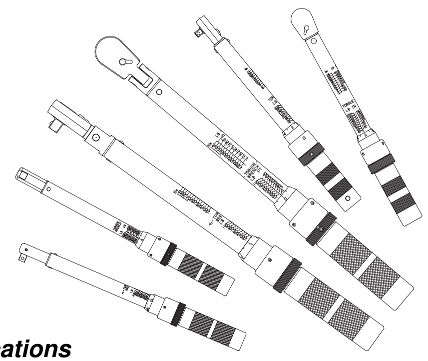
PRECISION INSTRUMENTS

User Manual

Micrometer Style Torque Wrench



Specifications

Drive	*Stock No.*	*Range Torque*	*Increments*	*Length*	*Weight*
Flex ratchet models					
3/8"	M2FR100F	20-100 lb.ft.	.5 lb.ft.	15"	2.27 lb
Fixed ratchet models					
1/4"	M1R50H	10-50 lb.in.	.5 lb.in.	9.87"	.89 lb
1/4"	M1R200H	40-200 lb.in.	1 lb.in.	9.87"	.89 lb
3/8"	M2R200H	40-200 lb.in.	1 lb.in.	9.87"	.89 lb
3/8"	M2R100F	20-100 lb.ft.	.5 lb.ft.	15"	2.31 lb
3/8"	M2R1000H	200-1000 lb.in.	5 lb.in.	15"	2.31 lb
1/2"	M3R250F	50-250 lb.ft.	1 lb.ft.	25"	4.13 lb
1/2"	M3R2500H	500-2500 lb.in.	10 lb.in.	25"	4.13 lb
Fixed head models					
1/4"	M1F50H	10-50 lb.in.	.5 lb.in.	9.68"	.83 lb
1/4"	M1F200H	30-200 lb.in.	1 lb.in.	9.68"	.83 lb
3/8"	M2F100F	20-100 lb.ft.	.5 lb.ft.	15"	2.31 lb
3/8"	M2F1000H	200-1000 lb.in.	5 lb.in.	14.29"	2.05 lb
1/2"	M3F250F	50-250 lb.ft.	1 lb.ft.	24.50"	4.13 lb
1/2"	M3F2500H	500-2500 lb.in.	10 lb.in.	24.50"	4.13 lb

All models available in a Black Oxide Finish. Add "B" to the end of the part number. Example: M2R1000HB

Features and Benefits

1. Improved accuracy **±3% of wrench setting**. Meets or exceeds ANSI / ASME B107.14m.
2. ***PATENTED*** Clockwise / Counter Clockwise operation with internal balance cam to provide the same accuracy in either direction.
3. ***PATENTED*** internal basic Calibration adjustment allows all calibration of instrument to be performed without disassembly.
4. ***PATENTED*** roller plunger reduces highest friction area by as much as 90%.
5. Ball bearing thrust washer reduces effort in turning adjustment handle.
6. Positive stops at both bottom and full scale prevents "OVER STRESSING" of internal mechanism.
7. ***PATENT PENDING*** Precision Instruments pear shaped ratchet for strength and easy access to hard to reach fasteners. The Precision Instruments ® Sealed Ratchet seals in permanent oil-graphite lubrication and seals out damaging dust, dirt and moisture. You get a smooth-running ratchet without the responsibility of routine maintenance.
8. ALL steel construction for strength and durability. No plastic to break or wear out. NO CADMIUM or MERCURY used.
9. ***PATENTED*** "torque release roller" calibration adjustment retains accuracy after passing "GGG" drop test.
10. Nickel-chrome plating for easy clean up and appearance
11. ***PATENTED*** full torque release roller allows virtual friction free click and release even at low torque settings.
12. **Made In The *U.S.A.***

Safety warnings and cautions

CAUTION

Torque Wrenches

Overtorquing can cause breakage. Wrench can be damaged while breaking fasteners loose. Force against flex stops on flex head torque wrenches can cause head breakage. An out of calibration torque wrench can cause part or tool breakage.

