Snap-on Tools

SCTM

Torque Wrench

Repair and Calibration Manual

REV C ISSUED ON: 10/10/97

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TORQUE WRENCH REPAIR AND CALIBRATION MANUAL

This manual provides repair and calibration procedures for qualified technicians to repair and calibrate torque wrenches manufactured and sold by Snap-on Tools. Snap-on Tools bears no responsibility in determining the qualification of any technicians, nor to the use of these procedures by anyone other than Snap-on Tools qualified employees.

INTRODUCTION

Today, many companies have achieved ISO 9000 Certification and they discovered that certain measuring equipment and tools must be controlled in the written Quality System. Other standards classify torque wrenches as Measuring and Test Equipment (M&TE), hence these products must be periodically checked and certified to ensure calibration specifications are in conformance. This task is a requirement of the ISO 9000 standard.

Many companies have justified the cost to do on-site calibration rather than sending torque wrenches to calibration contractors for periodical calibration and certification. The ISO 9000 standard requires calibration technicians to have written procedures available. The SCTM Torque Wrench Repair and Calibration Manual provides generic procedures that covers most hand actuated torque wrenches that were manufactured by Snap-on Tools. If there are questions in using these procedures, please feel free to write to the Service Department;

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SCTM Torque Wrench Repair and Calibration Manual

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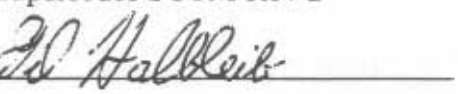
Signature:  ***Date:*** 10/10/97

CONTENTS

TITLE OF PROCEDURE	REV
Torque Tester General Information and Tips	A
QC Series Torque Wrench Repair, Maintenance & Troubleshooting Instructions	A
QJ Series Torque Wrench Repair and Calibration Procedure	C
QT2FR100, QT2R100, QT2R1000, QTFR2100, QTR2100 Repair Instructions	B
QT2FR100, QT2R100, QT2R1000, QTFR2100, QTR2100 Calibration Instructions	B
QTS135 and QTSP135 Torque Limiting Driver Calibration Instructions	D
Direct Reading Dial Types Torque Instrument Calibration and Repair Instructions	A
TQFR, TQR Series Torque Wrench Repair and Calibration Procedure	C
TQS Torqometer® Style Driver Repair and Calibration Procedure	C

Snap-on

QC SERIES TORQUE WRENCH

REPAIR

MAINTENANCE

AND

TROUBLESHOOTING

INSTRUCTIONS

REVISION: A
ISSUED ON: September 29, 1997

Torque Tester General Information and Tips

a) Torque Tester Accuracy

Total uncertainty of the torque tester, test bar, test weights and any other factors should be at least 4 times better than the torque wrench being tested. For example, for a torque wrench with ±4% accuracy specification, the cumulative error of the torque tester, test bar, test weights and any other factors must not exceed ±1% of the test reading. Refer to the manufacturer's specifications for the torque tester, test bar, test weights and any other factors that may affect accuracy. Periodical verification of accuracy should be performed to a torque tester to ensure the specification is in conformance. The frequency of accuracy verification must be determined by the user.

b) Gravitational Effects Factors

When checking calibration of a torque tester, refer to the manufacturer's instructions for applying a gravitational effects correction factor. Weight is affected by global location, referencing latitude and altitude. Weight is lightest at the Equator and heaviest at the poles of our planet. Also, weight grows lighter at altitudes higher than sea level and heavier at altitudes lower than sea level. Your local geological survey office can determine your exact latitude and altitude. Also, they may be able to determine if your location has dense formations of granite or other matter that may affect weight.

c) Torque Tester Usage and Safety

Refer to the instructions of the torque tester to use it properly to test the accuracy of torque wrenches. Be sure all safety warnings and comments are read and understood by all persons using the torque tester.

d) Test Points for Testing Torque Wrenches

Unless otherwise specified by the torque wrench manufacturer, accuracy should be tested at 20%, 60% and 100% of maximum capacity. For example; a 100 foot-pound torque wrench would be tested at 20, 60 and 100 foot-pound test points. Use the nearest graduation to 20%, 60% or 100% when the exact graduation is not available.

e) Applying Load to a Torque Wrench to Verify Accuracy

Follow the instructions of the torque tester and torque wrench manufacturers. Generally, both the torque tester and the torque wrench must be set to zero, then load is applied 3 successive times to 50% of maximum capacity of the torque wrench. This exercises the components of a torque wrench which is very important when considering it may have been used last in the opposite direction of torque. Be sure the load is applied to the center point of the hand hold of the torque wrench. The ASME B107.14M-1994 *Hand Torque Tools* standard (section 5.2.4) may be referenced to use the same torque testing techniques applied at the manufacturing facility. Be sure to fully release the load after taking a test reading, before loading to the next highest test point.

TABLE OF CONTENTS

TITLE	PAGE(s)
SAFETY INSTRUCTIONS – *WARNING & CAUTION*	7
INTRODUCTION	8
CLEANING	8
LUBRICATION	8
REPAIR TOOLS REQUIRED	8-9
QC Series Micrometer Adjustable	8
QC Series Pre-Set Torque Wrenches	9
OTHER REQUIRED MATERIALS	9
INSPECTION	9
CAUTION – Customer misuse	9
TROUBLESHOOTING	9
QC Series Micrometer Adjustable Torque Wrench Troubleshooting Matrix -*Table*	10-11
ACCURACY VERIFICATION AND MINOR CALIBRATION PROCEDURE	11-14
HANDLE VIEW - *Illustration*	12
HANDLE/TUBE VIEW - *Illustration*	13
HANDLE "0" ALIGNMENT TO TUBE - *Illustration*	13
Handle Locking -*Table*	14
MAJOR CALIBRATION AND REPAIR	14-20
To disassemble the tube	14

TABLE OF CONTENTS (Continued)

TITLE	PAGE(s)
To recalibrate the wrench	14-20
Pawl Orientation Chart - *Illustration*	15
Pawl Size - *Table*	15
Pawl Style Chart - *Table*	15
Pawl Identification Code Example	16
Pawl Selection Chart - *Table*	16
Example #1 with Pawl Selection Chart - *Table*	17
Example #2 with Pawl Selection Chart - *Table*	18
CAM STYLES - *Illustration*	19
CAUTION - Positive Spring Pressure	19
To check for positive pressure on the spring	19
HANDLE/LOCK RING REPAIR	20-23
To disassemble the handle/lock ring	20-21
HANDLE WITH GROOVE FOR FOD PLUG - *Illustration*	20
HANDLE WITH PLASTIC BUSHING - *Illustration*	21
HANDLE/LOCK RING ASSEMBLY - *Illustration*	22
To assemble the handle/lock ring	22-23
Handle Locking - *Table*	23
TUBE INSERT REPLACEMENT	23-26
TUBE INSERT - *Illustration*	24

TABLE OF CONTENTS (Continued)

TITLE	PAGE(s)
CAUTION - Grease the Tube Insert	24
CAUTION - Positive Spring Pressure	24
To check for positive pressure on the spring	25
Handle Locking - *Table*	25
CALIBRATION INSTRUCTIONS FOR QC SERIES PRE-SET TORQUE WRENCHES	26-27
QC SERIES PRE-SET TORQUE WRENCH - *Illustration*	26

TABLE OF ILLUSTRATIONS

TITLE	PAGE(s)
HANDLE VIEW	12
HANDLE/TUBE VIEW	13
HANDLE "0" ALIGNMENT TO TUBE	13
PAWL ORIENTATION CHART	15
CAM STYLES	19
HANDLE WITH GROOVE FOR FOD PLUG	20
HANDLE WITH PLASTIC BUSHING	21
HANDLE/LOCK RING ASSEMBLY	22
TUBE INSERT	24
QC SERIES PRE-SET TORQUE WRENCH	26

TABLE OF TABLES

TITLE	PAGE(s)
QC Series Micrometer Adjustable Torque Wrench Troubleshooting Matrix	10-11
Handle Locking	14, 23, 25
Pawl Size	15
Pawl Style Chart	15
Pawl Selection Chart	16
Example #1 with Pawl Selection Chart	17
Example #2 with Pawl Selection Chart	18

WARNINGS AND CAUTIONS

TYPE	PAGE(s)
SAFETY INSTRUCTIONS - *WARNING AND CAUTION*	7
CAUTION - Customer misuse	9
CAUTION - Positive Spring Pressure	19, 24
CAUTION - Grease the Tube Insert	24

REVISIONS

The QC Series Repair Manual was originated and first issued on October 10,1996. It was revised on September 29, 1997. The manual will be reviewed and revised as necessary to assure that it contains the latest changes in product or repair changes.

In between revision, product bulletins may be issued to assure any changes in product or repairs are supplied to authorized repair facilities.

REV	Date Issued	Affected Page(s)	Approved
NA	OCT. 21, 1996	New document issue	DB
A	SEPT. 29, 1997	Major rewrite. Obsolete 10-21-96 issue.	DB

Written By: Donna E. Brunot

Approved By: Gary Keefe

Date: 9/29/97

QC SERIES TORQUE WRENCH REPAIR, MAINTENANCE AND TROUBLESHOOTING INSTRUCTIONS

SAFETY INSTRUCTIONS

Failure to follow **WARNING** instructions can cause personal injury to the operator.
Failure to follow **CAUTION** instructions can cause the equipment to fail or break in use.

! WARNING

Always wear Safety Glasses or goggles when using or repairing hand tools.

Read this manual completely before repairing torque wrenches.

DO NOT use or test a wrench that shows signs of damage (bent tubes, cracked or broken parts) caused by misuse. Recommend replacement.

DO NOT use cheater extensions on the handles or tube to apply torque.

DO NOT exceed rated maximum torque.

Check all sockets or other test accessories for wear, damage or crack prior to their use with torque wrenches. Do not exceed their rated maximum torque.

Always pull (DO NOT push) to apply torque. Adjust your stance to prevent a fall if something should give suddenly.

Ratchet head torque wrenches must be checked for full (positive) engagement of the ratchet in the direction of use prior to applying a load on the wrench. Broken or slipping ratchets can cause injury.

CAUTION

Periodic recalibration is necessary to maintain accuracy.

Periodic examination and cleaning is necessary to maintain the wrench.

INTRODUCTION

This section covers the repair, maintenance and troubleshooting instructions to identify and remedy problems that could occur with the QC Series Torque Wrenches. Each wrench model has an Exploded Illustration that lists the component parts and shows assembly particulars. The exploded illustration must be used as a guide for assembling QC Series Torque Wrenches.

CLEANING

Wipe all exterior parts with a dry, clean and lint free cloth. **DO NOT USE** any abrasive or corrosive materials to clean any components of the QC Series Torque Wrenches.

After assembly, a non-abrasive polishing agent applied with a dry, clean and lint free cloth may be used to polish the chrome exterior parts.

LUBRICATION

Super Lube MULTI-Purpose Synthetic Lubrication with Teflon, Part # CDI101000. NO SUBSTITUTES ALLOWED.

REPAIR TOOLS REQUIRED

QC Series Micrometer Adjustable Torque Wrenches

1	**Flat blade mini screwdriver** (max. blade size .063 or 1.6mm) Snap-on Mini Screwdriver Set part # **CM6551**
1	**End Cutter** (modified jaws ground flat on top to allow rivet removal) Snap-on part # **17CP**
2	**Calibration Crank Handle** Snap-on part #'s: **QCS60081** (3/8") & **QCS60082** (7/16")
1	**0 to 1" micrometer** with tenth (.0000) increments Snap-on part # **GA 1000**
1	**16 oz. Bronze tip hammer** Snap-on part # **HBT160**
1	**40 to 200 In. Lb. Torque Wrench** Snap-on part # **QC2R200**
1	**3/8" 6 Point Deep Socket** Snap-on part # **SFS-121**
1	**7/16" 6 Point Deep Socket** Snap-on part # **SFS-141**

QC Series Pre-Set Torque Wrenches

1 **T Shaped Handle 1/8" Hex**
Snap-on part # **GAW1608** or **AWCG1608**

1 **T Shaped Handle 3/32" Hex**
Snap-on part # **GAW1606** or **AWCG1606**

OTHER REQUIRED MATERIALS

Torque Seal (Snap-on part # **CDI101100**)

INSPECTION

Inspect all wrenches repaired to determine that they are in an operational condition by visually inspecting for worn, broken, cracked or damaged parts. Replace parts not found to be in satisfactory condition.

CAUTION

Some customer's abuse torque wrenches and damage them beyond repair. The most common abuse is using the wrench as a breaker bar. This type of misuse is evident if the tube or the drive is bent in the clockwise direction in relation to the tube or marks from a cheater bar are on the tube or handle. **DO NOT REPAIR** the wrench if it shows signs of this type of misuse. The component parts may be permanently damaged. The **SAFETY** and **INTEGRITY** of the wrench could be impaired. Recommend that the wrench be replaced.

TROUBLESHOOTING

The **QC Series Pre-Set Torque Wrenches** generally do not require repair. They are sent in for calibration to the required use setting with the head or adapter chosen for use. All adjustments are to be made as shown in the section on **QC Series Pre-Set Torque Wrench Calibration**.

The **Troubleshooting Matrix** is for the **QC Torque Micrometer Adjustable Wrench** models **only**. Refer to the **Troubleshooting Matrix** for problems that could occur to the **QC Series Micrometer Adjustable Torque Wrenches** and their remedy.

QC Series Micrometer Adjustable Torque Wrench Troubleshooting Matrix

PROBLEM	CAUSE(s)	REMEDY
Calibration accuracy at 20% of scale is out of tolerance. **OR** Calibration accuracy at 20%, 60% and 100% of scale is out of tolerance. **OR** Calibration accuracy at 60% and 100% of scale is out of tolerance	Customer tampering (torque seal cracked or missing) **OR** Not set correctly at the factory. **OR** Customer unwound the handle below the stop point. (torque seal cracked or missing) **OR** Customer disassembled handle and reassembled wrong. (torque seal cracked or missing) **OR** Pawl and/or pawl slots worn or damaged.	**NOTE** Check handle prior to adjusting to assure it is engaged to the adjusting screw. Minor calibration Adjustment. **NOTE** If a minor calibration fails to bring the 20% of scale reading into tolerance or if adjustment causes the 60% or 100% of scale to fall out of the tolerance a major calibration is required. **OR** **NOTE** Check pawl and pawl slots prior to a major calibration. A major calibration.
When the lock ring is released the handle goes up and down the tube without turning the handle or the handle doesn't turn at all.	The tube insert is stripped due to handle misuse. (check for damage to handle) **OR** No lubrication placed on torque load screw at the factory.	See tube repair to replace tube insert.
Handle and load screw disassembled.	Customer disassembled handle (no torque seal) **OR** Handle was not locked on properly at factory.	See handle/lock ring repair section to assemble.

PROBLEM	CAUSE(s)	REMEDY
Lock Ring Doesn't Lock.	Customer forced handle to turn without releasing the lock ring. (the tube will show groove marks through the splines)	Replace the tube.
Lock ring is jammed or doesn't fall into lock position when released.	Handle spring problem.	Disassemble the handle/lock ring and replace lock ring spring.
The wrench does not click.	The pawl is not in the pawl slot. **OR** There is no pressure on the pawl.	Disassemble wrench and add washers to increase pressure on pawl. **NOTE** When placing the ratchet/head drive into the tube to insert the pivot pin, the drive pivot hole must be pushed into the tube to align the holes. If there is no pressures remove parts and add more washers to increase pressure on the pawl.
The wrench only clicks in one direction or can only be calibrated in one direction.	The head drive and/or secondary arm (if used) are not in centerline.	Replace the head drive and/or secondary arm (if used).
The pawl double clicks.	Sharp or rough edges on the pawl. **OR** Rough surfaces on the pawl slot of the head and/or secondary arm (if used).	Check and replace as needed head and/or secondary arm (if used). Check and replace the pawl, as needed.

ACCURACY VERIFICATION AND MINOR CALIBRATION PROCEDURE

This procedure is to be used to check the accuracy and, if necessary, perform a minor adjustment on calibration. It must also be used after a major calibration.

1. Preload the wrench by setting the wrench at 50% of full scale and operating three times in the direction of the test.

2. Reset handle to 20% of full scale. Place square drive in tester. Adjust the loading point of the tester until the load is being applied in the center of the handle.

NOTE

The handle support **MUST** be at the center of the handle when the handle is adjusted to 60% of scale and again at 100% of scale. Torque wrench readings, per industry standard (ASME B107.14M-current version), have to be obtained by applying the load to the center of the handle.

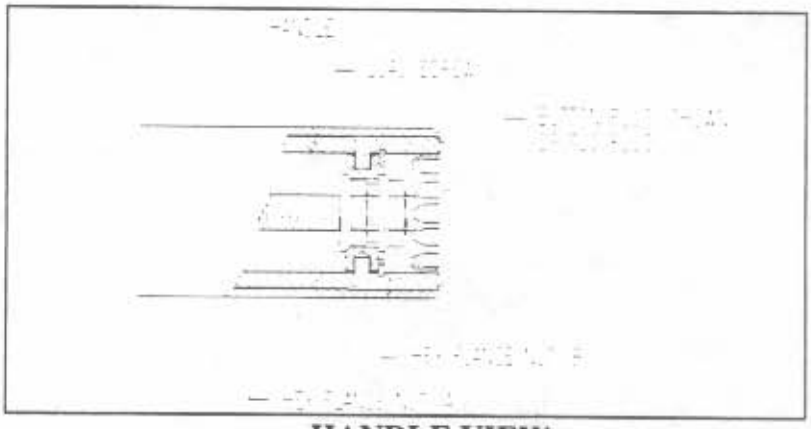
3. Test the wrench three (3) times at 20% noting the accuracy error for each reading. Set and test the wrench three (3) times at 60% and 100% of full scale noting the accuracy error for each reading. If the readings are within the accuracy requirements for the direction no calibration adjustment is required.

4. Test the torque wrench in the opposite direction by following steps 1 through 4 in that direction.

NOTE

A minor (handle) adjustment is used to adjust 20% of the scale reading. If the reading at 20% and 100% of scale are both either high or low to the required accuracy, a minor adjustment may be used to bring the accuracy within torque specification.

If the torque wrench requires minor adjustment follow steps 5 through 8.

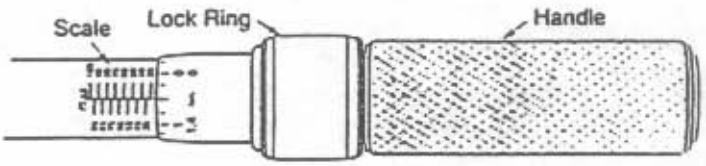


HANDLE VIEW

5. Set the handle at [1]20% of full scale. Remove the [2]plug from the end of the handle.
6. Check the torque seal on the load screw. If removed or cracked, the wrench calibration has been tampered with or the handle has been forced below its preset stop point.

[1] All torque wrenches with ¼" head drives must be calibrated at 100% of scale, not minimum (20%).
[2] See section on handle/lock ring for particulars on button plug or FOD plug removal.

6. Check the torque seal on the load screw. If removed or cracked, the wrench calibration has been tampered with or the handle has been forced below its preset stop point.



HANDLE/TUBE VIEW

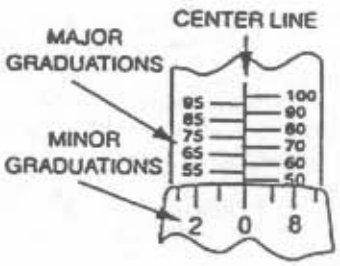
7. Push the lock ring forward and turn the handle until you reach the desired reading on the tester as follows:

A. If the reading on the tester was **below** the **accuracy limit** for the value tested turn the handle **clockwise** to **increase** the value. Repeat the test and adjustment procedure until the torque reading is within the accuracy limits.

B. If the reading on the tester was **above** the **accuracy limit** for the value tested turn the handle **counterclockwise** to **decrease** the value. Repeat the test and adjustment procedure until the torque reading is within the accuracy limits.

Release the lock ring and check the value on the tester.

8. With the lock ring in the locked position and holding the wrench handle firmly to prevent rotation of the handle, loosen the hex flange nut (B) with the calibration crank handle. The Torque seal will show a crack between the nut and screw. Remove the torque seal.



HANDLE "0" ALIGNMENT TO TUBE CENTERLINE VIEW

9. Push the lock ring forward, while applying a light force towards the wrench (to prevent handle disengagement) and turn handle until handle "0" mark is aligned to the centerline of the scale.

10. Tighten the hex flange nut (B) with a 200 in. lb. torque wrench as follows :

Handle Locking		
Torque Wrench Ranges	**Hex Flange Nut Size**	**Maximum Torque**
50 in. lb. to 250 in. lb.	3/8"	40 in. lb.
75 ft. lb. to 1000 ft. lb.	7/16"	100 in. lb.

11. Retest the wrench for accuracy (steps 1 through 4). If the wrench is not within specified accuracy requirements repeat steps 5 through 10 or the wrench may require a major calibration.

MAJOR CALIBRATION AND REPAIR

These instructions are to be used for the major calibration and repair, replacement or maintenance of the tube internal parts. Major calibration requires the wrench to be partially disassembled from the front, to inspect the internal component parts for contaminates, damage and/or wear. Refer to the trouble shooting matrix to determine when this procedure is required.

To disassemble the tube

1. Push up the lock ring and unwind the handle of the wrench below 20% of scale until it stops.

2. Remove the pivot pin rivet from the tube by using the modified end cutters. Push the pivot pin out of the tube to release the head drive.

To recalibrate the wrench

1. Pull the head drive, secondary arm (if required), pawl and cam slowly out of the wrench to prevent the pawl from [3]loosing its orientation in the cam.

2. The orientation, size and style of the pawl in the wrench must be determined, measured and noted so it can be found on the pawl selection chart. Use a micrometer to measure the pawl and determine its [4]size and style.

3 A major recalibration requires the selection of a new pawl. To find the correct pawl, locate the pawl removed from the wrench on the pawl selection chart. This is the starting point for selecting a new pawl.

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[3] If the pawl orientation in the slot of the cam is unknown rebuild the wrench without inserting the rivet into the pivot pin and retest.

