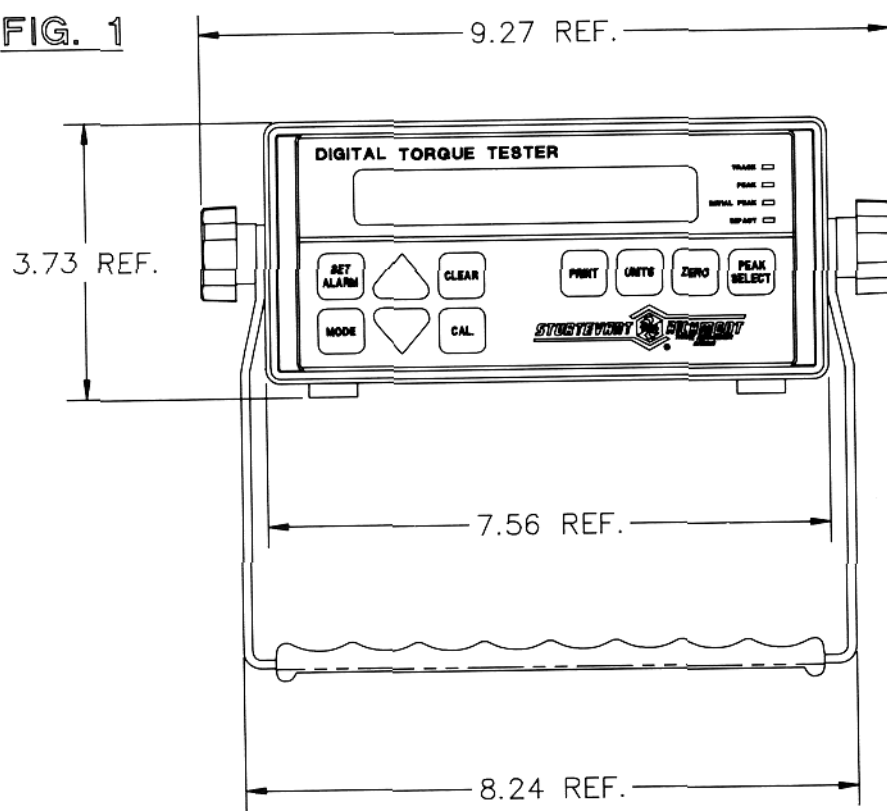
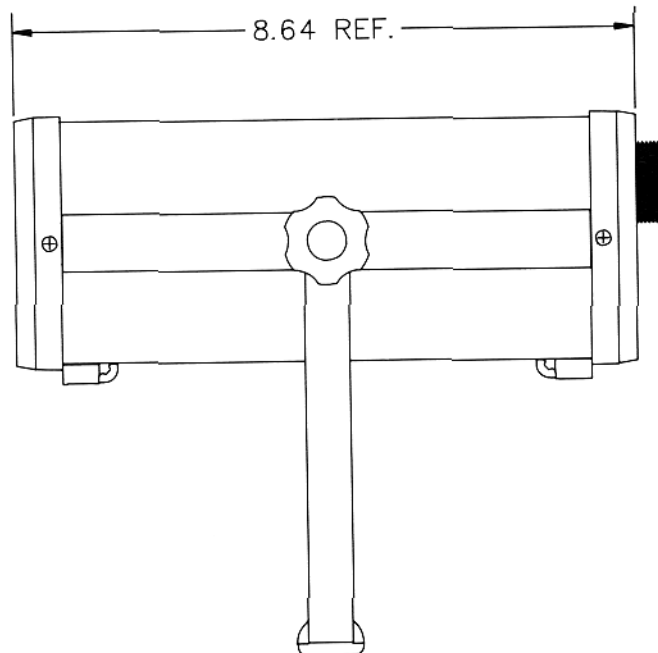


FIG. 2



MEASUREMENT SPECIFICATIONS:	SYSTEM 4	SYSTEM 5
SYSTEM ACCURACY 10% to 100% F.S. at 72 F:	.5% I.V.	.25% I.V.
SYSTEM ACCURACY 5 to 9.9% F.S. at 72 F:	1% I.V.	1% I.V.
DISPLAYED SYSTEM RESOLUTION WITH AUTO RANGING:	3.5 DIGIT	4.5 DIGIT
NON-LINEARITY (Amplifier):	.006% F.S.	.006% F.S.
NON-LINEARITY (A/D converter):	.006% F.S.	.001% F.S.
RESOLUTION (A/D converter):	1/16,384	1/16,384
CONVERSION RATE:	100 Khz	100 Khz
SIGNAL TO NOISE RATIO:	82 dB	78 dB
COMMON MODE REJECTION RATIO:	115 dB	120 dB
INPUT NOISE (Maximum) MICRO VOLTS:	.5	.5
BRIDGE EXCITATION:	+/- 3 VDC	+/- 3 VDC

POWER REQUIREMENTS:

LINE VOLTAGE: 120 or 240 VAC +/- 10%, 60 WATTS

FREQUENCY: 50 or 60 Hz

EXTERNAL CHARGER (Battery models only): 6 VDC, 500 mAh

BATTERY: 6 VDC lead acid rechargeable, 16 hours continous use (8 hours with backlite on)

COMPUTER INTERFACE SPECIFICATIONS:

TYPE: RS-232C, SERIAL

BAUD RATE (Selectable): 300, 1200, 2400, 4800, 9600 and 19200 (4800 is default)

STOP BITS: 1

PARITY (Selectable): even, odd, no, stick and mark (No is default)

CONNECTOR: DB9P (male)

PIN 2 = TXD PIN 3 = RXD PINS 4 and 6 = STRAP PINS 7 and 8 = STRAP PIN 5 = GND

HANDSHAKE: ASCII TEXT, protocol is NONE

ENVIROMENTAL SPECIFICATIONS:

OPERATING TEMPERATURE RANGE: 32 to 125 F (0 to 51.6 C)

STORAGE TEMPERATURE: -80 to 160 F (-26.7 to 71.1 C)

STORAGE HUMIDITY MAXIMUM: 95% RH non-condensing

SYSTEM TEMPERATURE EFFECT MAXIMUM: .009% / F

1.3.2 TT-SERIES STATIC TORQUE TRANSDUCER SPECIFICATIONS

CONSTRUCTION: Stainless steel

NON-LINEARITY (maximum): .1% F.S.

HYSTERESIS (maximum): .1% F.S.

NON-REPEATABILITY: .03% F.S.

OVERLOAD (safe): 50% of F.S. capacity.

OUTPUT : 2 mV / V (2 millivolts per volt of excitation)

BRIDGE RESISTANCE : 350 Ohms

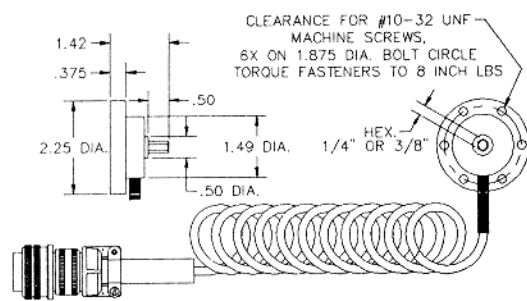
SHUNT CALIBRATION RESISTOR : (internal) 86.4K Ohms

OPERATING TEMPERATURE (maximum): -65 F to 225 F (-53 C to 107 C)

TEMPERATURE COMPENSATION RANGE (gain): 60 F to 160 F (15.6 C to 71 C)

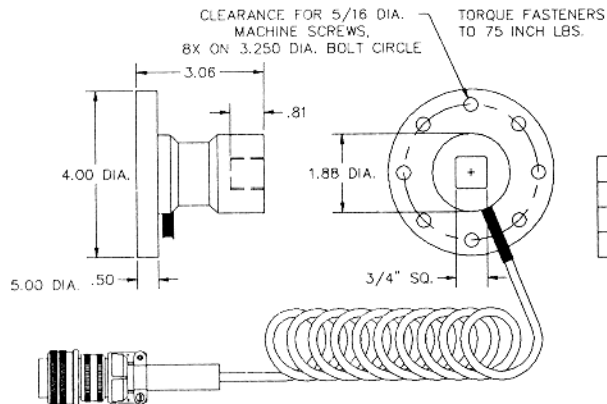
TEMPERATURE EFFECT (zero): .01% F.S. / F

RECOMMENDED TORQUE RANGE AND PHYSICAL SPECIFICATIONS:

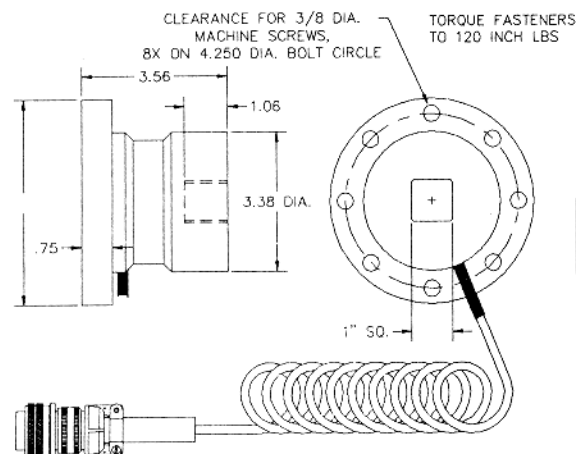


RECOMMENDED TORQUE RANGE						
PART NO.	MODEL NO.	INCH OZ.	INCH LBS.	cNm	kgf.cm	DRIVE
10009	TT-250I	2.5 - 25	.16 - 1.6	1.77 - 17.7	.18 - 1.8	1/4" M hex
10011	TT-100I	10 - 100	625 - 6.25	7.6 - 70.6	.72 - 7.2	1/4" M hex
10012	TT-250I	25 - 250	1.6 - 15.6	17.7 - 177	1.8 - 18	1/4" M hex
10013	TT-400I	40 - 400	2.5 - 25	28 - 280	2.9 - 29	1/4" M hex
10014	TT-50I	80 - 800	5 - 50	56 - 560	6 - 60	1/4" M hex

RECOMMENDED TORQUE RANGE						
PART NO.	MODEL NO.	INCH LBS.	FOOT LBS.	Nm	kgf.cm	DRIVE
10015	TT-100I	10 - 100		1.2 - 12	15 - 115	3/8" M hex
10016	TT-300I	30 - 300	2.5 - 25	3.5 - 35	35 - 350	3/8" M hex



RECOMMENDED TORQUE RANGE						
PART NO.	MODEL NO.	INCH LBS.	FOOT LBS.	Nm	kgf.cm	DRIVE
10017	TT-150	180 - 1800	15 - 150	20 - 200	210 - 2100	3/4" F SQ.
10018	TT-250	30 - 3000	25 - 250	34 - 340	35 - 3500	3/4" F SQ.
10019	TT-500	600 - 6K	50 - 500	67.5 - 675	700 - 7K	3/4" F SQ.



RECOMMENDED TORQUE RANGE						
PART NO.	MODEL NO.	INCH LBS.	FOOT LBS.	Nm	kgf.cm	DRIVE
10026	TT-1000	1200 - 10K	100 - 1000	135 - 1355	14 - 140	1" F SQ.
10027	TT-2000		200 - 2000	280 - 2800	28 - 280	1" F SQ.

1.3.3 INVENTORY OF PARTS

Each System 4 and 5 comes complete with an instruction manual, and storage/carrying case. The 120 VAC models also come with a power cord or charger. The 240 VAC models require that a separate power cord be ordered with the correct AC power connector per individual national standard.

1.3.4 CONFORMANCE TO SPECIFICATIONS

The System 4 and 5 meet or exceed the requirements of the following STANDARDS:

ANSI B107.14M

ISO 6789

JIS B4650

BS6703

All electric power supplies used in this piece of equipment are approved by UL, VDE and CSA. The equipment used to calibrate the System 4 and 5 is traceable to the United States National Institute of Standards and Technology (N.I.S.T.). Sturtevant Richmond maintains its inspection and calibration systems in conformance with MIL-45662A and MIL-45208A. ISO (International Organization for Standardization) certification to specification 9002 is pending.

1.4 ACCESSORIES

1.4.1 RUNDOWN ADAPTER

Used for testing power tools with greater accuracy. Provides a means for the power tool to rotate and build inertia, before making the final torque measurement. Available in 1/4" and 3/8" drive models for torque ranges up to 300 inch pounds.

1.4.2 DRIVE HEAD BUSHING SQUARE DRIVE ADAPTERS

Provides a means of connecting various size tools to the transducers. The following adapters are available:

P/N 870595 DHB 1/4" 1/4" Female square X 3/4" Male square Drive head bushing

P/N 870596 DHB 3/8" 3/8" Female square X 3/4" Male square Drive head bushing

P/N 870597 DHB 1/2" 1/2" Female square X 3/4" Male square Drive head bushing

P/N 870373 DHB 3/4" 3/4" Female square X 1" Male square Drive head bushing

It is highly recommended that the least amount of adapters be used for conducting accurate torque tests.

1.4.3 FOUR IN ONE TRANSDUCER MULTIPLEXOR BOX

Used to conveniently attach more than one transducer to the System 4 or 5. Up to four transducers can be attached to the multiplexor, which is then connected to the transducer input on the System 4 or 5. The multiplexor provides power to the transducers to keep them "warmed up". The operator can then quickly select the desired transducer by switching the selector switch to the appropriate number of the transducer. This accessory is very desirable for users who require various ranges of transducers.

1.4.4 OVERLOAD PROTECTION CLUTCH

This accessory can be fitted onto transducer ranges from 25 inch ounce to 300 inch pounds. The overload protection clutch provides a mechanical means of preventing torque overload of the transducer. This accessory can be ordered from the factory as a transducer option or retrofitted onto existing transducers at the factory. *The clutch slips at approximately 10% over the torque capacity of the transducer.*

1.4.5 RIGHT ANGLE "L-BRACKET"

This accessory provides a means to mount the transducer horizontally, for applications where operation in the vertical plane is cumbersome or inconvenient. This "L" shaped fixture is used for calibration of the System 4 and 5.

1.4.6 MECHANICAL WRENCH LOADER

Provides a means of mechanically applying force to the handle of the wrench. Used especially for dial or deflecting beam wrenches where pulling the handle of the wrench and viewing the scale can be difficult. Please call factory about details.