CAUTION

Do not exceed rated torque. Do not use a torque wrench to break fasteners loose.

CAUTION

Do not force head of flex head torque wrenches against stops.

CAUTION

Periodic recalibration is necessary to maintain accuracy.

CAUTION

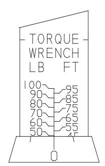
Broken tools can cause injury.

Click-Type Torque Wrenches

To Set the Desired Torque:

1. Unlock the torque wrench setting by pulling the lock ring toward the end of handle. A description on the retaining ring also indicates how to unlock the torque wrench.
2. The desired torque can be set by turning to the number indicated on the barrel. Line up the zero on the sleeve with the center line on the barrel (See figure 1). Then add the reading obtained by turning the sleeve clockwise. (See figure 2). Always approach the desired value from a lower setting.
3. Lock the torque setting by pushing the lock ring toward the ratchet, as shown by the description on the retaining ring. The torque wrench is then ready for use.

Figure 1
(Set at 50)



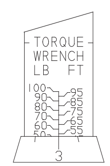


Figure 2
(Set at 53)

Correct Use of the Torque Wrench:

The correct amount of torque has been applied when the wrench releases and moves freely for a few degrees before becoming rigid. This release action will include an audible signal with all but small capacity models or at lowest settings. The movement indicates that the selected torque has been reached. The torque wrench can be used for either a clockwise or counter-clockwise application.

A Few Suggestions:

1. If the torque wrench has not been used for some time, operate it several times to re-distribute a thin film of lubricant on the working parts.
2. To assure an accurate torque application keep your hand centered on the handle grip, apply slow steady force until wrench releases, stop applying force and allow wrench to reset.
3. Don't forcibly unscrew the handle grip below the lowest torque reading.
4. Don't forcibly turn the handle grip with the lock ring in the "Lock" position. This could damage the locking device.
5. Do not apply more torque than the rated capacity of the torque wrench.
6. Always store the torque wrench with the torque setting in the *lowest position.*

Precision Instruments, Inc.

IN1203-PI

Printed in **U.S.A.**

Why Measure Torque

Modern consumer demand has forced industry to upgrade manufacturing efficiency. Because of this, manufacturers have expanded their production through special emphasis on such specifics as "increased power per cubic inch," "power per dollar" and "product efficiency factor per pound." In researching the need for increased product efficiency and the importance of complying with stringent safety standards, manufacturers found that the "nuts and bolts" principle needed special attention. Older products and machines were assembled using oversized parts having high safety factors and enormous strength. These assemblies required minimal attention, since nuts and bolts were much larger than necessary. In order to increase product efficiency per pound, smaller, more efficient machinery had to be produced using smaller yet stronger fasteners. Because of this, the "nuts and bolts" principles have new importance.

Threaded Fasteners

Threaded fasteners are used on all types of machinery, yet proper attention is often neglected. Improper torque can cause enough distortion to fracture castings, accelerate wear or cause running parts to seize. It is a known fact that a simple half-inch bolt may exert a force as high as 16,000 pounds-enough force to lift four or five automobiles. Quite obviously, threaded fasteners require special attention. Because of the importance nuts and bolts play in product efficiency, the Society of Automotive Engineers has established standards of minimum tensile strength for all major classes of threaded fasteners used by industry. Actually, the minimum tensile strength is only potential, considering practical usage. Because fasteners are used to hold assembly components together, stress caused by rapidly changing loads often complicates the fastener's job. For example, under stress the investment in extra potential strength of an SAE grade five bolt is lost, and the quality of the entire machine lessened, if it is not properly tightened. Bolts not tightened properly may eventually loosen and fall out. Even bolts secured with a locking devise, may fail from fatigue. When a bolt is properly tightened, extra locking devices are unnecessary. For its cost, the heat treated SAE grade five bolt offers the greatest potential strength in standard production situations. But, to realize this potential, the bolt must be properly tightened.

