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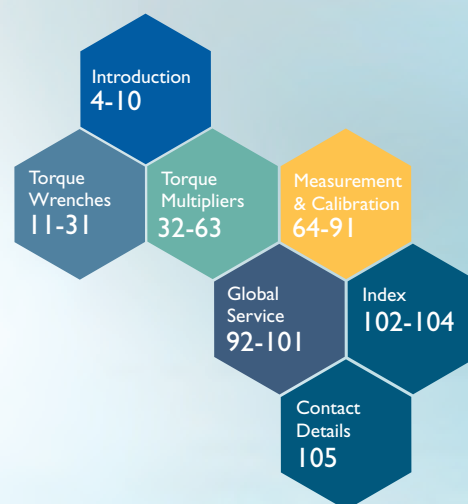
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Norbar® Torque Tools

History

In 1942 the 'North Bar Tool Co.' (as Norbar was then known) became the first company in Britain to commercially manufacture a torque wrench. The initial demand was driven by the need for the gasket-less cylinder head of the Rolls Royce Merlin engine to be accurately tightened. Bill Brodey and his partner Ernest Thornitt obtained a license from Britain's war-time Government to begin manufacture of torque wrenches and Norbar was born.

Since then, Norbar has continued to invest in the very latest design, manufacturing and quality control technology to achieve the highest level of innovation and precision in the field of torque control equipment.

The company has grown from strength to strength and now has one of the largest and most modern plants in the World devoted exclusively to the design, development and production of torque tightening and measuring equipment.

Norbar is owned solely by the descendants of the founder, Bill Brodey, and they remain every bit as passionate about providing customers with high quality, value for money products and services.



Global Service

Norbar is the only torque equipment manufacturer to be able to offer tool and instrument recalibration services to the original factory standard at five locations on four continents. The accredited laboratories in Australia, USA and Singapore use the same equipment and procedures as the factory's UKAS accredited laboratory in the UK. A further Norbar laboratory is now in operation in Shanghai, China with government accreditation expected in 2009.

In addition to this, most of Norbar's distributors offer repair and recalibration services and several have calibration accreditation by their local standards organisations.

Please see the web site for further detail of Norbar's global distributor network: www.norbar.com.

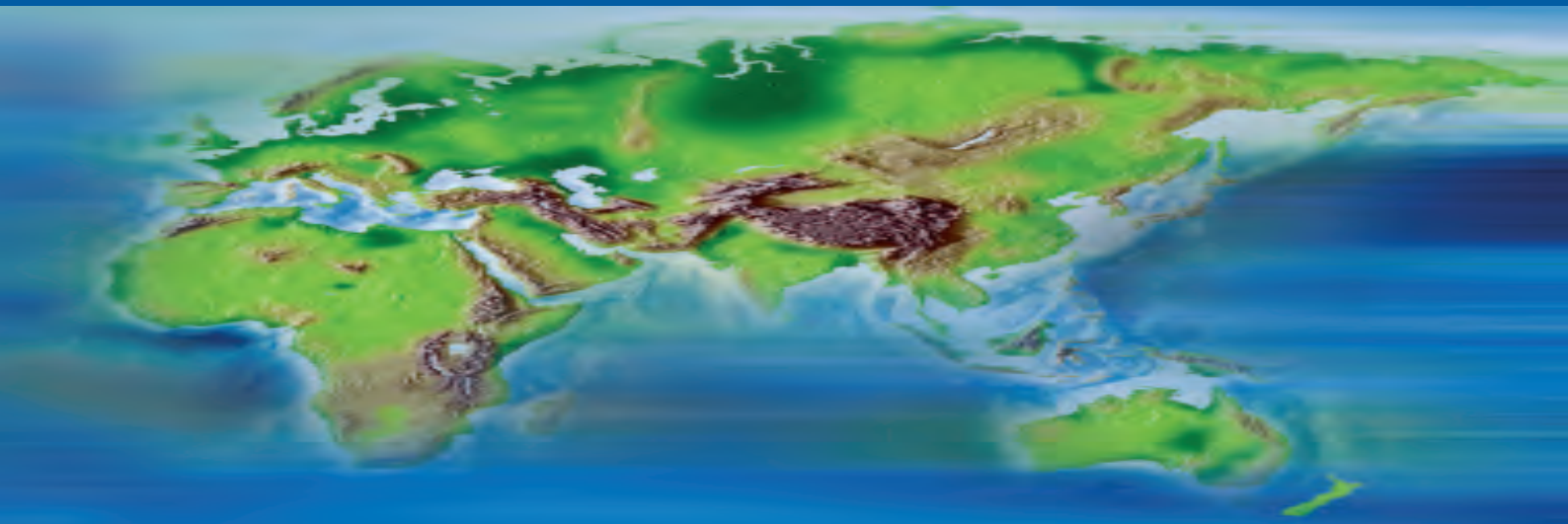


Norbar Torque Tools Ltd, Banbury, United Kingdom

Norbar's UK facility is the head office for the group, the primary manufacturing site and location of the UKAS accredited torque calibration laboratory. For full details of services offered from this location, see pages 92 and 93.



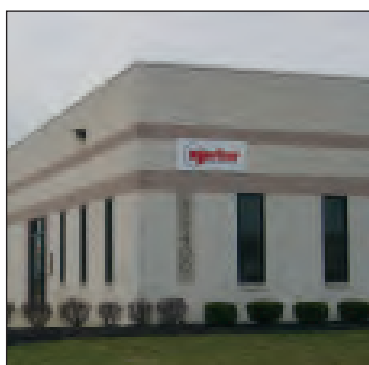
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Norbar Banbury



Norbar Adelaide



Norbar Willoughby, Ohio

Norbar Torque Tools Pty Ltd, Adelaide, South Australia

The regional head office in Adelaide not only stocks and services the extensive range of products in this catalogue but also offers and supports a full range of complementary bolting products and services via a network of branches throughout Australia. Adelaide is the location of our NATA accredited torque calibration laboratory. For full details, see pages 94 and 95.



Reg. No. 3800

Norbar Torque Tools Inc., Willoughby, Ohio, USA

The regional head office in the United States has a wealth of experience in the supply and service of Norbar products and has expertise in the customisation of products for particular applications. Willoughby is the location of our NVLAP accredited torque calibration laboratory. For full details, see pages 96 and 97.



Norbar Torque Tools (Shanghai) Ltd, China

Shanghai is Norbar's base for factory trained technical support personnel covering distributors throughout China. The facility offers spares and service for Norbar torque wrenches, Handtorque Multipliers and Pneutorque pneumatic torque wrenches, ensuring that tools can be serviced back to original Norbar standards without leaving China. The calibration laboratory is now accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF).



Calibration Laboratory

Norbar Torque Tools (NZ) Ltd, Auckland, New Zealand

The New Zealand office provides stock of most of the popular items along with product and application advice from our experienced staff. Additional stock and technical expertise is provided by the Adelaide office.

Norbar Torque Tools Pte Ltd, Singapore

Norbar's facility in Singapore holds extensive stock to serve distributors in South East Asia. Experienced sales personnel are based in this office and additional support is provided by Norbar Australia. Our fourth calibration laboratory, duplicating facilities in the UK, USA and Australia, opened in Singapore in the Autumn of 2004 and achieved SAC-SINGLAS accreditation in April 2005.



