

TECHNICAL MANUAL
CALIBRATION PROCEDURE
FOR
MANUALLY OPERATED
TORQUE WRENCHES
6% TO 20%

(GENERAL)

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Published under Authority of the Secretary of the Air Force

30 SEPTEMBER 2002
CHANGE 4 - 30 MAY 2005

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

NOTE: The portion of the text and illustrations affected by the changes is indicated by a vertical line in the outer margins of the page.

Date of issue for original and changed pages are:

Original.....0.....30 September 2002
 Change.....1..... 30 December 2002
 Change.....2..... 30 March 2003
 Change.....3..... 30 May 2004
 Change.....4..... 30 May 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 20, CONSISTING OF THE FOLLOWING:

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MANUALLY OPERATED TORQUE WRENCHES**6% TO 20%****(GENERAL)****1 CALIBRATION DESCRIPTION:***Table 1.*

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Torque Wrenches	Range: 0 to 2000 lbf/ft Accuracy: $\pm 6\%$ to 20% of Ind or 1 Division ** whichever is greater from 20 to 100% FS; $\pm\%$ of Ind + 1 Division or $\pm 6\%$ to 20%, whichever is greater	Verified using a Torque Calibrator
** NOTE		
When TI or Torque Calibrators are graduated so that the 6% to 20% accuracy can not be read use the nearest greater division.		

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub- Item
2.1 HIGH TORQUE CALIBRATOR	Range: 30.0 lbf/in to 2000 lbf/ft (see 3.3) Accuracy: $\pm 1.0\%$ of indicated torque	CDI 2000-0-1 P/O series 2000 Calibrator	As Applicable
2.2 LOW TORQUE CALIBRATOR	Range: ± 1.0 ozf/in to 200 lbf/in of Ind torque (see 3.3) Accuracy: $\pm 0.5\%$ of indicated, or ± 0.2 ozf/in whichever is greater	CDI 2000-0-2 P/O series 2000 Torque Calibrator	As Applicable
2.3 TRANSDUCERS AND ADAPTERS	Range: As Required Accuracy: N/A	P/O of 2000 Torque Calibrator	As Applicable

3 PRELIMINARY OPERATIONS:

3.1 Review and become familiar with the entire procedure before beginning the Calibration Process.

3.2 This is a General Procedure for Torque Wrenches with an accuracy of 6% to 20%. The user must supply the PMEL with the manufacturer's specifications and/or the user's requirements for the TI accuracy. It will require the PMEL technicians to calculate his or her own accuracy limits. Annotate accuracy on the appropriate certification label.

NOTE

When performing a uni-directional calibration on an Impulse Feel Type Torque Device or Torque Limiter, it is extremely important that the correct calibration label be affixed. If the torque device is capable of producing or measuring torque in the reverse direction, a Limited Certification Label) will be affixed. If necessary, test the Torque Wrench to determine whether it is capable of measuring torque in the reverse direction prior to selecting and affixing the calibration label. This may be accomplished by performing a test in the reverse direction at the 20% point or first calibration checkpoint, whichever comes first. Attach the wrench to the torque tester, and slowly increase the torque load to the torque wrench setting. If no break occurs as the torque setting is approached, continue applying load until the break occurs or 50% of the wrench full range value, whichever occurs first. If a measurement indicating a "break" is observed, a Limited Certification Label shall be affixed with the directional limitations noted in the "SPECIAL" block. If a torque measuring "break" is not observed, and no other limitations apply, a TMDE Certification Label shall be affixed indicating that the Torque Wrench is fully calibrated.

NOTE

All Torque Wrenches will have a directional arrow(s), indicating the calibrated direction(s), etched, scribed or affixed, in a permanent location on the barrel, shaft, near to, but not on, the hand grip. The arrow(s) must be visible to the operator. The preferred directional indicating method is the adhesive backed arrow(s) covered with a film of five (5) minute epoxy, or clear tape because of the increased visibility and the protection of metal surfaces. If the manufacturers arrow(s) is incorrect, eradicate it or cover it with an adhesive backed arrow. If an adhesive backed arrow(s) is affixed, cover it with a coating of five (5) minute epoxy, such as Devcon 14250, or clear tape, in a manner that renders it permanent and readily visible.