A Few Standard Precautions

A few standard precautions will help solve fastener problems. Since the fastener is usually the weakest link in any assembly, special attention is always necessary. This means that an incorrectly tightened fastener will fail before the machine itself fails. The job of determining proper bolt tightening is simple. First, examine the bolt itself to determine its torque limits. Then check its maximum potential. Naturally, there are circumstances which will determine procedures and torque value for special situations but these are rare. Caution! Always consult manufacturers specifications when available. The most commonly used rule for determining proper torque for a fastener is to apply 70% of the torque necessary to cause failure. The "Production Torque Guide" chart in this manual indicates these values. Tightening to utilize the fastener's potential strength is a necessary part of the fastener story, but it isn't the whole story. Proper lubrication, washers, etc. are just as important as proper tightening, since as much as 80% of the torque applied to a fastener is lost through friction. When the relationship between torque and tension is out of control, reliability is out; therefore, proper lubrication is necessary to provide a constant clamping force over a series of applications.

The best lubrication is a high stress type, such as "Never-Seez" Compound. On non-critical applications, seventy-two hour zinc phosphate and oil coating may be used. This is an inexpensive coating and is furnished on many industrial fasteners direct from the manufacturer.

Also, the surface under the head of the bolt or under the nut (whichever is the turned member) is important. Many manufacturers use hard flat washers with no spring effect. The hardness contributes to good correlation between the torque applied and the tension achieved. The unbroken circular flatness contributes to dimensional control and consistency of clamping force from bolt to bolt. Locking devices offer some protection against improper tightening. One of the latest trends is the use of nuts with physical disrupted threads to insure fastener locking. This type of device is manufactured by several companies, but should be examined for it's own merits. (Remember, however, that galling can disrupt the torque-tension correlation when locking devices are used.)

HOW TO COMPUTE TORQUE WHEN USING ADAPTORS

If an adaptor or extension is attached to the square drive of a torque wrench and this adds to its length, then the applied torque will be greater than the pre-set torque. A formula can be used to find what the preset-set torque should be in order to obtain the correct applied torque.

Here is the formula:

$$\text{Pre-Set Torque} = \frac{\text{Torque Wrench Pull Point} \times \text{Torque Desired}}{\text{Torque Wrench Pull Point} + \text{Extension Length}}$$

RS = Torque setting of the torque wrench.

$$\text{This becomes: } RS = \frac{A \times T}{A + B} \text{ when}$$

A = Distance from the center of the square drive of the torque wrench to the center of the handle grip pull point.

B = Length of the adaptor from the center of the square drive to the center of the nut or bolt. Use only the length which is parallel to the handle. (See figure 3)

T = Torque desired. This is the actual torque applied to the fastener.

Here is a typical problem: What should the setting be when "A" is 12", "B" is 6" and "T" is 30 lb. ft.

$$RS = \frac{A \times T}{A + B} \text{ or } \frac{12 \times 30}{12 + 6} \text{ or } \frac{360}{18} \text{ or 20 pound foot}$$

Therefore 30 pound foot of Torque will be applied at the fastener when "RS" is 20 pound foot.

Note: If the torque wrench reads in pound foot, then "T" should also be in pound foot. "T" and "RS" should be in the same unit of measurement. "A" and "B" should also be the same unit of measurement.

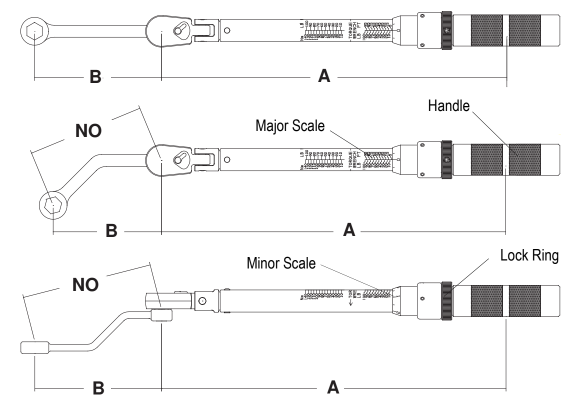


Figure 3

Precision Instruments, Inc.
1846 Miner Street
P.O. Box 1367
Des Plaines, IL. 60017