Cert No: LA-2005-0322-C

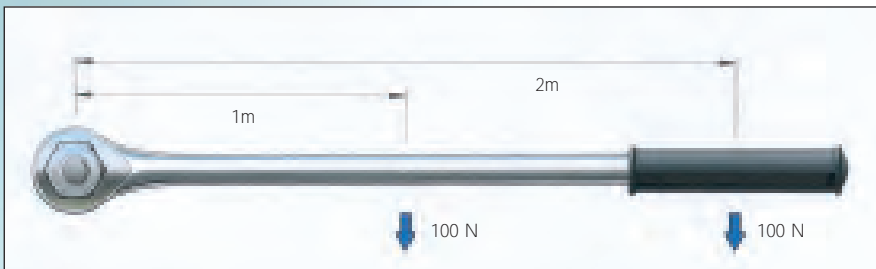
What is Torque?

Torque is any force or system of forces that tends to cause rotation about an axis.

Measurement of Torque

Imagine someone tightening a bolt using a socket attached to a meter long bar. If they apply 10 kg of force (kgf) perpendicular to the bar they will produce a torque of 10 kgf.m at the axis (the centre of the bolt).

However, under the S.I. system of measurement, force is expressed in Newtons (N) rather than kgf. The conversion between kgf and N is $\times 9.807$ so the person is applying 98.07 N.m of torque.



Torque = Force x Distance

Example 1: Distance = 1 m, Force = 100 N, Torque = 100 N.m.

Example 2: Distance = 2 m, Force = 100 N, Torque = 200 N.m.

Example 3: Distance = 1 ft, Force = 100 lbf, Torque = 100 lbf.ft (or 100 ft.lb)

The Importance of Torque Control

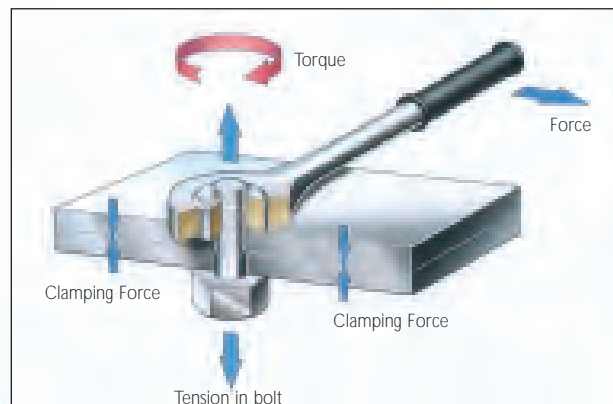
Although many methods exist to join two or more parts together, the ease of assembly and disassembly provided by threaded fasteners make them the ideal choice for many applications.

The object of a threaded fastener is to clamp parts together with a tension greater than the external forces tending to separate them. The bolt then remains under constant stress and is immune from fatigue. However, if the initial tension is too low, varying loads act on the bolt and it will quickly fail. If the initial tension is too high, the tightening process may cause bolt failure. Reliability therefore depends upon correct initial tension. The most practical way of ensuring this is by specifying and controlling the tightening torque.

Bolt Tension

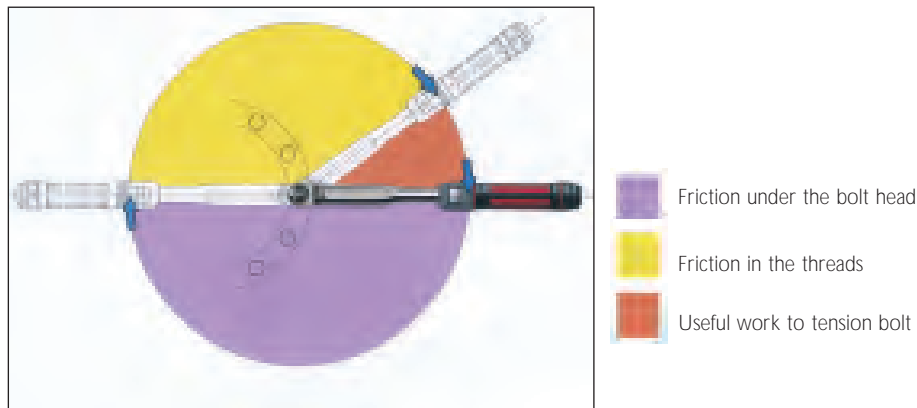
When an assembly is clamped by tightening a nut and bolt, the induced tension causes the bolt to stretch. An equal force acts to compress the parts which are thus clamped.

The proof load of a bolt, normally established by test, is the load which just starts to induce permanent set – also known as the yield point. Typically bolts are tightened to between 75% and 90% of yield.



Friction in the Bolted Joint

When a threaded fastener is tightened, the induced tension results in friction under the head of the bolt and in the threads. It is generally accepted that as much as 50% of the applied torque is expended in overcoming friction between the bolt head and the abutting surface and another 30% to 40% is lost to friction in the threads. As little as 10% of the applied torque results in useful work to tension the bolt.



Given that up to 90% of the applied torque will be lost to friction, it follows that any changes in the coefficient of friction resulting from differences in surface finish, surface condition and lubrication can have a dramatic effect on the torque versus tension relationship. Some general points can be made:

- Most torque tightened joints do not use washers because their use can result in relative motion between the nut and washer or the washer and joint surface during tightening. This has the effect of changing the friction radius and hence affects the torque-tension relationship. Where a larger bearing face is required then flange nuts or bolts can be used. If washers are to be used, hard washers with a good fit to the shank of the bolt give lower and more consistent friction and are generally to be preferred.
- Degreasing fasteners of the film of oil usually present on them as supplied will decrease the tension for a given torque and may result in shear of the fastener before the desired tension is achieved.
- Super lubricants formulated from graphite, molybdenum disulphide and waxes result in minimal friction. Unless allowance is made in the specified tightening torque, the induced tension may be excessive causing the bolt to yield and fail. However, used in a controlled manner, these lubricants serve a useful purpose in reducing the torque to produce the desired tension meaning that a lower capacity tightening tool can be used.
- For reasons of appearance or corrosion resistance, fasteners may be plated. These treatments affect the coefficient of friction and therefore the torque versus tension relationship.
- Friction is often deliberately introduced into the fastener to reduce the possibility of loosening due to vibration. Devices such as lock-nuts must be taken into account when establishing the correct tightening torque.

As a rough guide, the calculated tightening torque should be multiplied by the factor from the table opposite according to surface treatment and lubrication.

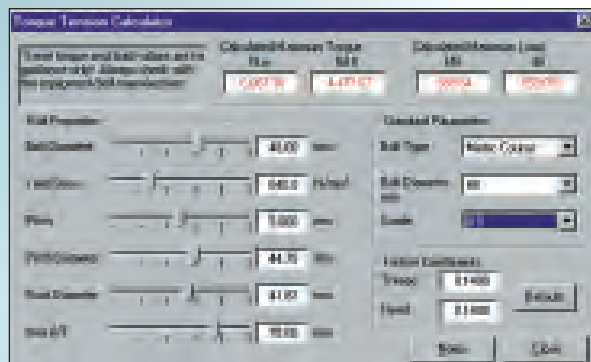
		Surface condition of bolt			
		Untreated	Zinc	Cadmium	Phosphate
Surface condition of nut	Untreated	1.00	1.00	0.80	0.90
	Zinc	1.15	1.20	1.35	1.15
	Cadmium	0.85	0.90	1.20	1.00
	Phosphate and oil	0.70	0.65	0.70	0.75
	Zinc with wax	0.60	0.55	0.65	0.55

Tightening to Yield

Bolts tightened to yield provide consistently higher preloads from smaller diameter bolts. The reduced fastener stiffness reduces the fatigue loading to which the bolt is subjected under repeated external load reversals, e.g. cylinder heads and connecting rods.