TORQUE WRENCH TYPES:

- DEFLECTING BEAM: (Section 4.1)
- RIGID CASE, DIAL INDICATING: (Section 4.2)
- ADJUSTABLE VALUE, SNAP-ACTION, IMPULSE FEEL: (Section 4.3)
- TEE HANDLE, RATCHETING, PRESET (FIXED VALUE), IMPULSE FEEL: (Section 4.4)
- ADJUSTABLE VALUE, SNAP-ACTION, IMPULSE FEEL, SCREWDRIVER, TORQUE LIMITERS OR LIMITING DEVICES: (Section 4.5)
- DIRECT READING, TORQUE SCREWDRIVER: (Section 4.6)

3.3 Technician should be familiar with torquing techniques.

WARNING

All safety equipment, shield, guards etc., supplied with the tester being used will be used. Failure to comply may result in personnel injury and/or equipment damage.

WARNING

Ensure all bolts and other hardware used to connect Torque Calibrator, Transducer, Adapters and other common hardware are securely fastened. Failure to comply may result in personnel injury and/or equipment damage.

CAUTION

All Mating surfaces of the Torque Calibrator drive mechanism, Transducers, and Adapters will be cleaned with a soft cloth prior to assembly. Dirt and other residue may damage the surfaces and affect their accuracy.

CAUTION

When using Digital Calibrators, use extreme care when selecting Torque Calibrator Transducer, and ensure Transducer has sufficient span to cover range of TI being calibrated. Do not overload Transducer, damage to equipment may occur. Damage to equipment will occur if 110% of transducers full-scale value is exceeded.

WARNING

Calibration arms are not designed to be exercise bars. Do **NOT** use calibration arms to exercise transducers.

CAUTION

When using Digital Calibrator, excitation voltage for the Transducers is provided by the Digital Indicator and is present whenever the system is powered. In order to prevent possible damage to the electronics, or Transducers, ensure Digital Indicator POWER switch is OFF when connecting or disconnecting Transducer cable.

CAUTION

TIs can be exercised on the torque calibrator, only if the calibrating personnel uses extreme caution, and does not exceed the maximum limits of the TI. At the same time calibrating personnel can use the TI to exercise the calibrator as long as neither the calibrator nor TI exceeds their maximum range.

3.4 Use of the CDI 2000 Torque Calibrator is the preferred method of calibration.

3.5 Connect CDI 2000 Torque Calibrator to appropriate power source. Set power Switch to ON and allow 30 minute warm-up.

3.6 When using the CDI 2000 Torque Calibrator, it is recommended that when possible, use the High Torque Calibrator (item 2.1). This method will obtain best accuracy and repeatability of unit under test.

3.7 If Series 2000 Torque Calibrator is not available, torque calibrator will have an accuracy equal to or better than $\pm 1\%$ of indicated reading.

3.8 By the use of Adapters, left hand (CCW) Torque Wrenches can be verified on calibration equipment that can only be used in a right (CW) direction. National stock numbers 6635-00-580-5888 and 6635-00-690-4001 will verify both right and left handed Torque Wrenches.

3.9 Bring TI into calibration area and set to lowest setting and allow to stabilize to the ambient temperature of the calibration area for 24 hours.

3.10 Ensure TI is perpendicular to the calibrator drive mechanism to eliminate misalignment or friction errors. The TI must be able to move freely.

3.11 For Tee Handle, Screwdriver Type Wrenches, etc., maintain the TI in alignment with the axis of rotation of the calibrator drive mechanism to eliminate misalignment or frictional errors.

3.12 If one (1) division is used and the reading is greater than the calculated accuracy of indicated value, attach a Limited Certification Label stating the actual accuracy to which the Torque Wrench was calibrated.