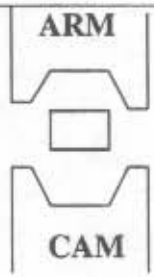
[4] Due to the machining tolerances, pawl sizes sometimes do not corresponding exactly to the number in the pawl selection chart. If this occurs choose the pawl on the chart closest to the pawl removed from the wrench.

Pawl Orientation Chart

O = Square Pawl

All sides are the same no orientation to pawl slot required.

T = Tall
Longer side of the pawl is perpendicular to the cam slot



S = Short
Shorter side of The pawl is perpendicular to the cam slot

Pawl Size

There are six different pawl sizes available for calibration starting with pawl number "0" with square cross sections.

STYLE / SIZE	A	B	C
0	-	.250 x .250	.187 x .187
1	-	.250 x .244	.187 x .183
2	.260 x .250	.250 x 240	.187 x .180
3	.260 x .245	.250 x .235	.187 x .176
4	.260 x .240	.250 x .230	.187 x .173
5	.260 x .235	-	.187 x .168

Style Chart

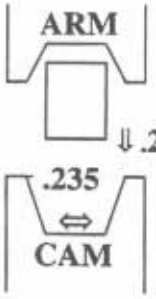
A = Pawl with longer side .260

B = Pawl with longer side .250 or both sides .250

C = Pawl with longer side .187 or both sides .187

NOTE: Style **"C"** is used on wrenches up to a maximum scale of .250 in. lb.

PAWL IDENTIFICATION CODE EXAMPLE



3 T B = size 3 = .250 x .235

3 = size

T = style = T = tall (longer side of pawl is perpendicular to the pawl slot)

B = style = B = pawl with longer side .250

B = orientation

PAWL SELECTION CHART

STYLE	SIZE & ORIENTATION										
♦	5T	4T	3T	2T	1T	0	1S	2S	3S	4S	5S
A (.260)	.260⇓ .235 ⇔	.260⇓ .240 ⇔	.260⇓ .245 ⇔	.260⇓ .250 ⇔							
or											
B (.250)		.250⇓ .230 ⇔	.250⇓ .235 ⇔	.250⇓ .240 ⇔	.250⇓ .244 ⇔	.250⇓ .250 ⇔	.244⇓ .250 ⇔	.240⇓ .250 ⇔	.235⇓ .250 ⇔	.230⇓ .250 ⇔	
TO DECREASE THE READING ⇐ ---------- ⇒ TO INCREASE THE READING											
Style C *for wrenches with a maximum scale up to 250 in. lb. ONLY.*											
♦	.187⇓ .168 ⇔	.187⇓ .173 ⇔	.187⇓ .176 ⇔	.187⇓ .180 ⇔	.187⇓ .183 ⇔	.187⇓ .187 ⇔	.183⇓ .187 ⇔	.180⇓ .187 ⇔	.176⇓ .187 ⇔	.173⇓ .187 ⇔	.168⇓ .187 ⇔

NOTES

To increase or decrease the torque reading approximately 2% requires changing the actual pawl size one location.

Always select a pawl to the left ⇐ of the actual pawl to decrease the wrench reading.

Always select a pawl to the right ⇒ of the actual pawl to increase the wrench reading.

There is an overlapping of pawl sizes. Style "A"' and "B" overlap from size 2T to 4T. Use style "A", if available.

EXAMPLE #1

The wrench reads approximately 5% low from nominal. You disassemble the wrench and measure the pawl. It was .260⇓ X .245⇔, orientated with the longer side of the pawl perpendicular to the cam slot. To find the correct pawl, locate the pawl removed from the wrench on the pawl selection chart. This pawl is number 3TA on the chart. This is the starting point for selecting a new pawl.

To increase the reading of the wrench 4% you would choose the pawl two places to the right of 3TA (.260⇓ X .245⇔) which is 1TB (.250⇓ X .244⇔). This pawl change should increase the wrench reading to within approximately 1% of nominal.

PAWL SELECTION CHART

STYLE	SIZE & ORIENTATION										
♦	5T	4T	3T	2T	1T	0	1S	2S	3S	4S	5S
A	.260⇓ .235 ⇔	.260⇓ .240 ⇔	.260⇓ .245 ⇔	.260⇓ .250 ⇔							
or											
B		.250⇓ .230 ⇔	.250⇓ .235 ⇔	.250⇓ .240 ⇔	.250⇓ .244 ⇔	.250⇓ .250 ⇔	.244⇓ .250 ⇔	.240⇓ .250 ⇔	.235⇓ .250 ⇔	.230⇓ .250 ⇔	

EXAMPLE #2

The wrench reads approximately 5% high from nominal. You disassemble the wrench and measure the pawl. It was .250⇓ X .244⇔, orientated with the longer side of the pawl perpendicular to the cam slot. To find the correct pawl, locate the pawl removed from the wrench on the pawl selection chart. This pawl number is 1TA on the chart. This is the starting point for selecting a new pawl.

To decrease the reading of the wrench 4% you would choose the pawl two places to the left of 1TB (.250⇓ X .244⇔) which is 3TA (.260⇓ X .245⇔) or 3TB (.250⇓ X .235⇔). The recommended change would be to a Style "A", if available. This pawl change should decrease the wrench reading to within approximately 1% of nominal.

PAWL SELECTION CHART

STYLE	SIZE & ORIENTATION										
♦	5T	4T	3T	2T	1T	0	1S	2S	3S	4S	5S
A	.260⇓ .235 ⇔	.260⇓ .240 ⇔	.260⇓ .245 ⇔	.260⇓ .250 ⇔							
or											
B		.250⇓ .230 ⇔	.250⇓ .235 ⇔	.250⇓ .240 ⇔	.250⇓ .244 ⇔	.250⇓ .250 ⇔	.244⇓ .250 ⇔	.240⇓ .250 ⇔	.235⇓ .250 ⇔	.230⇓ .250 ⇔	

4. Check the pawl and pawl slot for worn or damaged edges. Choose the appropriate pawl to increase⇒ or decrease⇐ the reading.

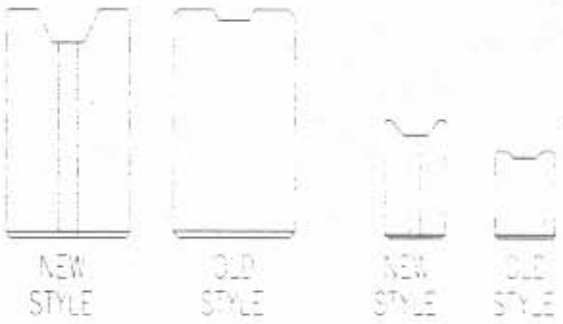
5. Remove all parts from tube. Examine them for wear and/or damage. Replace parts as required. Clean and lubricate internal parts with Super Lube.

6. Assemble the parts according to the assembly blueprint requirements (spacers, Thrust washers, flat washers & spring). Slide into the tube.

7. Place the cam on top of the spring, properly orientated to the pivot hole.

NOTE

The CAM for wrenches from 50 in. lb. to 250 in. lb. and for wrenches 500 ft. lb. to 2000 ft. lb. have been changed as illustrated. If you replace the old style CAM with the new style CAM based on the length differences you must add or subtract washers.



CAM STYLES

8. Lightly grease the pawl to hold it into position in the cam. Place the pawl in the cam slot.

9. Place the end of the drive head or arm carefully against the top of the pawl and slide assembly back into the tube. Place pivot pin through the tube and head.

CAUTION

The wrench must always be assembled with some positive pressure on the spring. To assure positive pressure, the pivot hole of the head must be pushed into alignment with the pivot hole on the tube. Failure to assemble the wrench with positive pressure will result in the wrench not being able to hold calibration.

To check for positive pressure on the spring

a) Place the pivot pin into the assembled wrench.

b) With the handle unwound to its lowest point (the handle stop), the wrench should be at 5% to 10% of full scale (example a 250 ft/ lb. wrench should read 12.5 to 25 ft. lb.) on a torque tester.

c) If the wrench does not click or reads below at 5% of full scale on a torque tester when the handle is at its lowest position, disassemble and add more washers to increase the pressure.

10. Push the lock ring up and adjust the wrench up to the maximum scale value. Cycle the wrench a minimum of 25 times in both directions (clockwise & counterclockwise).

11. Push the lock ring up and adjust the wrench down to minimum scale value. Let the wrench rest a minimum of 2 hours (to allow spring to relax back to its natural "set").

12. Perform an accuracy verification and if required, a minor calibration adjustment.

13. After calibration, insert a new rivet into the pivot pin. Use a bronze head hammer to lock rivet into pivot pin.

HANDLE/LOCK RING REPAIR

These instructions are to be used for the repair of the handles or lock rings. Calibration does not require the handle to be disassembled. Replacing the tube insert requires the handle to be disassembled.

To Disassemble the Handle/Lock Ring

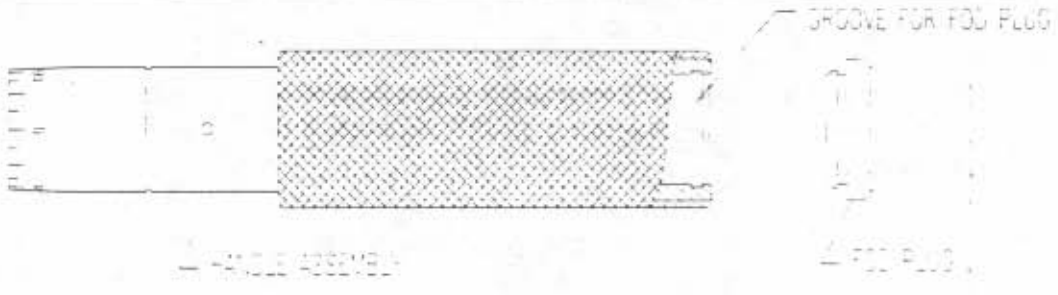
1. Remove the button (8a) or FOD (8b) plug with a flat blade mini screwdriver.

NOTE

There are two distinct end plugs for the QC Series torque wrenches.
They are:

- Steel button plug (8a) with a prongs, which requires 4 drops of adhesive (Locktite® 495) at the top, bottom and sides.
- FOD (foreign object damage) plug (8b) that requires a groove inside of the handle end for installation.

A steel button plug may be placed into a handle end with a FOD groove on the inside diameter. A FOD plug may not be used on a handle without a FOD groove on the inside of the handle.



HANDLE WITH GROOVE FOR FOD PLUG

2. Remove the Torque Seal from the screw and nut.

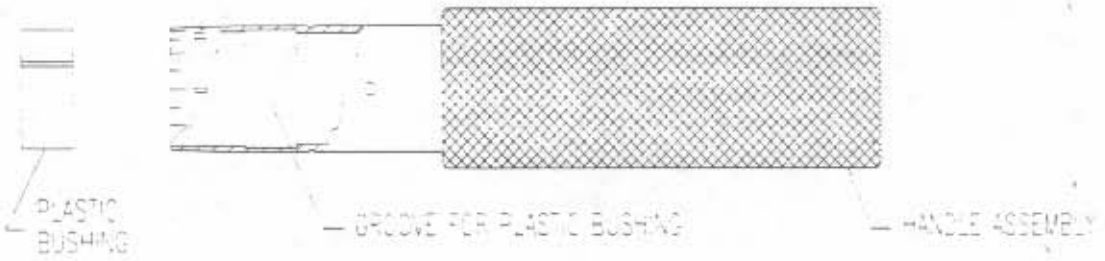
3. To disassemble the handle (5) from the tube, remove the nut (7) from the end of the wrench using the calibration crank handle. Next, remove the washer (6).

4. Push the lock ring (3) up to the unlock position (this releases the two balls (4) from the splines on the tube) and pull the handle off the tube.

NOTE

There are two distinct handle styles for the Q C Series torque wrenches.
They are:

- A handle without a plastic bushing in the front. This model requires that the groove in the tube (between the splines and roll marking) have a spring ring in it.
- A handle with a plastic bushing in the front. This handle requires the removal of the spring ring from the groove in the tube (between the splines and roll marking).

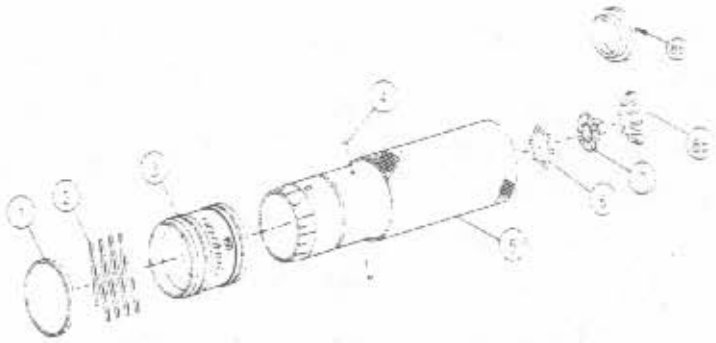


HANDLE WITH PLASTIC BUSHING

5. Remove the lock ring (3) from the handle by fitting the mini flat blade screwdriver under the retaining ring (1) and lifting the ring while rotating the handle. When the retaining ring (1) is completely disengaged, remove it from the handle (5).

6. Remove the lock ring spring (2). Then slide the lock ring (3) off of the handle.

7. Remove the two small round balls (4) (held with Super Lube to handle) from the inside of the handle.



HANDLE/LOCK RING ASSEMBLY

To assemble the handle/lock ring

1. Place Super Lube on the ball holes on handle (5). Place two balls (4) in holes (Super Lube will hold them in place).

2. Place lock ring (3) on handle (5). Next, place lock ring spring (2) on handle (5). It will fit between the handle (5) and the lock ring (2)

3. Spread the retaining ring (1) apart to fit it on the handle (5). Next, place the end of the retaining ring (1) into the handle (5) groove by applying pressure with the mini flat blade screwdriver. Continue to apply pressure while rotating the handle until the retaining ring (1) is fully engaged.

4. Push the lock ring (3) up into the unlock position while sliding the handle (5) as far as it will go onto the tube. Turn the handle (5) until the flange nut on the tube screw is engaged into the handle's insert. Release the lock ring (3) to engage the balls into the splines on the tube.

5. Next, set the handle (5) on the lowest increment of the tube. Push the lock ring (3) up to the unlock position and turn the handle until the top of the handle scale is lined up with the lowest increment on the tube. Release the lock ring to engage balls into the splines on the tube.

NOTE

The top of the handle must touch the increment line on the tube scale. When "0" is set, the top of the handle can not cover up the increment line on the tube scale or be below it.

6. If the center line of the tube is not lined up with the "0" on the handle (5), push up on the lock ring (3) to unlock it, pull the handle (5) back off of the flange nut on the tube screw (approx. ¼"). Turn the handle to reset the flange nut into the handle insert so that the "0" is lined up with the center line of the tube scale. Release the lock ring and jiggle the handle lightly left and right until the lock ring is fully engaged.

NOTE

Wrenches with maximum ranges from 50 in. lb. to 250 in. lb. require a lock washer (6) on the handle. Do not reuse the lock washer. Use a new lock washer (6) when reassembling the handle to the tube.

7. Tighten the hex flange nut (B) with a 200 in. lb. torque wrench as follows:

Handle Locking		
Torque Wrench Ranges	**Hex Flange Nut Size**	**Maximum Torque**
50 in. lb. to 250 in. lb.	3/8"	40 in. lb.
75 ft. lb. to 1000 ft. lb.	7/16"	100 in. lb.

8. An accuracy and minor adjustment must be performed after a handle is assembled.

TUBE INSERT REPLACEMENT

These instructions are to be used when the tube insert threads have been stripped. Replacing the tube insert requires the handle and tube to be disassembled. An accuracy check and calibration are required after a tube insert has been replaced.

1. Push up the lock ring and unwind the handle of the wrench below 20% of scale until it stops.

2. Remove the button (8a) or FOD (8b) plug with a flat blade mini screwdriver.

3. Remove the Torque Seal from the screw and nut.

4. To disassemble the handle (5) from the tube, remove the nut (7) from the end of the wrench using the calibration crank handle. Next, remove the washer (6).

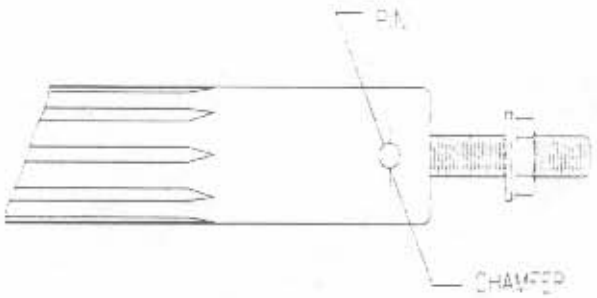
5. Push the lock ring (3) up to the unlock position (this releases the two balls (4) from the serration on the tube) and pull the handle off of the tube.

6. Remove the pivot pin rivet from the tube by using the modified end cutters. Push the pivot pin out of the tube to release the head drive.

7. Pull the head drive, secondary arm (if required), pawl and cam slowly out of the wrench to prevent the pawl from loosing its orientation in the cam.

8. The orientation, size and style of the pawl in the wrench must be determined, measured and noted to reassemble the wrench. Use a micrometer to measure the pawl and determine its size and style.

9. Remove the cam, spring and spacers from the tube.



TUBE INSERT

10. Using a Dremel tool with a 1/8" cylindrical cutter, remove the chamfer caused by staking the tube insert pin into the tube. Next tap the tube end and the pins will fall out. Remove and replace the insert.

CAUTION

Prior to assembling a new insert in the tube, the tube insert **MUST** be greased thoroughly inside the threaded area. Next, the screw **MUST** be run through the insert to assure that the tube insert is thoroughly and evenly greased.

Failure to do so can result in the threads of the insert stripping.

11. Assemble the parts according to the assembly blueprint requirements (spacers, Thrust washers, flat washers & spring). Slide into the tube.

12. Place the cam on top of the spring and orientated to the pivot hole.

13. Lightly grease the pawl to hold it into position in the cam. Place the pawl in the cam slot.

14. Place the end of the drive head or arm carefully against the top of the pawl and slide assembly back into the tube. Place pivot pin through the tube and head.

CAUTION

The wrench must always be assembled with some positive pressure on the spring. To assure positive pressure, the pivot hole of the head must be pushed into alignment with the pivot hole on the tube. Failure to assemble the wrench with positive pressure will result in the wrench not being able to hold calibration.

To check for positive pressure on the spring

a) Place the pivot pin into the assembled wrench.

b) With the handle unwound to its lowest point (the handle stop), the wrench should be at 5% to 10% of full scale (example a 250 ft/ lb. wrench should read 12.5 to 25 ft. lb.) on a torque tester.

c) If the wrench does not click or reads below at 5% of full scale on a torque tester when the handle is at its lowest position, disassemble and add more washers to increase the pressure.

15. Push the lock ring (3) up into the unlock position while sliding the handle (5) as far as it will go onto the tube. Turn the handle (5) until the flange nut on the tube screw is engaged into the handle's insert. Release the lock ring (3) to engage the balls into the serration on the tube.

16. Next, set the handle (5) on the lowest increment of the tube. Push the lock ring (3) up to the unlock position and turn the handle until the top of the handle scale is lined up with the lowest increment on the tube. Release the lock ring to engage balls into the serration on the tube.

NOTE

The top of the handle must touch the increment line on the tube scale. When "0" is set, the top of the handle can not cover up the increment line on the tube scale or be below it.

17. If the center line of the tube is not lined up with the "0" on the handle (5), push up on the lock ring (3) to unlock it, pull the handle (5) back off of the flange nut on the tube screw (approx. ¼"). Turn the handle to reset the flange nut into the handle insert so that the "0" is lined up with the centerline of the tube scale. Release the lock ring and jiggle the handle lightly left and right until the lock ring is fully engaged.

NOTE

Wrenches with maximum ranges from 50 in. lb. to 250 in. lb. require a lock washer (6) on the handle. Do not reuse the lock washer. Use a new lock washer (6) when reassembling the handle to the tube.

18. Tighten the hex flange nut (B) with a 200 in. lb. torque wrench as follows :

Handle Locking		
Torque Wrench Ranges	**Hex Flange Nut Size**	**Maximum Torque**
50 in. lb. to 250 in. lb.	3/8"	40 in. lb.
75 ft. lb. to 1000 ft. lb.	7/16"	100 in. lb.

19. An accuracy and minor adjustment must be performed after a handle is assembled.

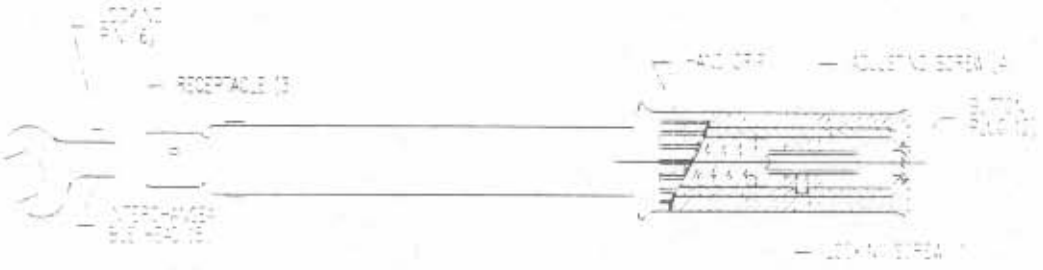
20. Push the lock ring up and adjust the wrench up to the maximum scale value. Cycle wrench a minimum of 25 times in both directions (clockwise & counterclockwise). Set the low reading.

21. Push the lock ring up and adjust the wrench down to minimum scale value. Let the wrench rest a minimum of 2 hours (to allow spring to relax back to its natural "set").

22. Perform an accuracy verification and if required, a minor calibration adjustment.

23. After calibration, insert a new rivet into the pivot pin. Use a bronze head hammer to lock rivet into pivot pin.

CALIBRATION INSTRUCTIONS FOR PRE-SET TORQUE WRENCHES



QC SERIES PRE-SET TORQUE WRENCH

1. Loosen locking screw (1) with the 3/32" T handled hex.

2. Remove Button Plug (2) from rubber handle end by bending a corner of the handle end until the edge of the plug appears. Then remove the plug by lifting the edge.

3. Insert the interchangeable head (5) into the wrench receptacle until the locking pin (6) is fully engaged with the corresponding receptacle hole (3).