In theory, a bolt tightened to its yield point will provide the strongest and most fatigue-resistant joint possible, within the physical limitations of the bolt material and manufacturing process.

Down side of this method is the cost of the sophisticated equipment necessary to determine when the bolt goes into yield.



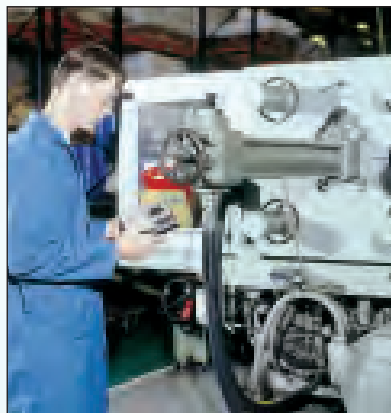
Torque Tension Calculator

For further information and guidance on establishing the correct tightening torque for a fastener, see Norbar's web site, www.norbar.com.

When Torque Doesn't Equal Tight

As we have established, it is the tension in a fastener rather than the torque that is the critical factor. Torque is an indirect means of establishing tension but, in a correctly engineered joint and with a controlled tightening process, it is a satisfactory method under the majority of circumstances.

However, in joints that are highly critical due to safety or the cost and implications of machine down-time, a more direct means of establishing tension is needed. Various methods exist including several types of load indicating bolt or washer. However, one of the most versatile methods is to measure the extension of the bolt due to the tightening process using ultrasound and this is exactly what Norbar's USM-3 does. For full details of this instrument see Norbar's web site: www.norbar.com.





Recommended Maximum Torque Values

The information supplied here is intended to be an acceptable guide for normal conditions. For critical applications, further information and research will be necessary. The following basic assumptions have been made:

- Bolts are new, standard finish, uncoated and not lubricated (other than the normal protective oil film).
- The load will be 90% of the bolt yield strength.
- The coefficient of friction is 0.14.
- The final tightening sequence is achieved smoothly and slowly.

If lubrication is to be applied to the nut/bolt, multiply the recommended torque by the appropriate factor shown in the table on page 7. Alternatively, use the Torque/Tension Calculator on the Norbar website which enables fastener and friction conditions to be modified with ease.

 M	Bolt Grade									 mm
	3.6	4.6	5.6	5.8	6.8	8.8	9.8	10.9	12.9	
	Torque in N.m									
M 1.6	0.05	0.07	0.09	0.11	0.14	0.18	0.21	0.26	0.31	3.2
M 2	0.11	0.14	0.18	0.24	0.28	0.38	0.42	0.53	0.63	4
M 2.5	0.22	0.29	0.36	0.48	0.58	0.78	0.87	1.09	1.31	5
M 3	0.38	0.51	0.63	0.84	1.01	1.35	1.52	1.9	2.27	5.5
M 4	0.71	0.95	1.19	1.59	1.91	2.54	2.86	3.57	4.29	7
M 5	1.71	2.28	2.85	3.8	4.56	6.09	6.85	8.56	10.3	8
M 6	2.94	3.92	4.91	6.54	7.85	10.5	11.8	14.7	17.7	10
M 8	7.11	9.48	11.9	15.8	19	25.3	28.4	35.5	42.7	13
M 10	14.3	19.1	23.8	31.8	38.1	50.8	57.2	71.5	85.8	17
M 12	24.4	32.6	40.7	54.3	65.1	86.9	97.7	122	147	19
M 14	39	52	65	86.6	104	139	156	195	234	22
M 16	59.9	79.9	99.8	133	160	213	240	299	359	24
M 18	82.5	110	138	183	220	293	330	413	495	27
M 20	117	156	195	260	312	416	468	585	702	30
M 22	158	211	264	352	422	563	634	792	950	32
M 24	202	270	337	449	539	719	809	1011	1213	36
M 27	298	398	497	663	795	1060	1193	1491	1789	41
M 30	405	540	675	900	1080	1440	1620	2025	2430	46
M 33	550	734	917	1223	1467	1956	2201	2751	3301	50
M 36	708	944	1180	1573	1888	2517	2832	3540	4248	55
M 39	919	1226	1532	2043	2452	3269	3678	4597	5517	60
M 42	1139	1518	1898	2530	3036	4049	4555	5693	6832	65
M 45	1425	1900	2375	3167	3800	5067	5701	7126	8551	70
M 48	1716	2288	2860	3813	4576	6101	6864	8580	10296	75
M 52	2210	2947	3684	4912	5895	7859	8842	11052	13263	80
M 56	2737	3650	4562	6083	7300	9733	10950	13687	16425	85
M 60	3404	4538	5673	7564	9076	12102	13614	17018	20422	90
M 64	4100	5466	6833	9110	10932	14576	16398	20498	24597	95
M 68	4963	6617	8271	11029	13234	17646	19851	24814	29777	100

Torque Conversion Factors

Units to be converted	S.I. Units		Imperial Units			Metric Units	
	cN.m	N.m	ozf.in	lbf.in	lbf.ft	kgf.cm	kgf.m
1 cN.m =	1	0.01	1.416	0.088	0.007	0.102	0.001
1 N.m =	100	1	141.6	8.851	0.738	10.20	0.102
1 ozf.in =	0.706	0.007	1	0.0625	0.005	0.072	0.0007
1 lbf.in =	11.3	0.113	16	1	0.083	1.152	0.0115
1 lbf.ft =	135.6	1.356	192	12	1	13.83	0.138
1 kgf.cm =	9.807	0.098	13.89	0.868	0.072	1	0.01
1 kgf.m =	980.7	9.807	1389	86.8	7.233	100	1

Force

lbf x 4.45 = N
N x 0.225 = lbf

Pressure

lbf/in² x 0.069 = bar
bar x 14.504 = lbf/in²

Flow

l/s x 2.119 = cu.ft/min
cu.ft/min x 0.472 = l/s

Power

hp x 0.746 = kW
kW = $\frac{\text{N.m} \times \text{rev/min}}{9546}$

Formulae

Accepted formulae relating torque and tension, based on many tests are:-

$$M = \frac{P \times D}{60}$$

M = torque lbf.ft
P = bolt tension lbf
D = bolt dia.ins

or for metric sizes:-

$$M = \frac{P \times D}{5000}$$

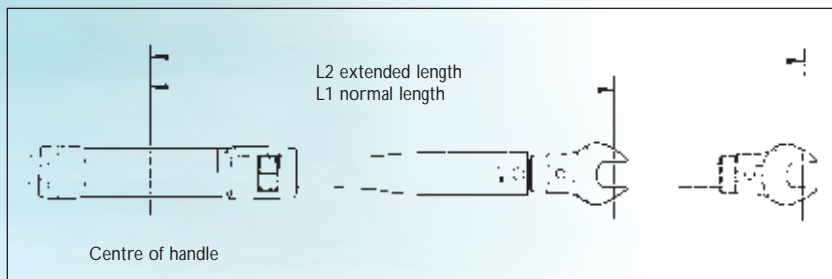
M = torque N.m
P = bolt tension Newtons
D = bolt dia. mm