3.13 Use only that portion of procedure pertaining to TI being calibrated.

3.14 A copy of Table 2, 3, or 3A can be used as a work sheet.

3.15 To calculate Torque Devices useable range and calibration points, 20%, 60% and 100%. This same mathematical theory will be used for 25%, 50%, 75%, and 100% Torque Devices. Examples:

Example 1

A Torque Device that reads 0 to 500 will not be calibrated below the lower 20%, or 100. The low point is 100 (20%) the high point will be 500 (100%), with the 60% point at 300.

$$20\% \text{ of } 500 = 100 \text{ (low point calibration)}$$

$$60\% \text{ of } 500 = 300 \text{ (mid-range calibration point)}$$

$$100\% \text{ of } 500 = 500 \text{ (high point calibration)}$$

Example 2

A Torque Device that reads 100 to 500 will not be calibrated below 20%. If the 20% of full scale is equal to lowest reading marked on the TI start your calibration at that point (100). The low point is 100 the high point will be 500, mid point will be 60% of 500 equal or 300.

$$20\% \text{ of } 500 = 100 \text{ (low point calibration)}$$

$$60\% \text{ of } 500 = 300 \text{ (mid-range calibration point)}$$

$$100\% \text{ of } 500 = 500 \text{ (high point calibration)}$$

NOTE

If a calibration test point does not fall on a TI scale increment, use the next higher TI scale increment.

3.16 Torque Standards will be exercised 3 times Full Scale of the Standard or TI which ever is less.

NOTE

Prior to calibration of item under test (TI), exercise TI six (6) times Full Scale in the direction to be tested.

NOTE

Some torque wrenches have exposed calibration adjustment holes which may be covered after calibration is complete. Positive sealing of these holes by use of Torque Seal, remelting fusible plugs, or placing a NOTICE CERTIFICATION VOID WHEN SEAL IS BROKEN label over the adjustment access is acceptable. The sealing method will be of sufficient security to detect tampering with TI (calibration) adjustment. Only qualified technicians may remove this seal. If tampering is detected, sealing is required for all torque TMDE calibrated by the PMEL for that Owning Work Center.

4 CALIBRATION PROCESS:

CAUTION

If the TI indication at the 100% calibration point exceeds the FS value of the torque transducer, use the next higher transducer if one is available or calibrate the TI at the 90% calibration point. If the 90% calibration point is used, consider the TI fully calibrated. Under no circumstance should the torque transducers be used above 100% of the transducer range.

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

NOTE

Any torque device that has been internally adjusted will remain at the lowest setting for 24 hours prior to recalibration.

4.1 DEFLECTING BEAM, CALIBRATION:

NOTES

The TI will not be calibrated below 20% of maximum range and may be calibrated in both directions.

If the exact calibration/limits are not listed in the appropriate Table(s) choose those cardinal points which are used in the Technical Order for the required range of the TI. Calculate your own calibration limits and proceed with the calibration.

4.1.1 Refer to operator's manual for operating instructions for the calibration equipment used.

4.1.2 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.

4.1.3 Attach TI to Torque Calibrator using proper Adapter(s).

NOTE

Do not use long sockets or extensions.

4.1.4 Select values from Table 2 (20, 60, and 100% of torque wrench range). (i.e., 5, 15, 25 lbf/in., for a 0 to 25 bf/in., maximum capacity wrench). If TI's lowest scale increment is greater than 20% of its maximum reading, see step 3.15.

NOTE

If TI full scale value is not listed, in Table 2, calculate test points at 20%, midpoint and full scale value. If mid-scale test point does not fall on a TI scale increment, use next higher scale increment.

4.1.5 Apply the first check point load perpendicular to handle, with a steady smooth action applied to the center of the handgrip. Make sure TI's with pivoting type handles do not contact the yoke. Ensure pointer does not touch any portion of the TI.

NOTE

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed (over torque applied), release load, then reapply load. The calibration point shall be approached in a smooth and continuous motion.