NOTE

Some heads used in pre-set torque wrenches have lengths that vary. It is recommended that pre-set torque wrenches are to be calibrated with the head that is to be used to assure the greatest accuracy in calibration.

4. Place the wrench on a torque tester and turn adjustment screw (4) with a T handle hex (1/8" or 3/32") until the desired setting is on the torque tester when a load is applied.

5. Tighten the locking screw (1). Test wrenches setting three more times. If the readings are correct, place torque seal into the locking screw (1) hex opening to prevent tampering.

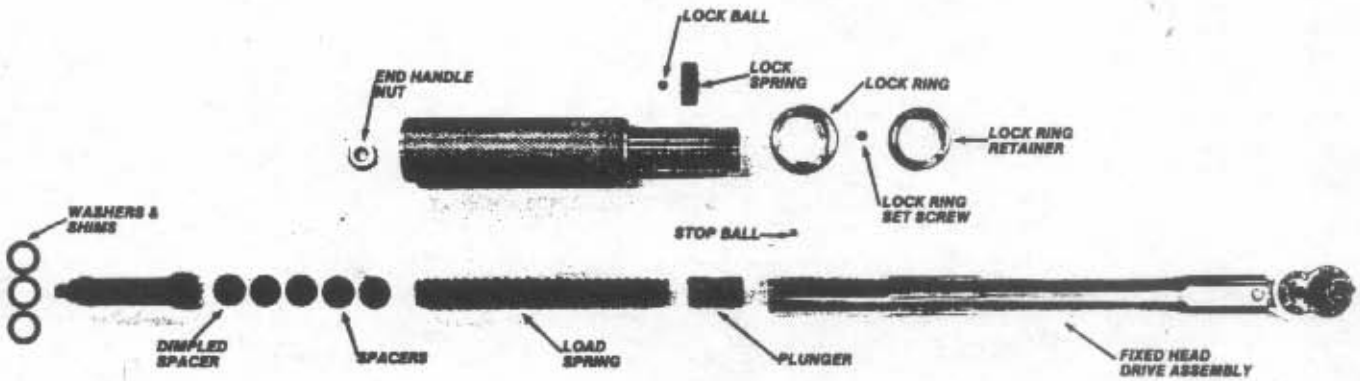
6. Place button plug (2) back into the handle end by inserting it into one side of the opening then applying pressure with your finger until it is fully engaged.

QJ SERIES TORQUE WRENCH REPAIR AND CALIBRATION PROCEDURE

REV C

QJ Introduction

Torque is indicated by an audible "click" and a release of tension, followed by several degrees of free movement. This is especially important in areas where a dial cannot be seen. Recalibration will periodically be necessary with normal use. This will help assure accurate applied torque. The ratchet mechanism should be cleaned and lubricated periodically with a light grade oil (not grease) to help ensure safe performance. Do not exceed the torque capacity of the wrench and always use the torque wrench as close to the middle of the handle as possible.



Assembly Instructions for QJ "click-type"

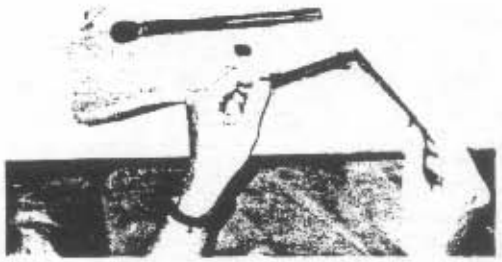
Torque Wrenches

Assembly instructions are necessary for QJ model torque wrenches because complete disassembly occurs during most calibrations. Disassembly only requires the removal of the end nut. All disassembly instructions needed for calibration are described in the calibration procedure for QJ "click type" torque wrenches.

1 During assembly, the following parts must be lubricated with a mixture of four parts ME18A18 Lubricant and 1 part SAE 20 wt. non-detergent oil. (do not use a substitute)

1.1 The spring tube should be lightly lubricated on the inner diameter by using a lubricating rod and swab.

1.2 The load spring should have a liberal coating on the entire outside surface.



1.3 The plunger should have a heavy coating on all of the outside surfaces. In addition, a little of the lubricating mixture should be applied to the pivot embossed area on the plunger. This will keep the pivot in place during the assembly process.

1.4 The threads on the load screw should have a liberal coating.

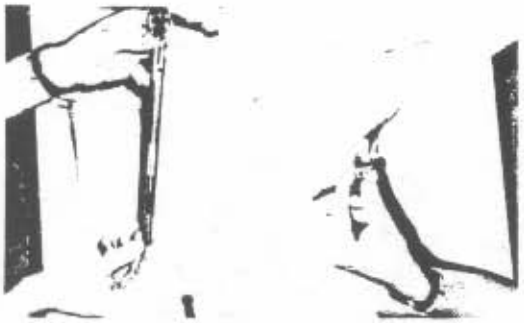
1.5 The slotted end of the ratchet head must be lubricated.

2 Place the ratchet head subassembly into the spring tube, align the holes and insert the rivet. Make sure the components are properly orientated.

3 Spin form the rivet. Check that the ratchet head moves freely from side to side.

4 Insert the correct length pivot block into the plunger depression (the pivot embossed area on the plunger).

5 Place the wrench in a vertical position with the ratchet head up and properly insert the plunger. The proper orientation for the plunger is one point of the hex in the up position and one point in the down position.



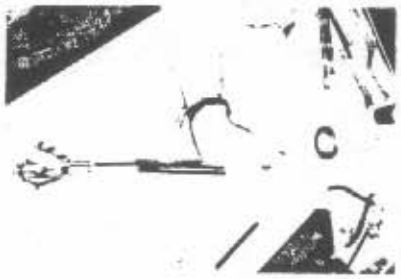
6 Keeping the wrench vertical, insert the load spring, half spacer and dimple spacer (raised portion down) into the spring tube.

7 To check that the assembly is put together correctly.

7.1 Put your finger on the last spacer inserted, or insert something to help apply reasonable pressure.

7.2 Press the internal components of the torque wrench together tightly.

7.3 While applying the pressure, move the ratchet head back and forth.



If the assembly is correctly put together, the components should move slightly in and out.

8 Insert the spring tube insert into the spring tube and observe the alignment of the insert and spring tube holes. Adjust the alignment by adding or removing half spacers between the load spring and the dimple spacer until the insert holes are located approximately one-half diameter past the spring tube holes toward the handle end.

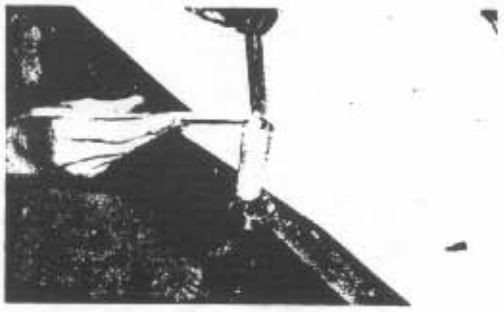
9 Compress the load spring and insert the stop balls into the holes in the spring tube.

10 Verify the wrench per the QJ "click-type" verification procedure in Page 5.

11 Assemble the handle onto the load screw serration. Note the position of the front of the sleeve in relation to the lowest scale mark on the spring tube. Remove the handle and add the correct amount of shims (thin washers). When set at zero, sleeve end must be within 2 clicks of scale mark but must not overload scale mark. Never use more than (5) .015" washers and (1) .005" shim on one wrench. If more than this is required, an additional half spacer is required between the dimpled spacer and the spring.

12 Install the handle, making sure the zero mark is properly aligned.

13 Put the nut on the load screw apply Loctite grade #290 through hex opening of nut and tighten it between 10-15 lb. in.



14 Seal the wrench by filling the end cavity with cerrosafe. (This is a very low melting point solder.)

QJ Ratchet Inspection

Before attempting to calibrate or verify calibration, it is critically important to disassemble the ratchet and check that the gear and pawl teeth are operably safe.

Ratchet inspection instructions:

Caution: Wear approved eye protection when using striking tools and when servicing spring-loaded assemblies. Use a workbench or vise and wood block when repairing a ratchet.

1 Cover plate and gear — Remove the two plate screws, and pull out the cover plate and gear. If necessary, strike the square drive downward against a block of wood to knock out the cover plate.

2 Inspect the teeth of both the gear and the pawl. If either of them have bad teeth, you must replace the ratchet assembly with the correct replacement kit. See the current Service Parts Catalog for the correct replacement kit for your ratchet.

3 If replacement is required, the ratchet repair instructions will be provided with your replacement kit.

4 If no replacement is required, insert the gear and lubricate the teeth of both the gear and pawl with a light machine oil. Do not use any kind of grease. Replace the plate. Position it by placing the hex end of a socket over the square drive and tapping the socket with soft face or a brass hammer.

5 Replace and tighten the screws and check the ratcheting action. If it works hard, strike the drive end against a wood block. Re-tighten the screws.

QJ Verification and Minor Calibration Procedure

This minor calibration procedure will determine whether a major calibration is necessary. Also, it should be performed after a major calibration is performed.

1 Preload the torque wrench.

2 After preloading the torque wrench, verify the wrench's accuracy by testing it at various test points. These test points are selected as required by your needs. Snap-on references the current ASME B107.14M-1994 Standard, which calls for testing at 20, 60, and 100% capacity with 3 test readings being taken at each check point.

3 Mount the torque wrench to the tester in the vertical position with the handle end down.

4 Adjust the loading point of the tester so the load is being applied in the center of the handle.

5 While testing the wrench at the lowest reading, notice the average of three readings taken at that point.

6 If the reading was too low, turn the handle in the clockwise direction. If the test reading was too high, turn the handle in the counter clockwise direction. Continue to do this until the tester readings are within the accuracy range of the torque wrench.

7 Remove the handle nut (the end nut that secures the handle).

Special note: To remove the Cerrosafe sealant, immerse the end of the handle in boiling water. Snap-on recommends that a solder pot be used to remove the Cerrosafe sealant.

Orientate the handle so that the zero is aligned with the 20% reading. Replace the handle and nut (do not firmly tighten the nut). See Page 3.

8 Turn the handle to the next higher setting and verify its accuracy. Do not repeat step 7. Continue to test at 60 and 100% of full scale. Repeat again in the counter clockwise direction. The accuracy specifications for QJ model torque wrenches are usually 4% in the clockwise direction and 6% in the counter clockwise direction.

9 If the tester readings all fall within the acceptable ranges, tighten the handle nut. Remember to tighten the handle nut between 10-15 lb.in. using Loctite #290 on threads, then apply Cerrosafe (Snap-on ME18A13).

10 If the torque wrench readings are only slightly out of the acceptable ranges, an attempt to bring the wrench into calibration can be made by altering the initial (20%) readings by following step 6 once again.

If the wrench cannot be brought into calibration, a major calibration (pivot change) is necessary.

QJ Major Calibration

1 Turn the wrench to the lowest possible setting and remove the handle.

2 Compress the load spring and remove the stop balls.

3 Remove the load screw and spring tube insert.

4 Remove the dimple spacer, half spacers, load spring, plunger and pivot block.

5 Measure the pivot length and adjust as follows:

5.1 If the readings from the verification test rise in relation to the wrench settings (tester reads too high at higher wrench settings), the pivot length must be increased.

5.2 If the readings from the verification test fall in relation to the wrench settings (tester reads too low at higher wrench settings), the pivot length must be decreased.

6 Reassemble the wrench per the assembly instructions. See Pages 2-4.

7 Repeat the verification procedure. See Page 5.

TO INCREASE THE CALIBRATION LIFE OF YOUR QJ MODEL TORQUE WRENCH, ALWAYS SET THE WRENCH AT ITS LOWEST POSITION BEFORE STORING.

Special Repair Tools for QJ Model Torque Wrenches

CJ949 Bearing Separator

CJ950 Bearing Separator

Ball Peen Hammer (8 oz.)

Butane Torch (local purchase)

Nut Driver Set

AW9K Hex Key Set

ME18A18 Lubricant (17.5 oz. Can)

Non-detergent Oil

ME18A13 Cerrosafe Calibration Sealant

PT7B Magnet

QT2FR100, QT2R100, QT2R1000 QTFR2100 and QTR2100

Torque Instrument Repair Instructions

Contents

Description	*Page*
RATCHET	2
RATCHET HEAD REPLACEMENT	2
REPAIR (INTERNAL)	2
REPAIR HINTS	3
ASSEMBLY INSTRUCTIONS	3
PLUNGER ASSY. WITH BALANCE CAM	4
PLUNGER AND BALANCE CAM ASSY ALIGNMENT AND INSTALLATION	5
INSTALLATION AND ALINGNMENT OF SPRING	5
INSTALLATION OF TRANSFER SCREW ASSEMBLY	6
HANDLE INSTALLATION	6
INITIAL CALIBRATION AFTER ASSEMBLY	6
ADJUSTING SPRING RATE	6
BALANCE CAM ADJUSTMENT	6
REPLACEMENT PARTS	7-9
SPECIAL REPAIR TOOLS	10

RATCHET

If ratchet components need replacement, repair instructions will be provided with the replacement kit. Replace all components and use entire contents of kit. Lubricate according to instructions.

RATCHET HEAD REPLACEMENT

To remove the ratchet head (QTFR2100REF) of the QT2FR100, remove the grooved pin using the TQN541 support jig and the TQN384 mandrel. When a new ratchet head is installed, use a new grooved pin (QTFR2100-27) and install it with the grooves in position approximately 60 degrees rotated from original orientation. Remember to install the ME1A-187 spring. Replacement of the QTR2100 ratchet head, (QTR2100REF), requires disassembly of the wrench (see disassembly instructions).

REPAIR (INTERNAL)

The wrench should be disassembled only if it fails to operate properly after all the calibration steps have been properly performed (see calibration instructions). Remove the plastic calibration plug from the handle end using a sharp instrument such as a YA339 awl. Also, remove the sentry seal inspectors lacquer from the handle lock screw by picking it out with the YA339 awl. Remove the lock screw at handle end using a 5/32 hex key. Knock out the brass spacer (under the screw). Unlock the lock ring, and then remove the complete handle assembly by pulling it rearward and rotating it counter-clockwise. Insert a 3/16" hex key in the end of the QTFR2100-8 transfer screw, which is now exposed. Rotate the transfer screw counter-clockwise until it stops and apply slight additional torque counter-clockwise (about 4-8 Lb. In.). Now examine the free lash of the screw using the hex key (about 2 degrees). Set the screw in the center of this lash (free play). This will free the 1/8 stop adjusting nut ball, which can now be removed. This 1/8 ball is

Figure 0

exposed and is located 1/2" from the tube end. Insert a thin sharp object through the adjusting nut slot (from the tube end) under the ball to lift and remove it. The YA339 awl might be used for this operation.

Now, with the wrench held horizontal in a fixture TQN542 (Figure 1), rotate the 3/16 hex key ccw with the transfer screw, carefully keeping the screw horizontal as it is removed. If this operation is done carefully, the stop-adjusting nut, ball retaining ring, four balls and the bearing race washer will all be removed from the tube as a sub assembly. Keep all these parts together and set aside.

The main spring will now be removed. With the tube body still held horizontally in the fixture, it will be noted that the spring end can be seen located about one inch inside the tube. Remove (only) the spring carefully, by hooking it with a tool such as the YA339 awl. Carefully remove the wrench from the fixture and while keeping the open tube end close to and above a clear space on the work table, move the tool slowly to a vertical position (open tube end down). Place the open tube end on the table with the tube straight up. If the remaining parts don't drop to the table, then strike the tube end sharply. When all remaining parts are removed, they should consist of the following:

1) QTFR2100-6	Balance cam
1) QTFR2100-4	Plunger
1) QTFR2100-17	Spring rate-adjusting screw (This is in the plunger)
1) QTFR2100-23	Spring rate pin (this is also in the plunger)
2) QTFR2100-21	Roller axles (these small rollers are usually still in channels of the plunger held by lubricant)
1) QTFR2100-19	Release roller this larger double roller if not located, may still be in the tube (stuck to the head extension interface with lube). Rap the tube again on the table to remove.

Assuming that the wrench was disassembled because of improper operation, all parts should be cleaned so that careful examination can be made.

REPAIR HINTS

If the spring rate could not be adjusted from the outside using the TQN527, the socket of the spring rate adjusting screw may have been stripped. Replace the plunger assembly, which includes the spring rate adjusting screw.

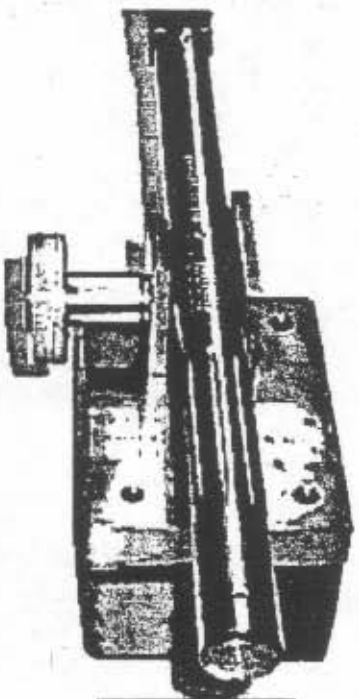


Figure 0

If the spring rate adjusting screw is too loose, and proper output could not be maintained, replace the plunger assembly.

If the spring rate adjustment could not produce torque output of 100 Lb. Ft. (1000 Lb. In. for QT2R1000) or above at a setting of 100 Lb. Ft. (1000.Lb. In. for QT2R1000) when calibration was proper at 20 Lb. Ft. (200 Lb. In. for QT2R1000), replace the main spring.

If the torque output was erratic, examine the small roller axles carefully. Replace if necessary as a pair.

If the clockwise output could not be matched to the counter-clockwise output using the balance cam-adjusting tool, this may be due to improper alignment between the main spring and balance cam. Consult the assembly procedures for this very important step (if the spring is not aligned in a certain exact way with the balance cam, the cw, ccw balance adjustment can not properly be made).

ASSEMBLY INSTRUCTIONS

The tube should be lightly lubricated with Lubriplate ® #130-AA on the inner diameter using a lubricating rod and swab. Cradle the tube and ratchet assembly in the holder TQN542 (Figure 2) horizontally with the ratchet end slightly forward. Turn the wrench as necessary so that the torque setting increments on the barrel are located exactly straight up. Tighten the clamp.

PLUNGER ASSY. WITH BALANCE CAM

The plunger assembly holder TQN543 (Figure 3) must be used to aid in the proper preparation of the plunger and related parts prior to installation in the torque tube.

1. Turn the fixture clamp so that the opening is in the horizontal position. Clamp the balance cam on its straight segment (horizontal position) (Figure 3).

2. Apply one drop (not more) Lubriplate ® #130-AA to the rounded small end only of the plunger and install it in the balance cam.

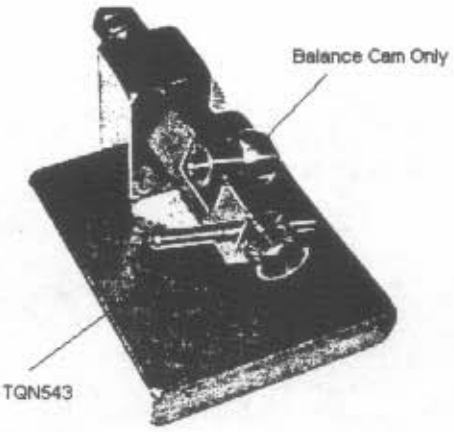
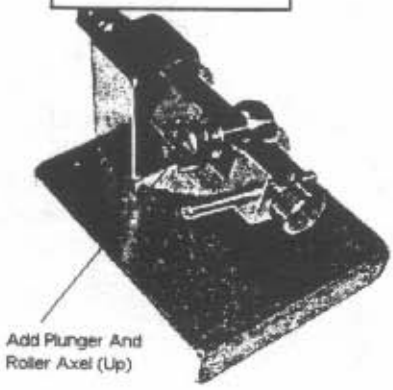


Figure 0

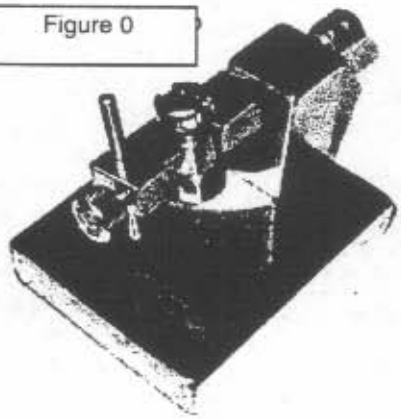
Figure 4



3. Rotate the plunger so that one pair of roller axle cradles is at top (Figure 4). Fill each cradle with Lubriplate ® #130-AA. Nest a roller axle in the cradles. Roll the roller axle in the cradles by rubbing an instrument along the center to make sure that the action is not restricted.

4. Rotate the plunger 180 degrees (one half turn) and follow the same procedure with the second roller axle (lubricant should keep the first roller from falling out).

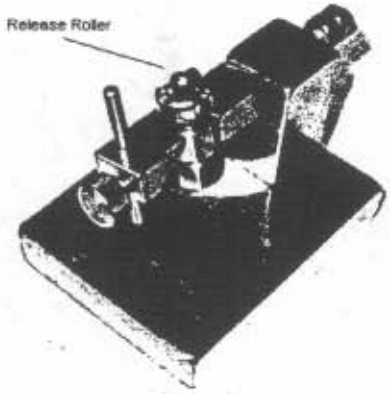
Figure 0



5. Now, turn the fixture clamp so that the balance cam holds the plunger straight up (the plunger large end is at the top (Figure 5)). Partially fill the slot in the center at top with Lubriplate ® #130-AA.

Select a spring rate pin and examine the ends before insertion. One end is flat while the other end is turned to a chamfer. Insert the chamfered end of the spring rate pin into the center of the large plunger end and press in as far as possible.

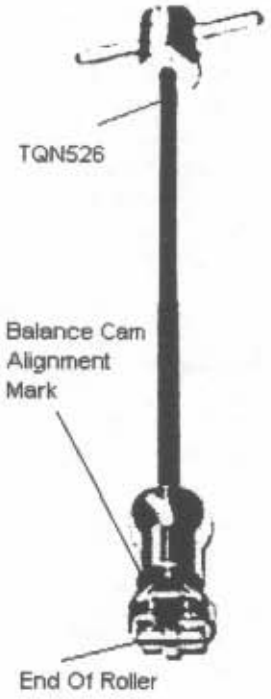
Figure 5



6. Coat the complete top of the plunger large end with Lubriplate ® #130-AA. Set a QTFR2100-19 release roller on top with the larger ring cradled in the plunger slot. The plunger and balance cam assembly is now complete (Figure 6).