1.4.7 PRINTER

This accessory provides a means of printing out test values. Although most serial printers will interface with the System 4 or 5, battery operated models can be difficult to obtain. The Sturtevant Richmond printer allows the operator to obtain print outs while using the battery model System 4 and 5.

1.5 WARNINGS

1.5.1 ELECTRIC POWER

The System 4 and 5 are electric powered devices. Always use the power cord provided by the manufacturer. Check the back panel and charger for the rated input voltage and current **before** attaching main power. If you are attempting to service the product in the field, disconnect all power and power cords from the System before opening the enclosure. Follow the service instructions in this manual explicitly. *Sturtevant Richmond is not responsible for damages do to negligent repair attempts.* **Never** use sharp instruments (e.g. screwdrivers, pens, etc.) to press the switches on the front switch panel. You will damage the switch and void your warranty. **Never** expose the System 4 or 5 to the elements. The tester is not designed for outdoor use.

1.5.2 SAFETY WITH HAND TOOLS

Safety goggles or glasses should be worn at all times when using any torque wrench. Always use the *correct size adapters for the torque range you are testing.* Make sure the adapter is firmly connected to the wrench and transducer before applying torque to the wrench. **Never use a cheater bar** on the end of a wrench to make it easier to pull.

1.5.3 TORQUE TRANSDUCERS

Section 1.3.2 shows the torque ranges of the transducers. **Do not** exceed the maximum torque rating of the transducer. The transducers that came with your System 4 and 5, and only these transducers, have been calibrated into your System. If new transducers are ordered after initial delivery of the System 4 or 5, then the System must be returned to the factory for calibration to the new transducers. There will be no additional charge for this calibration (it is included in the cost of the transducer). However, shipping costs to and from the factory are at the customers expense. If the customer has calibration equipment, calibration can be performed in the field by following the calibration instructions in SECTION 4 of this manual.

1.5.4 IMPACT WRENCHES

Never use impact wrenches (hammer and anvil type pneumatic tools often referred to as "impact wrenches") with your transducers. These type tools will damage your transducers and void your warranty. However, modified versions of these transducers can be used to test these style tools. Please consult the factory for explicit instructions.

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SECTION 2 PREPARATION FOR USE

2.1 INSTALLATION

2.1.1 INSTALLATION SITE

The installation site must be indoors, and large enough to operate torque wrenches safely. Fast temperature fluctuations should be avoided around the tester and transducer (e.g. near door to outside, in front of heater or air conditioner, etc.). Do not expose tester and transducer to the elements.

2.1.2 REQUIRED MATERIALS

To install the TT-series torque transducers, you will require the following equipment:

1. Nuts, bolts, and washers (SEE Section 1.3.2 Transducer specifications for correct sizes).
2. Torque wrench or torque screwdriver (SEE Section 1.3.2 Transducer specifications for correct sizes)
3. Bench, table or cart capable of withstanding maximum torque of the largest transducer purchased. The top of the bench, table or cart should be smooth. If the bench top is wooden a flat metal plate may be required under the transducer. If the bench top is metal, it should be grounded to earth.
4. Drive adapters for testing tools.
5. (Optional) L-bracket for horizontal mounting (SEE Section 1.4.5 and L-Bracket installation instruction sheet).
6. System 4 or 5 and transducers.
7. Drill and bits of appropriate size and punch.

2.1.3 INSTALLATION

Use transducer flange as template and mark centers with a punch on cart, table or bench top. Use drill and bits to drill holes for the six bolts. Make sure surface is flat with no uneven surfaces or burrs around the holes. Place transducer over holes with the cable at the 10 o'clock position and install nuts, bolts, and washers with torque wrench or torque screwdriver. It is very important that all bolts are tightened evenly to the correct torque value. If other electrical devices are also mounted on the table, bench or cart, use an ohm meter to check that the table top is grounded to earth. (If you require assistance in checking the table top ground please consult the factory).

2.2 TURNING THE POWER ON

Please consult Figures 4 and 5 for the following sections.

2.2.1 AC POWERED MODELS

Plug power cord into the external power supply. Plug other end of power cord into the plug on the back panel of the System 4 or 5 labeled **INPUT POWER** (#23). Flip the main power switch (#22) to the ON (I) position. The Buzzer will "chirp", the display will show "DTT System" followed by "Self Test.....". Then after a few seconds the system completes the self test and displays " SELF TEST OK" then the software version is displayed followed by "READING TABLES" then "NO TRANSDUCER".

2.2.2 BATTERY POWERED MODELS

The battery should be charged when you receive the product. Flip the **POWER** switch to the **ON** position (fig. 4 *21). The Buzzer will "chirp", the display will show " DTT System". Followed by "SELF TEST" .Then after a few seconds the system completes the self test and displays " SELF TEST OK" then the software version is displayed followed by "READING TABLES " then " NO transducer".

The battery model System 4 and 5 are also equipped with a "sleep" mode. This software program turns off the LCD and LED display to conserve battery life when the switches on the front panel are not pressed for more than 1 minute. To "wake up" the tester, simply press a switch on the front panel or turn the power switch off then on. NOTE: pressing the **UP** and **DOWN** arrows simultaneously will turn the backlite on the LCD on or off. This will double the operating time of the tester on battery power. When the battery runs low a **B** will flash on the right side of the display to alert the operator. To connect the charger, plug the charger into the power supply. (If you have a 240 VAC model, you first must plug the power cord into the power supply and then into the charger). Plug the other end of the charger into the **CHARGER INPUT** (fig.4. *16) plug on the back of the tester. Flip the **POWER** (*21) switch to the **OFF** position. Allow system to charge for 8 hours.

2.3 CONNECTING A TRANSDUCER

Select the appropriate transducer for the torque range you wish to test (SEE Section 3.3.1 and 3.2.2). Connect the transducer to the **TRANSDUCER INPUT** (fig. 4 and 5 *17) by threading the outside of the cable connector onto the threaded receptacle on the back of the tester. Press the **ZERO** (fig.3 *17) switch the display will show "READING TABLES" followed by the capacity of the transducer. Then the display will show "O FT.LB" or the default unit for the transducer capacity. The system has downloaded from memory the correct calibration table for the transducer and the tester is ready for use.

NOTE: Follow these instructions whenever you connect a new transducer to the system 4/5.

2.4 CONNECTING A PRINTER

To connect a printer, you will require a serial printer and a cable wired per specifications listed in Section 1.3.1. Connect the 9 pin connector to printer and interface on tester. Press the **MODE** switch and then simultaneously press the **SET LIMIT** switch. The display will show "SET BAUD RATE". Press the **UP** or **DOWN ARROW** switch to select the parity that matches your printers. Press the **MODE** switch to return to normal operating mode. Press the **MODE** switch and then simultaneously press the **SET LIMIT** switch. The display will show "SET BAUD RATE". Press the **UP** or **DOWN ARROW** switch to select the baud rate that matches your printers. Press the **MODE** switch to return to normal operating mode.

FIG. 3

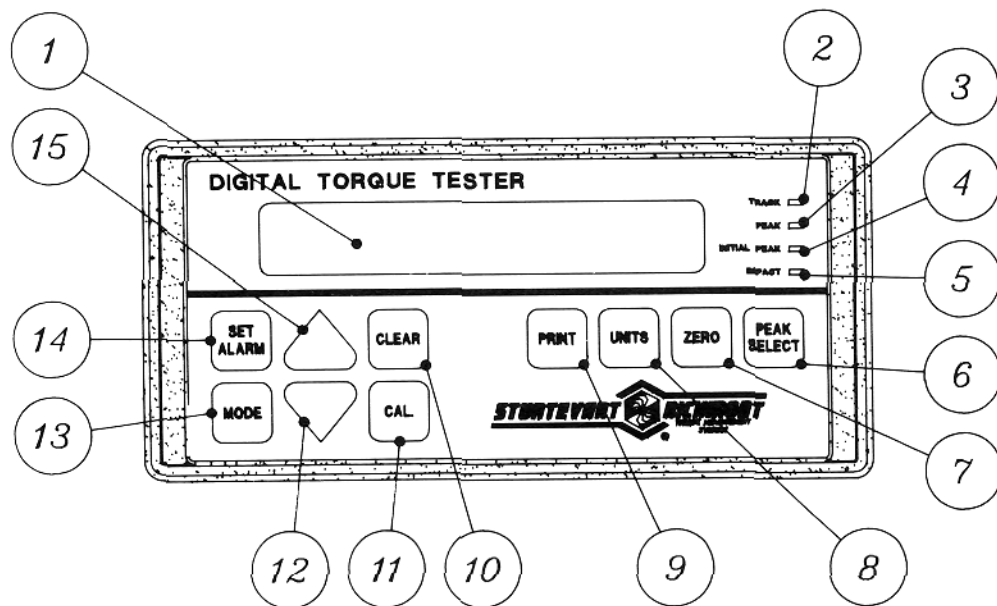


FIG. 4

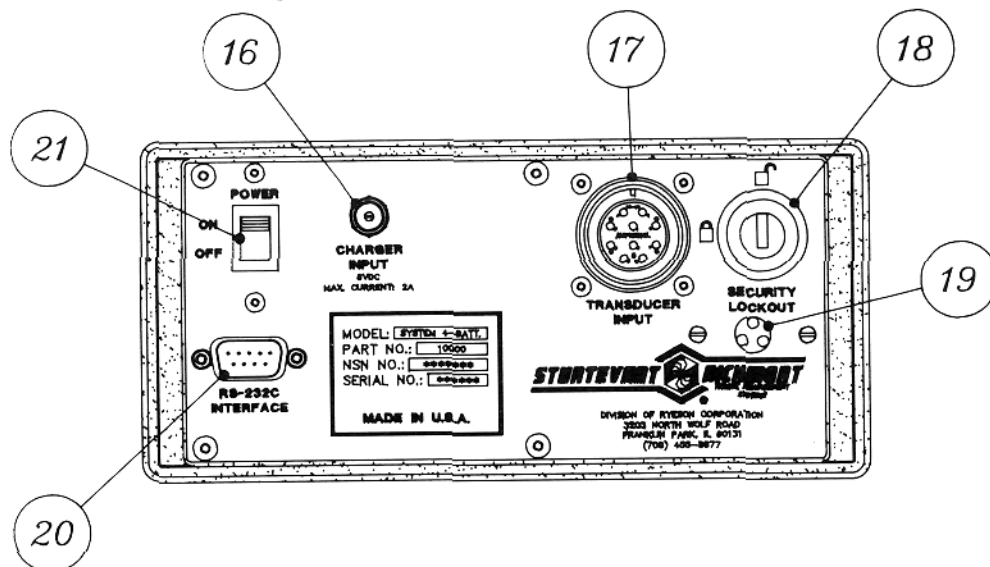
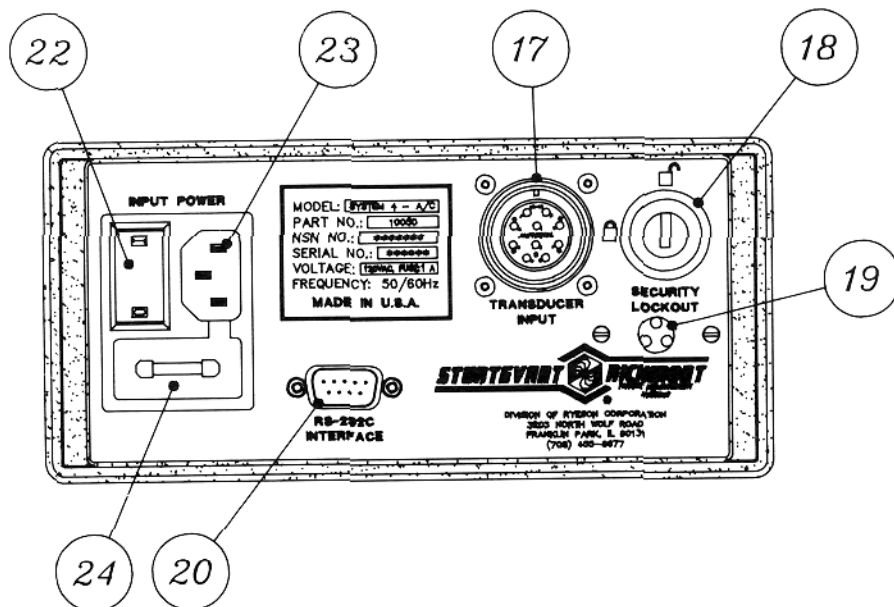


FIG. 5



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SECTION 3 OPERATING INSTRUCTION

3.1 CONTROL PANEL DESCRIPTION

Please consult FIGURES 3,4, and 5 for the following sections.

3.1.1 Power ON/OFF switch

This switch turns off the main power to the tester on AC powered testers (Fig. 5 #22) or battery powered testers (Fig. 4 #21).

3.1.2 Charger Input

(Fig. 4 #16) Connector for attaching the battery charger. NOTE: To charge the battery flip the power switch (Fig. 4 #21) to OFF position. Plug charger into main AC power supply. Attach charger connector to **CHARGER INPUT**. Allow 8 to 10 hours to fully recharge. NOTE: Unlike Nickel-cadmium batteries the System 4 and 5 is equipped with sealed Lead-acid batteries, which can be "trickle charged" without reducing the long term charging capacity of the battery. To replace the battery, see Section 5.3 Service instructions.

3.1.3 AC Power connector

(Fig. 5 #23) Connector for attaching AC power cord (AC models only). Power fuse (Fig. 5 #24) protects System from power input overload. The fuse will break the power contact if the current drawn by the tester exceeds 10 Amperes (Amps). To replace fuse, see Section 5.3 Service instructions.

3.1.4 Security lockout

When switch is turned to the locked position, the unit of measure cannot be changed. Additionally, the calibration mode cannot be entered. This prevents unwanted tampering with the tester by unauthorized personnel. NOTE: the key is removable.

3.1.5 RS-232C Interface

Serial communication port (Figure 4, 5 #20) for obtaining output from the System 4 or 5. For interface information see SECTION 1.3.1 Computer interface specifications.

3.1.6 Transducer Input

Connector for attaching the transducer to the tester (Figure 4, 5 #17). Thread the male plug end of the transducer over the threaded receptacle of the **TRANSDUCER INPUT** (Figure 4,5 #17) connector until it is fully threaded. Be careful not to cross thread the plug on the receptacle. Gently push on the rear of the plug, to make sure good contact is made with the receptacle.