4.1.6 Readings must all be within the calculated accuracy limits.

4.1.7 Release applied torque.

4.1.8 Repeat steps 4.1.5 through 4.1.7 for each check point selected in step 4.1.4. If TI passes proceed to step 4.1.10.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

NOTE

If TI is calibrated to less than its full directional capability, a Limited Certification Label will be affixed with directional limitation noted in the "SPECIAL" block and a single arrow indicating the calibrated direction will be permanently marked on the wrench.

4.1.9 If any of the readings are out of tolerance refer to appropriate data for adjustments.

4.1.10 Secure equipment.

4.2 RIGID CASE, DIAL INDICATING CALIBRATION:

NOTES

The TI will not be calibrated below 20% of maximum range and may be calibrated in both directions.

Rigid Case, Dial Indicating torque wrenches that are used with an extension handle(s) will be calibrated with the wrench as a set. Attach a label to the extension handle(s) identifying serial number of Torque Wrench calibrated with the handle(s).

Rigid Case, Dial Indicating Torque Wrenches have an indentation (knurling) around the handle to indicate the proper point in which force should be applied. Apply pressure at this point, or inaccuracies may result.

NOTE

If the exact calibration/limits are not listed in the appropriate Table(s) choose those cardinal points which are used in the Technical Order for the required range of the TI. Calculate your own calibration limits and proceed with the calibration.

- 4.2.1 Refer to operator's manual for operating instructions for the calibration equipment used.
- 4.2.2 Set TI bezel so zero (0) is lined up with pointer.
- 4.2.3 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.
- 4.2.4 Attach to TI Torque Calibrator using proper Adapter(s).

NOTE

Do not use long sockets or extensions.

- 4.2.5 Ensure TI is perpendicular to the calibrator drive mechanism to eliminate misalignment or friction errors. The TI must be able to move freely.
- 4.2.6 Select values from Table 2 (20, 60, and 100% of TI range). (i.e., 5, 15, 25 lbf/in., for a 0 to 25 lbf/in. wrench). If TI's lowest scale increment is greater than 20% of its maximum reading, see step 3.15.

NOTE

If TI full scale value is not listed in Table 2, calculate test points at 20%, midpoint of scale and full scale value. If mid-scale test point does not fall on a TI scale increment, use next higher scale increment.

- 4.2.7 Apply load perpendicular to handle, with a steady smooth action applied to the center of the handgrip. Make sure TI's with pivoting heads do not contact the yoke. Ensure pointer does not touch any portion of the dial face.

NOTE

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed (over torque applied), release load, then reapply load. The calibration point shall be approached in a smooth and continuous motion. If the calibration point is approached too slowly, inherent friction in the TI may cause an erroneous indication.

- 4.2.8 Readings must all be within the calculated accuracy limits.
- 4.2.9 Release applied torque.
- 4.2.10 Repeat steps 4.2.7 through 4.2.9 for each check point selected in step 4.2.6.
- 4.2.11 Test each checkpoint one (1) time. All readings must be within calculated accuracy limits. If test readings at all three (3) checkpoints are in limits, TI passes calibration. Proceed to step 4.2.13.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

4.2.12 If any of the test readings were out of calculated accuracy limits, refer to appropriate data for adjustment.

NOTE

If TI is calibrated to less than its full directional capability, a Limited Certification Label will be affixed with directional limitation noted in the "SPECIAL" block and a single arrow indicating the calibrated direction will be permanently marked on the TI.

4.2.13 Secure equipment.

4.3 ADJUSTABLE VALUE, SNAP-ACTION, IMPULSE FEEL CALIBRATION:

CAUTION

Do not turn the TI torque value adjusting mechanism more than one revolution either below the lowest scale reading or above the highest scale reading. Failure to comply may result in damage to equipment.

CAUTION

When the wrench is not in use, keep it set at the lowest increment torque value, or mechanical stop, whichever comes first. Failure to comply may result in damage to equipment.

NOTES

Adjustable Value, Snap-Action, Impulse Feel Torque Wrenches that have been internally adjusted and/or repaired in such a manner that would affect calibration will remain at the lowest setting for 24 hours prior to recalibration.

The TI will not be calibrated below 20% of maximum range.