Figure 6

PLUNGER AND BALANCE CAM ASSY ALIGNMENT AND INSTALLATION



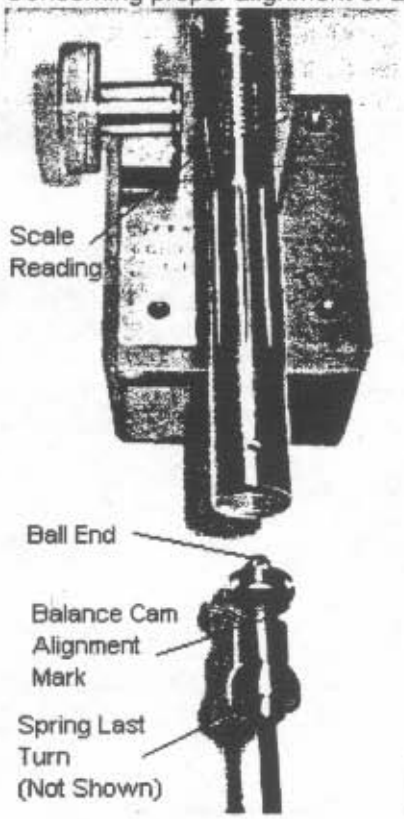
Turn the fixture clamp so that the plunger assembly is horizontal (clamp opening is up). Carefully insert the TQN526 balance cam-adjusting tool in the hex opening of the balance cam. Carefully support the plunger and balance cam assembly with the adjusting tool and loosen the holding fixture clamp. Tilt the entire assembly to a vertical position using the TQN526 as a holder. While holding the assembly in the vertical position with the TQN526, slowly rotate the assembly to locate the balance cam alignment mark.

The alignment mark is a center drilled superficial depression located on the end surface of the balance cam away from the ball end. Continue to rotate the TQN526 until you are looking directly at the alignment mark. While maintaining this position, turn the plunger until one end of the release roller on top is aligned exactly with the center drilled mark on the balance cam (Figure 7). Now, tilt the assembly down slowly toward the wrench tube opening and finally, with the assembly horizontal, move it into the tube end while keeping the balance cam alignment mark at top center. As the assembly is transferred into the tube, it is convenient to be aware of the TQN526 handle angular position in order to maintain alignment. Apply some pressure to the TQN526 with the assembly all the way in. Now, move the ratchet head back and forth. If the assembly is properly put together, the end of the TQN526 should move in and out slightly. Without changing TQN526 angular position make sure the shaft is in the center of the tube, then remove it.

Figure 7

INSTALLATION AND ALINGNMENT OF SPRING

Concerning proper alignment of all parts, remember that the tube was aligned in the TQN542 holder with the scale reading at top center. The alignment mark on the balance cam should be at top center inside the tube. Now, the spring must be aligned properly also.



Clean the spring if necessary. Examine both ends. The blue end face is at a slight angle. This is the end that must enter the tube first and that also must be in proper alignment. To prepare the spring, locate the end of the last turn on the blue end that has the angle (Figure 8). Using a narrow black ink marker, draw a line along the length of the spring with a straight edge from the last turn end. This will aid in keeping the spring aligned as it is installed in the tube. Coat the spring lightly with Lubriplate ® #130-AA. Install the spring so that when fully seated, the last turn end is placed at top center next to the balance cam (Figure 9).

Figure 8

Figure 9

INSTALLATION OF TRANSFER SCREW ASSEMBLY

The transfer screw assembly consists of QTFR2100-8 transfer screw, QTFR2100-5 ball retaining ring, 4 - 529TQP 7/64th balls, QTFR2100-9 bearing race washer and QTFR2100-7 stop adjustment nut (this nut should be seated against the transfer screw collar with 4- 8 Lb. In. of torque). These may still be together after being disassembled but if they are not, make sure proper lubrication is provided with Lubriplate ® #130-AA.

With the torque tube still mounted in the TQN542 fixture, thread the lubricated stop-adjusting nut (part of the assembly) into the tube end. Continue turning until some spring resistance is noted. Continue to turn 1-1/2 more turns and then turn in either direction until the slot in the stop adjusting nut aligns with the 1/8" ball hole at case end. Insert the 1/8th ball.

HANDLE INSTALLATION

Make sure the handle is in the unlocked condition. Very lightly coat the last five inches of the case adjacent to the open end with Lubriplate ® #130-AA. With a QT2FR100-14 thimble attached to the handle assembly push the handle onto the tube, then thread the handle onto the transfer screw until the transfer screw end projects about 1/16" into the rear handle opening. Insert the brass washer, then the QTFR2100-20 lock screw into the handle. Tighten the screw to an intermediate torque (this will be adjusted and properly torqued later). Tighten the three 8-32 set screws holding the thimble to the handle finger tight. Turn the handle clockwise until the forward edge of the thimble is below the 20 Lb. Ft. (200 Lb. In. for QT2R1000) increment. A distance of .005" - .020". Turn the handle to the nearest lock detent and lock. Re-check the clearance. When the spacing to the thimble is correct, loosen the three 8 - 32 thimble set screws and align the zero thimble increment with the centerline of graduations on the case tube. Tighten the thimble screws in several stages to **keep the thimble centered with the tube**. Torque the 8 - 32 set screws to 16 Lb. In.

INITIAL CALIBRATION AFTER ASSEMBLY

With the wrench locked at a setting of 20 Lb. Ft. (200 Lb. In. for QT2R1000), install the wrench on the TTD1000A tester in the vertical down position. Check the torque release in the clockwise direction.

If the release is other than 20 Lb. Ft. (200 Lb. In. for QT2R1000) loosen the 5/16 handle lock screw with a 5/32 hex key. Insert a 3/16 hex key in the transfer screw at handle end. If the release was below 20 Lb. Ft. (200 Lb. In. for QT2R1000) turn the key clockwise about 90 degrees for starters and check the release. When the release matches the 20 Lb. Ft. (200 Lb. In. for QT2R1000) setting, tighten the handle lock screw to an intermediate torque.

ADJUSTING SPRING RATE

Unlock the tool, reset and lock the wrench at a value of 100 Lb. Ft. (1000 Lb. In. for QT2R1000) Check the release both cw and ccw. Note the average value. If the average value is significantly above or below 100 Lb. Ft. (1000 Lb. In. for QT2R1000), adjust the spring rate with the TQN527 spring rate tool. Insert the tool in the handle end as far as it will go and rotate with slight pressure to engage the spring rate adjusting screw socket. If the average value was above 100 Lb. Ft. (1000 Lb. In. for QT2R1000), turn the adjusting tool clockwise a small amount (this adjustment is sensitive). Never leave the TQN527 in the wrench when checking the release. Average values below 100 Lb. Ft. (1000 Lb. In. for QT2R1000) require counter-clockwise spring rate adjustment.

Adjust the wrench back to 20 Lb. Ft. (200 Lb. In. for QT2R1000) and check the release in both directions. Adjust the 20 Lb. Ft. (200 Lb. In. for QT2R1000) setting by adjusting the position of the transfer screw as before. Re-check at 100 Lb. Ft. (1000 Lb. In. for QT2R1000) again if necessary until the spring rate is proper.

BALANCE CAM ADJUSTMENT

If the average of all clockwise readings is significantly different than the average of all counter-clockwise readings and this interferes with proper calibration, then a balance cam adjustment is required. Refer now too standard calibration instructions.

Remember **to torque the handle set screw to 60 Lb. In. when adjustments are completed.**

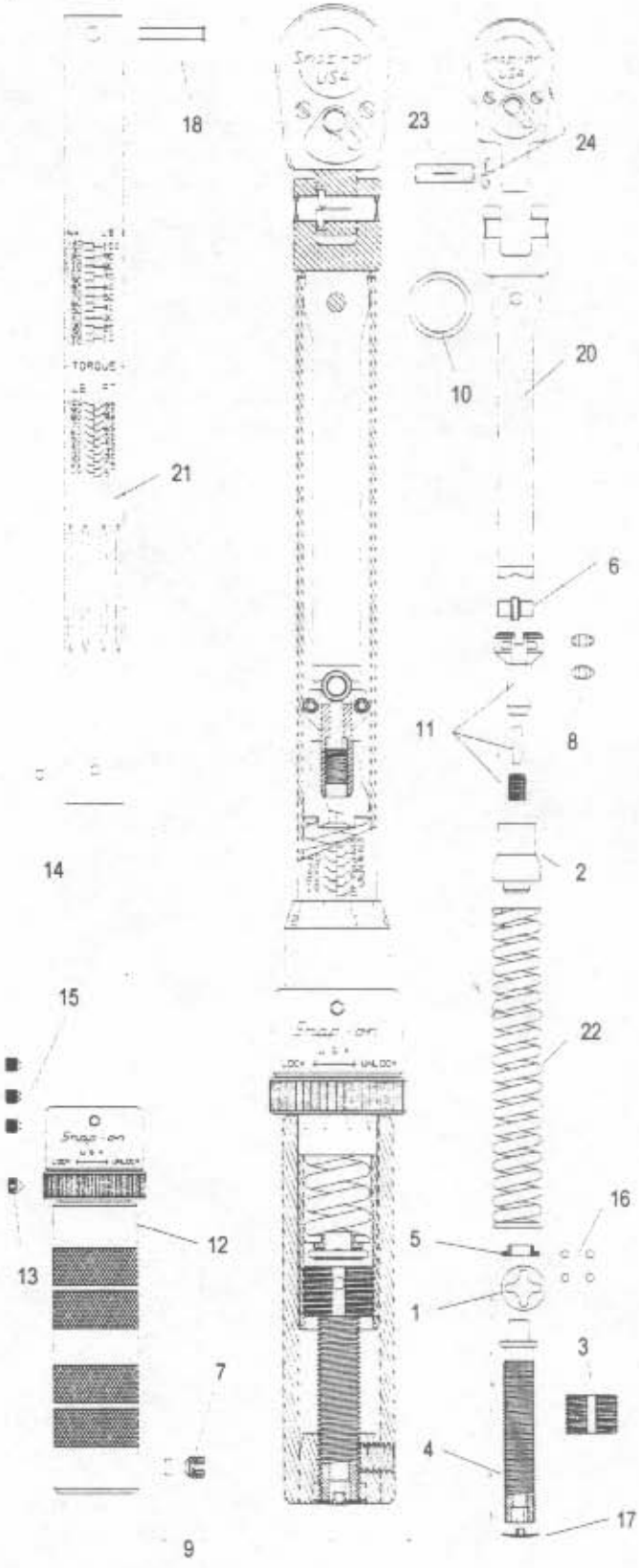
List of Replacement Parts for the

QT2FR100, QTFR2100

(100 Lb. Ft.)

No.	Item No.	Qty.	Description
Common			
1	QTFR2100-5	1	Ball Retaining Ring
2	QTFR2100-6	1	Balance Cam
3	QTFR2100-7	1	Stop Adjustment Nut
4	QTFR2100-8	1	Transfer Screw
5	QTFR2100-9	1	Bearing Race Washer
6	QTFR2100-19	1	Release Roller
7	QTFR2100-20	1	Handle Lock Screw
8	QTFR2100-21	2	Roller Axle
9	QTFR2100-22	1	Brass Spacer
10	QTFR2100-25	1	O-Ring
11	**QTFR2100-40**	1	Plunger Assembly
12	**QTFR2100-120**	1	Main Handle Assembly
13	ME3F59 *	1	Lock Ring Screw
14	45TQP	1	1/8" Ball
15	525TQP	3	Socket Set Screw
16	529TQP	4	7/64" Chrome Steel Ball
17	534TQP	1	Calibration Plug
18	566TQP	1	Rivet
19	PBG6	1	Plastic Box (Not Shown)
QT2FR100			
20	QTFR2100-28	1	Clevis Head
21	QTFR2100-15	1	Case Tube
22	QTFR2100-16	1	Coil Spring
23	QTFR2100-27	1	Grooved Pin
24	QTFR2100REF	1	Ratchet with Washer

Note: **** This*** *item included with the QTFR2100-120 Assembly.*



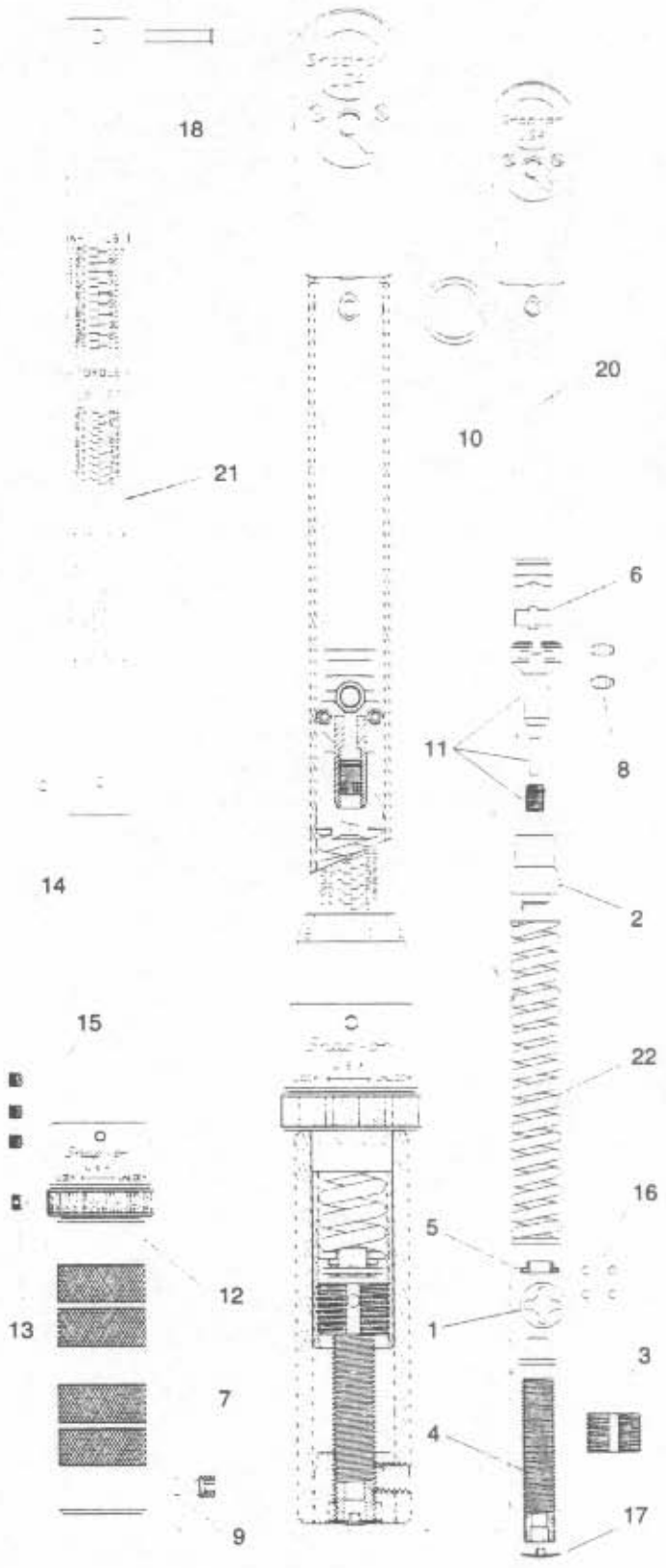
List of Replacement Parts for the

QT2R100, QTR2100

(100 Lb. Ft.)

No.	Item No.	Qty.	Description
Common			
1	QTFR2100-5	1	Ball Retaining Ring
2	QTFR2100-6	1	Balance Cam
3	QTFR2100-7	1	Stop Adjustment Nut
4	QTFR2100-8	1	Transfer Screw
5	QTFR2100-9	1	Bearing Race Washer
6	QTFR2100-19	1	Release Roller
7	QTFR2100-20	1	Handle Lock Screw
8	QTFR2100-21	2	Roller Axle
9	QTFR2100-22	1	Brass Spacer
10	QTFR2100-25	1	O-Ring
11	**QTFR2100-40**	1	Plunger Assembly
12	**QTFR2100-120**	1	Main Handle Assembly
13	ME3F59 *	1	Lock Ring Screw
14	45TQP	1	1/8" Ball
15	525TQP	3	Socket Set Screw
16	529TQP	4	7/64" Chrome Steel Ball
17	534TQP	1	Calibration Plug
18	566TQP	1	Rivet
19	PBG6	1	Plastic Box (Not Shown)
QT2R100			
20	QTR2100-11	1	Ratchet Assembly
21	QTFR2100-15	1	Case Tube
22	QTFR2100-16	1	Coil Spring

Note: ** This item included with the QTFR2100-120 Assembly.*



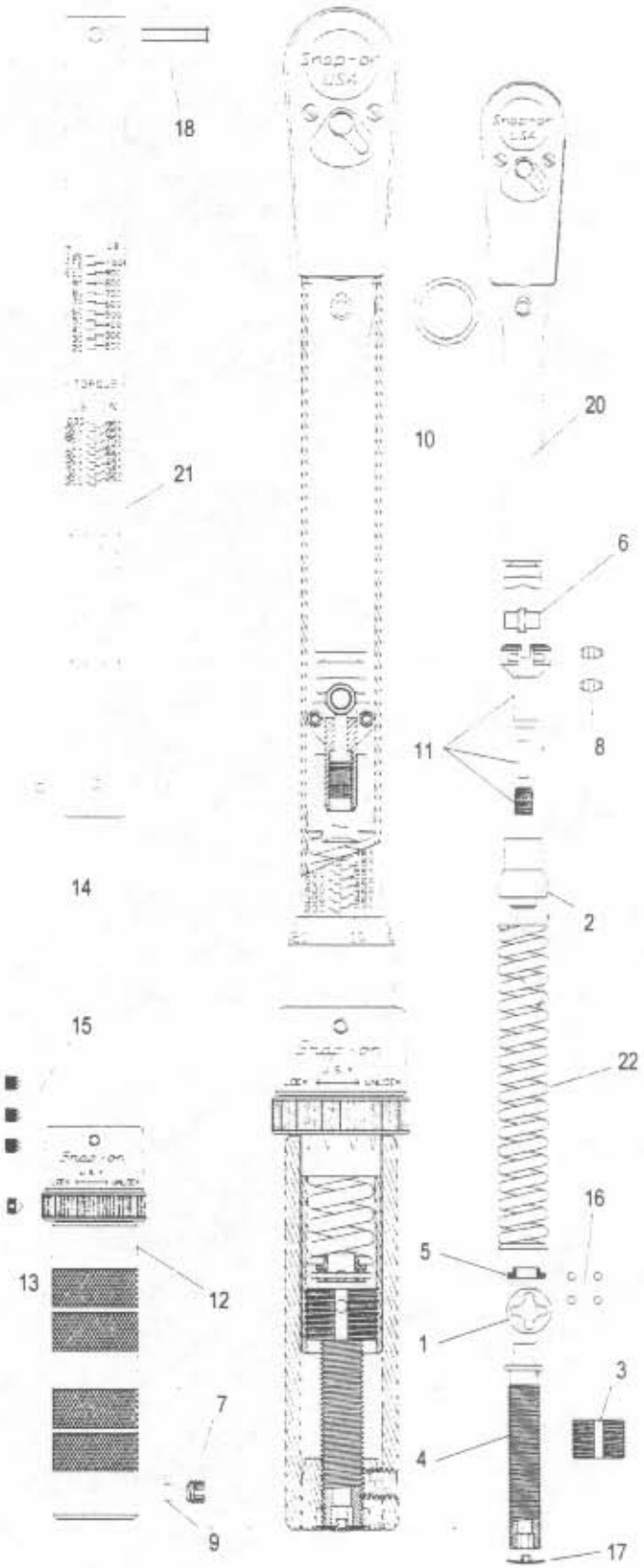
List of Replacement Parts for the

QT2R1000

(1000 Lb. In.)