3.1.7 Alarm

Access hole for audible alarm (Figure 4, 5 #19).

3.1.8 Liquid Crystal Display (LCD)

Used to display the torque value, unit of measure, special instructions and information to the operator (#1). The tester is equipped with a backlite that allows the display to be seen in dim lighting (this is the reason for the green background color on the display). On AC powered models, the backlite is always on. On battery models, the backlight can be turned on and off. Press the **MODE** switch (#13) and then the UP arrow switch (#15) to turn the backlight on. Press the **MODE** switch (#13) and then the DOWN arrow switch (#12) to turn the backlight off. NOTE: The hours of battery operation will be reduced to less than eight hours, when the backlight is on. To adjust the viewing angle of the display use the bail handle. Press the UP or DOWN arrow keys to adjust the contrast of the display.

3.1.9 Track, Peak, Initial Peak, and Impact LED's

These LED's (light emitting diodes) light next to the peak detection mode the tester is currently in. The following describes the mode to use to test certain types of tools.

TRACK (#2): This mode is primarily used to test deflecting beam, dial type, and direct reading screwdriver wrenches. **TRACK** is the slowest measuring mode and is designed specifically to measure static torque with a high degree of accuracy. This mode is also used during accuracy tests of the System 4 or 5.

PEAK (#3) : This mode is used to capture and hold the peak torque of click type torque wrenches and screwdrivers.

INITIAL PEAK (#4): This mode is used to capture and hold the initial peak of torque of click type torque wrenches.

IMPACT (#5): This mode is used to capture and hold the initial peak of torque from power tools. This is the fastest measuring mode of the System 4 or 5 and should only be used with power tools.

3.1.10 PEAK SELECT

This switch (#6) is used to change the peak detection mode of the tester. The LED next to the word **TRACK, PEAK, INITIAL PEAK** and **IMPACT** will light to signify the peak detection mode in use.

3.1.11 ZERO

The **ZERO** switch (#7) is used to set the zero point of the tester. Due to changes in temperature, differences in transducer zero balance, and small random drift the System 4 or 5 will require occasional zeroing. Never press this switch when applying a torque load. If this occurs, simply remove all torque load and press the **ZERO** switch again. The true zero of the transducer is stored in memory during the calibration mode. This switch is also used to change the transducer in use (SEE Section 2.4).

3.1.12 UNITS

Pressing this switch (*8) converts the torque unit of measure shown on the LCD display. The appropriate English, metric or S.I. units for the torque range of the transducer are displayable. (SEE APPENDIX for a chart of the displayable units of measure for each transducer). This switch will not function if the **SECURITY LOCKOUT** switch is in the locked position.

3.1.13 PRINT

If a printer is attached to the **RS232C** interface, pressing the **PRINT** switch (*9) will print the torque, unit of measure, direction, transducer capacity and mode on the printer. To automatically print out a captured **PEAK**, **INITIAL PEAK**, or **IMPACT** measurement, the System 4 and 5 has a special AUTOPRINT mode. Press and hold the **MODE** (*13) switch, then press the **PRINT** (*9) switch. The display will show "AUTOPRINT ON". To switch off the mode, press and hold the **MODE** (*13) switch, then press the **PRINT** (*9) switch. The display will show "AUTOPRINT OFF".

3.1.14 CLEAR

Press the **CLEAR** switch (*10) to clear the captured **PEAK**, **INITIAL PEAK**, or **IMPACT** values on the display. To automatically clear a captured **PEAK**, **INITIAL PEAK**, or **IMPACT** measurement, the System 4/5 has a special AUTOCLEAR mode. This mode will automatically clear the captured peak value on the display after 4 seconds. Press and hold the **MODE** (*13) switch, then press the **CLEAR** (*10) switch. The display will show "AUTOCLEAR ON". An **A** will be shown on the right side of the LCD display, to signal to the operator that the AUTOCLEAR mode is on. To switch off the mode, press and hold the **MODE** (*13) switch, then press the **CLEAR** (*10) switch. The display will show "AUTOCLEAR OFF". The **A** will no longer be displayed on the LCD.

3.1.15 CAL.

The **CAL.** switch (*11) is used to periodically check the calibration of the tester. Pressing the switch causes a shunt calibration resistor to be connected in parallel with the output of the transducer. This simulates a torque load on the transducer without using mechanical means and allows a quick check of the Systems accuracy. The display will show the simulated torque measurement when the switch is pressed. Compare the shunt calibration torque reading to the shunt value on your certification. If the value is not equal within 1 digit, it is likely your tester requires recalibration. To return to normal measuring mode, press the **CAL.** switch.

3.1.16 UP and DOWN ARROWS

Pressing the **UP** or **DOWN** arrows (*12, *15) adjusts the contrast of the LCD display. Also, these switches are used, in conjunction with other switches to activate modes of operation.

3.1.17 SET ALARM

The **SET ALARM** switch (*14) allows you to set an audible alarm. When the switch is pressed, the display shows; "SET LIMIT". Press the **UP** arrow switch and the least significant digit will increase by

one. Continuing to press the **UP** and **DOWN** arrow switch will continue to increase or decrease the least significant digit. To increase or decrease the display faster press the **PRINT** (*9) switch, and the changeable digit will move one place to the left (e.g. from 10.0 to 100.0). Continuing to press the **PRINT** (*9) switch, will shift the position over one place to the left. The position will "wrap around" when the **PRINT** switch is pressed at the 100's or 1000's place. To set the alarm and exit the SET ALARM mode, press the **SET ALARM** (*14) switch. The audible alarm will intermittently sound at 90% of the set torque value and will continue to sound when the set torque value is achieved. To clear the alarm press **SET ALARM** then **CLEAR** and then the **SET ALARM** switch.

3.1.18 MODE

The **MODE** (*13) switch is used to enter the special tester modes of operation. (SEE Section 2.3.2, 3.1.13, 3.1.14) Additionally, the **MODE** switch is used to enter the calibration mode. This mode allows you to calibrate new transducers to the System 4/5, or recalibrate existing transducers. SEE SECTION 4 Calibration Instructions for a full explanation of this mode.

3.2 HAND OPERATED TORQUE WRENCH TESTING INSTRUCTION

3.2.1 THE THREE LAWS OF TORQUE WRENCH TESTING

Always follow the three rules when performing torque tests.

LAW 1: Always check the torque wrench from lowest to highest setting, never vice versa. Never check the wrench (or transducer) by decreasing and then increasing the torque.

LAW 2: When changing direction from clockwise to counterclockwise, apply three full scale loads to the wrench and transducer in the new direction. This will compensate for inherent directional inaccuracy in both the wrench and transducer. This is a rule to be observed in any torque test or torque calibration.

LAW 3: Always begin testing with the wrench unloaded and indicating zero, or at lowest setting.

3.2.2 SELECTING THE CORRECT TRANSDUCER

The first step in testing a torque tool, is to select the correct torque capacity transducer. Select a transducer that best matches the capacity of the wrench. EXAMPLE: 150 foot pound torque wrench should be tested on a 150 foot pound transducer. Sometimes torque tools capacities will bridge two different transducer capacities. In these cases the wrench should be checked in the appropriate range on both transducers.

3.2.3 DIRECT READING WRENCH TESTING

Dial type screwdrivers, watches and wrenches, digital display torque wrenches, and deflecting beam type torque wrenches, are generally referred to as "direct reading torque wrenches". These tools are described in ANSI B107.14M as TYPE I indicating wrenches. These tools all display a measurement of torque instead of indicating or "signalling" (e.g. with a "click") that a certain amount of torque has been applied.

STEP 1: Select the correct drive adapter and attach to transducer.

STEP 2: Press the **PEAK SELECT** switch until the led lights next to the word **TRACK**. Sometimes it is difficult to pull on a wrench and see the display value. If this is the case press the **PEAK SELECT** switch until the LED next to **PEAK** lights.

STEP 3: If the display does not show zero, press the **ZERO** switch.

STEP 4: Press the **UNIT** switch until the unit of measure shown on the display of the tester matches the the unit of measure of the wrench.

STEP 5: Attach torque wrench to drive of transducer. The tool can be attached either vertically or horizontally. If tool is attached horizontally, the tare weight of the wrench will be shown. NEVER zero the tare weight of a torque wrench. The tare weight is a component part of the wrench calibration.

STEP 6: Pull on wrench until the scale indicates the torque value of the first set point. Press the **PRINT** switch if you wish to record the display value on the printer.

STEP 7: The tester shows the true torque delivered by the wrench. Compare the tester value to torque wrench indicated value. Decide if wrench is within the stated accuracy tolerance.

STEP 8: If wrench is within tolerance, continue to test each check point of the wrench. If **PEAK** mode is on press the **CLEAR** switch to clear the display value. If the wrench is out of tolerance, adjust tool per manufacturers instructions and redo STEPS 6- 7. When all test points have been checked and are within tolerance, testing of the tool is complete.

3.2.4 SETTING ("CLICK") TORQUE WRENCH TESTING

These tools are described in ANSI B107.14M as TYPE 2 setting wrenches and TYPE 3 limiting wrenches. These tools "signal" (e.g. with a "click") that a certain amount of torque has been applied. Setting wrenches are the most commonly used torque wrenches, and can be graduated (with incremental torque graduations) or ungraduated "preset" type tools.

STEP 1: Select the correct drive adapter and attach to transducer.

STEP 2: Press the **PEAK SELECT** switch until the led lights next to the word **INITIAL PEAK**. If using TYPE 3 torque limiting screwdrivers, use **PEAK** mode.

STEP 3: If the display does not show zero, press the **ZERO** switch.

STEP 4: Press the **UNIT** switch until the unit of measure shown on the display of the tester matches the the unit of measure of the wrench. If desired, set the AUTOCLEAR or AUTOPRINT functions.

STEP 5: Attach torque wrench to drive of transducer. The tool can be attached either vertically or horizontally. If tool is attached horizontally, the tare weight of the wrench will be shown. NEVER zero the tare weight of a torque wrench. The tare weight is a component part of the wrench calibration.

STEP 6: Set tool to the torque value of the first set point. Pull on wrench slowly and steadily until tool "clicks" or signals.

STEP 7: The tester shows the true torque delivered by the wrench. Compare the tester value to torque wrench indicated value. Decide if wrench is within the stated accuracy tolerance. Press the **PRINT** switch if you wish to record the display value on the printer.

STEP 8: If wrench is within tolerance, continue to test each check point of the wrench. Press the **CLEAR** switch to clear the display value. If AUTOCLEAR or AUTOPRINT is on, the display will print and clear automatically after 4 seconds. If the wrench is out of tolerance, adjust tool per manufacturers instructions and redo STEPS 6- 7. When all test points have been checked and are within tolerance, testing of the tool is complete.

3.3 POWER TOOL TESTING INSTRUCTION

3.3.1 SELECTING THE CORRECT TRANSDUCER

The first step in testing a power tool, is to select the correct torque capacity transducer. Select a transducer that matches the capacity of the power tool in the lower 50% of tool capacity. EXAMPLE: 100 inch pound torque setting on power tool should be tested on a 300 inch pound transducer. It is possible to use a transducer that matches the setting of the power tool. In this case first test the tool on a higher capacity transducer to make sure the torque will not exceed the capacity of the lower capacity transducer. Then proceed with the instructions below.

3.3.2 POWER TOOL TORQUE TESTING PROCEDURE

Power tools are pneumatically or electrically driven tools that will stall or ratchet when a certain amount of torque has been applied. The tools are generally "preset" type set to one torque set point, and must repeat within a certain tolerance. Impact wrenches are non-torque control (e.g. do not limit the torque applied) pneumatic tools. They are one of the most common power tools available. DO NOT TEST these style tools before consulting the factory. These style tools can damage your transducer beyond repair and will void your warranty. Please consult the factory for pre approval before testing this style tool.

STEP 1: Select the correct drive adapter and rundown fixture and attach to transducer. Make sure that the cap screw in the rundown fixture is loosened counterclockwise, at least three turns.

STEP 2: Press the **PEAK SELECT** switch until the led lights next to the word **IMPACT**.

STEP 3: If the display does not show zero, press the **ZERO** switch.

STEP 4: Press the **UNIT** switch until the desired unit of measure is shown on the display. It is not recommended to set the AUTOCLEAR or AUTOPRINT functions when checking power tools.

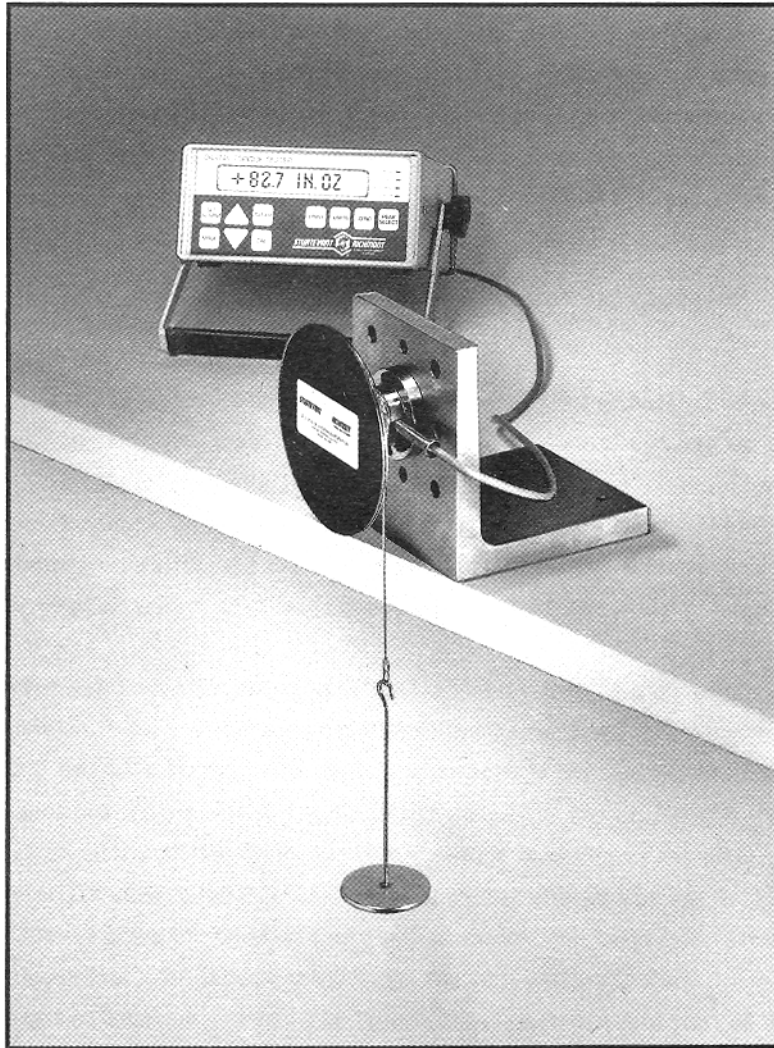
STEP 5: Attach power tool to drive of rundown fixture-transducer. The tool can be attached either vertically or horizontally. If tool is attached horizontally, the tare weight of the wrench will be shown. NEVER zero the tare weight of a torque wrench. The tare weight is a component part of the wrench calibration.