These formulae may be used for bolts outside the range of the tables,

Formula for Calculating the Effect of Torque Wrench Extensions

$$M2 = M1 \times L2/L1$$

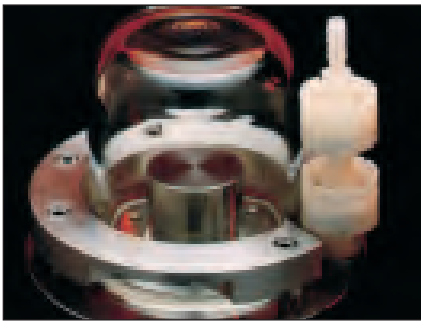
Where L1 is the normal length and L2 is the extended length, M1 is the set torque and M2 the actual torque applied to the nut.



Example

Torque setting 100 N.m
L1 = 500 L2 = 650
(units of length not important, this is a ratio)
 $M2 = 100 \times 650/500 = 130 \text{ N.m}$

Torque Wrench Traceable Calibration



Beams and Weights are traceable to International standards for length and mass

Photo courtesy of National Physical Laboratory



Production Line calibration equipment itself calibrated in Norbar's UKAS laboratory every four months.



Certificate generated on the production line during calibration



Certificate Key

1. Torque Wrench Model.
2. Torque Wrench individual serial number.
3. Torque settings to which the wrench is calibrated.
4. Upper and lower tolerance as defined by the standard stated below.
5. The actual torque readings achieved by the wrench.
6. The standard against which the wrench is being tested.
7. Details of the test equipment and calibration certificate number. This information provides the traceability to our UKAS laboratory and hence to National Standards.

Norbar Torque Tools Ltd
 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 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TruTorque™ Wrench

Models 20 N.m and 50 N.m (180 lbf.in and 35 lbf.ft)

Norbar proudly celebrates 67 years of torque wrench manufacture with the launch of our new range – TruTorque.

In engineering this new range, Norbar has paid close attention to accuracy, ease of setting and comfort in use.

Durability has been a primary development goal – both in terms of the lifetime of components and longevity of calibration accuracy. Cycle testing of wrenches at full torque was a key element of the development process and, in total, several million tightening cycles were accumulated. The result is a product that you can use with complete confidence that you have the best tool for the job.

- Accuracy: $\pm 3\%$ of reading exceeds all international standards for torque wrenches. Each wrench is supplied with a traceable calibration certificate.
- Micrometer Scale for simple and error free setting. (On dual scale wrenches, the micrometer increment applies to the N.m scale.)
- Quick and Light Adjustment: adjustment over the entire scale can quickly be achieved and with minimal effort in approximately ten complete turns (exact number varies by model).
- Adjustment Lock: all models feature a lock to prevent accidental adjustment of the set torque.
- Versatile Ratchets: the tough ratchets are reversible and have narrow engagement angles of 5° to allow easy positioning of the tool in the tight confines of today's vehicles and machines.
- Comfortable, Durable Handle: the handle is constructed using two materials: a base material for strength overlaid with a soft feel grip for comfort and slip resistance. The handle material and lens resist chemicals in common usage in the automotive, aviation and industrial environments.



Flip out lever provides lock and assists adjustment.



72 tooth reversible ratchet gives a narrow 5° engagement angle.





Ratchet Adjustables - Dual Scale

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	N.m	mm		mm	Kg
TT20	¼	13262	1 - 20	10 - 180*	0.05	30	72	230	0.4
TT20	⅜	13263	1 - 20	10 - 180*	0.05	30	72	230	0.4
TT50	⅝	13264	8 - 50	6 - 35	0.1	30	72	278	0.5
TT50	¾	13265	8 - 50	6 - 35	0.1	30	72	278	0.5

* lbf.in

Ratchet Adjustables - N.m only

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	N.m	mm		mm	Kg
TT20 N.m	¼	13250	1 - 20	N/A	0.05	30	72	230	0.4
TT20 N.m	⅜	13251	1 - 20	N/A	0.05	30	72	230	0.4
TT50 N.m	⅝	13252	8 - 50	N/A	0.1	30	72	278	0.5
TT50 N.m	¾	13253	8 - 50	N/A	0.1	30	72	278	0.5

Ratchet Adjustables - lbf.ft only

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		lbf.in	lbf.ft	lbf.ft	mm		mm	Kg
TT15 ft.lb	¼	13274	10 - 180	N/A	0.5*	30	72	230	0.4
TT15 ft.lb	⅜	13275	10 - 180	N/A	0.5*	30	72	230	0.4
TT35 ft.lb	⅝	13276	N/A	6 - 35	0.1	30	72	278	0.5
TT35 ft.lb	¾	13277	N/A	6 - 35	0.1	30	72	278	0.5

* lbf.in

TruTorque™ Wrench

Models 100 N.m to 300 N.m (75 lbf.ft to 250 lbf.ft)

Norbar proudly celebrates 67 years of torque wrench manufacture with the launch of our new range – TruTorque.

In engineering this new range, Norbar has paid close attention to accuracy, ease of setting and comfort in use.

Durability has been a primary development goal – both in terms of the lifetime of components and longevity of calibration accuracy. Cycle testing of wrenches at full torque was a key element of the development process and, in total, several million tightening cycles were accumulated. The result is a product that you can use with complete confidence that you have the best tool for the job.

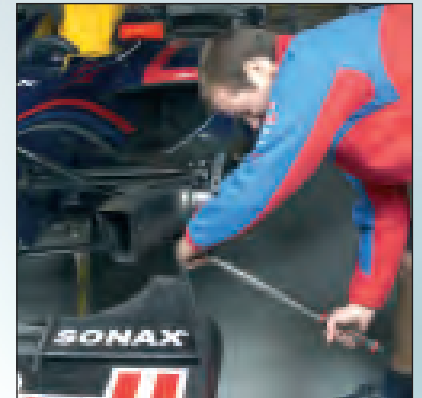
- Accuracy: $\pm 3\%$ of reading exceeds all international standards for torque wrenches. Each wrench is supplied with a traceable calibration certificate.
- Micrometer Scale for simple and error free setting. (On dual scale wrenches, the micrometer increment applies to the N.m scale.)
- Quick and Light Adjustment: adjustment over the entire scale can quickly be achieved and with minimal effort in approximately ten complete turns (exact number varies by model).
- Adjustment Lock: all models feature a lock to prevent accidental adjustment of the set torque.
- Versatile Ratchets: the tough ratchets are reversible and a narrow engagement angle of 6° to allow easy positioning of the tool in the tight confines of today's vehicles and machines.
- Bi-directional Torque: the ratchets are also 'push through' meaning that these wrenches will provide torque control in both the clockwise and anticlockwise directions.
- Comfortable, Durable Handle: the handle is constructed using two materials: a base material for strength overlaid with a soft feel grip for comfort and slip resistance. The handle material and lens resist chemicals in common usage in the automotive, aviation and industrial environments.