No.	Item No.	Qty.	Description
Common			
1	QTFR2100-5	1	Ball Retaining Ring
2	QTFR2100-6	1	Balance Cam
3	QTFR2100-7	1	Stop Adjustment Nut
4	QTFR2100-8	1	Transfer Screw
5	QTFR2100-9	1	Bearing Race Washer
6	QTFR2100-19	1	Release Roller
7	QTFR2100-20	1	Handle Lock Screw
8	QTFR2100-21	2	Roller Axle
9	QTFR2100-22	1	Brass Spacer
10	QTFR2100-25	1	O-Ring
11	**QTFR2100-40**	1	Plunger Assembly
12	**QTFR2100-120**	1	Main Handle Assembly
13	ME3F59 *	1	Lock Ring Screw
14	45TQP	1	1/8" Ball
15	525TQP	3	Socket Set Screw
16	529TQP	4	7/64" Chrome Steel Ball
17	534TQP	1	Calibration Plug
18	566TQP	1	Rivet
19	PBG6	1	Plastic Box (Not Shown)
QT2R1000			
20	QTR2100-11	1	Ratchet Assembly
21	QT2R1000-15	1	Case Tube
22	QT2R1000-16	1	Coil Spring

Note: **** This** item included with the QTFR2100-120 Assembly.*



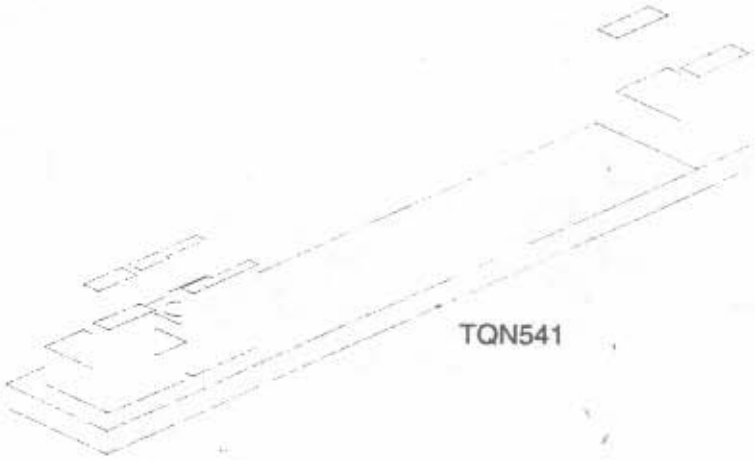
Repair Tools and Fixtures

Item No.	Qty.	Description
TQN384	1	Mandrel
TQN526	1	Balance Cam Adjusting Tool
TQN527	1	Spring Rate Adjusting Tool
TQN541	1	Ratchet Head Support Jig (For removing & installing ratchet pin)
TQN542	1	Torque Wrench Support Fixture
TQN543	1	Plunger Assembly Fixture
YA339	1	Awl (Optional) (Not Shown)

TQN526

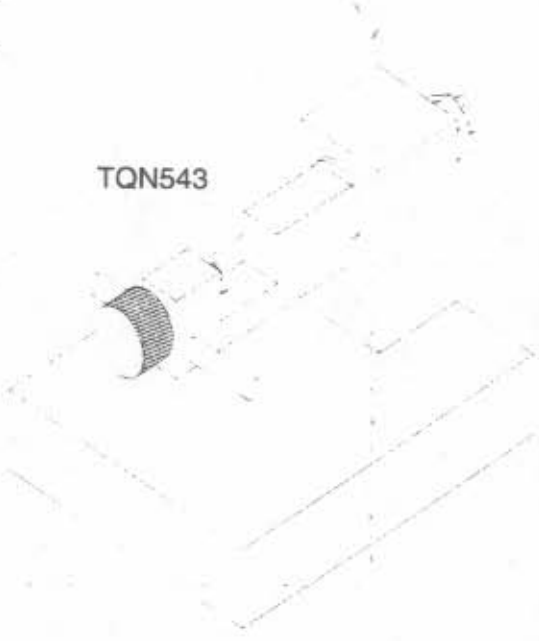
TQN527

TQN384

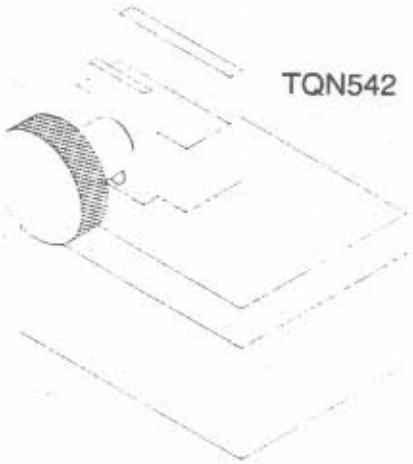


TQN541

TQN543



TQN542



QT2FR100, QT2R100, QT2R1000 QTFR2100 and QTR2100

Torque Instrument Calibration Instructions

QT2FR100, QT2R100, QT2R1000, QTFR2100 and QTR2100

Torque Instrument Calibration Instructions

Contents

Description	*Page*
Testing	2
Calibration	2
Simple Primary Calibration Procedure	2
Balance Cam Adjustment	3
Spring Rate Adjustment	3

Testing

Testing should be performed using the master tester TTD1000A. Adjust the wrench to a setting of 100 Lb. Ft. (1000 Lb. In, for QT2R1000) and secure the lock ring. Mount the wrench in the vertical position with the handle end down.

Always adjust the loading point of the tester so that the load will be applied to the center of the handgrip. Per GGG-W-2843, pre-load the wrench three times in both directions to the release value (100 Lb. Ft. approximately) (1000 Lb. In, for QT2R1000) as verified by the tester peak hold feature. Remove the wrench from the tester, unlock, adjust, and lock the wrench to a setting of 20 Lb. Ft. (200 Lb. In. for QT2R1000) Using the tester with the load applied to the center of the hand grip, apply torque slowly and smoothly in the clockwise direction. At the instant of release, apply no further torque. Note the tester reading using the hold feature. Release and apply the torque two more times and average the three readings. Without changing the setting, repeat the procedure in the counter-clockwise direction. With the average of the three readings recorded pre-set the wrench to 60 Lb. Ft. (600 Lb. In, for QT2R1000) and repeat the procedure in both directions. Set the wrench to 100 Lb. Ft. (1000 Lb. In, for QT2R1000) repeat the test and record the average of three readings in both directions.

Calibration

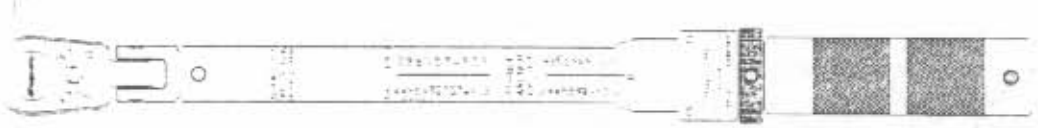
Most national torque wrench test standards require accuracy to be within plus or minus 4% of the reading from 20% of full scale to the full scale reading clockwise and plus or minus 6% of the reading counter-clockwise through the same range.

The "QT" Torque Instruments should be compared to a standard of plus or minus 3% of reading from 20% of full scale to full scale in both directions.

Simple Primary Calibration Procedure

Record the reading at 20% of full scale and full scale in both clockwise and counter-clockwise directions. If the readings are out of specification, it will generally be noted that the majority of readings tend to be high or low. To adjust all readings up or down, remove the sealant at "A" and the calibration plug at "B" (see figure 1). Set the wrench to full scale and lock. If repeated tests at full scale in both directions indicate that the average of readings should be raised or lowered, loosen the socket set screw at "A" with

Seal "B" and Screw



Seal "A" and Screw

Figure 1: Placement of various seals

a standard 5/32" hex key. Insert a 3/16" hex key in the handle end "B" and turn clockwise to raise or

counter-clockwise to lower all readings (1/4 turn for starters). Check at 20% and full scale both directions and adjust the setting to "average" all readings for best calibration. **When properly adjusted, torque the socket set screw "A" to 60 Lb. In.** Recheck the calibration at 20%, 60% and full scale in both directions. This will usually complete the calibration procedure.

Balance Cam Adjustment

In some instances the average of all clockwise readings will be significantly different than the average of the counter-clockwise readings. If the difference interferes with the proper calibration, the balance cam can be turned from the outside to achieve proper balance.

Set and lock the wrench at the full-scale reading. Compare the average of three clockwise and counter-clockwise torque applications. Insert the balance cam-adjusting tool TQN526 (figure 2) into the handle end as far as it will go. Make sure to engage the hex socket of the balance cam.

Turn the TQN526 1/4 turn clockwise; some resistance to turning should be noticed. Remove the tool and check the release value in both directions. Repeat the above procedure by rotating the balance cam in the clockwise direction 1/4 turn at a time until the wrench is within specifications.

Repeat previous simple primary calibration procedure as necessary.

Spring Rate Adjustment

In a few instances, the spring rate needs adjusting. An unequal variation or nonlinearity in the readings at different calibration points indicates this condition. For example, if the wrench releases at 20 Lb. Ft. (200 Lb. In. for QT2R1000) when set to 20 Lb. Ft. (200 Lb. In. for QT2R1000), but releases at 105 Lb. Ft. (1260 Lb. In. for the QT2R1000) when set at 100 Lb. Ft. (1000 Lb. In, for QT2R1000), the spring rate must be adjusted. With the above example, the torque releases are climbing faster that the setting indications.

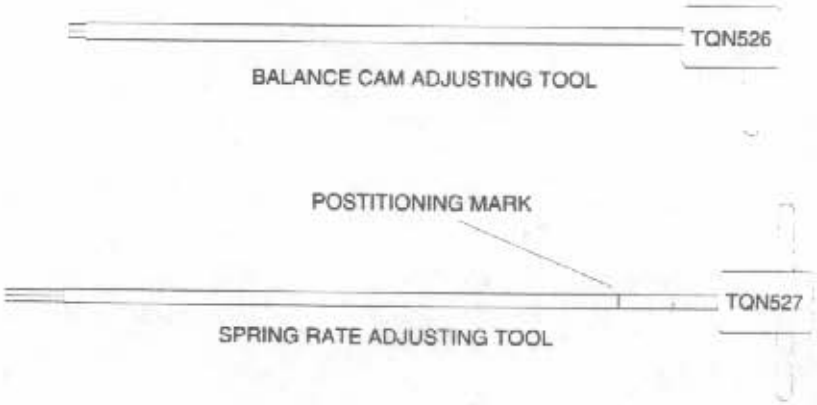


Figure 2: Tools for calibrating the QTFR2100

To reduce the spring rate, first set the wrench to 100 Lb. Ft. (1000 Lb. In. for QT2R1000) and lock. Insert TQN527 (figure 2) spring rate adjusting tool all the way into the end of the handle as far as it will go and engage the hex socket. To reduce the spring rate from that illustrated above, turn the TQN527 clockwise only about 10 degrees. This adjustment is very sensitive. Turning in the counter-clockwise direction will increase the spring rate.

Caution! When making a spring rate adjustment, always set the wrench to full scale. Make sure that the TQN527 is inserted all the way into the internal hex socket. Half engagement will cause "cam-out" which will damage the wrench.

After adjustment is made set the wrench to full scale and cycle both clockwise and counter-clockwise. Next check at 20% and full scale in both directions. If the spring rate is now correct, all the readings may be raised or lowered slightly if necessary using the simple primary calibration procedure.

QTS135 and QTSP135

Torque Limiting Driver Calibration Instructions

QTS135 and QTSP135

Torque Limiting Driver Calibration Instructions

Contents

Description	*Page*
Testing	2
Calibration	2
Simple primary Calibration Procedure (QTS135)	2
Calibration for Linearity Procedure (QTS135)	3
Simple Calibration Procedure (QTSP135)	4

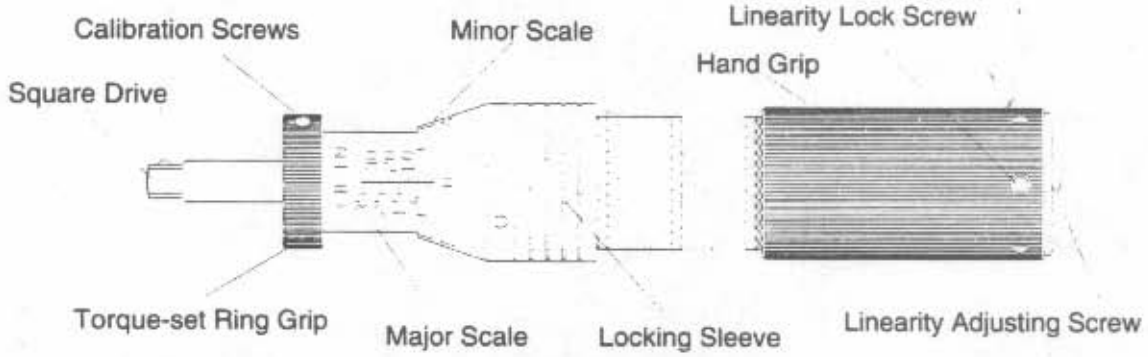
Testing

Testing should be performed using the TBT600 digital torque tester and TBTT12 transducer. This tester has a low inertial reaction-measuring element that can accurately track the torque release of the torque-limiting drivers. Components of the torque-limiting drivers are lightweight so they may react quickly and accurately with the torque application. Applications of the torque-limiting drivers must be made reasonably slow and very smooth for accurate test readings.

Calibration

The torque-limiting drivers are precision instruments and capable of high accuracy that exceeds most national torque driver standards. The adjustable QTS135 is accurate to within plus or minus 2% plus one minimum graduation from 7 Lb. In. to 35 Lb. In. in both the clockwise and counter-clockwise directions. The preset QTSP135 is accurate to within plus or minus 3% of setting from 5 Lb. In. to 35 Lb. In. in both the clockwise and counter-clockwise directions.

Simple Primary Calibration Procedure (QTS135)



Torque Range	Square Drive	Releases per Revolution	Rotation	Length	Weight
7-35 LB.IN.	1/4"	8	CW and CCW	7"	.915 Lb

During calibration always repeat each torque application a minimum of four times and average readings for an accurate test.

1) Pull and hold the locking sleeve back toward the handle end and turn the torque set ring grip in order to obtain a setting of 7 Lb. In. using the major and minor scales as with a micrometer. Release the locking sleeve allowing it to lock the setting. Using the TBT600 configured as mentioned before set the peak hold feature "on". Rotate the torque-limiting driver in the clockwise direction and as the preset torque is approached make sure the application is made slowly and smoothly. Torque release of the torque limiting

driver will be signaled by an audible report and slight impulse felt as the release mechanism resets for the next application. Note the tester reading.

2) If the tester reading is more than .3 Lb. In. above or below the preset 5 Lb. In. setting. Reset the torque limiting driver as above and rotate the torque set ring grip to the nearest locking detent that during testing will result in output values closest to a 5 Lb. In. tester reading.
3) Remove the torque-limiting driver from the tester and loosen, but do not remove, the two calibration screws in the torque set ring grip. Align the assembly, which consists of the torque set ring grip and the major scale so that the major setting indicates 5 Lb. In. and the minor scale indicates 0. The small flat end of the minor scale thimble should be aligned within plus or minus .020 inch of the flat major scale increment. See Fig. 1.

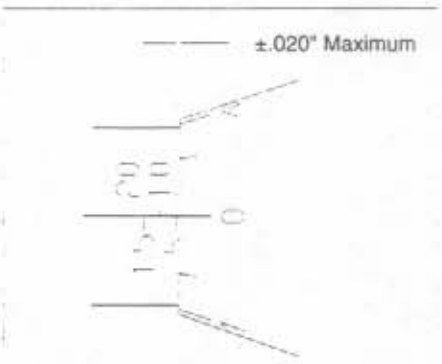


Fig. 1

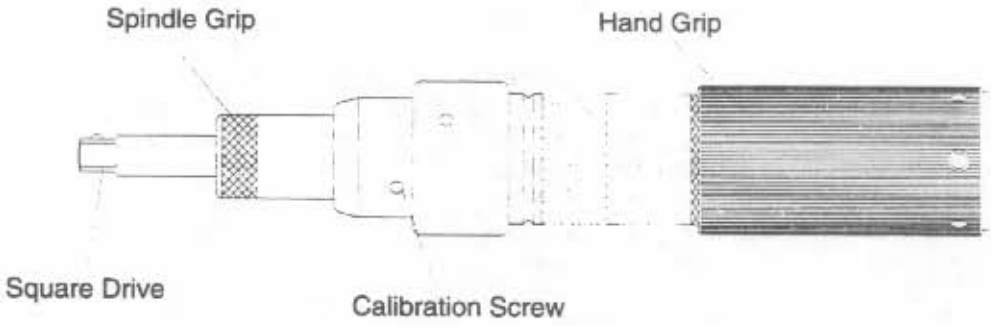
4) Tighten the two calibration screws to 12 Lb. In. to secure the calibration.
5) Check the accuracy at other settings and finally in the counter-clockwise direction. An adjustment in calibration using the procedure above at one point will produce the same numerical effect through out the entire calibration range.

Calibration for Linearity Procedure (QTS135)

1) Set the torque-limiting driver to a value of 5 Lb. In. and note the tester reading when the unit releases. Reset the driver if necessary using the instruction above.
2) Set the torque-limiting driver to 35 Lb. In. and check calibration in the clockwise direction and note the tester reading. If the readings are out of calibration loosen, but do not remove, the linearity lock screw using a 1/8" hex key after removing all sealant from the socket of the screw. Next remove the plastic seal covering the linearity adjusting screw. Using a 5/16" hex key turn the linearity adjusting screw counter-clockwise slightly if the calibration was high, or clockwise if the calibration was low (about 20 degrees of hex key turn). Tighten the linearity lock screw to 12 Lb. In. Do not test at this time at 35 Lb. In. setting but continue to step "3".
3) Readjust the torque-limiting driver to 5 Lb. In. Check the accuracy at 5 Lb. In. and recalibrate as necessary using the simple calibration procedure, not the calibration for linearity procedure.
4) Reset the unit to 35 Lb. In. and check accuracy. If further calibration adjustment is necessary, repeat steps 1 through 4.
5) When calibration is finished, replace the plastic seal over the linearity adjustment screw and reseal all other adjustment screws.

Note: After turning the linearity adjusting screw **always** return to the 5 Lb. In. setting, check calibration and adjust as necessary as outlined in step 4 before checking calibration at 35 Lb. In.

Simple Calibration Procedure (QTSP135)



Torque Range	Square Drive	Releases per Revolution	Rotation	Length	Weight
5-35 LB.IN.	1/4"	8	CW and CCW	7"	.846 Lbs

The QTSP135 preset torque limiting driver is designed for applications where it is used at the same torque setting and adjustment in the field is not authorized. Because the QTSP135 is calibrated at only one setting no provision for calibration for linearity is provided. The linearity lock screw and linearity adjusting screw **must never** be adjusted. To change the torque release calibration setting, loosen but do not remove the calibration screw. Rotate the spindle grip clockwise (in) to increase output or counter-clockwise (out) to lower output. Adjust as necessary until torque limiting driver output matches tester reading. When proper calibration is set tighten the calibration screw to 10 Lb. In. and recheck calibration.

Direct Reading Dial Types

(Except Snap-on TQS and TQ's series)

Torque Instrument Calibration and Repair Instructions

Table of Contents

Page	Description
3	Repair manual objective.
3	Calibration accuracy.
3	Certification of accuracy.
4	Bent handle.
4	Corners of square drive worn, tool in poor condition.
4	Cracks in the handle or main body.
4	Tool generally rusty and oxidized in appearance.
5	Broken square drive.
5	Calibration screw adjustments.
5	Analyzing direct reading dial type problems during calibration check.
6	Pointer jumps or suddenly lags.
6	Dial pointer stops abruptly.
6	Dial pointer does not move when torque is applied.
6	Torque tester indicates reading outside of allowable limits and consistently above or below proper values when dial indicates exact value.
7	Tester reading indicates values too low in clockwise direction compared with exact dial readings, but too high in counter-clockwise direction or vice versa.
7	Torque tester readings indicate proper values at high torque settings compared to the dial readings. But higher readings than the dial at low torque settings in both the clockwise and counter-clockwise directions.
7	Direct reading dial type disassembly procedure.
7	Removing the bezel and crystal assembly.
7	Removing pointer.
7	Removing dial.
8	Removing case.
8	Guard removal.
8	Rigid or flex beam members.
8	Removal of movement.
8	Direct reading dial type assembly procedure.
8	Movement assembly to main plate.
9	Aligning rigid and flex beams prior to installing calibration screw.
9	Installing calibration screw and nut.
9	Installing case.
9	Installing dial (non-light signaling models).
9	Installing main pointer (standard and follow-up (memory needle) models).
10	Installing crystal assembly (standard and follow-up (memory needle)).
10	Final operations and installation of access cover.
10	Assembly of light signaling models.
10	Installation of light signaling dial assembly.
11	Light signaling pointer installation and adjustments.
11	Calibration of light signaling models.
12-14	Special tools for all direct reading dial types

Repair Manual Objective

This repair manual is intended to be used as a guide for the repair of Direct reading dial types. Recommended procedures for assembling, disassembling, calibration and determining repair problems will be covered. Due to the extensive product line of Direct reading dial types, it would not be possible to list all components of all units. However, as the Direct reading dial types are basically the same in design and operation, the description of a standard unit will be used and all components specified only by name and not by number. An up-to-date service parts catalog should be consulted for component numbers when reordering. Should repair problems be encountered which cannot be answered with this manual, contact the Service Department for assistance.

Calibration Accuracy

Direct reading dial types are sold under two accuracy limits, 2% units and 1% units. These direct reading dial types are, therefore, to be certified accurate to within 1% or 2% of the reading from 20% of full scale to full scale. This means (for example) that a 100 Lb.Ft. 2% Direct reading dial type, is accurate to within ± 2 Lb.Ft. at the full-scale reading, ± 1 Lb.Ft. at a 50 Lb.Ft. reading, and ± 1/2 Lb.Ft. at a reading of 25. Correspondingly, a 1% Series unit is accurate to ± 1 Lb.Ft. at the 100 reading and ± 1/2 Lb.Ft. at the 50 reading (for a 100 Lb.Ft. Direct reading dial type).

Testing must be accomplished on a tester that is 4 times more accurate than the Direct reading dial types. It is suggested that the Snap-on model TTD" master torque testers be used for checking these units as these testers are accurate within one tenth of one percent.

When checking a Direct reading dial type for calibration, all readings should be well within the above limits. Borderline readings are to be corrected, as a properly working Direct reading dial type can be calibrated with high accuracy.

Certification of Accuracy

Frequently, customers will return Direct reading dial types simply to be assured that they are operating within guarantee accuracy limits. Certificates of accuracy may also be required or calibration curves requested.

In these instances, the Direct reading dial type should be checked at 5 or more checkpoints in both the clockwise and counter-clockwise directions. In checking accuracy, the Direct reading dial type should be loaded on a calibrated torque tester until the exact checkpoint is read on the Direct reading dial type dial. The actual torque should then be read on the tester and indicated on the certification sheet in the same units of measurement as represented on the dial. If variations exceed standard limits, recalibration should be performed and the certificate should reflect in the readings.

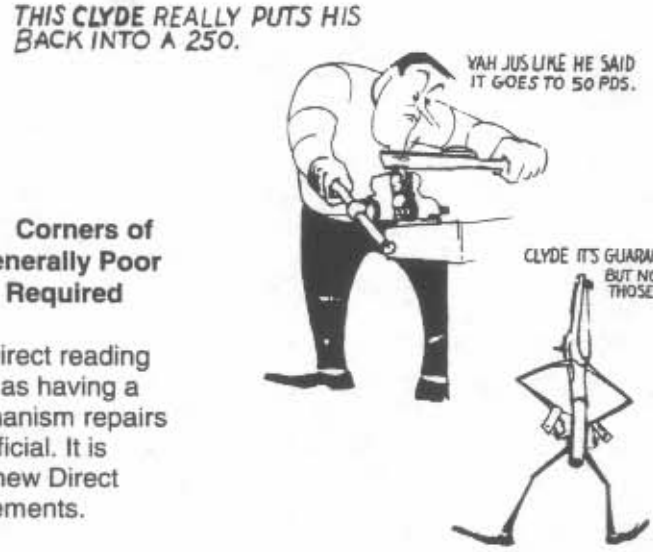
Checkpoints should be located at approximately 20, 40, 60, 80 and 100% of the full dial reading in both directions.

