TECHNICAL MANUAL

CALIBRATION PROCEDURE

FOR

TORQUE SCREWDRIVERS

(GENERAL)

This publication replaces T.O. 33K6-4-3014-1 dated 30 April 2002 and all subsequent changes.

Published under Authority of the Secretary of the Air Force

30 JULY 2005

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.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 July 2005

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 16, CONSISTING OF THE FOLLOWING:

Page No.	* Change No.	Page No.	* Change No.	Page No.	* Change No.
Title	0				
A	0				
1 - 14	0				

*Zero in this column indicates an original page

TORQUE SCREWDRIVERS

(GENERAL)

1 CALIBRATION DESCRIPTION:

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Torque Screwdrivers	Range: 0 to 200 in lb Accuracy: ±2% of indication ±3% of indication ±4% of indication ±5% of indication ±6% of indication from 20 to 100% FS	Verified using a Torque Calibrator
Specialized Tool Set P/N 269776		
P/N 269857 (CW)	Range: 8 in oz Accuracy: ±1 in oz	
P/N 269859 (CCW)	Range: 440 in oz Accuracy: ±15 in oz	
P/N 269860 (CCW)	Range: 330 in oz Accuracy: ±12 in oz	
P/N 269864 (CW)	Range: 130 in oz Accuracy: ±5 in oz	
P/N 271789 (CW)	Range: 14 in oz Accuracy: ±2 in oz	

2 EQUIPMENT REQUIREMENTS:

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.1 HIGH TORQUE CALIBRATOR	Range: 30.0 in lbs to 2000 ft lbs Accuracy: ±0.5% of indicated torque	CDI 2000-0-1 P/O Series 2000 Calibrator	As Applicable

Noun	Minimum Use Specifications	Calibration Equipment	Sub-Item
2.2 LOW TORQUE CALIBRATOR	Range: 0.5 in oz to 200 in lbs Accuracy: ±0.5% of indicated, or ±0.2 in oz, whichever is greater	CDI 2000-0-2 P/O Series 2000 Torque Calibrator	As Applicable

3 PRELIMINARY OPERATIONS:

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

WARNING

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power.

NOTE

All Torque Screwdrivers must 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. If the manufacturers arrow(s) is incorrect or on the hand grip, place another arrow in proper location. 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 the arrow(s) permanent and readily visible.

NOTE

Bi-directional type Torque Screwdrivers may be calibrated in either or both directions, upon request by the user. Both directions must be calibrated to within the accuracy requirement of Table 1.

3.2 The Calibration Technician should be familiar with torquing techniques. Refer to operators manual for operating instructions for the calibration equipment used.

WARNING

All safety equipment, shields, guards etc., supplied with the tester being used, will be used. However, the safety shield cannot be used with the CDI-2000 low range multi-transducer. The shields must be used with all other transducers on the CDI-2000. 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.

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.

NOTE

Some torque screwdrivers 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, metallic tape, 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.

NOTE

The use of the torque screwdriver calibration adapting crank mechanism is optional.

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

3.4 Connect CDI 2000 Torque Calibrator to appropriate power source. Set Power Switch ON and allow 30 minutes warm-up.

3.5 Exercising the Torque Calibrator three (3) times, at least once daily, is required prior to calibrating a TI. This can be done with an exercise bar. If possible, exercise the Torque Calibrator to full scale. If an exercise bar is not available, the TI may be used to exercise the Torque Calibrator. When exercising the Torque Calibrator with the TI, do not exceed the limits of the TI or Torque Calibrator. When changing directions (CW/CCW), repeat the exercise process to calibrating TI in new direction.

3.6 When using the CDI 2000 Digital Torque Calibrator, select a single torque cell to cover the entire range of the TI being calibrated, whenever possible.

3.7 Bring TI into calibration area, set to lowest setting, and allow to stabilize to the ambient temperature of the calibration area for 8 hours prior to calibration.