TruTorque is available with either dual scale (N.m and lbf.ft) or single scale (N.m or lbf.ft)

Adjustment is achieved by rotating the end knob. The centre ring provides the lock feature.





Ratchet Adjustables - Dual Scale

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	N.m	mm		mm	Kg
TT100	$\frac{3}{8}$	13266	20 – 100	15 - 75	0.5	38	60	405	1.0
TT100	$\frac{1}{2}$	13267	20 – 100	15 - 75	0.5	38	60	405	1.0
TT150	$\frac{1}{2}$	13268	30 – 150	20 - 110	0.5	38	60	455	1.1
TT200	$\frac{1}{2}$	13269	40 – 200	30 - 150	1.0	46	60	505	1.2
TT250	$\frac{1}{2}$	13270	50 – 250	40 - 185	1.0	46	60	560	1.4
TT300	$\frac{1}{2}$	13271	60 – 300	45 - 220	1.0	46	60	610	1.6

Ratchet Adjustables - N.m only

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	N.m	mm		mm	Kg
TT100 N.m	$\frac{3}{8}$	13254	20 – 100	N/A	0.5	38	60	405	1.0
TT100 N.m	$\frac{1}{2}$	13255	20 – 100	N/A	0.5	38	60	405	1.0
TT150 N.m	$\frac{1}{2}$	13256	30 – 150	N/A	0.5	38	60	455	1.1
TT200 N.m	$\frac{1}{2}$	13257	40 – 200	N/A	1.0	46	60	505	1.2
TT250 N.m	$\frac{1}{2}$	13258	50 – 250	N/A	1.0	46	60	560	1.4
TT300 N.m	$\frac{1}{2}$	13259	60 – 300	N/A	1.0	46	60	610	1.6

Ratchet Adjustables - lbf.ft only

Model	Square Drive	Part No.	Range		Resolution	Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	lbf.ft	mm		mm	Kg
TT75 ft.lb	$\frac{3}{8}$	13278	N/A	15 - 75	0.5	38	60	405	1.0
TT75 ft.lb	$\frac{1}{2}$	13279	N/A	15 - 75	0.5	38	60	405	1.0
TT110 ft.lb	$\frac{1}{2}$	13280	N/A	20 - 110	0.5	38	60	455	1.1
TT150 ft.lb	$\frac{1}{2}$	13281	N/A	30 - 150	1.0	46	60	505	1.2
TT185 ft.lb	$\frac{1}{2}$	13282	N/A	40 - 185	1.0	46	60	560	1.4
TT220 ft.lb	$\frac{1}{2}$	13283	N/A	45 - 220	1.0	46	60	610	1.6
TT250 ft.lb	$\frac{1}{2}$	13284	N/A	50 - 250	1.0	46	60	610	1.6

Professional Torque Wrench Model 5

The Model 5 is a torque wrench that offers high accuracy and the convenience of interchangeable 1/4 in. hexagon bits. (ISO 1173:1988 Form C drive bits).

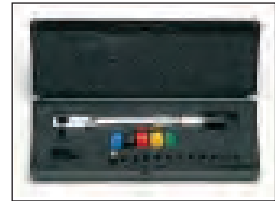
- Accuracy of $\pm 3\%$ of reading exceeds all torque wrench standards.
- Traceable calibration certificate supplied, to satisfy ISO9000:2000 quality systems.
- Non Length dependent. The Model 5 remains accurate regardless of hand position.
- Supplied in a storage case. The case allows space for the storage of additional drive bits and optional stepless ratchet.



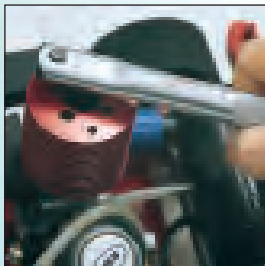
Production 'P' Types

The 'P' type version prevents unauthorised alteration of torque setting. No external calibration equipment is required to set the Model 5 'P' Type.

Coloured end seals are provided to identify the wrench to a particular operator, torque setting or calibration period.



Model 5 'P' Type



Adjustable Torque Wrenches

Model	Units	Square Drive	Part No.	Range	Length	Weight
		in			mm	
5	N.m	3/4	13001	1-5 N.m	170	0.12
5	lbf.in	3/4	13002	10-50 lbf.in	170	0.12
5	kgf.cm	3/4	13003	10-50 kgf.cm	170	0.12



Optional stepless ratchet (Part No. 13122)

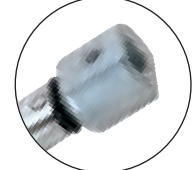
'P' Type Torque Wrenches

Model	Units	Square Drive	Part No.	Range	Length	Weight
		in			mm	
5 'P'	N.m	3/4	13004	1-5 N.m	154	0.12
5 'P'	lbf.in	3/4	13005	10-50 lbf.in	154	0.12
5 'P'	kgf.cm	3/4	13006	10-50 kgf.cm	154	0.12

Professional Torque Wrench

The 'Professional' is Norbar's core torque wrench range containing the most popular models and the most model variants to suit almost every application.

More than 60 years of torque wrench manufacture has shaped this range and no aspect of design, manufacture or materials is taken to chance. Every new product and design change is rigorously tested before introduction, a process that makes these wrenches amongst the most durable and accurate on the market.



Ratchets

The Professional torque wrench is available with a choice of ratchets and as a 'Torque Handle' for interchangeable fittings.

Torque Scale

Unique 'harmonic drive' scale mechanism allows a long scale length and therefore accurate and error free setting.



Torque Mechanism

Norbar's accurate mechanism has been developed and enhanced over a 40 year period and several million examples have been produced. Less parts to maintain than 'pivot block' mechanisms. Simple calibration adjustments without disassembly.

Adjustment Lock

A robust lock prevents accidental adjustment of the wrench during use. Fingertip light adjustment comes from the best design and materials.

Norbar 5 station tester is used for durability and benchmark testing.



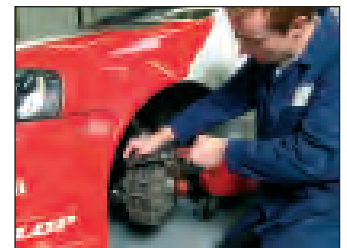
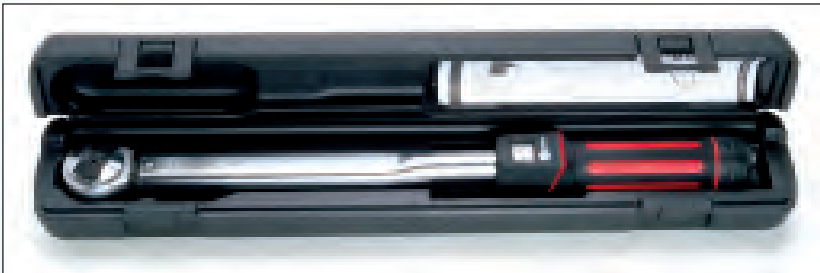


Professional Torque Wrench 'Automotive' Ratchet Models

The Professional torque wrench offers an ideal combination of accuracy, robust construction, comfort and ease of use.