STEP 6: Engage power to the tool, until tool stalls or ratchets. (If tool ratchets, disengage power to the tool immediately).

STEP 7: The tester shows the true torque delivered by the power tool. Compare the tester value to the desired torque setting for the tool. If desired, press the **PRINT** switch. Reverse the tool (or manually) loosen the rundown fixture screw. Press the **CLEAR** switch.

STEP 8: If wrench is within tolerance, redo STEPS 6-7 at least five times to assure good tool repeatability. If the wrench is out of tolerance, adjust tool per manufacturers instructions and redo STEPS 6- 7. When tool repeats consistently within desired torque tolerance, testing of the tool is complete.

CALIBRATION EQUIPMENT EXAMPLE



SECTION 4 CALIBRATION INSTRUCTIONS

4.1 INTRODUCTION

The System 4 or 5 may periodically require calibration depending on the usage and environment surrounding the system. It is recommended that the system's calibration is verified at least once a year.

There are two steps to analyzing the accuracy of the System 4 or 5; verification and calibration. Verification is the process of COMPARING the readings of the system to known torque force standards. CALIBRATION is the process of changing the readings of the System 4 or 5 to conform to known torque force standards. The first step is verification and if required, calibration follows.

Torque is the force that resists a turning movement and is measured by multiplying the distance from the central axis of rotation by the force applied. To create known torque force requires two elements: a known lever distance and deadweights traceable to government standards. The weight is suspended vertically at the certified length, creating a torque at the central axis of rotation. The torque is calculated using the following formula:

$$\text{TORQUE} = \text{LEVER LENGTH (Inches or meters)} \times \text{WEIGHT (pounds or kilograms)}$$

Example #1: 48 inch lever length X 5 pounds = How much torque?

Answer #1: 48 X 5 = 240 inch pounds of torque force

Example #2: 1 meter lever length X 2 kilograms force = How much torque?

Answer #2: 1 X 2 = 2 kilogram force meter of torque force.

The System 4 or 5's accuracy is verified using the same principles as described above. A five pound weight suspended from a forty-eight inch lever length attached to the drive square of the torque transducer, creates 240 inch pounds of torque at the drive square of the transducer. The torque indicated by the tester can be compared to the nominal (comparison) value of 240 inch pounds. The deviation from the nominal can be determined and compared to the tolerance table in SECTION 4.5 of this manual. If the System 4 or 5's readings are determined to fall outside the tolerance limits, the tester must be calibrated. Both the System 4 and 5 have an internal calibration software program that allows the operator to calibrate the transducer to the tester. The program uses a series of calibration set points at 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% of the full scale of the transducer. These points are set in the clockwise and counter-clockwise directions for equal accuracy in both directions. Each calibration point is stored in the memory of the tester, and is only valid for a specific transducer. Linearity is maintained by the microprocessor in the System 4 or 5, allowing precise accuracy to be attained.

4.2 REQUIRED MATERIALS

The following N.I.S.T. traceable torque calibration equipment is sold by Sturtevant Richmond. Because of the breadth of transducer capacities, the instructions use the 100 inch pound calibration kit as an example. Each calibration kit has individual instruction sheets to clarify proper set up and use of the

kit. If the owner has different torque calibration equipment than that specified on the following page, please consult the factory for additional information.

PART NO.	MODEL NO.	DESCRIPTION
10075	DWTK-25IO	Deadweight test kit for 25 inch ounce transducer
10076	DWTK-100IO	Deadweight test kit for 100 inch ounce transducer
10077	DWTK-250IO	Deadweight test kit for 250 inch ounce transducer
10078	DWTK-400IO	Deadweight test kit for 400 inch ounce transducer
10079	DWTK-50I	Deadweight test kit for 50 inch pound transducer
10080	DWTK-100I	Deadweight test kit for 100 inch pound transducer
10081	DWTK-300I	Deadweight test kit for 300 inch pound transducer
10082	DWTK-150	Deadweight test kit for 150 foot pound transducer
10083	DWTK-250	Deadweight test kit for 250 foot pound transducer
10084	DWTK-500	Deadweight test kit for 500 foot pound transducer
10085	DWTK-1000	Deadweight test kit for 1000 foot pound transducer
10086	DWTK-2000	Deadweight test kit for 2000 foot pound transducer
20435	L-BRACKET	Horizontal transducer mounting bracket for calibration.

NOTE: L-bracket must be ordered with deadweight test kit. Deadweight test kits include: weights, calibration arm and storage case. All deadweight test kits come with N.I.S.T. traceable certification.

For the example, the deadweight test kit for the 100 inch pound transducer comes with the following equipment; one 10 inch calibration arm, one 1 pound platform and nine 1 pound slotted weights. Also an L-bracket is required.

4.3 VERIFICATION OF ACCURACY

STEP 1 : Mount and level the L-bracket to the bench or table, per L-bracket instruction sheet.

STEP 2 : Follow instructions in Section 2.1 to 2.3 for setup.

STEP 3 : Set System 4 or 5 to **TRACK** mode. Allow the tester and transducer to "warm up" (receive power) for 1 hour.

STEP 4 : Follow the instructions for counter balancing that are included with the calibration arm. Attach the drive of the 10 inch calibration arm to the 3/8" drive of the transducer.

STEP 5 : Hang platform and all nine 1 pound weights on the hook of the 10 inch calibration arm, in the clockwise direction. Wait one minute then remove the weights and calibration arm from the transducer.

STEP 6 : Wait one minute then press the **ZERO** switch on the tester.

STEP 7 : Attach the drive of the 10 inch calibration arm to the 3/8" drive of the transducer.

STEP 8 : Hang 1 pound platform from the hook on the 10 inch calibration arm. The 1 pound weight at a 10 inch radius creates a known torque of 10 inch pounds, and is the 10% point of the transducers scale. The displayed torque on the System 4 or 5, should be within the accuracy tolerances shown in Table 6 of Section 4.5. If the value is not within the accuracy tolerance go to Section 4.4 Calibration

Instructions. If the value is within the accuracy tolerance proceed to STEP 9.

STEP 9: Hang 1 pound slotted weight on top of 1 pound platform. This is 2 pounds at a 10 inch radius creating a known torque of 20 inch pounds, and is the 20% point of the transducers scale. The displayed torque on the System 4 or 5, should be within the accuracy tolerances shown in Table 6 of Section 4.5 for the 20% point. If the value is not within the accuracy tolerance go to Section 4.4 Calibration Instructions. If the value is within the accuracy tolerance proceed to STEP 10.

STEP 10: Continue to check each calibration point at 30%, 40%, 50%, 60%, 70%, 80%, 90% and 100% in the clockwise direction. Each time compare the displayed torque on the System 4 or 5, with the accuracy tolerances shown in Table 6 of Section 4.5 for each point. If the value is not within the accuracy tolerance go to Section 4.4 Calibration Instructions. When the 100 inch pound clockwise calibration check is completed, go to STEP 11.

STEP 11: Reverse the calibration arm to load counterclockwise. Follow STEPS 5 thru 10 loading in the counterclockwise direction. If the displayed torque on the System 4 or 5, is within the accuracy tolerances shown in Table 6 of Section 4.5 at 20 points, the verification of accuracy is complete. Return calibration equipment to storage containers, and resume use of the tester.

4.4 CALIBRATION INSTRUCTIONS

STEP 1: Set System 4 or 5 to **TRACK** mode. Allow the tester and transducer to "warm up" (receive power) for 1 hour. Turn the **SECURITY LOCKOUT** key switch to the unlocked position. NOTE: you cannot enter the calibration mode until the **SECURITY LOCKOUT** key switch is in the unlocked position.

STEP 2: Enter the calibration mode. Press the **MODE** switch, then simultaneously press the **CAL.** switch. The display will show; "CALIBRATION MODE". Release the **MODE** and **CAL.** switches. After 10 seconds the display will show; "PASSWORD?". Press the **UP ARROW** switch then simultaneously press the **DOWN ARROW** switch. The display will show "INC" then "DEC". Release both switches, and press the **MODE** switch. The display will show "READING TABLES" and then transducer capacity "100 in.lbs".

STEP 3: Follow the instructions for counter balancing that are included with the calibration arm. Attach the drive of the 10 inch calibration arm to the 3/8" drive of the transducer.

STEP 4: Press the **UP ARROW** switch, the display shows: "TQ 100% F.S. CW". The display is prompting the operator to use the dead weights and test beam to load to the full scale clockwise capacity of the transducer, which is 100 inch pounds. Hang platform and all nine 1 pound weights on the hook of the 10 inch calibration arm, in the clockwise direction. Wait until weights are still, then press the **CAL.** switch.

STEP 5: The display shows; "Remove TQ <CAL>". Remove all weights and calibration arm from transducer. Press the **CAL.** switch.

STEP 6: The display shows; "Press <ZERO>". Wait one minute then press the **ZERO** switch. Repeat STEPS 4 - 6, two more times, then proceed to STEP 7.

STEP 7: The display shows; "TQ 10% F.S. CW". Consult Calibration Chart for the transducer in

Section 4.5 Hang 1 pound platform from the hook on the 10 inch calibration arm. The 1 pound weight at a 10 inch radius creates a known torque of 10 inch pounds, and is the 10% point of the transducers scale. Wait until weights are still, then press the **CAL.** switch.

STEP 8: The display shows; "TQ 20% F.S. CW". Consult Calibration Chart for the transducer in Section 4.5 Hang 1 pound platform and one pound slotted weight from the hook on the 10 inch calibration arm. The 2 pounds of weight at a 10 inch radius creates a known torque of 20 inch pounds, and is the 20% point of the transducers scale. Wait until weights are still, then press the **CAL.** switch.

STEP 9: The display shows; "TQ 30% F.S. CW". Consult Calibration Chart for the transducer in Section 4.5 Hang 1 pound platform and another one pound slotted weight from the hook on the 10 inch calibration arm. The 3 pounds of weight at a 10 inch radius creates a known torque of 30 inch pounds, and is the 30% point of the transducers scale. Wait until weights are still, then press the **CAL.** switch.

STEP 10: Continue this procedure for the 40%, 50%, 60%, 70%, 80%, 90% calibration points.

STEP 11: When the **CAL.** switch is pressed after the 90% calibration point clockwise, the display shows; "TQ 100% F.S. CCW". Repeat STEPS 4-11. When the **CAL.** switch is pressed after the 90% calibration point counterclockwise, the display shows; "To Save <CAL>". The System is asking whether you wish to save the new calibration table. If you have properly calibrated the System, press the **CAL.** switch, and the new calibration table is saved in the memory of the tester. NOTE: you will destroy the "old" or previous calibration table if you press the **CAL.** switch. If you do not wish to save the new calibration table exit the calibration mode by switching the power to the tester off.

STEP 12: If you saved the new calibration table in STEP 11, the display will show "WAIT". Then the display will return to normal track measurement mode. Repeat STEPS 5 -11 of Section 4.3 to verify the accuracy of the tester.

4.5 CALIBRATION TOLERANCE CHARTS

The next eight pages contain the tolerance charts (minimum and maximum allowable deviation) for each transducer. The chart also details the contents of the deadweight test kits sold by Sturtevant Richmond. Note: The System 4 and System 5 have different tolerances. Please be careful to consult the correct tolerance chart.

Tolerance Chart System 4 with TT-25ID

PART NO. 10075 DEADWEIGHT TEST KIT 25 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	2.500	2.512	2.488	1 ounce platform
20%	5.000	5.025	4.975	+ 1 ounce weight
30%	7.500	7.537	7.463	+ 1 ounce weight
40%	10.00	10.05	9.950	+ 1 ounce weight
50%	12.50	12.56	12.44	+ 1 ounce weight
60%	15.00	15.07	14.93	+ 1 ounce weight
70%	17.50	17.54	17.46	+ 1 ounce weight
80%	20.00	20.10	19.90	+ 1 ounce weight
90%	22.50	22.61	22.39	+ 1 ounce weight
100%	25.00	25.12	24.88	+ 1 ounce weight

Tolerance Chart System 4 with TT-100ID

PART NO. 10076 DEADWEIGHT TEST KIT 100 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	10.00	10.05	9.950	4 ounce platform
20%	20.00	20.10	19.90	+ 4 ounce weight
30%	30.00	30.15	29.85	+ 4 ounce weight
40%	40.00	40.20	39.80	+ 4 ounce weight
50%	50.00	50.25	49.75	+ 4 ounce weight
60%	60.00	60.30	59.70	+ 4 ounce weight
70%	70.00	70.35	69.65	+ 4 ounce weight
80%	80.00	80.40	79.60	+ 4 ounce weight
90%	90.00	90.45	89.55	+ 4 ounce weight
100%	100.0	100.5	99.50	+ 4 ounce weight

Tolerance Chart System 4 with TT-250ID

PART NO. 10077 DEADWEIGHT TEST KIT 250 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	25.00	25.12	24.88	8 oz. platfrom + 2 oz. weight
20%	50.00	50.25	49.75	+ 8 oz. weight + 2 oz. weight
30%	75.00	75.37	74.63	+ 8 oz. weight + 2 oz. weight
40%	100.0	100.5	99.50	+ 8 oz. weight + 2 oz. weight
50%	125.0	125.6	124.4	+ 8 oz. weight + 2 oz. weight
60%	150.0	150.7	149.3	+ 8 oz. weight + 2 oz. weight
70%	175.0	175.8	174.2	+ 8 oz. weight + 2 oz. weight
80%	200.0	201.0	199.0	+ 8 oz. weight + 2 oz. weight
90%	225.0	226.1	223.9	+ 8 oz. weight + 2 oz. weight
100%	250.0	251.2	248.8	+ 8 oz. weight + 2 oz. weight