If the exact calibration/limits are not listed in the appropriate Table(s) choose those cardinal points which are used in the Technical Order for the required range of the TI. Calculate your own calibration limits and proceed with the calibration.

4.3.1 Refer to operator's manual for operating instructions for the calibration equipment used.

4.3.2 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.

CAUTION

Do not attempt to lock the torque setting between scale increments. Failure to comply may result in damage to equipment.

4.3.3 Prior to beginning calibration of an Adjustable Value Impulse Feel Torque Wrench, adjust the TI torque value to maximum range and cycle through the breakaway torque six (6) times.

4.3.4 Adjust TI to lowest calibrated reading (20% of maximum range).

4.3.5 Attach TI to Torque Calibrator using proper Adapters.

NOTE

Do not use long sockets or extensions.

4.3.6 Ensure TI is perpendicular to the calibrator drive mechanism to eliminate misalignment or friction errors. The TI must be able to move freely.

4.3.7 Select values from Table 2 (20, 60, and 100% of Torque Wrench range). (i.e., 5, 15, 25 lbf/in., for a 25 lbf/in. maximum capacity wrench). If TI's lowest scale increment is greater than 20% of its maximum reading, see step 3.15.

NOTE

If TI lowest scale increment is greater than 20% of full scale value, start calibration at lowest scale increment and calculate the middle test point halfway from the first test point to the full scale value. Finally, test at full scale value.

4.3.8 Apply load perpendicular to handle, with a steady smooth action applied to the center of the handgrip note where the TI broke. For Model H1493 and 319404-00 apply force to the center of the large knurled ring on the wrench handle.

NOTE

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed (over torque applied), release load, then reapply load. The calibration point shall be approached in a smooth and continuous motion. If the calibration point is approached too slowly, inherent friction in the TI may cause an erroneous indication.

4.3.9 Release applied torque.

4.3.10 Repeat steps 4.3.8 and 4.3.9 for mid and full range check point selected in step 4.3.7.

4.3.11 Test each breakpoint one (1) time. All readings must be within the calculated accuracy limits. If test readings at all three (3) checkpoints are within limits, TI passes calibration. Proceed to step 4.3.13.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

4.3.12 If any test reading was out of calculated accuracy limits, repeat step 4.3.8 and 4.3.9, three (3) times at each checkpoint. If all readings of the retest are in limits, TI passes calibration. If any of the readings were out of the calculated accuracy limits, refer to T.O. 32B14-3-1-101 for or appropriate data for internal adjustment.

4.3.13 Secure equipment. When applicable, Torque Wrenches shall be stored at the lowest setting or mechanical stop, whichever comes first.

4.4 TEE HANDLE, RATCHETING, PRESET (FIXED VALUE), IMPULSE FEEL CALIBRATION:

NOTES

If the exact calibration/limit is not listed in the appropriate Table(s) choose that cardinal point which is used in the Technical Order for the required range of the TI. Calculate your own calibration limits and proceed with the calibration.

Some torque wrenches of this type may have multiple break points as the handle is rotated 360°. These wrenches will be cycled through each breakaway point six (6) times (six (6) complete revolutions) and tested at each breakpoint in one (1) complete revolution.

4.4.1 Refer to operator's manual for operating instructions for the calibration equipment used.

4.4.2 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.

4.4.3 Attach TI to Torque Calibrator using proper Adapters.

NOTE

Do not use long sockets or extensions.

4.4.4 Apply preset load value with a steady smooth action.

NOTES

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed (over torque applied), release load, then reapply load. The calibration point shall be approached in a smooth and continuous motion. If the calibration point is approached to slowly, inherent friction in the TI may cause an erroneous indication.

Some Torque Wrenches of this type have multiple break points as the handle is rotated 360°. These wrenches will be carefully rotated 360 degrees, one (1) time at each test value, observing that all breaks are within tolerance.

4.4.5 TI breakpoint must be within the calculated accuracy limits of Table 2 for the preset value. If test TI breakpoint are within limits, TI passes calibration. Proceed to step 4.4.7.