The reversible ratchets on these models are designed with compact dimensions and a narrow engagement angle resulting from the 72 tooth pattern. These features make the wrench ideal for use in the confined spaces of modern motor vehicles and many other applications.

- Accuracy of $\pm 3\%$ of reading exceeds all international standards for torque wrenches.
- Every wrench is supplied with a calibration certificate to satisfy the requirements of ISO 9000:2000.
- Soft feel handle provides excellent grip even in oily conditions.
- Handle material and lens resist all chemicals in common automotive, industrial and aviation use.
- Locking mechanism prevents accidental adjustment of the wrench during operation.
- Long scale graduated in N.m and lbf.ft allows for foolproof and accurate setting.
- Supplied in moulded box for storage and protection.



Ratchet Adjustables - Automotive Ratchet

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	mm		mm	Kg
60	$\frac{3}{8}$	13010	8 – 60	5 – 45	31	72	307	0.6
60	$\frac{1}{2}$	13011	8 – 60	5 – 45	31	72	307	0.6
100	$\frac{3}{8}$	13012	20 – 100	15 – 80	31	72	347	0.7
100	$\frac{1}{2}$	13013	20 – 100	15 – 80	31	72	347	0.7
200	$\frac{1}{2}$	13014	40 – 200	30 – 150	41	72	443	1.0

Professional Torque Wrench 'Industrial' Ratchet Models

These wrenches offer the same outstanding features as those on the previous page but with a wider model range – up to 400 N.m – and a different ratchet concept.

The push-through ratchets on these models are robustly engineered for strength and durability. The strength and high wear resistance comes from the design of the tooth pattern while a principle of offset ratchet pawls gives a narrow engagement angle.

The push through square drive is not only a robust design but allows the wrench to be used for torque control in both the clockwise and anti clockwise directions. Please note that the 3/4" square drive of the Model 400 has to be removed and re-inserted on the other side of the ratchet head rather than pushed through.



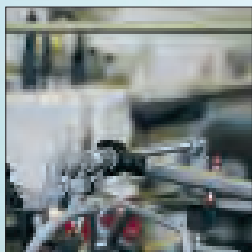
Ratchet Adjustables - Industrial Ratchet

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	mm		mm	Kg
60	$\frac{3}{8}$	13042	8 – 60	5 – 45	35	72	312	0.66
60	$\frac{1}{2}$	13043	8 – 60	5 – 45	40	72	320	0.74
100	$\frac{3}{8}$	13044	20 – 100	15 – 80	35	72	353	0.73
100	$\frac{1}{2}$	13045	20 – 100	15 – 80	40	72	359	0.80
200	$\frac{1}{2}$	13046	40 - 200	30 – 150	42	72	442	1.01
300	$\frac{1}{2}$	13047	60 - 300	45 – 220	49	60	570	1.38
330	$\frac{1}{2}$	13049	60 - 330	45 – 250	49	60	683	1.50
400	$\frac{3}{4}$	13050	80 - 400	60 – 300	49	60	683	2.09



Adjustable - 16mm Spigot

Model	Part No.	Range		Length	Weight
		N.m	lbf.ft	mm	Kg
60 TH	13018	8 – 60	5 – 45	301	0.55
100 TH	13019	20 – 100	15 – 80	340	0.6
200 TH	13020	40 – 200	30 – 150	423	0.78
300 TH	13021	60 – 300	45 – 220	548	1.13



Female Ended Adjustable - 9 x 12mm and 14 x 18mm

Model	Part No.		Range		Length	Weight
	9x12	14x18	N.m	lbf.ft	mm	Kg
60 TH	13022	-	8 – 60	5 – 45	300	0.55
100 TH	13023	-	20 - 100	15 – 80	340	0.6
200 TH	13024	13025	40 – 200	30 – 150	421/431	0.78
300 TH	-	13026	60 – 300	45 – 220	546.5	1.13
400 TH	-	13028	80 – 400	60 – 300	658	1.78

Professional Torque Wrench Torque Handles

Norbar Torque Handles are based on the 'Professional' wrench range and share the same high precision engineering.

Two end fitting styles are catered for: 16mm diameter spigot type and the 9 x 12mm and 14 x 18mm rectangular type.

For many applications a spanner end fitting rather than a socket is the best or, often, the only solution. Typically this will be because the joint is a pipe union (such as a brake pipe).

Production 'P' Type - 16mm Spigot

Model	Part No.	Range		Length	Weight
		N.m	lbf.ft	mm	Kg
60 THP	11167	8 – 60	5 – 45	280	0.55
100 THP	11143	10 – 100	8 – 80	320	0.6
200 THP	11144	20 – 200	15 – 150	402	0.78
300 THP	11117	30 – 300	22 – 220	640	1.13

Female Ended Production 'P' Type - 9 x 12mm & 14 x 18mm

Model	Part No.		Range		Length	Weight
	9x12	14x18	N.m	lbf.ft	mm	Kg
60 THP	11170	-	8 – 60	5 – 45	280	0.55
100 THP	11150	-	10 - 100	8 – 80	319	0.6
200 THP	11151	11152	20 – 200	15 – 150	400/410	0.78
300 THP	-	11153	30 – 300	22 – 220	528	1.13
400 THP	-	13068	40 – 400	30 – 300	640	1.75

Available Fittings

See pages 28 & 29





End Cap Kit and Locking Tool
Part No. 11698



'P' Type wrenches have no scale. They must be set against a torque testing device such as Norbar's Professional Torque Tester (see page 68).



Professional Torque Wrench Production 'P' Types

'P' Type wrenches are designed for the production environment where they will be set and then dedicated to a particular application. There is no scale, the wrench must be set against a torque testing device such as Norbar's Professional Torque Tester (see page 68).

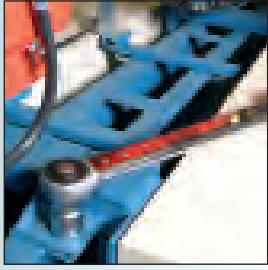
'P' Type wrenches are available with two ratchet types – 'Industrial' and 'Automotive' (see explanation on pages 18 and 19) and as 'Torque Handles' for interchangeable end fittings.

Ratchet Torque Wrench Production 'P' Type - Automotive Ratchet

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	mm		mm	Kg
60 'P'	$\frac{3}{8}$	11164	8 – 60	5 – 45	31	72	286	0.6
60 'P'	$\frac{1}{2}$	11171	8 – 60	5 – 45	31	72	286	0.6
100 'P'	$\frac{3}{8}$	11138	10 – 100	8 – 80	31	72	326	0.69
100 'P'	$\frac{1}{2}$	11139	10 – 100	8 – 80	31	72	326	0.69
200 'P'	$\frac{1}{2}$	11140	20 - 200	15 – 150	41	72	423	1.0

Ratchet Torque Wrench Production 'P' Type - Industrial Ratchet

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.ft	mm		mm	Kg
60 'P'	$\frac{3}{8}$	13051	8 – 60	5 – 45	35	72	291	0.62
60 'P'	$\frac{1}{2}$	13052	8 – 60	5 – 45	40	72	299	0.69
100 'P'	$\frac{3}{8}$	13053	10 – 100	8 – 80	35	72	332	0.68
100 'P'	$\frac{1}{2}$	13054	10 – 100	8 – 80	40	72	338	0.74
200 'P'	$\frac{1}{2}$	13055	20 - 200	15 - 150	42	72	422	0.96
300 'P'	$\frac{1}{2}$	13057	30 – 300	22 – 220	49	60	663	1.45
400 'P'	$\frac{3}{4}$	13056	40 – 400	30 - 300	49	60	663	2.04



Professional Torque Wrench Models 550 - 1500

- Accuracy of $\pm 3\%$ of reading.
- Traceable calibration certificate supplied.
- Non length dependent. Extension handle can be used to reduce operator effort (handle supplied as standard with Model 800, 1000 and 1500).
- Positive 'click' can be heard, seen and felt.
- Low weight - Model 1000 just 5.8kg.
- Long scale length in N.m and lbf.ft allows error free setting.
- Fine 60 tooth ratchet allows the wrench to be used in confined areas.
- Supplied in carry case for storage and protection.