Tolerance Chart System 4 with TT-400ID

PART NO. 10078 DEADWEIGHT TEST KIT 400 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL.,	WEIGHTS TO USE FROM KIT
10%	2.500	2.512	2.488	1 pound platform
20%	5.000	5.025	4.975	+ 1 pound weight
30%	7.500	7.537	7.463	+ 1 pound weight
40%	10.00	10.02	9.975	+ 1 pound weight
50%	12.50	12.53	12.47	+ 1 pound weight
60%	15.00	15.03	14.97	+ 1 pound weight
70%	17.50	17.54	17.46	+ 1 pound weight
80%	20.00	20.05	19.95	+ 1 pound weight
90%	22.50	22.55	22.44	+ 1 pound weight
100%	25.00	25.06	24.94	+ 1 pound weight

Tolerance Chart for System 4 with TT-50I

PART NO. 10079 DEADWEIGHT TEST KIT 50 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL.,	WEIGHTS TO USE FROM KIT
10%	5.000	5.025	4.975	.5 platform
20%	10.00	10.05	9.950	+ .5 pound weight
30%	15.00	15.07	14.93	+ .5 pound weight
40%	20.00	20.10	19.90	+ .5 pound weight
50%	25.00	25.12	24.88	+ .5 pound weight
60%	30.00	30.15	29.85	+ .5 pound weight
70%	35.00	35.17	34.83	+ .5 pound weight
80%	40.00	40.20	39.80	+ .5 pound weight
90%	45.00	45.22	44.78	+ .5 pound weight
100%	50.00	50.25	49.75	+ .5 pound weight

Tolerance Chart for System 4 with TT-100I

PART NO. 10080 DEADWEIGHT TEST KIT 100 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL.,	WEIGHTS TO USE FROM KIT
10%	10.00	10.05	9.950	1 pound platform
20%	20.00	20.10	19.90	+ 1 pound weight
30%	30.00	30.07	29.93	+ 1 pound weight
40%	40.00	40.20	39.80	+ 1 pound weight
50%	50.00	50.25	49.75	+ 1 pound weight
60%	60.00	60.30	59.70	+ 1 pound weight
70%	70.00	70.35	69.65	+ 1 pound weight
80%	80.00	80.40	79.60	+ 1 pound weight
90%	90.00	90.45	89.55	+ 1 pound weight
100%	100.0	100.5	99.50	+ 1 pound weight

Tolerance Chart for System 4 and TT-300I

PART NO. 10081 DEADWEIGHT TEST KIT 300 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	30.00	30.15	29.85	1 lbs. platform + (2) 1 lbs. weights
20%	60.00	60.30	59.70	+ (3) 1 pound weights
30%	90.00	90.45	89.55	+ (3) 1 pound weights
40%	120.0	120.6	119.4	+ (3) 1 pound weights
50%	150.0	150.7	149.3	+ (3) 1 pound weights
60%	180.0	180.8	179.2	+ (3) 1 pound weights
70%	210.0	211.0	209.0	+ (3) 1 pound weights
80%	240.0	241.2	238.8	+ (3) 1 pound weights
90%	270.0	271.3	268.7	+ (3) 1 pound weights
100%	300.0	301.5	298.5	+ (3) 1 pound weights

Tolerance Chart System 4 with TT-150

PART NO. 10082 DEADWEIGHT TEST KIT 150 FOOT. LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	180.0	180.9	179.1	5 lbs. platform + 10 lbs.+ (3) 1 lbs.
20%	360.0	361.8	358.2	+10 lbs + 5 lbs. + (3) 1 lbs. weights
30%	540.0	542.7	537.3	+10 lbs + 5 lbs. + (3) 1 lbs. weights
40%	720.0	723.6	716.4	+10 lbs + 5 lbs. + (3) 1 lbs. weights
50%	900.0	904.5	895.5	+10 lbs + 5 lbs. + (3) 1 lbs. weights
60%	1080	1085.4	1074.6	+10 lbs + 5 lbs. + (3) 1 lbs. weights
70%	1260	1266.3	1253.7	+10 lbs + 5 lbs. + (3) 1 lbs. weights
80%	1440	1447.2	1432.8	+10 lbs + 5 lbs. + (3) 1 lbs. weights
90%	1620	1628.1	1611.9	+10 lbs + 5 lbs. + (3) 1 lbs. weights
100%	1800	1809.0	1791.0	+10 lbs + 5 lbs. + (3) 1 lbs. weights

Tolerance Chart System 4 with TT-250

PART NO. 10083 DEADWEIGHT TEST KIT 250 FOOT.LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	300.0	301.5	298.5	5 lb platform + 1 lb + .25 lb weight
20%	600.0	603.0	597.0	+ 5 lb + 1 lb + .25 lb weight
30%	900.0	904.5	895.5	+ 5 lb + 1 lb + .25 lb weight
40%	1200	1206	1194	+ 5 lb + 1 lb + .25 lb weight
50%	1500	1507	1493	+ 5 lb + 1 lb + .25 lb weight
60%	1800	1809	1791	+ 5 lb + 1 lb + .25 lb weight
70%	2100	2110	2090	+ 5 lb + 1 lb + .25 lb weight
80%	2400	2412	2388	+ 5 lb + 1 lb + .25 lb weight
90%	2700	2713	2687	+ 5 lb + 1 lb + .25 lb weight
100%	3000	3015	2985	+ 5 lb + 1 lb + .25 lb weight

Tolerance Chart System 4 with TT-500

PART NO. 10084 DEADWEIGHT TEST KIT 500 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	600.0	603.0	597.0	5 lb platform + 5 lb + 2 lb + .5 lb
20%	1200	1206	1194	+ 10 lb + 2 lb + .5 lb weights
30%	1800	1809	1791	+ 10 lb + 2 lb + .5 lb weights
40%	2400	2412	2388	+ 10 lb + 2 lb + .5 lb weights
50%	3000	3015	2985	+ 10 lb + 2 lb + .5 lb weights
60%	3600	3618	3582	+ 10 lb + 2 lb + .5 lb weights
70%	4200	4221	4179	+ 10 lb + 2 lb + .5 lb weights
80%	4800	4824	4776	+ 10 lb + 2 lb + .5 lb weights
90%	5400	5427	5373	+ 10 lb + 2 lb + .5 lb weights
100%	6000	6030	5970	+ 10 lb + 2 lb + .5 lb weights

Tolerance Chart for System 4 with TT-1000

PART NO. 10085 DEADWEIGHT TEST KIT 1000 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	1200	1206	1194	5 lb platform + 20 lb weight
20%	2400	2412	2388	+ 20 lb + 5 lb weight
30%	3600	3618	3582	+ 20 lb + 5 lb weight
40%	4800	4824	4776	+ 20 lb + 5 lb weight
50%	6000	6030	5970	+ 20 lb + 5 lb weight
60%	7200	7236	7164	+ 20 lb + 5 lb weight
70%	8400	8442	8358	+ 20 lb + 5 lb weight
80%	9600	9648	9552	+ 20 lb + 5 lb weight
90%	10800	10854	10746	+ 20 lb + 5 lb weight
100%	12000	12060	11940	+ 20 lb + 5 lb weight

Tolerance Chart System 4 with TT-2000

PART NO. 10086 DEADWEIGHT TEST KIT 2000 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	2400	2412	2388	5 lb platform + 5 lb + (2)20 lb weight
20%	4800	4824	4776	+ 50 lb weight
30%	7200	7236	7164	+ 50 lb weight
40%	9600	9648	9552	+ 50 lb weight
50%	12000	12060	11940	+ 50 lb weight
60%	14400	14472	14328	+ 50 lb weight
70%	16800	16884	16716	+ 50 lb weight
80%	19200	19296	19104	+ 50 lb weight
90%	21600	21708	21492	+ 50 lb weight
100%	24000	24120	23880	+ 50 lb weight

Tolerance Chart for System 5 with TT-25ID

PART NO. 10075 DEADWEIGHT TEST KIT 25 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	2.5	2.506	2.494	1 ounce platform
20%	5.0	5.012	4.988	+ 1 ounce weight
30%	7.5	7.518	7.482	+ 1 ounce weight
40%	10.0	10.02	9.975	+ 1 ounce weight
50%	12.5	12.53	12.47	+ 1 ounce weight
60%	15.0	15.03	14.97	+ 1 ounce weight
70%	17.5	17.54	17.46	+ 1 ounce weight
80%	20.0	20.05	19.95	+ 1 ounce weight
90%	22.5	22.55	22.44	+ 1 ounce weight
100%	25.0	25.06	24.94	+ 1 ounce weight

Tolerance Chart for System 5 with TT-100ID

PART NO. 10076 DEADWEIGHT TEST KIT 100 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	10.00	10.02	9.98	4 ounce platform
20%	20.00	20.05	19.95	+ 4 ounce weight
30%	30.00	30.07	29.93	+ 4 ounce weight
40%	40.00	40.10	39.90	+ 4 ounce weight
50%	50.00	50.12	49.88	+ 4 ounce weight
60%	60.00	60.15	59.85	+ 4 ounce weight
70%	70.00	70.17	69.83	+ 4 ounce weight
80%	80.00	80.20	79.80	+ 4 ounce weight
90%	90.00	90.22	89.78	+ 4 ounce weight
100%	100.0	100.2	99.75	+ 4 ounce weight

Tolerance Chart for System 5 with TT-250ID

PART NO. 10077 DEADWEIGHT TEST KIT 250 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH OZ.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	25.00	25.06	24.94	8 oz. platfrom + 2 oz. weight
20%	50.00	50.12	49.88	+ 8 oz. weight + 2 oz. weight
30%	75.00	75.18	74.82	+ 8 oz. weight + 2 oz. weight
40%	100.0	100.2	99.75	+ 8 oz. weight + 2 oz. weight
50%	125.0	125.3	124.7	+ 8 oz. weight + 2 oz. weight
60%	150.0	150.3	149.7	+ 8 oz. weight + 2 oz. weight
70%	175.0	175.4	174.6	+ 8 oz. weight + 2 oz. weight
80%	200.0	200.5	199.5	+ 8 oz. weight + 2 oz. weight
90%	225.0	225.5	224.5	+ 8 oz. weight + 2 oz. weight
100%	250.0	250.6	249.4	+ 8 oz. weight + 2 oz. weight

Tolerance Chart for System 5 with TT-400ID

PART NO. 10078 DEADWEIGHT TEST KIT 400 IN.OZ. 2.5 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	2.500	2.506	2.494	1 pound platform
20%	5.000	5.012	4.988	+ 1 pound weight
30%	7.500	7.518	7.482	+ 1 pound weight
40%	10.00	10.02	9.975	+ 1 pound weight
50%	12.50	12.53	12.47	+ 1 pound weight
60%	15.00	15.03	14.97	+ 1 pound weight
70%	17.50	17.54	17.46	+ 1 pound weight
80%	20.00	20.05	19.95	+ 1 pound weight
90%	22.50	22.55	22.44	+ 1 pound weight
100%	25.00	25.06	24.94	+ 1 pound weight

Tolerance Chart for System 5 with TT-50I

PART NO. 10079 DEADWEIGHT TEST KIT 50 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	5.000	5.012	4.988	.5 platform
20%	10.00	10.02	9.975	+ .5 pound weight
30%	15.00	15.03	14.97	+ .5 pound weight
40%	20.00	20.05	19.95	+ .5 pound weight
50%	25.00	25.06	24.94	+ .5 pound weight
60%	30.00	30.07	29.93	+ .5 pound weight
70%	35.00	35.08	34.92	+ .5 pound weight
80%	40.00	40.10	39.90	+ .5 pound weight
90%	45.00	45.11	44.89	+ .5 pound weight
100%	50.00	50.12	49.88	+ .5 pound weight

Tolerance Chart for System 5 with TT-100I

PART NO. 10080 DEADWEIGHT TEST KIT 100 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	10.00	10.02	9.975	1 pound platform
20%	20.00	20.05	19.95	+ 1 pound weight
30%	30.00	30.07	29.93	+ 1 pound weight
40%	40.00	40.10	39.90	+ 1 pound weight
50%	50.00	50.12	49.88	+ 1 pound weight
60%	60.00	60.15	59.85	+ 1 pound weight
70%	70.00	70.17	69.83	+ 1 pound weight
80%	80.00	80.20	79.80	+ 1 pound weight
90%	90.00	90.22	89.78	+ 1 pound weight
100%	100.0	100.2	99.75	+ 1 pound weight

Tolerance Chart for System 5 and TT-300I

PART NO. 10081 DEADWEIGHT TEST KIT 300 IN.LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	30.00	30.07	29.93	1 lbs. platform + (2) 1 lbs. weights
20%	60.00	60.15	59.85	+ (3) 1 pound weights
30%	90.00	90.22	89.78	+ (3) 1 pound weights
40%	120.0	120.3	119.7	+ (3) 1 pound weights
50%	150.0	150.3	149.7	+ (3) 1 pound weights
60%	180.0	180.4	179.6	+ (3) 1 pound weights
70%	210.0	210.5	209.5	+ (3) 1 pound weights
80%	240.0	240.6	239.4	+ (3) 1 pound weights
90%	270.0	270.6	269.4	+ (3) 1 pound weights
100%	300.0	300.7	299.3	+ (3) 1 pound weights

Tolerance Chart System 5 with TT-150

PART NO. 10082 DEADWEIGHT TEST KIT 150 FOOT. LBS. 10 INCH CAL. ARM				
SCALE %	INCH LBS.	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	180.0	180.4	179.6	5 lbs. platform + 10 lbs.+ (3) 1 lbs.
20%	360.0	360.9	359.1	+10 lbs + 5 lbs. + (3) 1 lbs. weights
30%	540.0	541.3	538.7	+10 lbs + 5 lbs. + (3) 1 lbs. weights
40%	720.0	721.8	718.2	+10 lbs + 5 lbs. + (3) 1 lbs. weights
50%	900.0	902.2	897.8	+10 lbs + 5 lbs. + (3) 1 lbs. weights
60%	1080	1082.7	1077.3	+10 lbs + 5 lbs. + (3) 1 lbs. weights
70%	1260	1263.1	1256.9	+10 lbs + 5 lbs. + (3) 1 lbs. weights
80%	1440	1443.6	1436.4	+10 lbs + 5 lbs. + (3) 1 lbs. weights
90%	1620	1624.0	1616.0	+10 lbs + 5 lbs. + (3) 1 lbs. weights
100%	1800	1804.5	1795.5	+10 lbs + 5 lbs. + (3) 1 lbs. weights