3.8 Maintain the TI in alignment with the axis of rotation of the calibrator drive mechanism to eliminate misalignment or frictional errors.

3.9 If the TI cannot meet manufacturers specifications, as stated in Table 1, and cannot be adjusted or repaired to meet these specifications, it must be made NRTS, and returned to the Owner/User. The Owner/User may request the TI be downgraded to less than manufacturers specifications. If the TI is downgraded to less than manufacturers specifications, a Limited Certification Label shall be affixed to the TI stating the actual accuracy provided.

3.10 To calculate Torque Screwdrivers useable range and calibration points, use 25, 50, 75 and 100% of the TI's Max Torque Value. Example: A TI with a range of 0 to 40 in lb will be checked at 10, 20, 30 and 40 in lb.

3.11 Annotate the accuracy to which the TI was calibrated to in the SPECIAL block of the appropriate TMDE Certification Label. Example: 4% CW and 6% CCW, or 4% CW and 4% CCW.

4 CALIBRATION PROCESS:

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 Screwdriver that has been internally adjusted will remain at the lowest setting for 8 hours prior to recalibration, except adjustments to rezero dials.

4.1 ADJUSTABLE VALUE TORQUE SCREWDRIVER CALIBRATION:

CAUTION

Do not turn the TI torque value adjusting mechanism more than one (1) 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 Torque Screwdriver 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.

NOTE

The TI will not normally be calibrated below 25% of maximum range. An exception would be if the TI has scale increments below 25% and a special calibration is requested within this normally uncalibrated and unused range. Document all special calibrations in the SPECIAL block of the TMDE Certification Label.

4.1.1 Prior to beginning calibration on Adjustable Value Torque Screwdrivers, set TI on maximum value, attach it to the breaking adapter, and rotate the handle 360° six (6) times.

NOTE

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

CAUTION

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

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

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

4.1.4 Attach TI to Torque Calibrator using proper adapters.

NOTE

Do not use long sockets or extensions.

NOTE

Applicable Table refers to Tables 2, 2A, 2B, 2C, 2D, 3, 3A, 3B, 3C and 3D located at the end of this procedure.

4.1.5 Select values from applicable table for TI being calibrated for 25, 50, 75 and 100% of TI range; i.e., 9, 18, 27 and 36 in lb, for a 36 in lb, maximum capacity Torque Screwdriver. Start calibration at 25% test point, then use remaining values from applicable table.

NOTE

If TI lowest scale increment is greater than 25% of full scale value, start calibration at lowest scale increment and calculate the 50 and 75% test point values. The 50 and 75% test point values must also be calculated if TI full scale value is not listed in applicable table. Test at 25% or first scale increment, whichever is greater. Subtract the value of the first test point from the full scale value, then divide the result by three (3). The final resultant value can be added to the first test point to determine the 50% test point, and subtracted from the full scale value to determine the 75% test point. If a test point does not fall on a TI scale increment, use next higher scale increment. If any test point is not found in applicable tables, calculate your own calibration limits for that test point and proceed with calibration.

4.1.6 Apply load with a steady smooth action. Note where TI broke.

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.

NOTE

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 in tolerance.

4.1.7 Repeat step 4.1.6 for all remaining calibration points selected in step 4.1.5. Ensure that Torque Calibrator reads zero (0) prior to testing each calibration point.

4.1.8 Test each breakpoint one (1) time. All readings must be within tolerance. If all test readings are in tolerance, TI passes calibration. If opposite direction is not calibrated, proceed to step 4.1.10.

4.1.9 If any test reading is out of tolerance, repeat steps 4.1.5 through 4.1.7, checking each test point three (3) times before proceeding to the next test point. If all readings of the retest are in tolerance, TI passes calibration. If any of the readings are out of tolerance, refer to T.O. 32B14-3-1-101 or appropriate commercial data for internal adjustment.