General Inspection Prior to Testing

The following section will cover the various repair problems encountered in the field, as well as the proper method for repairing such a problem.

Bent Handle

When a Direct reading dial type is received with a bent handle, do not attempt to straighten the handle. This unit has been greatly over torqued and any guarantee is normally void under these conditions.



Corners of Generally Poor Condition with Additional Repairs Required

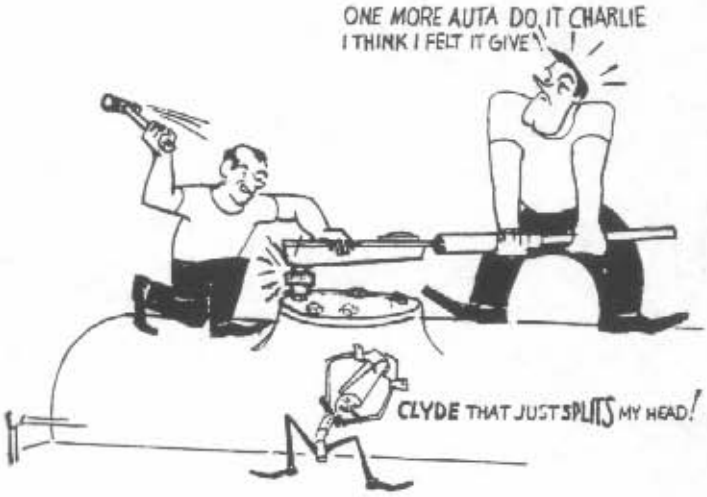
A Direct reading dial type, which shows extended use such as having a worn square drive or having mechanism repairs to the extent, where repair might not be beneficial. It is recommended that the unit be replaced with new Direct reading dial type having the latest refinements.

Cracks in the Handle or Main Body

When a Direct reading dial type is received from the field having cracks in either the handle or the main body. And the Direct reading dial type handle or other related components are not bent and do not show evidence of abuse, the manufacturer will replace or repair (at their option) such defective parts at no charge. This unit should be sent to the manufacturer for repair and should not be attempted by the Service Center.

Tool generally rusty and oxidized in Appearance

If a Direct reading dial type appears extremely rusty and oxidized in appearance with other repairs required. It indicates that the unit has probably been left in an acid or other environment such as with a high concentration of salt, etc., for long periods, and these units are generally not fit for repair. When subjected to an oxidizing environment for long periods of time, the components do not perform as intended and all components would require replacement.



Broken Square Drive

The square drive may fracture because of normal fatigue failure after extended use or because of abnormal stress concentration when used with worn sockets. Also, users have demanded tools having square drives smaller than recommended for certain capacities. Examples of these are the 250 Lb.Ft. model with 1/2" square drive and the 2,000 Lb.Ft. model with 1" square drive. These particular tools are allowed only limited guarantee and in most cases, failure may be traced to normal fatigue rather than to defects in material or workmanship. In any case, credit or replacement of complete tools or plate assemblies can be allowed only if examination at the factory discloses a manufacturing defect

Calibration Screw Adjustments

When making calibration changes on Direct reading dial types, it is necessary to have a method for making minute adjustments to the calibration screw. As a 0.008-inch change in the screw, position will cause about a 2% change in calibration. With the following method, it is possible to establish a reference position for the screw that can be changed slightly, but with precision. Use a scriber or similar tool having an approximate 0.090 inch diameter and sharpened to a thin tapered point, the point being as sharp as possible. To move the screw in the direction of the scriber as in Figure 1, establish a position for the scriber as shown in No. 1 and sink the tip slightly into the "Y" plate with hand pressure. Swing the scriber into position No. 2. With a small screwdriver (Snap-on #SDD232), loosen the screw and slide it towards the scriber until it rests against the scriber. Snug (Do Not exceed 16 Oz.In. of torque) the screw and retest the Direct reading dial type for accuracy. Torque the calibration screw to 1 Lb.In. (16 Oz.In.) using torque driver, Snap-on TQS012, or equivalent after making the final setting adjustment.

Always make adjustments and tests considering full-scale readings on both sides first. Compare the lower readings afterwards and balance the calibration between the upper and lower readings in both directions, as it is necessary to meet all specifications.

Analyzing Direct Reading Dial Type Problems During Calibration Check

This section on Direct reading dial type repair will cover the checking of calibration and results or problems encountered during the calibration check. In all instances when checking calibration, the Direct reading dial type should be placed in a horizontal position, the dial set to zero and the direct reading dial type loaded to full scale. After removing the load from the Direct reading dial type, remove the unit from the torque tester and re-zero the dial. Place the unit back on the torque tester and apply the proper load for testing. The Direct reading dial type should always have calibration checks made by starting with the lowest torque checkpoint and proceeding upwards to the maximum torque checkpoint. When loading the unit to a specific torque, always approach the checkpoint from the low side of the torque range.

If the checkpoint has been exceeded by the loading mechanism, decrease the load until the torque has been reduced to approximately the previous checkpoint and reload the unit until the new checkpoint has been reached. Note that in all instances when checking calibration, the unit is first to be loaded to full scale then removed from the tester and re-zeroed before the calibration check is made. When checking a calibration point using a torque tester, the Direct reading dial type is loaded until the checkpoint has been indicated on the Direct reading dial type dial. Then, check the torque tester for the actual torque being applied by the unit.

Pointer Jumps or Suddenly Lags

If the dial pointer is not smooth in operation as the load is progressively increased, the following items should be checked. If the pointer jumps, it may be caused by a bent pointer pinion, in which case the movement must be replaced.

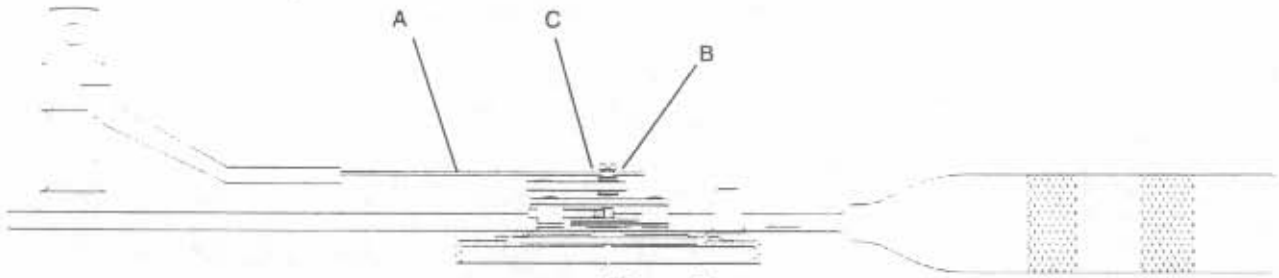


Figure 2

Foreign matter in the movement gear teeth may also cause jumping of the pointer, or in large capacity models, by having the rigid and flex beams not being in proper alignment. The flex beam (A) may be improperly floated in the center of the "calibration screw land" (C) at (B). Remove the case if necessary and re-float the flex beam in both directions using a Duckbill Pliers, Snap-on No. 60R and Beam Adjuster TQN217. See the instructions for reassembling the unit if necessary.

Dial Pointer Does Not Travel To Full Reading, But Stops Abruptly at Some Point and Will Travel No Further

Remove the access cover with access cover wrench, TQN219. Examine the alignment of the flex beam through the center axis of movement. If the flex beam is over to one side, evidence of overtorque is apparent. To check for overtorque damage, realign the flex beam with the swing tool. The case does not need to be removed during this operation. Next, zero the pointer, apply force to the handle in a clockwise direction to the full-scale reading, and release slowly. Remove the Direct reading dial type from the tester and carefully re-zero the pointer. Place the Direct reading dial type back on the tester, apply a force in the counter-clockwise direction to the full-scale torque reading, and release slowly. Carefully examine the relation of the pointer to the zero increment after removal from the tester in both instances. A lag of two increments or more indicates "overtorque" and this tool should not be expected to give adequate future service. If the unit cannot be adjusted to give linear results in both directions, it also cannot be adjusted and should be returned to the customer as not repairable.

Dial Pointer does not move when Torque Is Applied To Handle or Readings Are Grossly Out Of Tolerance

The calibration screw and nut may be loose or may have dropped out of position completely. Remove the access cover and examine the screw for tightness. Recalibrate if necessary. If the nut and screw have disengaged completely, they may be removed by inverting the wrench after which they can be easily worked out through the access hole. The screw inserting tool, TQN226, may then be used to relocate first the nut, then the screw in proper place while screwdriver, Snap-on No. SDD232 or equivalent is used to provide thread engagement. Follow the general instructions for recalibration and torque the calibration screw to 1 Lb.In. (16 Oz.In.) using torque driver Snap-on TQS012, or equivalent after making the final setting adjustment.

Torque Tester Indicates Readings Outside Of Allowable Limits And Consistently above Or Below Proper Values When Dial Indicates Exact Value

This situation indicates that the calibration screw setting is not proper and the ratio between the flex beam and movement must be changed. When setting the dial at a checkpoint and the tester readings are low (the Direct reading dial type dial is fast), the adjustment must be made to slow the unit by moving the calibration screw toward the square drive. If the tester readings are higher than the dial readings (the dial is slow), the dial must be adjusted to "speed up" by moving the calibration screw away from the square drive. After having made the adjustment, retighten the screw to the 1 Lb.In. torque specification.

Tester Reading Indicates Values Too Low In Clockwise Direction Compared with Exact Dial Readings, But Too High In Counter-Clockwise Direction or Vice Versa

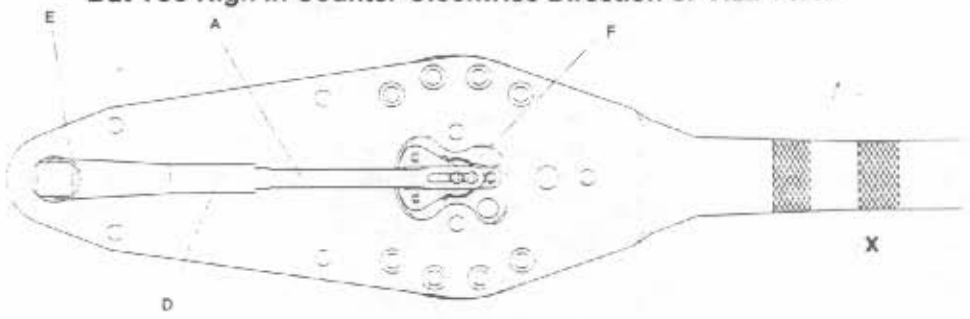


Figure 3

This condition requires that the ratio between the clockwise and counter-clockwise directions be balanced. Usually this operation should not be necessary if proper assembly instructions have been followed. Balancing the readings is done by swinging the flex beam (A) to one side or the other, to bring out of balance readings into balance. Move the flex beam so that the end of the lower slotted member "F" is out of center alignment equal to no more than 1/16 inch as measured at the end. Use the appropriate swing tool, TQN220 or TQN221, to accomplish the balancing operation without case removal. Carefully insert the swing tool until it is at position "D" against the rigid length. Establish the new flex beam alignment by applying leverage a little at a time.

Care must be taken not to break the flex beam or spot-welds at location "E". "X" indicates that to swing the beam in this direction if the torque tester readings are too low in the clockwise direction compared with the counter-clockwise direction.

Torque Tester Readings Indicate Proper Values At High Torque Settings Compared To The Dial Readings, But Higher Readings Than The Dial At Low Torque Settings In Both The Clockwise And Counter-Clockwise Directions

Friction usually is the cause of pointer lag and low readings when readings are correct at full scale. The friction can be caused by flex beam pressure against the upper or lower shoulder of the calibration screw. If this is the cause, the case should be removed and the flex beam readjusted. Friction can also be caused by interference between the square drive head and the case due to the case possibly being installed improperly, causing the head to rub at one side or the other.

Friction interference can be checked in the following manner: Mount the Direct reading dial type horizontally in a smooth jawed vise or a vise with brass inserts. Apply torque in one direction to about 10% of full scale, and then note the exact position of the pointer after the load is removed.

Next, apply torque in the other direction to about 10% of full scale and note the new position of the pointer after the load has been removed. Compare the new and the original pointer positions. A difference of more than 1-1/2 increments indicates a greater than allowable amount of friction and adjustments must be made to bring the friction allowance back within specifications.

Direct Reading Dial Type Disassembly Procedure

This section will cover the disassembly of all the components on the Direct reading dial types along with the proper tools and procedures to be used.

Removing the Bezel and Crystal Assembly

A thick piece of paper should be placed beneath the TQN59 Dial Ring Removing Tool and the plate in order to protect the finish. The ring-removing tool is then inserted under the edge of the outer crystal ring. A leverage action applied to the tool, which will quickly lift the ring so that it may be removed.

Removing Pointer

The grooved edge of the pointer remover, TQN61, is inserted under the pointer hub. A leverage action applied to the tool, which will quickly lift the pointer so that it may be removed.

Removing Dial

Carefully insert the ears of the TQN227 Removing Tool under the dial edges through the center pinion hole being careful not to bend the pinion during insertion or dial removal. A sharp upward thrust of the tool after it is carefully inserted should remove the dial.

Caution! Some high capacity models and all light signaling models are equipped with a steel-retaining ring. This

ring must be disengaged from its retainer slot before removing the dial.

Removing Case

A drill press, proper drill and a torque wrench holder are required for case removal. For the 1/4 square drive through 3/8 square drive use a No. 19 drill and the TQN224 Torque Wrench Holder. For the 1/2 square drive, use a No. 19 drill and a TQN225 Holder. 3/4 square drive requires a 1/4-inch drill and the TQN228 Holder. T Direct reading dial type rests in the holder with the access cover up. The drill should be aligned with the rivet center and drilling should be accomplished at medium speed and with light consistent pressure. Drill to a depth slightly beyond the case thickness. The rivets can then be removed with a hammer and starter or pin punch. When using a hammer, be sure to wear safety goggles or glasses.

Guard Removal

Should replacement of the guards ever be necessary. The same general procedure should be used as for the cases, using a No. 19 drill for sizes up to and including 1/2 square drive and a 1/4 inch drill for the 3/4 square drive

Rigid or Flex Beam Members

Removal and/ or replacement of the rigid or flex beams is not authorized in the service centers.

Removal of Movement

To remove the movement from a Direct reading dial type, use the appropriate Direct reading dial type holder a was used in the case removal. A No. 19 drill is used to drill into the rivets and a starter or pin punch will drive them out. Do not attempt to reuse a movement after it has been removed from a Direct reading dial type.

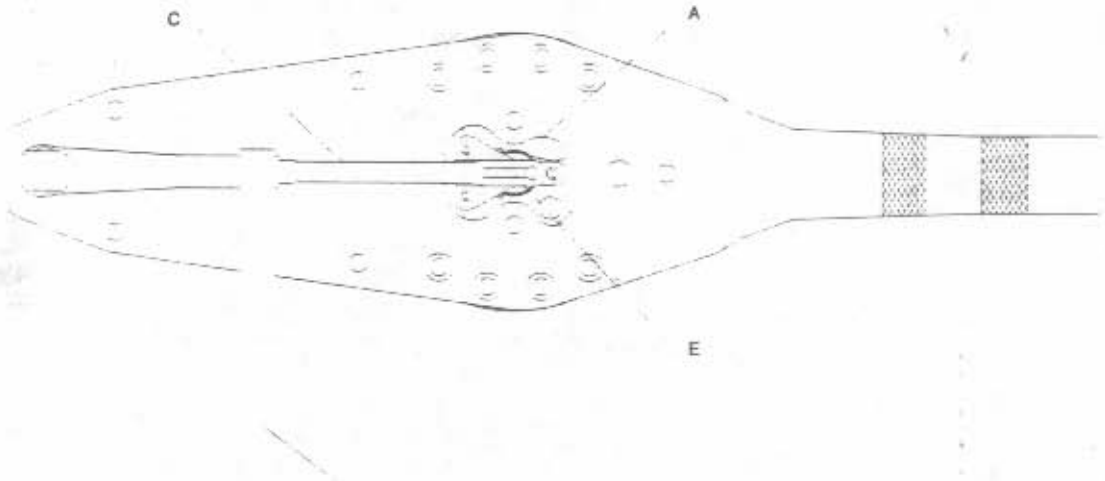
Direct Reading Dial Type Assembly Procedure

The following section will deal with the assembly procedures of the various components of the Direct reading dial type. Care should be taken in all assembly steps to insure that each component is working properly.

Movement Assembly to Main Plate

This operation requires the use of the model 913 Riveter and the T740 and T1023 Rivet Accessories. Assembly is performed with the Direct reading dial type in an upright position. The spring retainer and spring are inserted and the friction ball is balanced on the spring. Check to see that the movement and lower dial ring rotat freely when mated. A drop of oil will help if needed. The movement and lower dial ring are brought into positi as a matched pair, thus, compressing the ball and spring into the retaining cup. With the assembly carefully h in place, the rivets are both inserted into the movement and through the main plate with the heads up. When the positioning of the parts is completed, the assembly is inverted and placed into position on the 913 Riveter. Riveter linkage setting should be set such that when the pedal is fully depressed, proper clinching is achieved.

Figure 4



TQN217 Beam Adjuster

The rivet should not be set so tightly that distortion to the movement plate takes place. Clinching must be sufficient, however, to hold the movement firmly and allow no movement later. After riveting, be sure to chec looseness by attempting to tip or turn the movement with finger pressure.

Aligning Rigid and Flex Beams Prior To Installing Calibration Screw

This is an important step in proper assembly. The beam must be floated precisely both horizontally and vertically. Horizontal alignment should first be accomplished using a TQN217 Beam Adjuster. Bend the rigid length slightly if necessary to place the center of the flex beam end exactly over the pinion. Next, check the distance between the flex beam and in the slotted member "A". This distance should be approximately 1/16 of an inch, bend the flex beam in the area of point "C" if necessary using a Duckbill Pliers, Snap-on No. 60R. Make sure that the exposed segment of the beam is flat and parallel with the plate surface.

Installing Calibration Screw and Nut

Place the base of the calibration nut in the end cavity of the nut inserter, TQN128. Align the nut such that when it is located under the slotted member, it will suitably align with the slot. Insert the nut into the slot from beneath and carefully use the tool to establish parallel relationship between the slotted member and the flex beam. Relax the finger grip on the tool so that the tool counterweight holds the nut in place and holds the slotted member in a parallel position. Leave it in this position and insert the head of the calibration screw through the wide end of the slot in the flex beam. Slide the screw along the slot until it aligns with the nut threads. Use a TQN216 Screwdriver to engage the threads. Move the screw and nut into a center position in the slot and tighten it only enough to secure it until calibration is accomplished.

Important! It is extremely important that the flex beam be realigned as in Step 2 after the calibration screw is installed. Make sure that the edge of the slotted member "A" is absolutely parallel with the edge of the flex link "B". The flex beam must be floated so that it contacts the small diameter of the calibration screw midway between the screw head and the lower screw land. One adjustment may affect the other, so be careful to recheck all components.

Installing Case

The 913 Rivet Setter is suitable for setting case rivets on all Direct reading dial types up to and including the 3/4 square drive capacity units. The T740 and T1023 Accessories are used on Direct reading dial types from 1/4 square drive through 1/2 square drive. For 3/4 square drive, the TQN179 and TQN180 Accessories should be used. Make sure that adjustments are made so that proper crimping is accomplished when the pedal is fully depressed. Rivets should be set securely, but not to the point where cases or the 913 Setter is subjected to undue strain.

Check the alignment of the square drive head with the case hole when the case and plate holes are in alignment. The square drive head must not rub the case hole after riveting. Install a single rivet adjacent to the square drive head hole first. Force the case out of alignment with the farthest rivet hole which is adjacent to the handle equal to one rivet hole diameter in each direction and then realign. This will align the single rivet in the case to help give the head adequate case clearance. Complete the riveting operation by assembling all remaining rivets.

Installing Dial (Non-light Signaling Models)

The Direct reading dial type should be installed in the proper torque-wrench holder with the dial face up. A dial should be selected having the proper numerals and increments matching the torque capacity. Units of measurement indicated on the dial such as Lb.In. or Lb.Ft. should also be compared.

The follow-up (memory needle) dial should have no stop pin; however, the standard dial should have a stop pin located at the full-scale reading. The dial staking tool, TQN156 will be used to secure the dial. Staking should take place at four points. The staker point should be held against the lower dial ring with hand pressure and at an angle of about 10 degrees from the dial face (the adjacent segment of the tool will contact the dial). Lift the staker slightly (just clearing the dial) while retaining point contact at the dial ring. Execute a sharp, light hammer blow (2 Oz. hammer) which will set the point of the staker. Next, lift the staker to approximately 45 degrees while retaining the set point position. A sharp hammer blow applied while in this position should cause a ridge of material to be displaced and projected over the edge of the dial. After final staking, attempt to lift the dial making sure that it is firmly set.

Installing Main Pointer
(Standard and Follow-Up (Memory Needle) Models)

First, check the pointer to be sure that it is straight and that the end is not out of alignment. Then check the center hub-bushing clutch. Hold the center bushing between the fingers and rotate the pointer. Some clutch resistance should be noted. If there is no resistance, discard the pointer. Mount the pointer on to the pinion with the pointer end faced towards the handle. Use the Automatic Pointer Setter, TQN222 or TQN514 to set the pointer.

Make sure that the automatic setter is held in the proper vertical alignment such that the pinion will not bend when release action takes place. Clearance between the end of the pointer and the dial should be 0.040 - 0.060

inches. On follow-up (memory needle) models, a segment at the end of the main pointer (1/8 inch long) should be bent upward at an angle of 30 degrees. Make sure that the resulting bend is straight and not over to one side or the other.

Installing Crystal Assembly (Standard and Follow-Up (Memory Needle))

The crystal and bezel should be installed a little at a time using Duckbill Pliers, No. 60R. Rotate the dial as the ring is progressively engaged until it is seated. Follow-up (memory needle) assemblies may require removal and re-installation of the crystal and bezel assembly a few times to insure that proper alignment between the follow-up (memory needle) and main pointer is insured. After achieving proper follow-up pointer alignment, rotate the dial a full turn while examining the follow-up (memory needle) pointer engagement.