Tolerance Chart System 5 with TT-250

PART NO. 10083 DEADWEIGHT TEST KIT 250 FOOT.LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL..	WEIGHTS TO USE FROM KIT
10%	300.0	300.7	299.3	5 lb platform + 1 lb + .25 lb weight
20%	600.0	601.5	598.5	+ 5 lb + 1 lb + .25 lb weight
30%	900.0	902.2	897.8	+ 5 lb + 1 lb + .25 lb weight
40%	1200	1203	1197	+ 5 lb + 1 lb + .25 lb weight
50%	1500	1503	1497	+ 5 lb + 1 lb + .25 lb weight
60%	1800	1804	1796	+ 5 lb + 1 lb + .25 lb weight
70%	2100	2105	2095	+ 5 lb + 1 lb + .25 lb weight
80%	2400	2406	2394	+ 5 lb + 1 lb + .25 lb weight
90%	2700	2706	2694	+ 5 lb + 1 lb + .25 lb weight
100%	3000	3007	2993	+ 5 lb + 1 lb + .25 lb weight

Tolerance Chart System 5 with TT-500

PART NO. 10084 DEADWEIGHT TEST KIT 500 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL.	WEIGHTS TO USE FROM KIT
10%	600.0	601.5	598.5	5 lb platform + 5 lb + 2 lb + .5 lb
20%	1200	1203	1197	+ 10 lb + 2 lb + .5 lb weights
30%	1800	1804	1796	+ 10 lb + 2 lb + .5 lb weights
40%	2400	2406	2394	+ 10 lb + 2 lb + .5 lb weights
50%	3000	3007	2993	+ 10 lb + 2 lb + .5 lb weights
60%	3600	3609	3591	+ 10 lb + 2 lb + .5 lb weights
70%	4200	4210	4190	+ 10 lb + 2 lb + .5 lb weights
80%	4800	4812	4788	+ 10 lb + 2 lb + .5 lb weights
90%	5400	5413	5387	+ 10 lb + 2 lb + .5 lb weights
100%	6000	6015	5985	+ 10 lb + 2 lb + .5 lb weights

Tolerance Chart for System 5 with TT-1000

PART NO. 10085 DEADWEIGHT TEST KIT 1000 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL.	WEIGHTS TO USE FROM KIT
10%	1200	1203	1197	5 lb platform + 20 lb weight
20%	2400	2406	2394	+ 20 lb + 5 lb weight
30%	3600	3609	3591	+ 20 lb + 5 lb weight
40%	4800	4812	4788	+ 20 lb + 5 lb weight
50%	6000	6015	5985	+ 20 lb + 5 lb weight
60%	7200	7218	7182	+ 20 lb + 5 lb weight
70%	8400	8421	8379	+ 20 lb + 5 lb weight
80%	9600	9624	9576	+ 20 lb + 5 lb weight
90%	10800	10827	10773	+ 20 lb + 5 lb weight
100%	12000	12030	11970	+ 20 lb + 5 lb weight

Tolerance Chart System 5 with TT-2000

PART NO. 10086 DEADWEIGHT TEST KIT 2000 FOOT LBS 48 INCH CAL. ARM				
SCALE %	INCH LBS	+ TOL.	- TOL.	WEIGHTS TO USE FROM KIT
10%	2400	2406	2394	5 lb platform + 5 lb + (2)20 lb weight
20%	4800	4812	4788	+ 50 lb weight
30%	7200	7218	7182	+ 50 lb weight
40%	9600	9624	9576	+ 50 lb weight
50%	12000	12030	11970	+ 50 lb weight
60%	14400	14436	14364	+ 50 lb weight
70%	16800	16842	16758	+ 50 lb weight
80%	19200	19248	19152	+ 50 lb weight
90%	21600	21654	21546	+ 50 lb weight
100%	24000	24060	23940	+ 50 lb weight

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SECTION 5 CARE AND SERVICE INSTRUCTIONS

5.1 ROUTINE PRODUCT CARE AND MAINTENANCE

Keep your System 4 or 5 clean and dry. To clean, wipe the System with a damp cloth. The switch panel can be cleaned with a lint free cloth, dampened with alcohol. Do not clean with solvents. Do not hold the transducer or System by the transducer cable. Always use the bail handle when carrying your tester. The System requires only periodic battery replacement for routine maintenance.

5.2 SERVICE INSTRUCTIONS

If properly maintained your System 4 or 5 will provide years of carefree use. However, if service is required, please contact the factory for prompt customer service. The following instructions are for the two most common service problems with the tester.

5.2.1 BATTERY REPLACEMENT

STEP 1: Turn power switch to off position. Disconnect charger. Flip tester up side down.

STEP 2: Remove the four bezel cover screws.

STEP 3: Remove bezels and bottom cover.

STEP 4: Battery is exposed. Disconnect the two battery power connectors.

STEP 5: Remove battery and replace with new battery. Connect power connectors to terminal leads on new battery.

STEP 6: Reassemble cover and bezels.

STEP 7: Charge System for 16 hours. Battery replacement is complete.

5.2.2 FUSE REPLACEMENT

STEP 1: Turn off power and disconnect power cord.

STEP 2: Use flat blade screwdriver to open access door on **POWER INPUT** connector.

STEP 3: Remove fuse and replace with new .5 Amp slow blow fuse.

STEP 4: Replace access door. Tester is ready for use.

5.3 LIMITED WARRANTY

Sturtevant Richmond Division of Ryeson Corporation warrants this product against defects in workmanship or material for one year from the date of purchase. Should any failure to conform to this warranty appear within one year from the date of purchase, Sturtevant Richmond shall, upon notification, proof of purchase and inspection at its factory, correct such non-conformity by, at its option, repairing or replacing, free of charges for parts and labor, the defective product. This warranty excludes product calibration thirty days after the date of purchase. The purchaser shall bear all shipping, packaging and insurance costs to the factory. Misuse, modification, repair, alteration, abuse or negligence to the product by the purchaser or third parties voids this warranty.

This warranty is in lieu of all warranties of merchantability, fitness for purpose, or other warranties , express or implied, oral or written. Sturtevant Richmond's repair or replacement of defective products, in the manner and for the period of time provided above, shall be purchaser's sole and exclusive remedy for defects in material or workmanship. Neither party shall be liable for special, indirect or consequential damages.

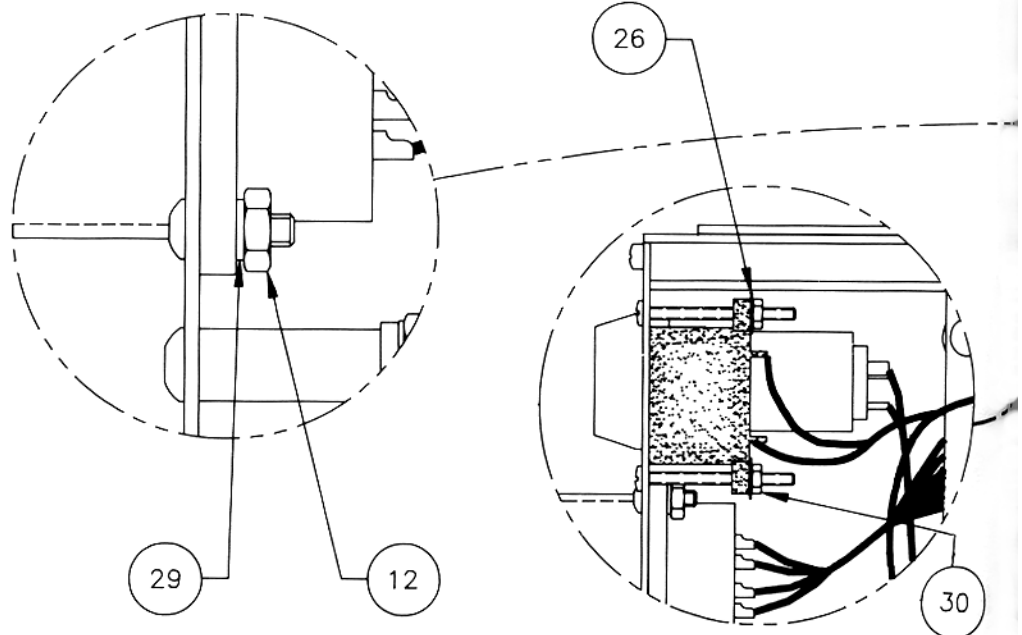
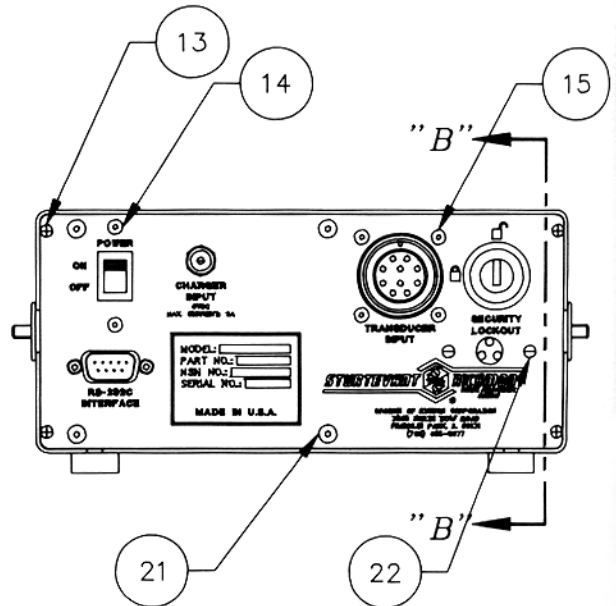
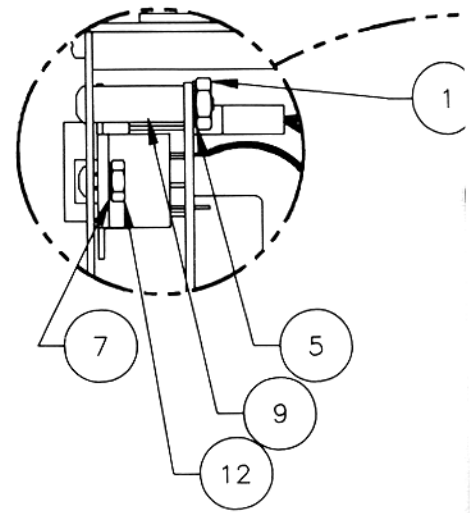
5.4 TROUBLESHOOTING CHART

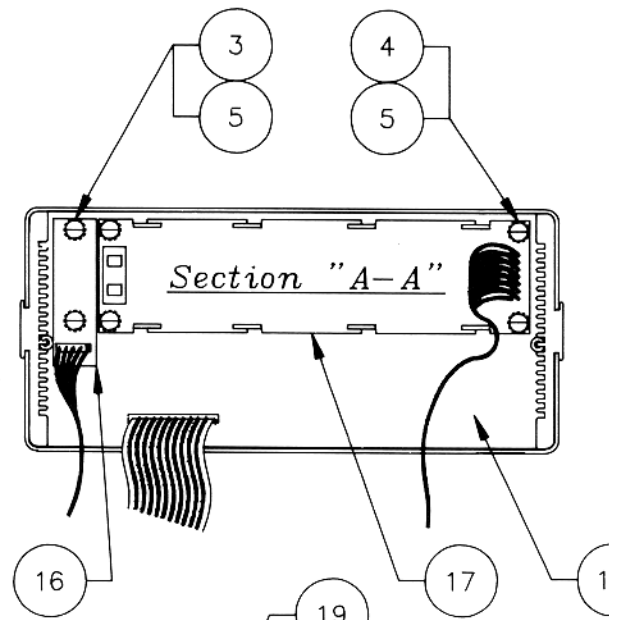
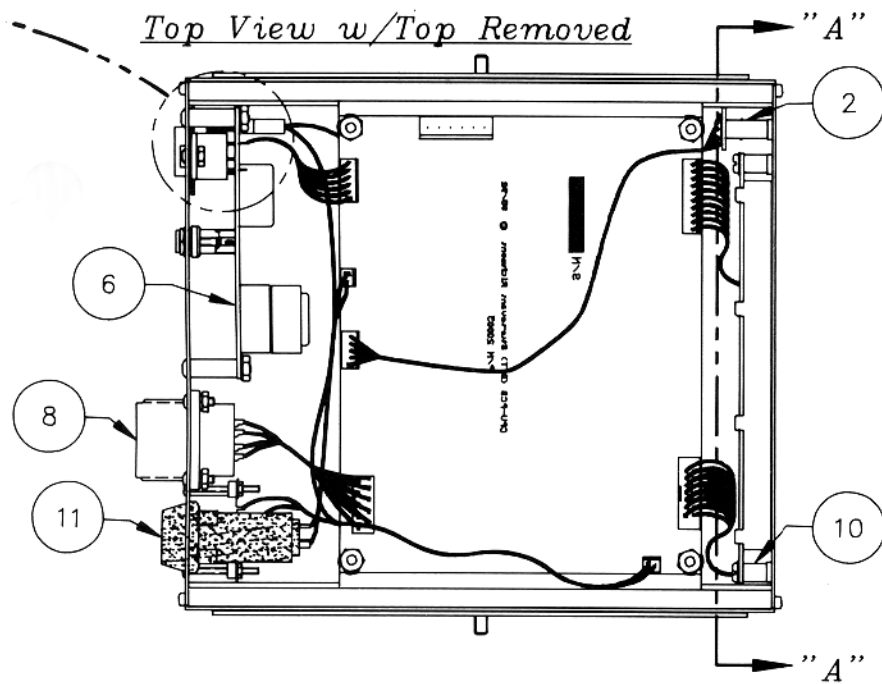
PROBLEM	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
No power to System	Power switch in OFF position	Flip power switch to ON
	Power cable not connected	Check power cable connection.
	Mains power disconnected	Check mains power cables and circuit breakers
	Broken internal wiring	Have certified electrician check the wiring from power to CPU PCB
	Power fuse blown	Replace fuse per section 5.2.2
	Power cable is defective	Replace power cable
"B" flashes on LCD	Low battery power	Recharge battery per Section 2.2.2
Battery will not recharge	Battery requires replacement	Replace battery per Section 5.2.1
	Broken internal wiring	Have certified electrician check wiring from power PCB to battery
	Battery charger is defective	Replace battery charger
	Power supply PCB defective	Replace power PCB
No Transducer message on LCD	Transducer not connected	Connect transducer to System Input
	Defective transducer cable wiring	Check transducer cable and wiring
	Defective transducer system wiring	Check internal transducer wiring
Invalid transducer message on LCD	Incorrect transducer ID resistor	Consult factory
	Defective transducer cable wiring	Check transducer cable and wiring
Zero constantly changes on LCD	Transducer over torqued	Replace transducer
	Defective CPU PCB	Contact factory
	Transducer on unground surface	Ground table to earth ground
"Invalid FLASH" shown on LCD	Critical memory failure	Contact factory
	Improper program download	Contact factory
Audible alarm will not sound	Piezo-buzzer is defective	Replace buzzer
	Defective wiring to buzzer	Have certified electrician check wiring from power PCB to buzzer
LCD does not operate	LCD cable disconnected	Have certified electrician check wiring from CPU PCB to LCD
	Defective LCD	Replace LCD
No LCD backlight	Backlight burnt out	Replace LCD