NOTE

When the direction (CW/CCW) is changed, the transducer and TI must be exercised in the new direction of use, to the range, (up to full scale) being used, prior to taking readings. Then in a no load condition press the Zero Tare button on the Digital Indicator.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply load to cycle through breakpoint until TI has been rotated through six (6) full 360° revolutions, in the new direction, prior to beginning calibration. Release load, and reset torque calibrator 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. A directional limitation will be noted in the SPECIAL block and a single arrow indicating the calibrated direction will be permanently marked on the TI.

4.1.10 Secure equipment. Adjustable Value Torque Screwdrivers will be stored at the lowest setting or mechanical stop, whichever comes first.

4.2 PRESET (FIXED VALUE) TORQUE SCREWDRIVER CALIBRATION:

NOTE

If preset torque values can be found in the applicable table for the TI being calibrated, use upper and lower calibration limits from the table. If the preset value and calibration limits are not listed in the table, multiples of table values may be used, or calculate your own calibration limits and proceed with the calibration.

4.2.1 Prior to beginning calibration on Preset Torque Screwdriver type wrenches, attach TI to the breaking adapter, and rotate the handle 360° six (6) times in direction that it will be used and calibrated.

NOTE

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

4.2.2 Attach TI to Torque Calibrator using proper adapters.

NOTE

Do not use long sockets or extensions.

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

4.2.4 Apply load with a steady smooth action. Note where TI broke.

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.

4.2.5 Reset Torque Calibrator to zero (0), if necessary and repeat step 4.2.4, testing each breakpoint in one (1) 360° revolution of the TI.

4.2.6 TI test breakpoint(s) must be within the manufacturers stated specifications for the preset value of TI being calibrated. If all test TI breakpoints in one (1) 360° revolution of the TI are within tolerance, TI passes calibration. Proceed to step 4.2.8.

4.2.7 If any test breakpoint(s) is out of tolerance, repeat steps 4.2.4 through 4.2.6, three (3) times. If all readings of the retest are in tolerance, the TI passes calibration. If any of the readings are out of tolerance, refer to T.O. 32B14-3-1-101 or appropriate commercial data for adjustments.

NOTE

When the direction (CW/CCW) is changed, the transducer and TI must be exercised in the new direction of use, to the range (up to full scale) being used, prior to taking readings. Then in a no load condition press the Zero Tare button on the Digital Indicator.

NOTE

Preset (Fixed Value) Torque Screwdrivers that have been internally adjusted will remain idle for a minimum of 8 hours prior to final recalibration.

NOTE

When changing directions of operation (CW/CCW), repeatedly apply TI value to cycle through breakpoint until TI has been rotated through six (6) full 360° revolutions, in the new direction, prior to beginning calibration. Release load and reset torque calibrator 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. A directional limitation will be noted in the SPECIAL block and a single arrow indicating the calibrated direction will be permanently marked on the TI. All Preset Torque Screwdrivers must have their set value annotated on the Limited Certification Label.

4.2.8 Secure all equipment.

4.3 DIRECT READING, TORQUE SCREWDRIVER CALIBRATION:

NOTE

The TI will not normally be calibrated below 25% of maximum range. An exception would be if the TI has scale increments below 25% and a special calibration is requested within this normally uncalibrated and unused range. Document all special calibrations in the SPECIAL block of the TMDE Certification Label.

NOTE

Prior to calibration, exercise TI six (6) times full scale in the direction to be tested.

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

4.3.2 Attach TI to Torque Calibrator using proper adapter(s).

4.3.3 Ensure that the TI indicating device is set on Zero (0) or its Neutral Point before proceeding with the Calibration Process.

NOTE

Do not use long sockets or extensions.

4.3.4 Select values from applicable table for TI being calibrated for 25, 50, 75, and 100% of TI range; i.e., 3, 6, 9 and 12 in lb, for a 12 in lb, maximum capacity Torque Screwdriver. Start calibration at 25% test point, then use remaining values from applicable table.