4.4.6 If any test reading were out of calculated accuracy limits, repeat step 4.4.4 and 4.4.5, three (3) times at each checkpoint. If all readings of the retest are in limits, TI passes calibration. If any of the readings were out of the calculated accuracy limits, refer to T.O. 32B14-3-1-101 or appropriate data for internal adjustment.

NOTE

Tee Handle, Ratcheting, Preset Torque Wrenches that have been internally adjusted will sit idle for 24 hours prior to recalibration.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

4.4.7 Secure equipment.

4.5 ADJUSTABLE VALUE, SNAP-ACTION, IMPULSE FEEL, SCREWDRIVER CALIBRATION, TORQUE LIMITERS OR LIMITING DEVICES:

CAUTION

Do not turn the TI torque value adjusting mechanism more than one revolution either below the lowest scale reading or above the highest scale reading. Failure to comply may result in damage to equipment.

CAUTION

When the wrench is not in use, keep it set at the lowest increment torque value, or mechanical stop, whichever comes first. Failure to comply may result in damage to equipment.

NOTES

The TI will not be calibrated below 25% of maximum range.

If the exact calibration/limits are not listed in the appropriate Table(s) choose those cardinal points which are used in the Technical Order for the required range of the TI. Calculate your own calibration limits and proceed with the calibration.

4.5.1 Refer to operator's manual for operating instructions for the calibration equipment used.

4.5.2 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.

CAUTION

Do not attempt to lock the torque setting between scale increments. Failure to comply may result in damage to equipment.

4.5.3 Prior to beginning calibration, adjust the TI value to maximum range, attach to the Breaking Adaptor, and rotate the handle 360 degrees six (6) times, actuating each break point six (6) times.

4.5.4 Adjust TI to lowest calibrated reading (25% of maximum range).

4.5.5 Attach TI to Torque Calibrator using proper Adapters.

NOTES

Do not use long sockets or extensions.

Some Torque Wrenches of this type have multiple break points as the handle is rotated 360 degrees. These wrenches will carefully rotated 360 degrees, one (1) time at each test value, observing that all breaks are within tolerance.

4.5.6 Select value from Table 3 (25, 50, 75, and 100% of TI range). (Example: (9, 18, 27, and 36 lbf/in., for a 36 lbf/in., maximum capacity wrench). If TI's lowest scale increment is greater than 25% of its maximum reading, see step 3.13.

NOTE

If TI full scale value is not listed, or if TI range is not compatible with Table 3, test at 25%, or first scale increment, whichever comes later. Next, subtract the value of the first point from the maximum scale value and divide it by three (3) in order to locate the 50% and 75% test points. If test points do not fall on a TI scale increments, use next the next higher scale increment.

4.5.7 Apply load with a steady smooth action applied to the center of the handgrip.

NOTE

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed (over torque applied), release load, then reapply load. The calibration point shall be approached in a smooth and continuous motion. If the calibration point is approached too slowly, inherent friction in the TI may cause an erroneous indication.

4.5.8 Repeat step 4.5.7 for all remaining check points selected in step 4.5.6.

4.5.9 Test each breakpoint one (1) time. All readings must be within calculated accuracy limits in Table 3. If test readings at all four (4) checkpoints are in calculated accuracy limits, wrench passes calibration. If TI passes, proceed to step 4.3.11.

4.5.10 If any test reading was out of calculated accuracy limits, repeat step 4.5.6 through 4.5.8 three (3) times at each breakpoint. If all readings of the retest are in limit, wrench passes calibration. If any of the readings were out of calculated accuracy limits, refer to T.O. 32B14-3-1-101 or appropriate data for internal adjustment.

NOTE

Adjustable Value, Snap-Action, Impulse Feel Torque Wrenches that have been internally adjusted will remain at the lowest setting for 24 hours prior to recalibration.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

4.5.11 Secure equipment. When applicable, Torque Wrenches shall be stored at the lowest setting or mechanical stop, whichever comes first.

4.6 DIRECT READING, TORQUE SCREWDRIVER CALIBRATION:

NOTES

The TI will not be calibrated below 25% of maximum range.