Note! Both pointers must have adequate clearance between the dial face and the clear crystal material through a full 360 degrees of rotation.

Final Operations and Installation of Access Cover

Follow the calibration procedure carefully to calibrate the Direct reading dial type. Check that the calibration screw has been tightened to a 1 Lb.In. torque (16 Oz.In.) with a TQS012 (Snap-on) and TQN223 tools. Install the access cover using the TQN219 Socket. Engage the access cover with the case through the slots provided and turn the cover until alignment between the case projections is accomplished.

Assemble of Light Signaling Models

Assembly instructions are much the same for light signaling models and standard models, except for the following:

Movement - The movement (1LTQP) is equipped with the plate threaded to accept the proper dial contact assembly.

Lower Dial Ring - Lower dial ring is grooved to accept a special, snap ring retainer for the dial.

Light Case Assembly - Light case assemblies for repairs include all components for the light circuit except the dial, movement, battery and bulb. The light case assembly 231TQP is used for the 1/4 square drive through 3/8 square drive Direct reading dial types. No. 35TQP is furnished for the higher capacity models.

Procedure - After the movement is secured to the plate, the dial contact wire assembly is threaded into the movement. The light case cover should be mated with the light case bottom.

This assembly should be placed on the Direct reading dial type plate (bulb end towards dial). A 2TQP steel riv should be placed in position through the small hole, with the head located on the same side as the flex beam. Install 2 fiber washers (35TQP8) from both sides temporarily in the large hole and hold firmly to establish light case alignment (washers should have the small diameters faced together).

Set the small 2TQP9 with the lug at the end of the dial contact wire.

Place a fiber washer, 35TQP8, with the large diameter towards the rivet head on the rivet barrel. Install the resulting assembly into position. Then install a similar fiber washer (with the small diameter into the hole) on the other side (inside light case). Finally, mount the spring contact (35TQP6) on the barrel of the brass rivet with the spring member mounted toward the dial side of the light case. Be sure an adequate clearance is available around the spring contact and that the brass rivet is completely isolated and insulated from the electrical contact with the plate. Set the rivet using the TQN204 Anvil, then carefully place the location of the dial contact wire so that it will not interfere with the case, but will stay out of contact with the rigid or flex end.

Insert the bulb in the light case and screw it in until the spring contact is displaced approximately 3/32 of an inch. If the bulb is lit, a short circuit exists. If it does not light, establish electrical current between the spring loaded dial contact pin and the plate or dial ring. The bulb should then light indicating that the assembly has been properly accomplished.

Installation of Light Signaling Dial Assembly

Using emery cloth, scrape the bottom surface of the dial in the area that the electrical contact will contact the dial. This operation will insure a good electrical contact for the light signal. Coat the spring loaded dial contact with Truck-Lite (NYK Corrosion Preventive Compound). The application of a single drop is sufficient. Light signaling dials must be insulated from other parts of the tool. The dials are therefore, insulated around their periphery with a Neoprene band. Dials are also furnished with a gold ring plated stop pin, which is located approximately midway between the center and the outer dial edge adjacent to the zero increment.

To install the "U" shaped Neoprene band on the dial, begin by attaching the end and then stretch and work the band around the dial until fully covered. Clip off excess if necessary. Only the slightest pressure should now be necessary to seat the dial in the lower dial ring. If the insulating strip is distorted in any way during this operation the light may light, indicating that the insulation has broken down. When the dial is properly seated, the snap rin

is worked in a little at a time from one end. The Duckbill Pliers, No. 60R may be used to seat the ring progressively in the groove 1/8-inch at a time.

Light Signaling Pointer Installation and Adjustments

This pointer is the dual type pointer, which is to be utilized during torque applications (see CALIBRATION OF LIGHT SIGNALING MODELS below). The "pointer hub clutch" resistance should be as great or greater than the standard pointer. The pointer should be bent if necessary so that it retains the usual 0.062-inch dial clearance at the tips, but has a 3/32-inch to 1/8-inch clearance at the stop pin contact position. The pointer is secured to the pinion with the automatic pointer setter, TQN222 or TQN514.

Important! To aid in calibration, check the alignment of the pointer tips with the zero increment as they contact the stop pin, one side, then the other. Tips must align with zero precisely. Bend the pointer tips if necessary with the fingers so that the resulting bend takes place through the pin contact area. The resulting bend should be barely discernible to the eye. The contact pin may also be straightened somewhat if necessary in order to achieve zero alignment.

Calibration of Light Signaling Models

When calibrating light signaling models in the clockwise direction, set the gold pointer end to the desired torque value (red pointer end for counterclockwise direction) and a load applied to the Direct reading dial type until the light indicates. The subsequent reading on the torque tester is to be compared and adjustments made for calibration if necessary.

If the bulb refuses to light when pointer touches gold contact pin, check the battery and bulb, or the pointer and stop pin may need cleaning. When operating correctly, the pointer touches the stop pin and the battery, bulb and electrical circuit are operating such that the light indicates the torque has been reached. Never file the gold plated pointers or stop pins.

You may clean the contact area by wiping the contact area vigorously with a clean, fresh cotton swab. The swab should first be immersed in a solvent degreaser (designed for electrical instruments) that will aid in the elimination of contamination. LPS instant contact cleaner is recommended for this use. It is important to keep fingers away from the contact area after cleaning.

Special Tools For All Direct Reading Dial Types
(Except Snap-on TQS Series)
(Can be ordered thru Snap-on or Williams)

PART No.	DESCRIPTION	USED ON (MODELS)
TQN59	Outer Dial Ring Remover	all direct reading dial types.
TQN61	Pointer Remover	all direct reading dial types.
TQN156	Dial Staking Tool	1/4 square drive - 3/4 square drive (series), Snap-on TEX602 (series), and Snap-on TQS (series) (all non-lighted models only).
TQN179	Rivet Setter	3/4 square drive (series) cases dial guards 3/4 square drive - 1 square drive Series (for Chicago Riveter only), use with TQN396, Rivet Adapter Setting Tool when using a Shepard Thomason Riveter.
TQN180	Lower Anvil	3/4 square drive (series) Dial Guards 3/4 square drive - 1 square drive series used on the Chicago Rivet Riveter only.
TQN203	Light Case Rivet Setter	All direct reading dial types with optional light signal only (for Chicago Riveter only), use with TQN396, Rivet Adapter Setting Tool when using a Shepard Thomason Riveter.
TQN204	Lower Anvil	all direct reading dial types with optional light signal only used on the Chicago Rivet Riveter only.
TQN217	Beam Adjuster	All direct reading dial types except Snap-on TQS series.
TQN218	Nut Inserter	all direct reading dial types.
TQN219	Access Cover Wrench	all direct reading dial types with access cover.
TQN220	Swing Tool	1/4 square drive - 3/8 square drive (series).
TQN221	Swing Tool	1/2 square drive - 1-1/2 square drive (series) all Snap-on TEX (series).
TQN222	Auto Point Setter (large)	3/4 square drive - 1-1/2 square drive (series), all Snap-on TEX and TQS (series).
TQN222A	Auto Point Setter (small)	****See Part No. TQN514.**
TQN223	Screwdriver Adapter	All direct reading dial types (comes with 1/4" female drive) optional Snap-on TQS012 or TQSS012 (series) required.
TQN226	Nut and Screw Inserter	All direct reading dial types (except Snap-on TQS series).

Special Tools For All Direct Reading Dial Types
(Except Snap-on TQS Series)
(Can be ordered thru Snap-on or Williams)

PART No.	DESCRIPTION	USED ON (MODELS)
TQN227	Dial Remover	all direct reading dial types
TQN228	tool Base (holder)	1/4 square drive - 3/4 square drive (series)
TQN393	Lower Anvil	1/4 square drive - 1/2 square drive series only (case), all direct reading dial type with movements (1TQP) used on the Shepard Thomason Riveter only.
TQN394	Lower Anvil	3/4 square drive (series) dial guards 3/4 square drive - 1 square drive Series used on the Shepard Thomason Riveter only.
TQN395	Lower Anvil	all direct reading dial types with optional light signal only, used on the Shepard Thomason Riveter only.
TQN396	Rivet Adapter	setting tool adapter to be used with TQN179, TQN518, TQN203 AND T-740 (rivet setters) used on the Shepard Thomason Riveter only.
TQN504	Pointer Spacer Gauge	all direct reading dial types.
TQN514	Auto Point Setter (small)	1/4 square drive - 1/2 square drive (series).
TQN515	Lower Anvil	1/4 square drive - 1/2 square drive series only (including TEX602 thru TEX2005 case) (case), all direct reading dial types with movements (1TQP), used on the Chicago Rivet Riveter only, old number was TQN222A.
TQN518	Rivet Setter	1/4 square drive - 1/2 square drive series only dial guards (for Chicago Riveter only) use with TQN396, rivet adapter setting tool when using a Shepard Thomason Riveter.
TQN522	Spring Pin Insertion Tool	Used for the insertion of the spring pin into the lock plug assembly used on the following Extension Handle models: 92TQPA, 93TQPA, 94TQPA, 229TQPA, TE91TQPA & Snap-on model TQP250
TQN545	Lower Anvil	for TE1-250 case & movements and all lighted models without beam assembly. Upper Rivet Setters and Lower Anvils For the Chicago Rivet Model 915 (hand setter) Light cases can be done if the beam assembly is not on the unit. If the beam assembly is on the unit, then the unit has to be sent to the service center for assembly.
TQN546	Upper Rivet Setter	for TE1-250 case & movement all lighted models, Upper Rivet Setters and Lower Anvils For the Chicago Rivet Model 915 (hand setter) Light cases can be done if the beam assembly is not on the unit. If the beam assembly is on the unit, then the unit has to be sent to the service center for assembly.

Special Tools For All Direct Reading Dial Types
(Except Snap-on TQS Series)
(Can be ordered thru Snap-on or Williams)

PART No.	DESCRIPTION	USED ON (MODELS)
TQN547	Lower Anvil	for TE1-250 dial guards only, Upper Rivet Setters and Lower Anvils for the Chicago Rivet Model 915 (hand setter)
TQN548	Upper Rivet Setter	for TE1-250 dial-guards only (tapered tip). Upper Rivet Setters and Lower Anvils. For the Chicago Rivet, Model 915 (hand setter).
TQN549	Lower Anvil	for TE 252-602 case rivets TE 252-1003 dial guards, Upper Rivet Setters and Lower Anvils For the Chicago Rivet Model 915 (hand setter)
TQN550	Upper Rivet Setter	for TE 252-1003 dial guards, Upper Rivet Setters and Lower Anvils. For the Chicago Rivet, Model 915 (hand setter)
TQN551	Upper Rivet Setter	for TE 252-602 cases, Upper Rivet Setters and Lower Anvils. For the Chicago Rivet, Model 915 (hand setter)
T-740	Rivet Setter	1/4 square drive - 1/2 square drive series only (including TEX602 thru TEX2005 case) (case), and all direct reading dial types with movements (1TQP). Supplied by Chicago Rivet (their part number, part modified) use with TQN396, rivet adapter setting tool when using a Shepard Thomason Riveter (can not be used with the Model 915 Bench Riveter).
T-176	Rivet Setter	3/4 square drive series case and dial guards only. Supplied by Chicago Rivet (their part number, part modified) use with TQN396, rivet adapter setting tool when using a Shepard Thomason Riveter (can not be used with the Model 915 Bench Riveter).
Model 915	Bench Riveter (hand setter)	The Model 915 Bench Riveter (hand setter)(Chicago Rivet & Machine Co.) is for all Direct Reading Dial Types requiring riveting. This model is the only replacement (to date) for the older Chicago Rivet and Shepard Thomason Riveter. The following anvils and setters can be used with the Model 915, TQN545, TQN546, TQN547, TQN548, TQN549, TQN550, and TQN551.
TQS012	Torque Screwdriver	all direct reading dial types (except Snap-on TQS's) Snap-on
60R	Duckbill Pliers	Snap-on
SDD232	Small Screwdriver	Snap-on

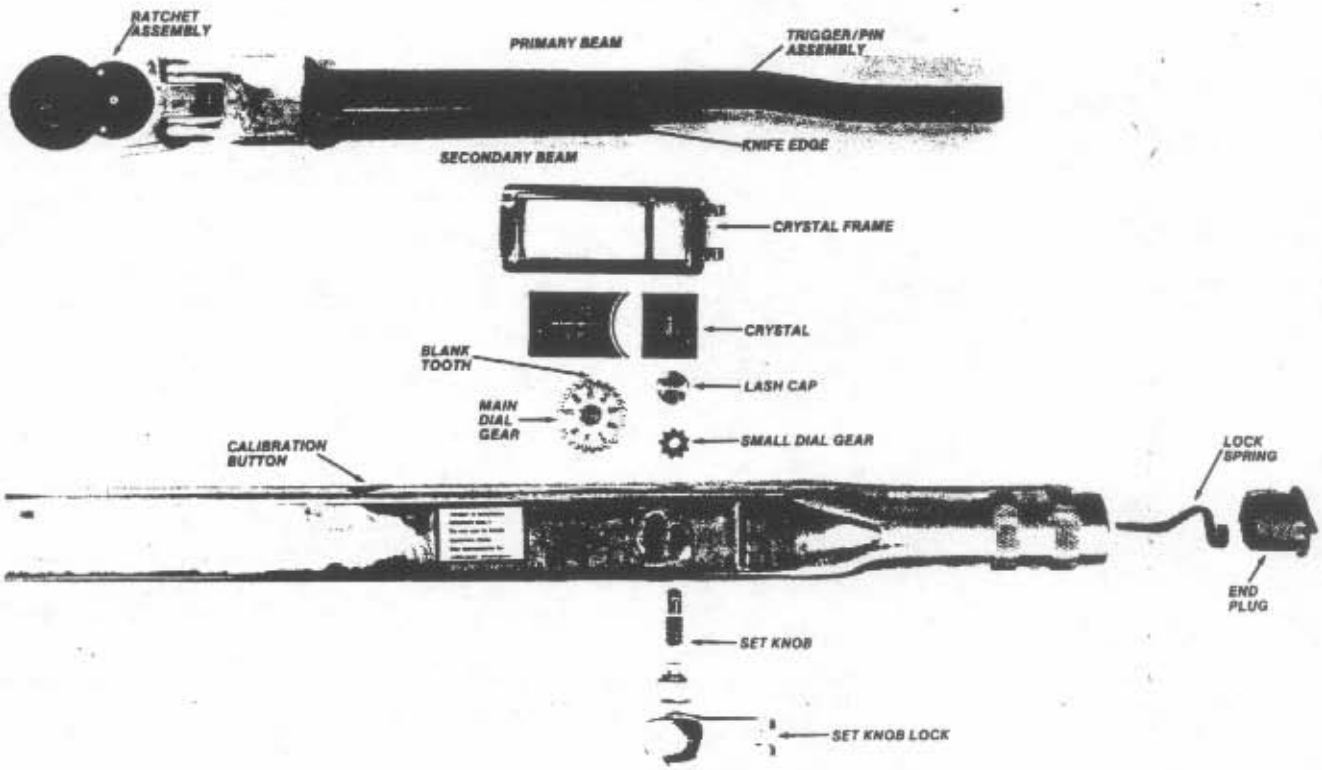
TQFR, TQR SERIES TORQUE WRENCH REPAIR AND CALIBRATION PROCEDURE

REV C

TQ Introduction

Snap-on "TQ" series of click-type torque wrenches are accurate to ±4% of any setting from 20% of maximum dial capacity to maximum capacity with exception of TQR600B and TQRM80B Models which have dials that begin at 200 lb. ft. and 26 KG-M respectively. These two models are accurate to ±5% of the torque setting. TQ series torque wrenches may be used to remove fasteners that have been broken loose buy another wrench. There is a choice of three head styles: Flex-ratchet models with a reversible ratchet, ratchet models that give you a fixed line of torque, or fixed models which are used where ratcheting action is not required.

Changes in torque settings are fast and easy because there is no spring tension on the adjusting knob. The wrench clicks and gives a few degrees of free movement when the desired torque is reached. When pressure on the wrench is completely released, it automatically resets for the next application.



TQ Disassembly Instructions

The main body of the TQ series torque wrenches should not be disassembled if the repair does not call for it to be done. Therefore, several checks should be made to determine whether the problem can be remedied with external repair methods.

Disassembly may be required if the unit cannot be made to release properly at the pre-set torque, if the lock fails, or if the trigger fails to actuate.

1 Remove the plastic dust cap located inside the handle end. We recommend either using the vise or a duckbill pliers for this operation.

2 Remove the epoxy with a pick, then remove the lash cap with the lash cap rotator TQN340. This may be accomplished by rotating the cap in the counter clockwise direction. Removal of this cap will then expose the small gear, which may be removed now or after complete disassembly.

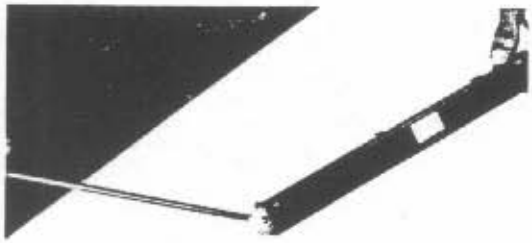
3 Remove the main lock spring using the TQN342 lock spring tool. Turn the wing screw counter clockwise on the inserter until only a few threads at the end of the screw are engaged. Insert the remover into the handle end and turn the wing screw clockwise to begin forcing the main lock spring out of the torque wrench. This releases the lock that holds the set knob.

4 Remove the lock and then release the tension the lock spring tool. Remove the lock spring tool and tip the wrench on end to allow the lock spring to fall out. Discard the lockspring as it is now distorted.

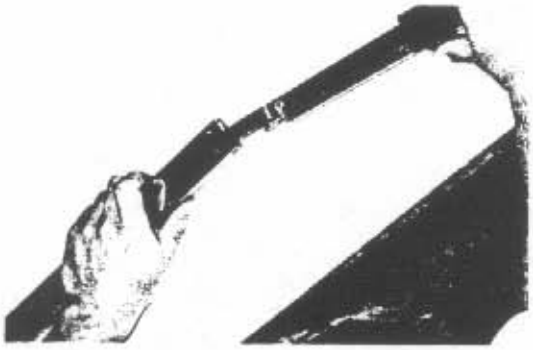
5 Unscrew the set knob and remove. Slide the main beam assembly out of the case. Make sure the small gear, and the main dial gear are removed from the case.

TQ Assembly Instructions

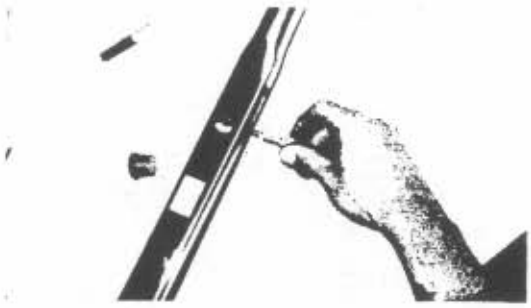
Lubricate all parts of the trigger and the set knob threads using a clean grease. We recommend using one of the following: Molybdenum Disulphite, Lubriplate, or a good quality White Lithium lubricant.



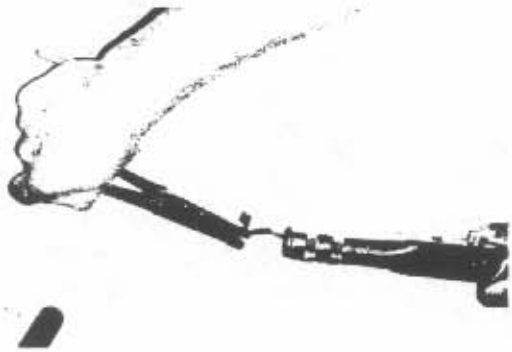
1 Place the dial gear on the short support pin of the dial gear inserter. Insert the dial gear through the open end of the case and seat it in the alignment hole provided in the case. Hold the case upsidedown so the dial gear will rest in the alignment hole.



2 The Beam assembly can now be slid into the case. Check to make sure the square drive is pointing in the right direction (upward). Make certain that the dial gear is not knocked out of place by the beam assembly. When the beam is fully engaged, the main dial gear should not fall out.



3 Insert the set knob and screw it all the way in.



4 Clip the lock spring onto the lock spring tool and insert as shown (fully collapsed). If the lock spring tool and main spring do not go into the end of the torque wrench easily, tap the end of the lock spring tool with a small hammer. Turn the lock spring tool wing nut clockwise to force the lock spring out of the torque wrench opening.

6 If cleaning of the plastic scale overlay is needed, remove the rivets from the case using a chisel. Snap-on recommends using a Snap-on PP408A chisel and a small cutter

5 Insert the lock lever (use a small screw driver to guide the spring out of the hole if needed). Release the tension of the lock spring tool and remove.

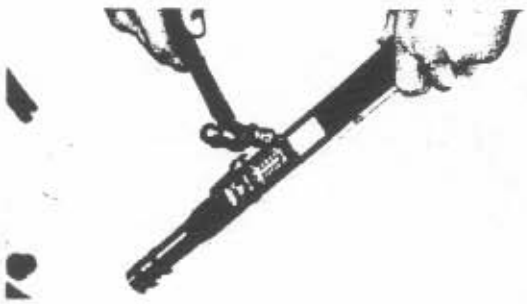
6 With the set knob in as far as it will go (clockwise), put a pencil mark on the knob. Now turn the knob counter clockwise precisely 1 1/4 turns. Now lock the set knob with the lock lever.

Postition the tool so that the handle is to the right and the hole where the lash cap was is facing upward.

7 With a thin tool, rotate the teeth of the main dial gear so the blank tooth is just to the left of center. The small gear has a convex side and a flat side. This gear will be placed into position with the flat side down. The main dial gear may need a very slight adjustment so that the gears will mesh correctly.

8 Using a TQN340 lash cap rotator, thread the lash cap in until it is snug. Now check the set knob. If it does not move easily, back out the lash cap 1/8th of a turn and try again. When the lash cap is satisfactorly positioned, use a 5-minute epoxy adhesive and cover the cap.

9 Install the end cap into the torque wrench handle using either the TQN343 installation tool or a duckbill pliers.



10 Replace the crystal & crystal frame using two appropriate rivets. (See the current Service Parts Catalog for the correct part numbers).