PROBLEM	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
LED's inoperable	LED PCB disconnected from CPU PCB	Have certified electrician check internal LED to CPU PCB wiring
	Defective LED PCB	Replace LED PCB
	Defective CPU PCB	Contact factory
Switch panel does not operate	Stuck membrane switch	Contact factory
	Punctured membrane switch	Replace switch panel
Units of measure will not change	Key switch in locked position	Turn key switch to unlocked position
	Defective key switch	Replace key switch
Cannot enter calibration mode	Key switch in locked position	Turn key switch to unlocked position
	Defective key switch	Replace key switch
Printer will not print	Cable incorrectly wired	Check cable wiring, reverse pins 2 & 3
	Signal parameters do not match	Check parity, stop bits and baud rate settings of printer and tester

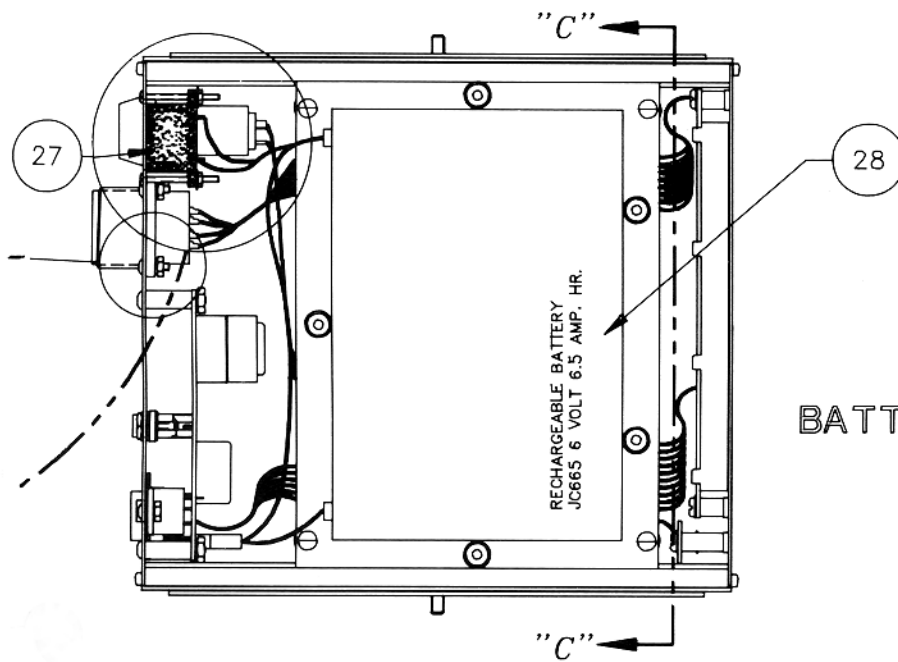
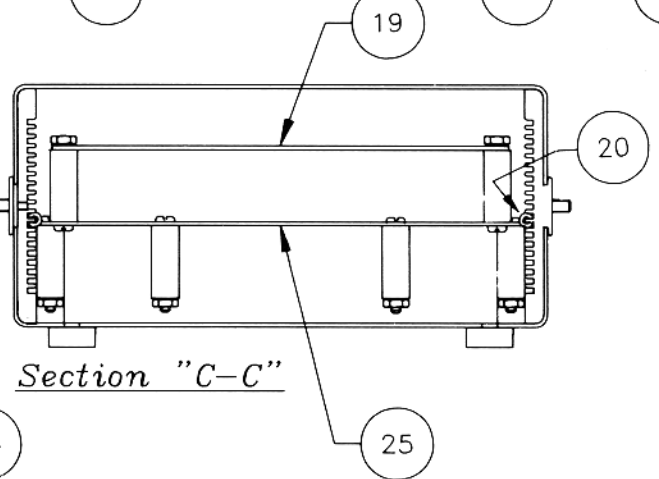
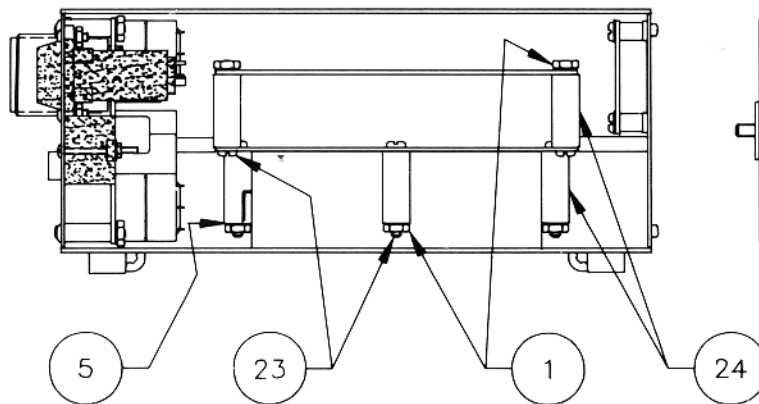
INTERNAL PARTS BREAKDOWN

ITEM #	QTY.	PART #	DESCRIPTION
1	13	30442	6-32 HEX. NUT, STD., STEEL/ZINC
2	2	30431	6-32x9/16", SPACER, NYLON/NATURAL
3	2	30113	6-32x3/4", PAN HD. SLOTTED, ZINC PLATE
4	4	30111	6-32x1/2", PAN HD. SLOTTED, ZINC PLATE
5	19	30482	#6 EXT. TOOTH LOCK WASHER, C.S./ZINC
6	1	20428	POWER SUPPLY BOARD: BATT. MODEL
7	2	30481	#4 EXT. TOOTH LOCK WASHER, C.S./ZINC
8	1	20430	AMPHENOL CONNECTOR: FEMALE
9	4	30432	6-32x5/8", SPACER, NYLON/NATURAL
10	4	30430	6-32x5/16", SPACER, NYLON/NATURAL
11	1	20429	SWITCHLOCK
12	6	30441	4-40 HEX. NUT, STD., STEEL/ZINC
13	8	30010	4-40x1/4", FILLISTER HD. PHILLIPS, ZINC PLATE
14	2	30000	4-40x1/4", BUTT. HD. HEX. SOC., BLACK
15	4	30001	4-40x3/8", BUTT. HD. HEX. SOC., BLACK
16	1	20444	LED BOARD SUB-ASSY.
17	1	20443	LCD MODULE
18	1	20445	FRONT PANEL PLATE SUB-ASSEMBLY
19	1	20005	PRINTED CIRCUIT BOARD: SYSTEM 4 BATT.: 10000
			PRINTED CIRCUIT BOARD: SYSTEM 4 BATT./240V: 10054
19	1	20023	PRINTED CIRCUIT BOARD: SYSTEM 5 BATT.: 10051
			PRINTED CIRCUIT BOARD: SYSTEM 5 BATT./240V: 10056
20	6"	868215	EDGE LINERS, (2)2" PCS. & (2)1" PCS.
21	4	30100	6-32x7/8", BUTT. HD. HEX. SOC., BLACK
22	2	30200	2-56x1", BINDING HD. SLOTTED, NYLON/BLACK
23	9	30112	6-32x1-1/4", PAN HD. SLOTTED, ZINC PLATE
24	9	30433	6-32x1", SPACER, NYLON/NATURAL
25	1	20434	CHASSIS PLATE
26	2	30480	#2 EXT. TOOTH LOCK WASHER, STAINLESS STL.
27	1	20432	PIEZOELECTRIC CERAMIC BUZZER UNIT
28	1	20427	BATTERY
29	4	30461	#4 SPLIT LOCKWASHER
30	2	30440	2-56 HEX. NUT, STD., NYLON/BLACK



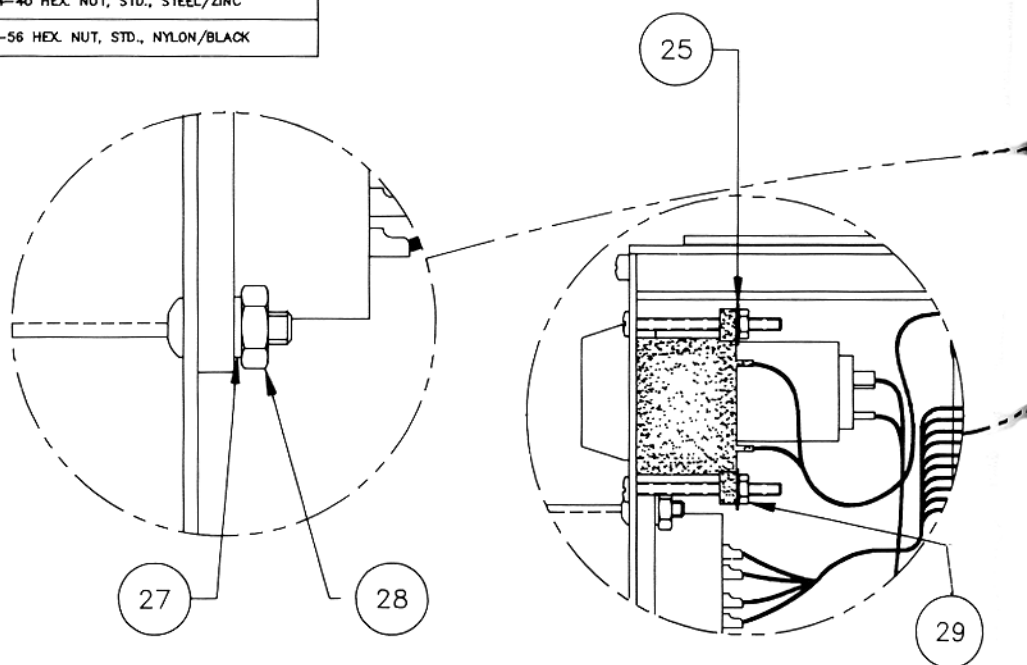
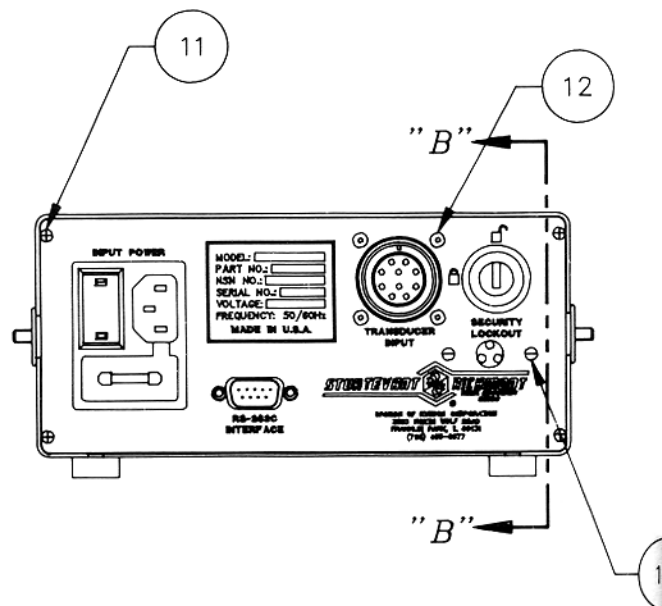


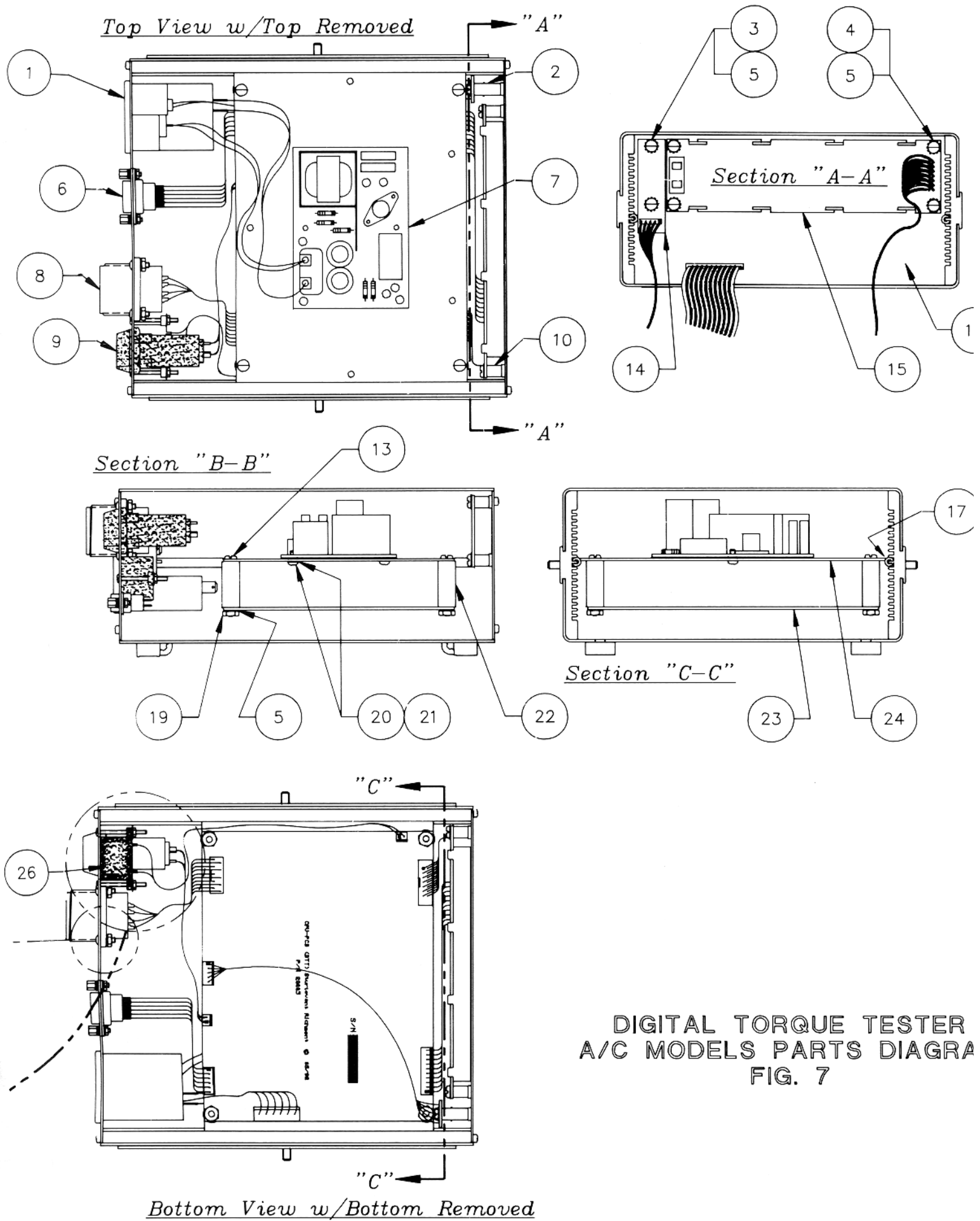
Section "B-B"