NOTE

If TI lowest scale increment is greater than 25% of full scale value, start calibration at lowest scale increment and calculate the 50 and 75% test point values. The 50 and 75% test point values must also be calculated if TI full scale value is not listed in applicable table. Test at 25% or first scale increment, whichever is greater. Subtract the value of the first test point from the full scale value, then divide the result by three (3). The final resultant value can be added to the first test point to determine the 50% test point, and subtracted from the full scale value to determine the 75% test point. If a test point does not fall on a TI scale increment, use next higher scale increment. If any test point is not found in applicable tables, calculate your own calibration limits for that test point and proceed with calibration.

4.3.5 Apply load with a steady smooth action. Note TI indication.

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.

4.3.6 All readings must be within specifications listed in applicable table for TI being calibrated.

NOTE

When the direction (CW/CCW) is changed, the transducer and TI must be exercised in the new direction of use, to the range (up to full scale) being used, prior to taking readings. Then in a no load condition press the Zero Tare button on the Digital Indicator.

NOTE

When changing directions of operation (CW/CCW), load TI six (6) times to 100% of full scale, in the new direction, prior to beginning calibration. Release load, and reset Torque Calibrator to zero (0) if required.

4.3.7 Release applied torque.

4.3.8 Repeat step 4.3.5 through 4.3.7 for all remaining check points selected in step 4.3.4.

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.

4.3.9 Secure all equipment.

4.4 DIAL INDICATING TORQUE SCREWDRIVER CALIBRATION:

NOTE

The TI will not normally be calibrated below 25% of maximum range. An exception would be if the TI has scale increments below 25% and a special calibration is requested within this normally uncalibrated and unused range. Document all special calibrations in the SPECIAL block of the TMDE Certification Label.

NOTE

Applicable Table refers to Tables 2, 2A, 2B, 2C, 2D, 3, 3A, 3B, 3C and 3D located at the end of this procedure.

NOTE

Prior to calibration, exercise TI six (6) times full scale in the direction to be tested.

4.4.1 Ensure that the TI indicating device is set on Zero (0) or its Neutral Point before proceeding with the Calibration Process.

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 adapter(s).

NOTE

Do not use long sockets or extensions.

4.4.4 Select values from applicable table for TI being calibrated for 25, 50, 75, and 100% of TI range; i.e., 3, 6, 9 and 12 in lb, for a 12 in lb, maximum capacity Torque Screwdriver. Start calibration at 25% test point, then use remaining values from applicable table.

NOTE

If TI lowest scale increment is greater than 25% of full scale value, start calibration at lowest scale increment and calculate the 50 and 75% test point values. The 50 and 75% test point values must also be calculated if TI full scale value is not listed in applicable table. Test at 25% or first scale increment, whichever is greater. Subtract the value of the first test point from the full scale value, then divide the result by three (3). The final resultant value can be added to the first test point to determine the 50% test point, and subtracted from the full scale value to determine the 75% test point. If a test point does not fall on a TI scale increment, use next higher scale increment. If any test point is not found in applicable tables, calculate your own calibration limits for that test point and proceed with calibration.

4.4.5 Apply load with a steady smooth action. Note TI indication.

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.

4.4.6 Indication must be within specifications listed in applicable table for TI being calibrated.

4.4.7 Release applied torque.

4.4.8 Repeat steps 4.4.5 through 4.4.7 for all remaining check points selected in step 4.4.4.

4.4.9 If opposite direction is not calibrated, proceed to step 4.4.11.

NOTE

When the direction (CW/CCW) is changed, the transducer and TI must be exercised in the new direction of use, to the range (up to full scale) being used, prior to taking readings. Then in a no load condition press the Zero Tare button on the Digital Indicator.

NOTE

When changing directions of operation (CW/CCW), load TI six (6) times to 100% of full scale, in the new direction, prior to beginning calibration. Release load, and reset Torque Calibrator to zero (0) if required.

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.