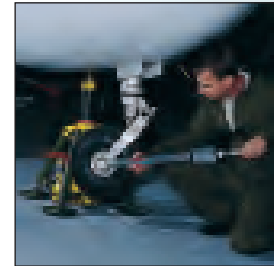


Extension Handle Part No. 14142 - supplied as standard with Models 800 to 1500

Ratchet Adjustables

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Length inc ext handle	Weight*
	in		N.m	lbf.ft	mm		mm	mm	Kg
550	$\frac{3}{4}$	14001	110 – 550	80 – 400	61	60	845	-	4.0
800	$\frac{3}{4}$	14015	200 – 800	150 – 600	75	60	1035	1535	5.2
800	1	14016	200 – 800	150 – 600	75	60	1035	1535	5.2
1000	$\frac{3}{4}$	14002	300 – 1000	220 – 750	75	60	1250	1750	5.8
1000	1	14003	300 – 1000	220 – 750	75	60	1250	1750	5.8
1500	$\frac{3}{4}$	14004	500 – 1500	370 – 1100	75	60	1570	2070	6.7
1500	1	14005	500 – 1500	370 – 1100	75	60	1570	2070	6.7

* Weight excluding extension handle. Extension handle, length 700 mm, weight 1.6 kg



Adjustable Torque Handles

Model	End Fitting	Part No.	Range		Length	Weight
			N.m	lbf.ft	mm	Kg
550 TH	14x18mm Female	14011	110 – 550	80 – 400	790	3.6
550 TH	22mm Male	14012	110 – 550	80 – 400	780	3.6

Available Fittings

See page 29



Torque Handles Production 'P' Type

Model	End Fitting	Part No.	Range		Length	Weight
			N.m	lbf.ft	mm	Kg
550 THP	14x18mm Female	14013	110 – 550	80 – 400	790	3.6
550 THP	22mm Male	14014	110 – 550	80 – 400	780	3.6



End Cap Kit and Locking Tool
Part No. 14166

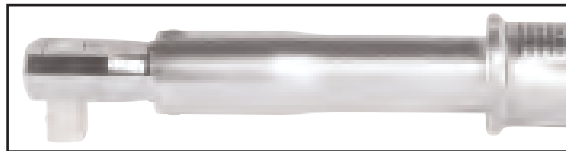
Ratchet Torque Wrench Production 'P' Type

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Length inc ext handle	Weight*
	in		N.m	lbf.ft	mm		mm	mm	Kg
550 'P'	$\frac{3}{8}$	14006	110 – 550	80 – 400	61	60	845	-	4.0
800 'P'	$\frac{3}{8}$	14017	200 – 800	150 – 600	75	60	1035	1535	5.2
800 'P'	1	14018	200 – 800	150 – 600	75	60	1035	1535	5.2
1000 'P'	$\frac{3}{8}$	14007	300 – 1000	220 – 750	75	60	1250	1750	5.8
1000 'P'	1	14008	300 – 1000	220 – 750	75	60	1250	1750	5.8
1500 'P'	$\frac{3}{8}$	14009	500 – 1500	370 – 1100	75	60	1570	2070	6.7
1500 'P'	1	14010	500 – 1500	370 – 1100	75	60	1570	2070	6.7

* Weight excluding extension handle. Extension handle, length 700 mm, weight 1.6 kg

Slimline™ Torque Wrench Model SLO

- Accuracy exceeds all international standards.
- Unmistakable signal when set torque is reached.
- Traceable calibration certificate supplied to satisfy ISO 9000:2000 quality systems.
- High quality 72 tooth ratchet allows use in confined spaces.
- Fixed head version has a push through square for left and right handed torque tightening.
- Moulded grip aids correct handle location and operator comfort.



Fixed Head

Adjustable Wrenches - Ratchet and Fixed Head

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.in	mm		mm	Kg
SLO	¼	11037	1-20	10 - 180	29	72	218	0.4
SLO	⅜	11034	1-20	10 - 180	29	72	218	0.4
SLO Fixed	⅜	11035	1-20	10 - 180	-	-	211	0.4
SLO	½	11123	4-20	40 - 180	29	72	220	0.4
SLO	¾	11087	4-20	40 - 180	29	72	220	0.4
SLO Fixed	¾	11125	4-20	40 - 180	-	-	213	0.4

Slimline™ Torque Wrench Model SLO

- Torque Handle versions are available for both 16mm spigot and 9 x 12mm fittings.
- Production 'P' type versions are designed to discourage unauthorised alteration.
- 'P' Type versions have no scale. These wrenches must be set against a torque testing device such as Norbar's Professional Torque Tester (see page 68).

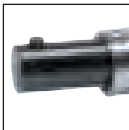


Adjustable Torque Handles

Model	End Fitting	Part No.	Range		Length	Weight
			N.m	lbf.in	mm	Kg
SLO TH	16mm Spigot	11036	1-20	10 – 180	207	0.4
SLO TH	16mm Spigot	11126	4-20	40 – 180	210	0.4
SLO TH	9x12mm Female	11122	4-20	40 – 180	205	0.4

Torque Handles Production 'P' Types

Model	End Fitting	Part No.	Range		Length	Weight
			N.m	lbf.in	mm	Kg
SLO THP	16mm Spigot	11090	1-20	10 – 180	207	0.4
SLO THP	9x12mm Female	11088	1-20	10 – 180	203	0.4



16mm Spigot



9x12mm Female

Available Fittings

See pages 28 & 29



Fixed Head



Ratchet Head

Ratchet and Fixed Head - Production 'P' Types

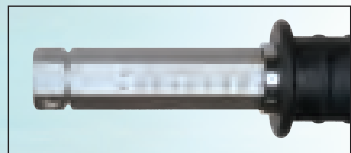
Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length	Weight
	in		N.m	lbf.in	mm		mm	Kg
SLO 'P'	1/4	11085	1-20	10 - 180	29	72	218	0.4
SLO 'P'	3/8	11086	1-20	10 - 180	29	72	218	0.4
SLO Fixed	3/8	11089	1-20	10 - 180	-	-	211	0.4

Industrial Torque Wrench Adjustable Models

- Robust construction gives accurate results, to $\pm 4\%$, even in arduous working conditions.
- Every wrench supplied with a calibration certificate to satisfy requirements of ISO 9000:2000.
- The large break angle improves accuracy by reducing the possibility of over torquing.
- Cam control of the mechanism gives a controlled break which will not throw the operator off balance.
- Dual scaled, N.m and lbf.ft.
- Supplied in a carry case for storage and protection.
- If storage space is limited, for example in vehicle tool kits, models 4R to 5R can be supplied in two piece form where the longer of the pieces is 900mm.