TQ Ratchet Inspection
(if so equipped)

Caution: Wear approved eye protection when using striking tools and when servicing spring-loaded assemblies. Use a workbench or vise and wood block when repairing a ratchet.

1 Cover plate and gear—	Remove the two plate screws, and pull out the cover plate and gear. If necessary, strike the square drive downward against a block of wood to knock out the cover plate.
2 Inspect the teeth of both the gear and the pawl.	If either of them have bad teeth, you must replace the ratchet assembly with the correct replacement part. See the current Service Parts Catalog for the correct replacement kit for your ratchet.

3 If replacement is required, the ratchet repair instructions will be provided with your replacement part.

4 If no replacement is required, insert the gear and lubricate the teeth of both the gear and pawl with a light machine oil. Do not use any kind of grease. Replace the plate. Position it by placing the hex end of a socket over the square drive and tapping the socket with soft face or a brass hammer.

5 Replace and tighten the screws and check the ratcheting action. If it works hard, strike the drive end against a wood block. Re-tighten the screws.

Models that are NOT Flex-head Ratchets

On models with a stable head, the head is not to move at all. If the head moves, the wrench cannot be repaired to become a non-flexing wrench. At this point you have two options. You may either:

1 Send the torque wrench to your nearest authorized Snap-on Service Center for verification that the repair is uneconomical and the proper procedures will be taken by the service center personnel.

or

2 Send the torque wrench to your nearest authorized Snap-on Service Center for repair. You must request that the torque wrench be made into a flex head, as this is the only economical repair available.

TQ Verification Procedure

Snap-on type TQ model torque wrench has an accuracy specification of ±4% of any dial reading, beginning at 20% of maximum dial capacity and extending to maximum dial capacity with exception of TQR600B and TQRM80B Models which have dials that begin at 200 lb. ft. and 26 KG·M respectively. These two models are accurate to ±5% of the torque setting. When checking a TQ series torque wrench for calibration accuracy, it is checked in the right hand or clockwise direction only.

1 The following test can be performed if the unit is in working order within or near accuracy specifications. The purpose for this test is to determine an overloaded condition or impending Fatigue Failure.

1.1. Set dial to maximum capacity and lock the knob.

1.2. Load torque wrench in CCW direction until tester reading equals wrench capacity, then remove load.

1.3. Load torque wrench in clockwise direction until click signal occurs, note the reading, then relax load.

1.4. Load the torque wrench again in the clockwise direction and note the reading as the click signal occurs.

1.5. Compare the reading of step 1.3 with step 1.4. A difference of four or more percent between the two readings indicates probable overtorque unless the knife edges are worn so as to cause unstable readings.

2 Preload the torque wrench between 50% and 100% of full scale.

3 When verifying accuracy of torque wrenches, one may want to refer to existing specifications to ensure that the procedure complies with your testing needs. Snap-on Service Centers use the current ASME B107.14M-1994 Standard.

4 Fundamentally, this specification indicates that 3 check points of accuracy are recorded. Three tests are recorded at each checkpoint. The check points are suggested to be made at 20, 60, and 100% of maximum dial capacity. The check points are loaded in succession from the lowest value to the highest.

5 If the accuracy is not within the ±4% accuracy specification, the torque wrench must go through the TQ Calibration Procedure.

TQ Calibration Procedure

When the verification procedure indicates that calibration is necessary, use the following procedure.

1 CASE 1

Generally, the readings will either all be too low or all the readings will be too high.

To correct this problem you must first remove the epoxy adhesive covering the set screw. Use a thin sharp punch and a very light hammer to expose the socket portion of the set screw.

Remember — USE SAFETY EYEWEAR

1.1
To Raise all Readings

Using a good hex key, turn the set screw counter clockwise. A few degrees of rotation will affect torque readings considerably. Repeat the verification procedure.

1.2
To Lower all Readings

Using a good hex key, turn the set screw clockwise. A few degrees of rotation will affect torque readings considerably. Repeat the verification procedure.

Note: If the set screw doesn't turn easily, apply heat, then make adjustment

When calibration is complete, apply a 5-minute epoxy adhesive to the set screw.

2 CASE 2

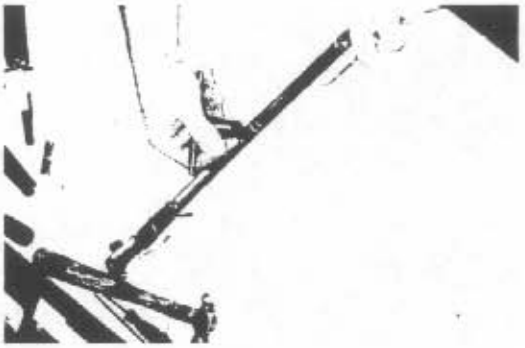
When torque calibration readings indicate that the torque readings are not linear (low at one end and high at the other end), this means that the spring rate must be adjusted.

To correct this problem you must first remove the epoxy adhesive covering the entire calibration button. Use a thin sharp punch and a very light hammer to expose the button and all of its holes.

Remember — USE SAFETY EYEWEAR

2.1

Problem	Remedy
The torque is reading high at the high end and low at the low end.	Using tool TQN293, turn the calibration button so that the set screw moves towards the handle end. Repeat the verification procedure.



2.2

Problem	Remedy
The torque is reading low at the high end and high at the low end.	Using tool TQN293, turn the calibration button so that the set screw moves towards the square drive end. Repeat the verification procedure.

When calibration is complete, apply a 5-minute epoxy adhesive to the entire calibration button including the set screw.

TQ Internal Repair

Disassemble the torque wrench according to the disassembly instructions for TQ model torque wrenches. Completely clean the trigger area to remove all lubricant and dirt.

Examine:

a. The **trigger** — replace if it is cracked or broken.

b. The **beam knife edge** — check for wear or burrs.

c. The **set knob** — replace if broken.

d. The **small gear** — replace if distorted.

e. The **dial gear** — replace if distorted, clean if necessary.

f. The **lock lever** — replace the lock spring if loose.

1 Replace the needed parts. Reassemble the torque wrench according to the assembly instructions. Note that the part numbers for the replacement parts can be found in the current Snap-on Service Parts Catalog.

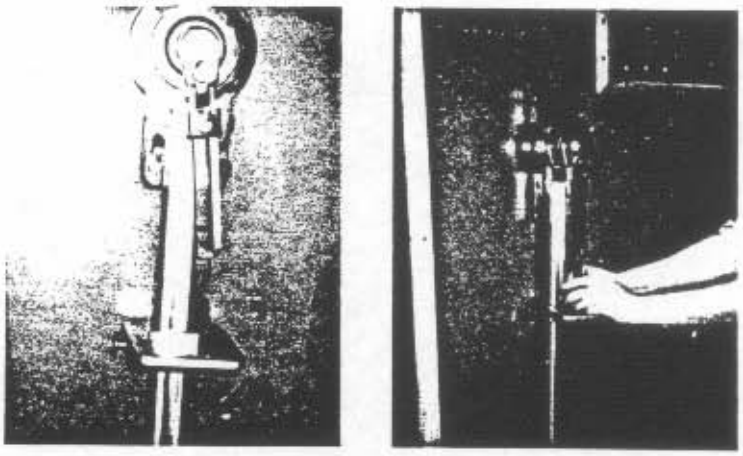
2 If the **beam knife edge seems to be defective**, please send the torque wrench to your nearest Authorized Snap-on Service Center for repair. This may not be repairable.

3 **Replacing the trigger** — Support the beam assembly so it will not move when removing the triggers' pin. Remove the pin using a suitable pin punch. Discard the old trigger and insert a new one. Press in the new pin and balance the position of the pin so neither side of the trigger can become disengaged.

To insert the trigger spring, first seat the large end in the hole under the trigger, then compress the spring and insert the small end into the guide hole provided in the trigger. The use of a small screw driver may be helpful for this step.

4 If calibration still cannot be achieved, the following procedure checks for bent beams.

Disassemble the entire torque wrench as in the disassembly instructions. Mount the torque wrench on the tester and apply a torque of approximately half scale. Then manually release the trigger from the knife edge. See picture below.



The trigger should click back into place at the readings found in the table below.

TQ model number	release (click back) range
100	7 - 12 lb ft
250	18 - 24 lb ft
600	43 - 58 lb ft

If the trigger did not click back within the specified range, the torque wrench was probably over stressed at one time and may not be repairable. The torque wrench should be sent to your nearest authorized Snap-on Service Center for repair.

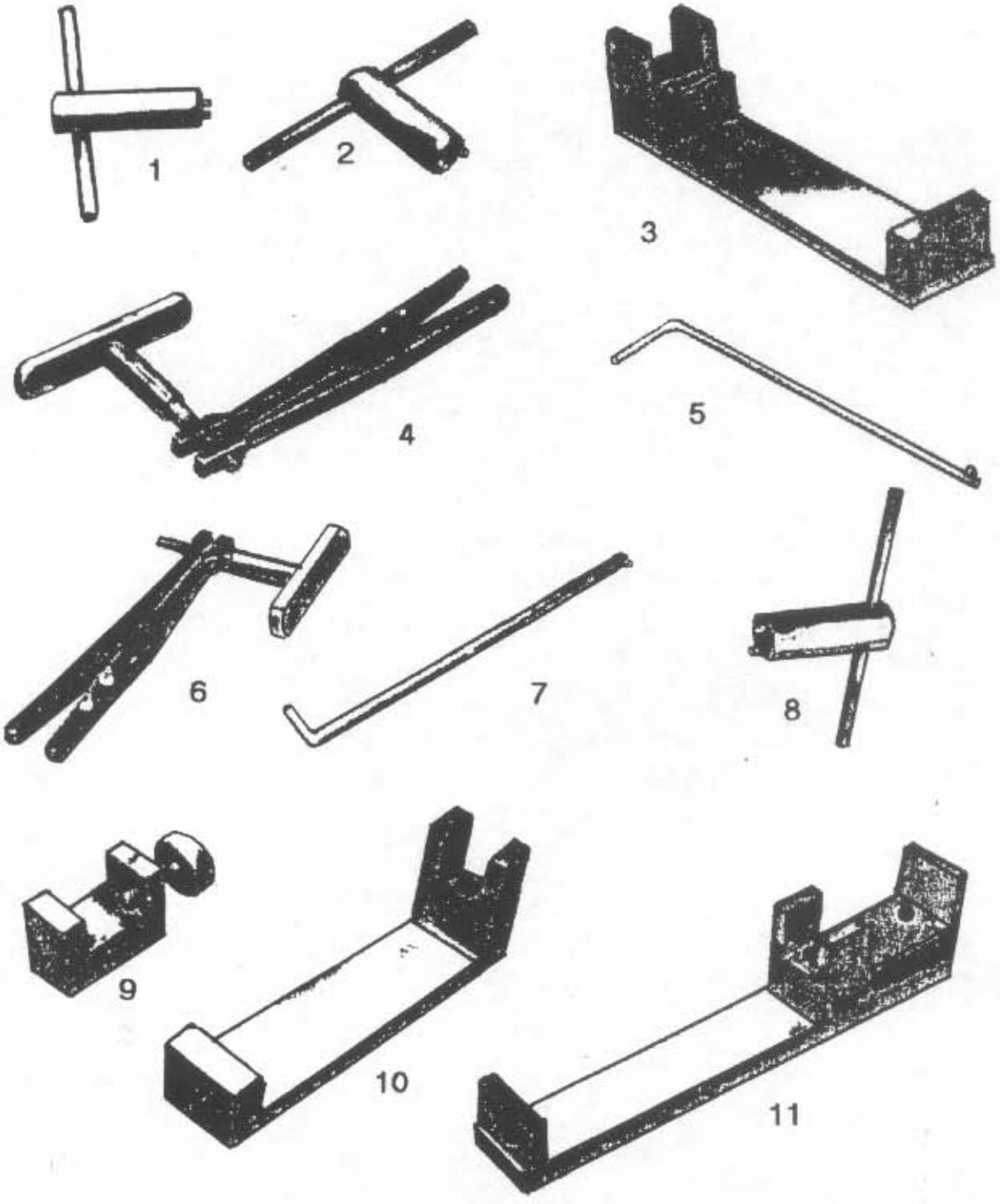
TQR/TQFR Series Repair Tools

Picture	Part Number	Description	Used For
1	TQN293	Calibration button rotator	All TQR/TQFR models
2	TQN340	Lash cap rotator	TQR/TQFR250-600 models
3	TQN341	Ratchet head support jig	TQFR250 model (no suffix)
4	TQN342	Lock spring inserter/remover	TQR/TQFR250-600 models
5	TQN344	Dial gear inserter	TQR/TQFR250-600 models
6	TQN385A	Lock spring inserter/remover	TQR/TQFR50-100 models
7	TQN386	Dial gear inserter	TQR/TQFR50-100 models
8	TQN388	Lash cap rotator	TQR/TQFR50-100 models
9	TQN508	C-clamp beam adjustor	TQR/TQFR250-600 models
10	TQN382	Ratchet head support jig	TQFR50A-100A models
11	TQN505	Ratchet head support jig	TQFR250A model
None	TQN509	Diamond file	All TQR/TQFR models

* *Note - All pictures of the repair tools are not to scale and are for reference only.*

STANDARD TOOLS

1/16 inch hex key wrench
#27 drill bit
PPC408A chisel
Duckbill pliers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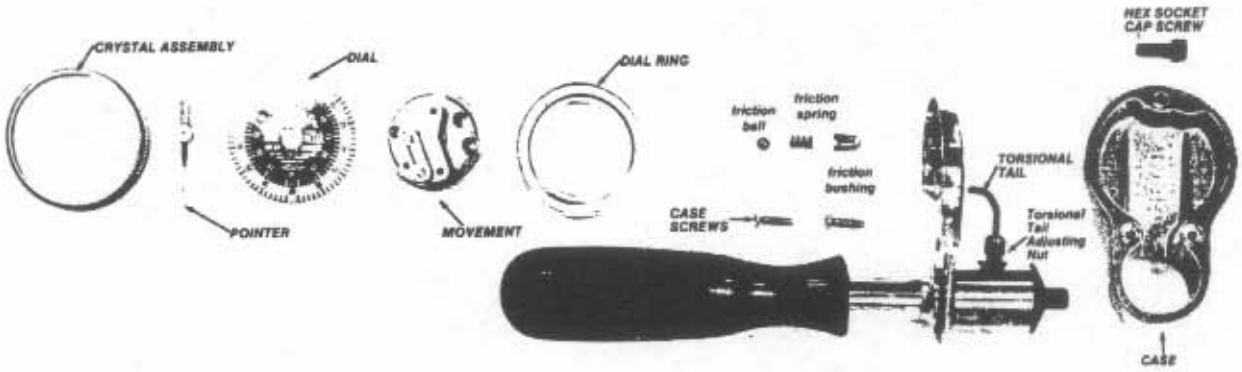
TQS TORQOMETER® STYLE DRIVER REPAIR AND CALIBRATION PROCEDURE

REV C

TQS Introduction

TQS series Torque Drivers are actually Torqometers. They feature all the benefits of other patented Snap-on torque measuring tools. They are available in both standard ±2% accuracy models or precise ±1% accuracy models on special order. Models are available with follow-up pointers that retain peak readings.



TQS Disassembly Instructions

Set the torque screwdriver in the TQN398 holding fixture when disassembling.

1 Remove the crystal assembly using the TQN59 Crystal Assembly Removing Tool.

2 Remove the dial pointer using the TQN61 Dial Pointer Removing Tool.

3 Remove the dial using the TQN227 Dial Removing Tool.

4 Using a long Phillips head screwdriver, remove the two case screws.

5 Turn the entire torque screwdriver over and remove the Hex Socket Cap Screw using a 5/32" hex key.

6 Carefully remove the Movement rivets. Use the appropriate drill bit (and rivet machine if available).

7 Carefully remove the movement and make certain not to damage the torsional members tail. If necessary, loosen the tail adjusting nut.

Note: Never re-use a movement after removing.

8 The dial ring, friction ball & spring, and retaining bushing may then be removed.

Note: See the current Snap-on Service Parts Catalog for replacement part numbers.

TQS Assembly Instructions

1 Insert the retaining bushing, and friction ball & spring into the plate. Position the dial ring in place.

2 Carefully position the movement in place (make sure not to bend the tail when positioning). Clench the movement rivets securely so that the movement does not have any play, but do not bend the plate to which it is attached.

3 Attach the case using the hex socket cap screw. Place the torque screwdriver in the TQN398 holding fixture. Insert and securely tighten the two case screws.

4 Using the TQN156 staking tool, stake the dial in at 4 points.

5 Press fit the dial pointer onto the movement pinion using the TQN222A automatic pointer setter tool.

6 Attach the crystal assembly to the dial ring using a duckbill pliers.

Torque Screwdriver Pre-repair Inspection

To determine whether your TQS-model screwdriver can be calibrated or repaired, you must first check the following.

Place the torque screwdriver in the TQN398 torque screwdriver holding fixture. Apply a torque to the screwdriver handle of approximately 40 lb. in. If any movement at the crimp between the screwdriver shank and the case takes place, the screwdriver is unrepairable and should be tagged as such.

TQS Verification Procedure

For verification of the TQS torque screwdrivers using a TTD-series Digital Master Tester, a TTD50-1SDA screwdriver adaptor is needed. This screwdriver adaptor is a holding fixture that allows accurate loading by avoiding side loading affects.

Snap-on precise models use the same repair / verification / calibration procedures except they are calibrated to ±1%.

1 Preload

Preload the screwdriver three times in the clockwise direction between 50% of maximum capacity to its maximum dial capacity.

2 Document Reference

When verifying accuracy of TQS torque screwdrivers, one may want to refer to specifications that are in existence to ensure that the current procedure complies with you needs. Snap-on Service Centers use the current ASME B107.14M-1994 Standard.

3 Checkpoints

Fundamentally, this specification indicates that 3 check points of accuracy are recorded in each direction of torque. Three tests are recorded at each checkpoint. The check points are suggested to be made at 20, 60 and 100% of maximum dial capacity. The check points are loaded in succession from the lowest value to the highest.

4 Procedure Notes

If at any time the dial pointer goes past the desired reading, fully unload the torque applied to the screwdriver and start again. Never go back to a reading, it will be incorrect.

5 To avoid parallax, the position of the pointer to the check point on the dial must be viewed as directly as possible. This also applies when setting the dial/pointer to zero.

Note: For screwdrivers with follow-up pointers, always use the follow-up when verifying or calibrating.

6 Step-by-step procedure

6.1 Load the screwdriver to the lowest desired check point and record the test reading from the torque tester (this assumes that the preload was done for this direction of torque--clockwise or counter clockwise).

Remember to use the peak hold feature of your torque tester.

6.2 Load the screwdriver to the next higher desired check point and record the test reading from the torque tester.

6.3 Repeat step 6.2 until all desired check points are recorded.

6.4 Repeat steps 6.1 to 6.3 in the opposite direction of torque from which was previously done.

6.5 If calibration is required, refer to the TQS Torque Screwdriver Calibration Procedure on Page 6.

TQS Torque Screwdriver Calibration Procedure

When calibration is not within specification as referenced on the torque tester after loading the torque screwdriver to the dial increment for the test reading, perform the following procedure:

It is recommended that the clockwise direction of torque be calibrated before the counter-clockwise direction of torque is checked to ensure both directions are within the accuracy specification for the torque screwdriver. The case must be removed to perform calibration.

1 Torque tester reading is **too high** as compared to the reading of the torque screwdriver dial. Loosen the nut of the beam and move the tail in a direction **away from the square drive/ torsion member** until the test reading is within spec. This adjustment is normally made at the highest dial reading of the torque screwdriver. Snug up the nut while making sure that the tail protrudes straight down into the slot of the movement pivot arm. Friction may be induced when the tail is canted into the slot of the pivot arm more than 10 degrees.

2 Torque tester reading is **too low** as compared to the reading of the torque screwdriver dial. Loosen the nut of the beam and move the tail in a direction **towards the square drive/torsion member** until the test reading is within spec. This adjustment is normally made at the highest dial reading of the torque screwdriver. Snug up the nut while making sure that the tail protrudes straight down into the slot of the movement pivot arm. Friction may be induced when the tail is canted into the slot of the pivot arm more than 10 degrees.

3 After the clockwise calibration is brought into spec, repeat the procedure in the counterclockwise torque direction. If the calibration is not in spec, do the following:

3.1 Loosen the nut of the beam.

3.2 If the counterclockwise reading is **too high**, cant the tail towards the **left** while looking at the torque screwdriver as shown in the photo. Be sure that the tail is not canted more than 10 degrees from a vertical attitude to avoid developing friction between the tail and the slot of the pivot arm. Tighten the beam nut and recheck calibration.

3.3 If the counterclockwise reading to **too low**, cant the tail towards the **right** while looking at the torque screwdriver as shown in the photo. Be sure that the tail is not canted more than 10 degrees from a vertical attitude to avoid developing friction between the tail and the slot of the pivot arm. Tighten the beam nut and recheck calibration.

4 If in step 3.2 or 3.3 the tail has to be canted more than 10 degrees to balance out the rest readings in each direction of torque, perform the following procedure:

4.1 Loosen the beam nut and remove the tail. Clamp the tail in a vise that has smooth jaws and bend the tail in the appropriate direction as noted in steps 3.2 and 3.3.

4.2 Install the tail into the beam and tighten the beam nut securely, then revert to step 1 to repeat the procedure.

5 Install the case and perform accuracy verification as noted in previous page to ensure all required checkpoints are within specification. If necessary, revert to step 1 and repeat the procedure.

Special Repair Tools for TQS's

TQN398
screwdriver support fixture

TQN59
Crystal/ Ring Removing Tool

TQN61
Pointer Remover

TQN156
Dial Staking Tool

TQN222A
Automatic Pointer Setter

TQN227
Dial Remover

NOTE: most of above tools are shown in section 15.

Standard tools:

Phillips screwdriver
Snap-on SSDP82 Screwdriver
is suggested

Riveter
We suggest the same riveter for the TQS models as the for the TE models (see section 15).

Duckbill Pliers
#60R

5/32" Hex Key

3/16" open end wrench

1/4" open end wrench