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(866-897-3624)
Fax: 847-824-7629

E-mail us at: sales@torqwrench.com

Visit us at: **www.torqwrench.com**

If Your Torque Wrench Needs Repair

1. Send it to an authorized Precision Instruments Service Center, or give it to your Precision Sales representative. Do not attempt to repair it yourself.
2. If the warranty is no longer in effect, your Precision Instruments Customer Service Representative will contact you with repair charges for your approval before being repaired.
3. A series of testers are available from Precision Sales for checking the accuracy of your Torque Wrench. See your Precision Sales representative for more information.

TORQUE PRODUCTS FULL WARRANTY

PRECISION INSTRUMENTS WARRANTS THAT PRECISION TORQUE PRODUCTS ARE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS. Precision Instruments will repair or replace these tools which fail to give satisfactory service due to defective workmanship or materials.

This warranty for Precision Instruments torque products is for ONE YEAR from the date of the original purchase. Repair or replacement shall be at the election and expense of Precision Instruments . Except where unreasonable, the product must be returned to Precision Instruments prepaid for warranty service. Precision Instruments does not provide any warranty for any product, or its calibration, subjected to abnormal use. Abnormal use includes misuse, modification, unreasonable use, neglect, lack of maintenance, lack of periodic calibration, or use after the tool is significantly worn.

PRECISION INSTRUMENTS SHALL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL COSTS OR DAMAGES INCURRED BY THE PURCHASER OR OTHER including, without limitations, lost profits, revenues, anticipated sales, business opportunities, goodwill, or interruption of business and any other injury of damage. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty is your exclusive remedy and is in place of all other rights and remedies. You may have other rights which vary from state to state or country.

Precision Instruments, Inc.
Warranty Information
P. O. Box 1306
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Rev 01/03

GENERAL TORQUE SPECIFICATION CHART
FOR I.F.I.* METRIC FASTENERS**
(when SAE10 oil is used as a lubricant)

Minimum Tensile *** Strength Mpa		400	420	520	830	900	1040	1220
Proff Load MPa		225	310	380	600	650	830	970
Property Class		4.6	4.8	5.8	8.8	9.8	10.9	12.9
Bolt Diameter		Torque: Newton Metre						
metric	inch							
5mm	0.197	2.9	4	5	-	8	11	12
6mm	0.236	5	7	8	-	14	18	21
7mm	0.276	8	11	14	-	24	30	35
8mm	0.315	12	16	20	-	34	44	50
10mm	0.394	23	32	40	-	70	85	100
12mm	0.472	40	56	70	-	120	150	180
14mm	0.551	65	90	110	-	190	240	280
16mm	0.63	100	140	170	270	290	380	440
20mm	0.787	200	-	330	520	-	740	860
24mm	0.945	340	-	580	920	1260	1480	-
30mm	1.181	680	-	-	1820	-	2520	2940

*** Megapascal
** Note: Use only when manufacturers specifications are not available, these values are for stiff metal-to-metal joints and are based on 90% of proof load. DO NOT USE for gaskets joints or joints of soft materials.
* I.F.I. = Industrial fasteners Institute.