DIGITAL TORQUE TESTER
BATTERY MODELS PARTS DIAGRA
FIG. 6

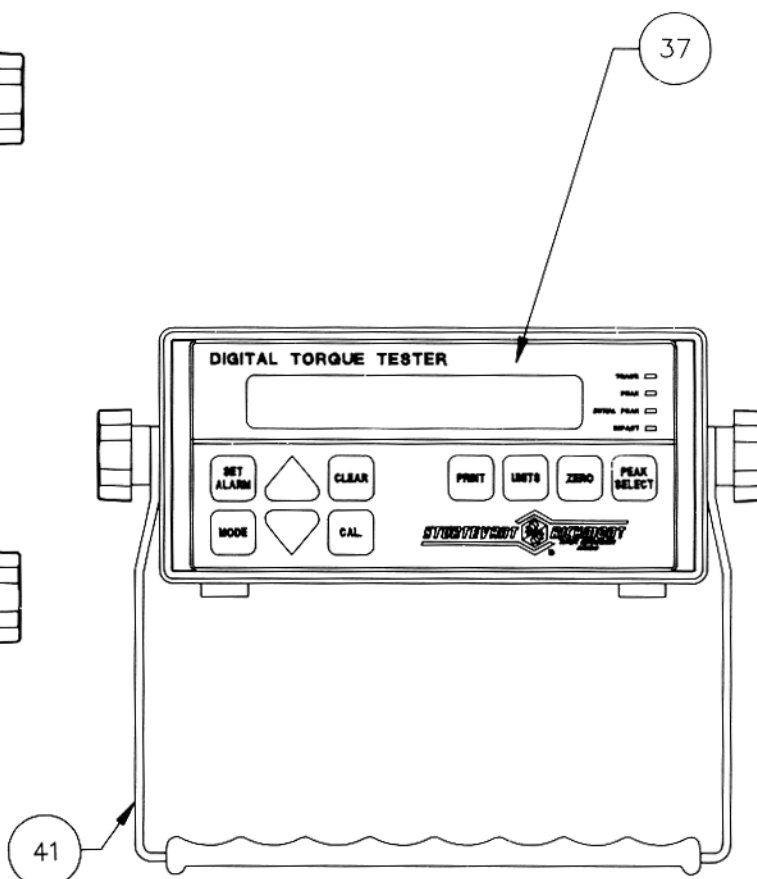
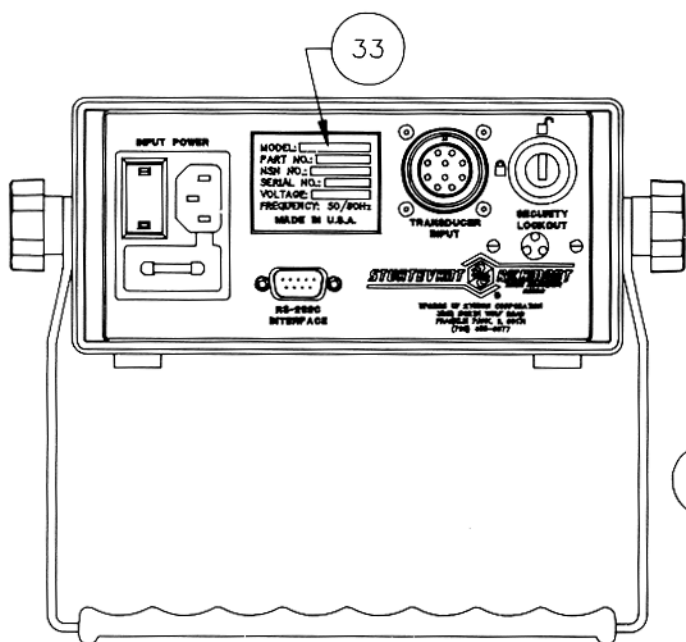
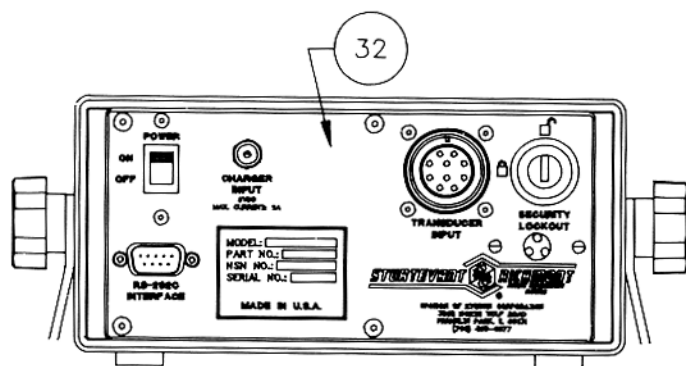
INTERNAL PARTS BREAKDOWN			
ITEM #	QTY.	PART #	DESCRIPTION
1	1	20442	IEC CONNECTOR
2	2	30431	6-32x9/16", SPACER, NYLON/NATURAL
3	2	30113	6-32x3/4", SCREW, PAN HD. SLOTTED, ZINC PLATE
4	4	30111	6-32x1/2", SCREW, PAN HD. SLOTTED, ZINC PLATE
5	10	30482	#6 EXT. TOOTH LOCK WASHER, C.S./ZINC
6	1	20447	RS-232C CONNECTOR-FEMALE
7	1	20433	110V A/C POWER MODULE: SYSTEM 4 A/C: 10050
			110V A/C POWER MODULE: SYSTEM 5 A/C: 10052
7	1	20446	240V A/C POWER MODULE: SYSTEM 4 AC/240V: 10053
			240V A/C POWER MODULE: SYSTEM 5 AC/240V: 10055
8	1	20430	AMPHENOL CONNECTOR: FEMALE
9	1	20429	SWITCHLOCK
10	4	30430	6-32x5/16", SPACER, NYLON/NATURAL
11	8	30010	4-40x1/4", FILLISTER HD. PHILLIPS, ZINC PLATE
12	4	30001	4-40x3/8", SCREW, BUTT. HD. HEX. SOC., BLK.
13	4	30112	6-32x1-1/4", SCREW, PAN HD. SLOTTED, ZINC PLATE
14	1	20444	LED BOARD SUB-ASS'Y.
15	1	20443	LCD MODULE
16	1	20445	FRONT PANEL PLATE SUB-ASSEMBLY
17	6"	868215	EDGE LINERS, (2)2-3/16" PCS. & (2)13/16" PCS.
18	2	30200	2-56x1", SCREW, BIND'G. HD. SLOTTED, NYLON/BLK.
19	4	30442	6-32 HEX. NUT, STD., STEEL/ZINC
20	2	30020	4-40x1/4" SCREW, PAN HD. PHILLIPS, ZINC PLATE
21	2	30481	#4 EXT. TOOTH LOCK WASHER, C.S./ZINC
22	4	30433	6-32x1", SPACER, NYLON/NATURAL
23	1	20005	PRINTED CIRCUIT BOARD: SYSTEM 4 A/C: 10050
			PRINTED CIRCUIT BOARD: SYSTEM 4 AC/240V: 10053
23	1	20023	PRINTED CIRCUIT BOARD: SYSTEM 5 A/C: 10052
			PRINTED CIRCUIT BOARD: SYSTEM 5 AC/240V: 10055
24	1	20434	CHASSIS PLATE
25	2	30480	#2 EXT. TOOTH LOCK WASHER, STAINLESS STL.
26	1	20432	PIEZOELECTRIC CERAMIC BUZZER UNIT
27	4	30461	#4 SPLIT LOCKWASHER
28	4	30441	4-40 HEX. NUT, STD., STEEL/ZINC
29	2	30440	2-56 HEX. NUT, STD., NYLON/BLACK

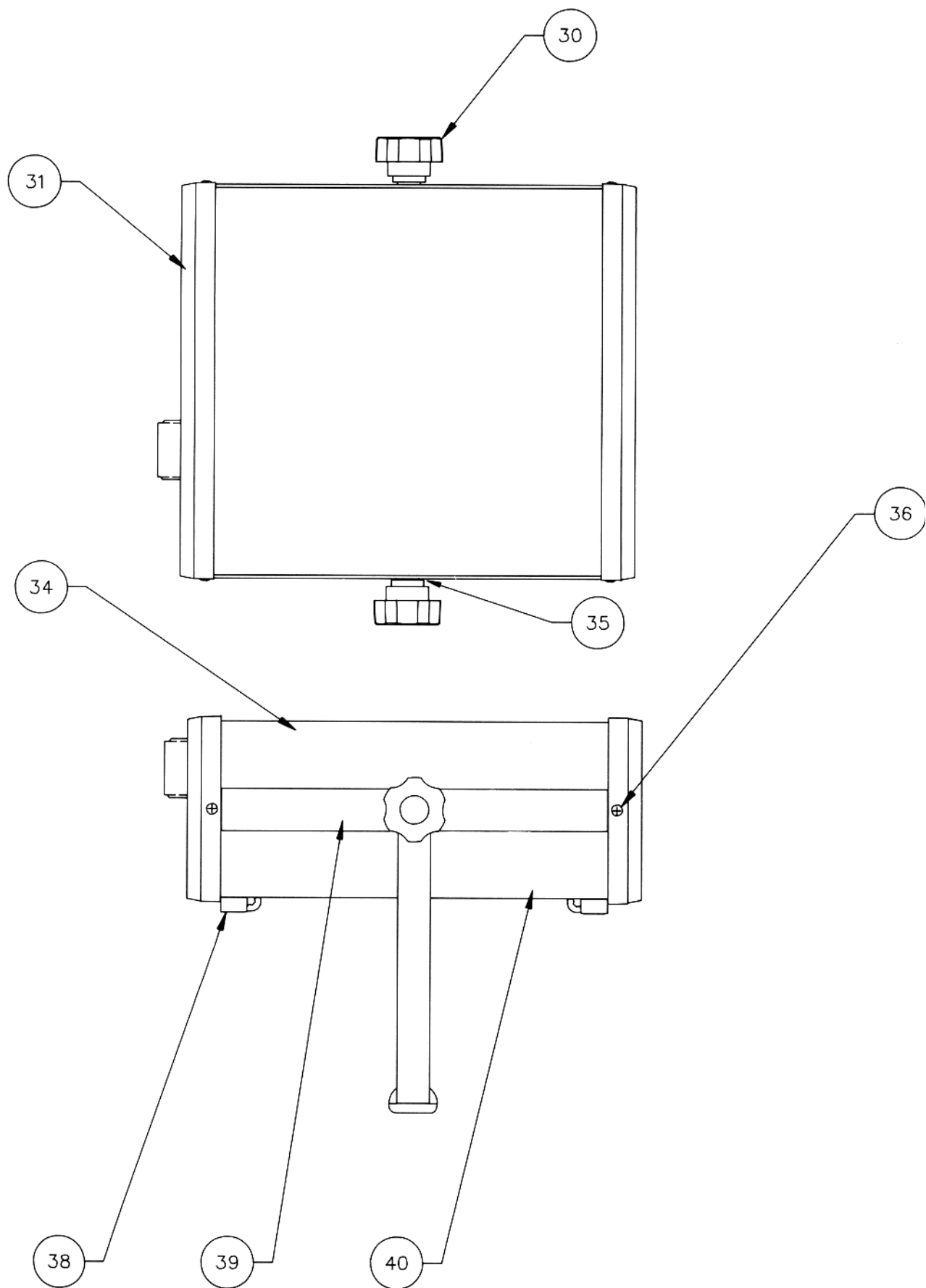




EXTERNAL PARTS BREAKDOWN

ITEM #	QTY.	PART #	DESCRIPTION
30	2	20425	KNOB, PART OF HOUSING
31	2	20439	BEZEL, PART OF HOUSING
32	1	20428	BACK PANEL PLATE, BATTERY MODELS
33	1	20441	BACK PANEL PLATE, A/C MODELS
34	1	20437	TOP PANEL, PART OF HOUSING
35	2	30474	#10 WASHER, NYLON
36	4	30020	4-40x1/4", PAN HEAD PHILLIPS, PART OF HOUSING
37	1	20421	MEMBRANE SWITCHPANEL
38	4	20440	FEET, PART OF HOUSING
39	2	20436	SIDE PANEL, PART OF HOUSING
40	1	20438	BOTTOM PANEL, PART OF HOUSING
41	1	20424	ADJ. HANDLE/SUPPORT, PART OF HOUSING





DIGITAL TORQUE TESTER
ALL MODELS PARTS DIAGRAM
FIG. 8



Sturtevant Richmond

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