If the exact calibration/limits are not listed in the appropriate Table(s) choose those cardinal points which are used in the Technical Order for the required range of the TI.

Calculate your own calibration limits and proceed with the calibration.

4.6.1 Refer to operator's manual for operating instructions for the calibration equipment used.

4.6.2 Ensure Torque Calibrator reads zero (0) for proper direction of torque being applied.

4.6.3 Attach TI to Torque Calibrator using proper Adapter(s).

NOTE

Do not use long sockets or extensions.

4.6.4 Select values from Table 3 (25, 50, 75, and 100% of Torque Wrench range). (Example: 3, 6, 9, and 12 lbf/in., for a 12 lbf/in., maximum capacity wrench). If TI's lowest scale increment is greater than 25% of its maximum reading, see step 3.13.

NOTES

If TI full scale value is not listed, or if TI range is not compatible with Table 3, test at 25%, or first scale increment, whichever comes later. Next, subtract the value of the first test point from the maximum scale value and divide it by three in order to locate the 50% and 75% test points. If test points do not fall on a TI scale increment, use next higher scale increment.

Before starting calibration load the TI to half scale and release torque and readjust zero (0) if necessary.

4.6.5 Apply load with a steady smooth action applied to the center of the handgrip.

NOTE

A fast or jerky motion will result in an improper torque reading. If selected value is inadvertently passed, (over torque applied) release load, then reapply load. The calibration point shall be approached in smooth and continuous motion. If the calibration point is approached too slowly, inherent friction in the TI may cause an erroneous indication.

4.6.6 Readings will be within the calculated accuracy limits of Table 3. If TI full range value is not listed in Table 3, all readings must be within plus or minus the manufacture's stated accuracy for each test point calculated accuracy limit.

4.6.7 Release applied torque.

4.6.8 Repeat step 4.6.5 through 4.6.7 for all remaining check points selected in step 4.6.4. If TI passes, proceed to step 4.6.10.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI maximum value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolution, in the new direction, prior to beginning calibration. Release load and reset torque calibration to zero (0), if required, before resuming calibration.

4.6.9 If any test reading was out of the calculated accuracy limits, repeat step 4.6.4 through 4.6.7 three (3) times at each breakpoint. If all readings of the retest are in limits, wrench passes calibration. If any of the readings were out of calculated accuracy limits, refer to T.O. 32B14-3-1-101 or appropriate data for internal adjustment.

4.6.10 Secure equipment. When applicable, Torque Wrenches shall be stored at the lowest setting or mechanical stop, whichever comes first.

NOTES

The column entitled "Max Torque Values" applies to all Torque Wrenches except the ones that are preset.

The column entitled "Usable Wrench Range" includes torque usage ranges from 20% to full scale or 25% to full scale. Usage within the ranges between 0 and 20% or 0 to 25% requires special accuracy checks made on particular torque values to be used, because accuracies within this range are not warranted by the manufactures.

Calibration of Torque Wrenches within ranges not included in Table 2 and Table 3 may be calibrated by using multiples of the table values shown.

Some Torque Wrenches have a lower, limits which is above the 20% verification point. In these cases, see step 3.15.

The columns entitled "W" is percent of full scale for TI being calibrated.

By the use of Adapters, left hand (CCW) Torque Handles can be verified on calibration equipment that can only be used in a right (CW) direction. National Stock Number 6635-00-580-5888 and 6635-00-690-4001 will verify both right and left hand handles.

Calibration of Torque Wrenches within ranges not included in tables may be calibrated by using multiples of the Table values shown.