4.4.10 Repeat steps 4.4.4 through 4.4.8 for the Opposite Direction.

4.4.11 Secure all equipment.

NOTE

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

NOTE

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

Table 2. Calibration Deviations Allowable for Adjustable Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 2%		W 50%	CW Or CCW Dev 2%		W 75%	CW or CCW Dev 2%		W 100%	CW or CCW Dev 2%	
20	4-20	5.00	4.90	to 5.10	10.00	9.80	to 10.20	15.010	14.71	to 15.31	20.00	19.60	to 20.40
30	6-30	7.50	7.35	to 7.65	15.00	14.70	to 15.30	22.50	22.05	to 22.95	30.00	29.40	to 30.60
36	7.2-36	9.00	8.82	to 9.18	18.00	17.64	to 18.36	27.00	26.46	to 27.54	36.00	35.28	to 36.72
100	20-100	25.00	24.50	to 25.50	50.00	49.00	to 51.00	75.00	73.50	to 76.50	100.00	98.00	to 102.00
150	30-150	37.50	36.75	to 38.25	75.00	73.50	to 76.50	112.50	110.25	to 114.75	150.00	147.00	to 153.00
200	40-200	50.00	49.00	to 51.00	100.00	98.00	to 102.00	150.00	147.00	to 153.00	200.00	196.00	to 204.00

Table 2A. Calibration Deviations Allowable for Adjustable Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 3%		W 50%	CW Or CCW Dev 3%		W 75%	CW or CCW Dev 3%		W 100%	CW or CCW Dev 3%	
20	4-20	5.00	4.85	to 5.15	10.00	9.70	to 10.30	15.00	14.55	to 15.45	20.00	19.40	to 20.60
30	6-30	7.50	7.28	to 7.73	15.00	14.55	to 15.45	22.50	21.83	to 23.18	30.00	29.10	to 30.90
36	7.2-36	9.00	8.73	to 9.27	18.00	17.46	to 18.54	27.00	26.19	to 27.81	36.00	34.92	to 37.08
100	20-100	25.00	24.25	to 25.75	50.00	48.50	to 51.50	75.00	72.75	to 77.25	100.00	97.00	to 103.00
150	30-150	37.50	36.38	to 38.63	75.00	72.75	to 77.25	112.50	109.13	to 115.88	150.00	145.50	to 154.50
200	40-200	50.00	48.50	to 51.50	100.00	97.00	to 103.00	150.00	145.50	to 154.50	200.00	194.00	to 206.00

Table 2B. Calibration Deviations Allowable for Adjustable Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 4%			W 50%	CW Or CCW Dev 4%			W 75%	CW or CCW Dev 4%			W 100%	CW or CCW Dev 4%		
20	4-20	5.00	4.80	to	5.20	10.00	9.60	to	10.40	15.010	14.40	to	15.60	20.00	19.20	to	20.80
30	6-30	7.50	7.20	to	7.80	15.00	14.40	to	15.60	22.50	21.60	to	23.40	30.00	28.80	to	31.20
36	7.2-36	9.00	8.64	to	9.36	18.00	17.28	to	18.72	27.00	25.92	to	28.08	36.00	34.56	to	37.44
100	20-100	25.00	24.00	to	26.00	50.00	48.00	to	52.00	75.00	72.00	to	78.00	100.00	96.00	to	104.00
150	30-150	37.50	36.00	to	39.00	75.00	72.00	to	78.00	112.50	108.00	to	117.00	150.00	144.00	to	156.00
200	40-200	50.00	48.00	to	52.00	100.00	96.00	to	104.00	150.00	144.00	to	156.00	200.00	192.00	to	208.00