CONVERSION OF VARIOUS UNITS OF TORQUE

Convert			Convert		
From	*To*	*Multiply*	*From*	*To*	*Multiply*
lb.in.	oz.in.	16	oz.in.	lb.in.	.0625
lb.in.	lb.ft.	.08333	lb.ft.	lb.in.	12
lb.in.	kg.cm.	1.1519	kg.cm.	lb.in.	.8681
lb.in.	kg.m.	.011519	kg.m.	lb.in.	86.81
lb.in.	N•m	.133	N•m	lb.in.	8.85
lb.in.	dN•m	1.13	dN•m	lb.in.	.885
lb.ft.	kg.m.	.1382	kg.m.	lb.ft.	7.236
lb.ft.	N•m	1.356	N•m	lb.ft.	.7376
N•m	dN•m	10	dN•m	N•m	.10
N•m	kg.cm.	10.2	kg.cm.	N•m	.09807
N•m	kg.m.	.102	kg.m.	N•m	9.807

THREADED FASTENER TENSION GUIDE
(Figures Represent Pounds of Clamping Force)

Stress Area	0.0091	0.0141	0.0175	0.0318	0.0524	0.0775	0.1063	0.1419	0.1819	0.226	0.3344	0.4617	0.6057	0.7632	0.9691	1.4052	1.8993
Outside Diameter	No.6	No.8	No.10	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1-1/8"	1-1/4"	1-1/2"	1-3/4"
Threads Per Inch	32	32	24	20	18	16	14	13	12	11	10	9	8	7	7	6	5
Torque: 5 lb.in.	205	157															
10 lb.in.	410	316	315														
20 lb.in.	820	632	630	337													
40 lb.in.		1264	1264	674	541												
80 lb.in.				1348	1082	987											
10 lb.ft.				2043	1625	1482	1224										
20 lb.ft.				4092	3250	2964	2448	2143									
40 lb.ft.					6503	5928	4896	4286	3899								
80 lb.ft.						11857	9796	8572	7799	7065							
100 lb.ft.							12245	10716	9749	8832	7915						
125 lb.ft.								13395	12186	11049	9894						
150 lb.ft.								16091	14623	13261	11872						
175 lb.ft.									17061	15462	13851	12117					
200 lb.ft.									19498	17664	15830	13836	12113				
250 lb.ft.									24373	22100	19788	17296	15142	11985			
300 lb.ft.										26523	23745	20776	18170	14382	13247		
400 lb.ft.											31660	27700	24227	19176	17663		
500 lb.ft.											39576	34592	30284	23971	22079	19754	
750 lb.ft.												51941	45426	35956	33118	29631	22678

In some cases it may be desirable to know the total clamping force obtained for a given torque. Values are approximate. SAE 30 engine oil was used as lubricant. Use of high stress lube may increase value 20% or more. Highest values for a given size may only be obtained with heat treated bolts having minimum tensile strengths of 150,000 P.S.I. or more.

* Stress area is calculated as the area of the circle whose diameter is the mean between the root and pitch diameters. This closely approximates the actual stress condition. Maximum theoretical clamping force cannot be obtained from threaded fasteners. Additional stresses to the fastener are caused by the torsional forces of tightening.

Caution

Always use manufacturers specifications when available. These specifications are approximate and may not be appropriate for some applications. No liability is assumed for errors which may result from the use of any of these specifications.