Table 2. Calibration Points for all Torque Wrenches Except the Screwdriver Type

Max. Torque Value	Usable Wrench Range	Calibration Points					
		W 20%	CW or CCW Dev %	W 60%	CW or CCW Dev %	W 100%	CW or CCW Dev %
5	1-5	1.00	to	3.00	to	5.00	to
10	2-10	2.00	to	6.00	to	10.00	to
15	3-15	3.00	to	9.00	to	15.00	to
16	3-16	3.20	to	9.60	to	16.00	to
25	5-25	5.00	to	15.00	to	25.00	to
30	6-30	6.00	to	18.00	to	30.00	to
32	6-32	6.40	to	19.20	to	32.00	to
50	10-50	10.00	to	30.00	to	50.00	to
60	12-60	12.00	to	36.00	to	60.00	to
75	15-75	15.00	to	45.00	to	75.00	to
80	16-80	16.00	to	48.00	to	80.00	to
100	20-100	20.00	to	60.00	to	100.00	to
120	24-120	24.00	to	72.00	to	120.00	to
150	30-150	30.00	to	90.00	to	150.00	to
160	32-160	32.00	to	96.00	to	160.00	to
175	35-175	35.00	to	105.00	to	175.00	to
200	40-200	40.00	to	120.00	to	200.00	to
240	48-240	48.00	to	144.00	to	240.00	to
250	50-250	50.00	to	150.00	to	250.00	to
			to		to		to

Table 2 (continued) Calibration Points for all Torque Wrenches Except the Screwdriver Type

Max. Torque Value	Usable Wrench Range	Calibration Points					
		W 20%	CW or CCW Dev %	W 60%	CW or CCW Dev %	W 100%	CW or CCW Dev %
300	60-300	60.00	to	180.00	to	300.00	to
350	70-350	70.00	to	210.00	to	350.00	to
420	84-420	84.00	to	252.00	to	420.00	to
425	85-425	85.00	to	255.00	to	425.00	to
500	100-500	100.00	to	300.00	to	500.00	to
600	120-600	120.00	to	360.00	to	600.00	to
750	150-750	150.00	to	450.00	to	750.00	to
760	152-760	152.00	to	456.00	to	760.00	to
1000	200-1000	200.00	to	600.00	to	1,000.00	to
1200	240-1200	240.00	to	720.00	to	1,200.00	to
1600	320-1600	320.00	to	960.00	to	1,600.00	to
1800	360-1800	360.00	to	1,080.00	to	1,800.00	to
2000	400-2000	400.00	to	1,200.00	to	2,000.00	to
2400	480-2400	480.00	to	1,440.00	to	2,400.00	to
3000	600-3000	600.00	to	1,800.00	to	3,000.00	to
3800	720-3600	760.00	to	2,280.00	to	3,800.00	to
4200	840-4200	840.00	to	2,520.00	to	4,200.00	to
4800	960-4800	960.00	to	2,880.00	to	4,800.00	to
7200	1440-7200	1,440.00	to	4,320.00	to	7,200.00	to
			to		to		to

Table 3. Calibration Deviations Allowable for Adjustable Screwdriver Type Torque Wrenches.

Max. Torque Value	Usable Wrench Range	Calibration Points							
		W 25%	CW or CCW Dev %	W 50%	CW Or CCW Dev %	W 75%	CW or CCW Dev %	W 100%	CW or CCW Dev %
20	4-20	5.00	to	10.00	to	15.010	to	20.00	to
30	6-30	7.50	to	15.00	to	22.50	to	30.00	to
36	7.2-36	9.00	to	18.00	to	27.00	to	36.00	to
100	20-100	25.00	to	50.00	to	75.00	to	100.00	to
			to		to		to		

Table 3A. Calibration Deviations Allowable for Direct-Reading Screwdriver Type Torque Wrenches.

Max. Torque Value	Usable Wrench Range	Calibration Points							
		W 25%	CW or CCW Dev %	W 50%	CW Or CCW Dev %	W 75%	CW or CCW Dev %	W 100%	CW or CCW Dev %
6	1.2-6	1.50	to	3.00	to	4.50	to	6.00	to
12	2.4-12	3.00	to	6.00	to	9.00	to	12.00	to
25	5-25	6.25	to	12.50	to	18.75	to	25.00	to
50	10-50	12.50	to	25.00	to	37.50	to	50.00	to
100	20-100	25.00	to	50.00	to	75.00	to	100.00	to
			to		to		to		to

CALIBRATION PERFORMANCE TABLE

Not Required