Table 2C. Calibration Deviations Allowable for Adjustable Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 5%			W 50%	CW Or CCW Dev 5%			W 75%	CW or CCW Dev 5%			W 100%	CW or CCW Dev 5%		
20	4-20	5.00	4.75	to	5.25	10.00	9.50	to	10.50	15.00	14.25	to	15.75	20.00	19.00	to	21.00
30	6-30	7.50	7.13	to	7.88	15.00	14.25	to	15.75	22.50	21.38	to	23.63	30.00	28.50	to	31.50
36	7.2-36	9.00	8.55	to	9.45	18.00	17.10	to	18.90	27.00	25.65	to	28.35	36.00	34.20	to	37.80
100	20-100	25.00	23.75	to	26.25	50.00	47.50	to	52.50	75.00	71.25	to	78.75	100.00	95.00	to	105.00
150	30-150	37.50	35.63	to	39.38	75.00	71.25	to	78.75	112.50	106.88	to	118.13	150.00	142.50	to	157.50
200	40-200	50.00	47.50	to	52.50	100.00	95.00	to	105.00	150.00	142.50	to	157.50	200.00	190.00	to	210.00

Table 2D. Calibration Deviations Allowable for Adjustable Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 6%			W 50%	CW Or CCW Dev 6%			W 75%	CW or CCW Dev 6%			W 100%	CW or CCW Dev 6%		
20	4-20	5.00	4.70	to	5.30	10.00	9.40	to	10.60	15.010	14.11	to	15.91	20.00	18.80	to	21.20
30	6-30	7.50	7.05	to	7.95	15.00	14.10	to	15.90	22.50	21.15	to	23.85	30.00	28.20	to	31.80
36	7.2-36	9.00	8.46	to	9.54	18.00	16.92	to	19.08	27.00	25.38	to	28.62	36.00	33.84	to	38.16
100	20-100	25.00	23.50	to	26.50	50.00	47.00	to	53.00	75.00	70.50	to	79.50	100.00	94.00	to	106.00
150	30-150	37.50	35.25	to	39.75	75.00	70.50	to	79.50	112.50	105.75	to	119.25	150.00	141.00	to	159.00
200	40-200	50.00	47.00	to	53.00	100.00	94.00	to	106.00	150.00	141.00	to	159.00	200.00	188.00	to	212.00

Table 3. Calibration Deviations Allowable for Direct-Reading Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 2%			W 50%	CW Or CCW Dev 2%			W 75%	CW or CCW Dev 2%			W 100%	CW or CCW Dev 2%		
6	1.2-6	1.50	1.47	to	1.53	3.00	2.94	to	3.06	4.50	4.41	to	4.59	6.00	5.88	to	6.12
12	2.4-12	3.00	2.94	to	3.06	6.00	5.88	to	6.12	9.00	8.82	to	9.18	12.00	11.76	to	12.24
25	5-25	6.25	6.12	to	6.38	12.50	12.25	to	12.75	18.75	18.38	to	19.13	25.00	24.50	to	25.50
50	10-50	12.50	12.25	to	12.75	25.00	24.50	to	25.50	37.50	36.75	to	38.25	50.00	49.00	to	51.00
100	20-100	25.00	24.50	to	25.50	50.00	49.00	to	51.00	75.00	73.50	to	76.50	100.00	98.00	to	102.00
200	40-200	50.00	49.00	to	51.00	100.00	98.00	to	102.00	150.00	147.00	to	153.00	200	196.00	to	204.00

Table 3A. Calibration Deviations Allowable for Direct-Reading Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 3%			W 50%	CW Or CCW Dev 3%			W 75%	CW or CCW Dev 3%			W 100%	CW or CCW Dev 3%		
6	1.2-6	1.50	1.46	to	1.55	3.00	2.91	to	3.09	4.50	4.37	to	4.64	6.00	5.82	to	6.18
12	2.4-12	3.00	2.91	to	3.09	6.00	5.82	to	6.18	9.00	8.73	to	9.27	12.00	11.64	to	12.36
25	5-25	6.25	6.06	to	6.44	12.50	12.13	to	12.88	18.75	18.19	to	19.31	25.00	24.25	to	25.75
50	10-50	12.50	12.13	to	12.88	25.00	24.25	to	25.75	37.50	36.38	to	38.63	50.00	48.50	to	51.50
100	20-100	25.00	24.25	to	25.75	50.00	48.50	to	51.50	75.00	72.75	to	77.25	100.00	97.00	to	103.00
200	40-200	50.00	48.50	to	51.50	100.00	97.00	to	103.00	150.00	145.50	to	154.50	200	194.00	to	206.00