PRODUCTION TORQUE GUIDE

Fastener	Type	Minimum Tensile Strength	Material	Body size of Outside Diameter: 2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1	1-1/8	1-1/4	1-3/8	1-1/2
	S.A.E 2 Steel	74000 P.S.I	Low Carbon								6	12	20	32	47	69	96	155	206	310	480	675	900	1100
	S.A.E. 5 Steel	120000 P.S.I	Medium Carbon Heat Treat								10	19	33	54	78	114	154	257	382	587	794	1105	1500	1775
	S.A.E. 7 Steel	133000 P.S.I.	Medium Carbon Alloy								13	25	44	71	110	154	215	360	570	840	1325	1825	2500	3000
	S.A.E. 8 Steel	150000 P.S.I.	Medium Carbon Alloy								14	29	47	78	119	169	230	380	600	900	1430	1975	2650	3200
	Socket Head Cap Screw	160000 P.S.I.	High Carbon Quenched Tempered								16	33	54	84	125	180	250	400	640	970	1520	2130	2850	3450
	Socket Set Screw	212000 P.S.I.	High Carbon Quenched Tempered					**9***	**16***	**30***	**70***	**140***	18	29	43	63	100	146						
	Machine Screw Stainless		18-8	**2.6***	**4***	**5.5***	**8***	**10***	**20***	**23***	**75***	**132***	20	31	43	58	95	130	194	260	400	500		725
	Machine Screw Stainless		316	**2.7***	**4***	**5.7***	**8***	**10***	**22***	**25***	**80***	**140***	22	34	46	60	100	135	210	280	425	515		750
	Machine Screw Yellow Brass	60000 P.S.I.	CU 63 ZN 37	**2***	**3.3***	**4.4***	**6.4***	**8***	**16***	**20***	**65***	**110***	17	27	37	49	78	104	160	215	325	400		595
	Silicone Bronze Type "B"	70000 P.S.I.	CU 96 ZNI-5 Min.	**2.3***	**3.7***	**4.9***	**7.2***	**10***	**19***	**22***	**70***	**125***	20	30	41	53	88	117	180	250	365	450		655
	Machine Screw Aluminum	55000 P.S.I.	CU 3.8-4.9 1.2-1.8 MN .3-.9	**1.4***	**2.1***	**2.9***	**4.3***	**5.4***	**12***	**15***	**46***	**82***	13	20	27	36	62	83	128	170	255	315		460
	Machine Screw Monel	82000 P.S.I.	NI 67 CU 30 FE 1.4	**2.5***	**4***	**5.5***	**8***	**11***	**21***	**27***	**87***	**155***	23	36	50	67	115	155	235	315	475	585		850
	Sems Heat Treated Steel	120000 P.S.I.	1018 1022	**4***	**5***	**7***	**11***	**15***	**27***	**37***	**90***	**200***	**330***											
	Studs	Use SAE 2.5 and 8 values when grade is known, with nut of sufficient strength.																						
	Tapping Screw	Set up joint as it will be in production use 70% of over-torque failure as production specifications.																						

All figures are POUND FEET except those marked with an **ASTERISK (*)** which are POUND INCHES. These values are for lubricated fasteners.

GENERAL TORQUE SPECIFICATION CHART FOR I.S.O.** METERIC FASTENERS*** (when SAE 10 oil is used as a lubricant)											
Minimum Tensile Strength	kg/mm2	40		50		60			80	100	120
	P.S.I.	56900		71100			85340		113800	142200	170700
Proof Load	kg/mm2	22.6	29.1	28.2	36.4	33.9	43.7	47.5	58.2	79.2	95
	P.S.I.	32150	41390	40110	51770	48220	62160	67560	82780	112650	135130
Property Class		4.6	4.8	5.6	5.8	6.6	6.8	6.9	8.8	10.9	12.9
Bolt Diameter		Figures are KILOGRAM METER except those that are **bolded** which are KILOGRAM CENTEMETER									
Metric	Inch										
6 mm	0.236	***49***	***63***	***61***	***79***	***74***	***95***	***103***	***126***	***172***	***206***
8 mm	0.315	***119***	***153***	***148***	***191***	***178***	***230***	***250***	***306***	***417***	***500***
10 mm	0.394	***235***	***303***	***294***	***379***	***353***	***455***	***495***	***606***	8.2	10
12 mm	0.472	***411***	***529***	***427***	***662***	***616***	7.9	8.6	10.5	14	17
14 mm	0.551	***654***	8.4	8.2	10.5	10	12	13	17	23	27
16 mm	0.63	10	13	12	16	15	20	21	26	36	43
18 mm	0.709	14	18	17	23	21	27	30	36	49	59
22 mm	0.866	27	35	34	44	41	52	57	70	95	114

*** NOTE: Use only when manufacturers specifications are not available, these values are for stiff metal-to-metal joints and are based on 90% of proof load.
DO NOT USE for gasket joints or joints of soft materials
** I.S.O.= International Standardization Organization.