Table 3B. Calibration Deviations Allowable for Direct-Reading Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 4%			W 50%	CW Or CCW Dev 4%			W 75%	CW or CCW Dev 4%			W 100%	CW or CCW Dev 4%		
6	1.2-6	1.50	1.44	to	1.56	3.00	2.88	to	3.12	4.50	4.32	to	4.68	6.00	5.76	to	6.24
12	2.4-12	3.00	2.88	to	3.12	6.00	5.76	to	6.24	9.00	8.64	to	9.36	12.00	11.52	to	12.48
25	5-25	6.25	6.00	to	6.50	12.50	12.00	to	13.00	18.75	18.00	to	19.50	25.00	24.00	to	26.00
50	10-50	12.50	12.00	to	13.00	25.00	24.00	to	26.00	37.50	36.00	to	39.00	50.00	48.00	to	52.00
100	20-100	25.00	24.00	to	26.00	50.00	48.00	to	52.00	75.00	72.00	to	78.00	100.00	96.00	to	104.00
200	40-200	50.00	48.00	to	52.00	100	96.00	to	104.00	150.00	144.00	to	156.00	200	192.00	to	208.00

Table 3C. Calibration Deviations Allowable for Direct-Reading Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 5%			W 50%	CW Or CCW Dev 5%			W 75%	CW or CCW Dev 5%			W 100%	CW or CCW Dev 5%		
6	1.2-6	1.50	1.43	to	1.58	3.00	2.85	to	3.15	4.50	4.28	to	4.73	6.00	5.70	to	6.30
12	2.4-12	3.00	2.85	to	3.15	6.00	5.70	to	6.30	9.00	8.55	to	9.45	12.00	11.40	to	12.60
25	5-25	6.25	5.94	to	6.56	12.50	11.88	to	13.13	18.75	17.81	to	19.69	25.00	23.75	to	26.25
50	10-50	12.50	11.88	to	13.13	25.00	23.75	to	26.25	37.50	35.63	to	39.38	50.00	47.50	to	52.50
100	20-100	25.00	23.75	to	26.25	50.00	47.50	to	52.50	75.00	71.25	to	78.75	100.00	95.00	to	105.00
200	40-200	50.00	47.50	to	52.50	100	95.00	to	105.00	150.00	142.50	to	157.50	200.00	190.00	to	210.00

Table 3D. Calibration Deviations Allowable for Direct-Reading Torque Screwdrivers.

Max. Torque Value	Usable Wrench Range	Calibration Points											
		W 25%	CW or CCW Dev 6%			W 50%	CW Or CCW Dev 6%			W 75%	CW or CCW Dev 6%			W 100%	CW or CCW Dev 6%		
6	1.2-6	1.50	1.41	to	1.59	3.00	2.82	to	3.18	4.50	4.23	to	4.77	6.00	5.64	to	6.36
12	2.4-12	3.00	2.82	to	3.18	6.00	5.64	to	6.36	9.00	8.46	to	9.54	12.00	11.28	to	12.72
25	5-25	6.25	5.88	to	6.63	12.50	11.75	to	13.25	18.75	17.63	to	19.88	25.00	23.50	to	26.50
50	10-50	12.50	11.75	to	13.25	25.00	23.50	to	26.50	37.50	35.25	to	39.75	50.00	47.00	to	53.00
100	20-100	25.00	23.50	to	26.50	50.00	47.00	to	53.00	75.00	70.50	to	79.50	100.00	94.00	to	106.00
200	40-200	50.00	47.00	to	53.00	100.00	94.00	to	106.00	150.00	141.00	to	159.00	200.00	188.00	to	212.00

CALIBRATION PERFORMANCE TABLE

Not Required