Carry case standard (except 4 TH and 4 THP)



Adjusting Scale



Ratchet Adjustables

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length †	Weight
	in*		N.m	lbf.ft	mm		mm	Kg
3AR	$\frac{3}{8}$	12001	100 – 500	70 – 350	70	36	910	5.2
4R	$\frac{3}{8}$	12006	150 – 700	100 – 500	70	36	1150	6.3
4AR	$\frac{3}{8}$	12007	200 – 800	150 – 600	70	36	1250	6.4
5R	$\frac{3}{8}$	12009	300 – 1000	200 – 750	70	36	1475	7.3
5AR	$\frac{3}{8}$	12012	700 – 1500	500 – 1000	70	36	1475	10.4

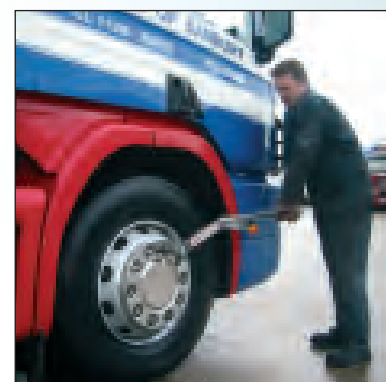
* $1"$ square drive versions are also available. Part No. becomes 12001.01 etc

† Length with adjusting nut set to minimum torque.

Industrial Torque Wrench

Torque Handles and Production 'P' Type Models

- Robust construction gives accurate results, to $\pm 4\%$, even in arduous working conditions.
- Every adjustable wrench supplied with a calibration certificate to satisfy requirements of ISO 9000:2000.
- 'P' Type Wrenches can be set by the factory or distributor on request. Part code SQ2222.
- The break angle improves accuracy by reducing the possibility of over torquing.
- All models listed are also available as Production 'P' types with no setting scale. These must be set against a torque testing device such as Norbar's Professional Torque Tester. See page 68.
- Supplied in a carry case for storage and protection (except 4TH and 4THP).



Adjustable and Production 'P' Type Torque Handles

Model	End Fitting	Part No.	Range		Length †	Weight
			N.m	lbf.ft		
4 TH	22mm Spigot	12003	130 - 550	100 - 400	935	4.6
4 THP	22mm Spigot	12017	130 - 550	100 - 400	835	4.6

† Length with adjusting nut set to minimum torque.

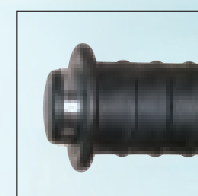
Available Fittings

See page 29



Ratchet Torque Wrench Production 'P' Type

Model	Square Drive	Part No.	Range		Ratchet Diameter	Engagements per revolution	Length †	Weight
	in*		N.m	lbf.ft				
3AR	3/4	12015	100 - 500	70 - 350	70	36	810	5.2
4R	3/4	12020	150 - 700	100 - 500	70	36	1050	6.3
5R	3/4	12023	300 - 1000	200 - 750	70	36	1385	7.3
5AR	3/4	12002	700 - 1500	500 - 1000	70	36	1385	10.4



'P' Type - Sealed Adjustment

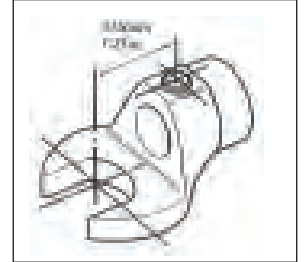
* 1" square drive versions are also available. Part No. becomes 12023.01 etc

† Length with adjusting nut set to minimum torque.

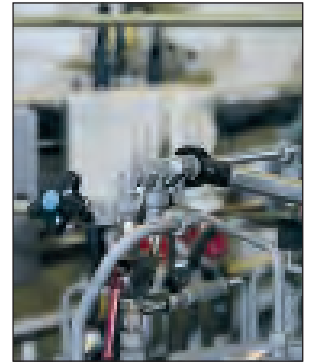
Torque Handle Fittings - Fittings for 16mm Spigot

A/F Size mm	Open Ends		Ring Ends		Flare Ends	
	Part No.	Max Torque* (N.m)	Part No.	Max Torque* (N.m)	Part No.	Max Torque* (N.m)
7	29841	9	29881	25	29921	4
8	29842	13	29882	35	29922	7
9	29843	19	29883	45	29923	9
10	29844	25	29884	52	29924	12
11	29845	32	29885	73	29925	16
12	29846	41	29886	89	29926	25
13	29847	51	29887	107	29927	28
14	29848	63	29888	128	29928	31
15	29849	77	29889	150	29929	38
16	29850	92	29890	175	29930	46
17	29851	107	29891	201	29931	53
18	29876	128	29913	230	29953	65
19	29877	149	29914	261	29954	74
20	29852	172	29892	294	29932	86
21	29853	198	29893	330	29933	100
22	29854	225	29894	330	29934	112
23	29855	255	29895	330	29935	123
24	29856	287	29896	330	29936	143
25	29857	322	29897	330	-	-
26	29858	330	29898	330	-	-
27	29878	330	29915	330	29955	150
30	29861	330	29901	330	29941	200
32	29863	330	29903	330	29943	200
Imperial - in						
¼	29701	7	29726	25	-	-
⅜	29702	13	29727	35	29752	7
½	29703	21	29728	42	29753	9
⅝	29704	32	29729	73	29754	15
¾	29705	48	29730	115	29755	23
⅞	29706	67	29731	170	29756	32
1	29707	90	29732	226	29757	44
1 ⅛	29708	118	29733	260	29758	58
1 ¼	29709	150	29734	305	29759	74
1 ⅝	29710	187	29735	330	29760	93
1 ¾	29711	230	29736	330	29761	114
1 ⅞	29712	281	29737	330	29762	140
2	29713	330	29738	330	29763	166
2 ⅛	29714	330	29739	330	29764	166
2 ¼	29715	330	29740	330	-	-
2 ⅝	29716	330	29741	330	-	-
2 ¾	29717	330	29742	330	-	-
2 ⅞	29718	330	29743	330	-	-
3	S1921	330	-	-	-	-

*Max torque values listed are proof torques quoted in BS 192:1982 & BS 3555:1988 (tested on hardened hexagon test stud).




Where the distance between centres differs from 1.25 in (31.8mm) the torque applied will not be as set on the wrench (see page 10)



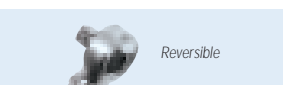

Torque Handle Fittings

Fittings for 16mm Spigot



Square Drive	Part No.	Diameter	
in		mm	in
$\frac{3}{8}$	29828	19	0.75
$\frac{1}{2}$	29827	25	1.0

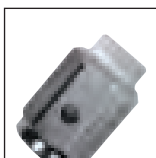
Ratchet Heads

Square Drive	Part No.	Diameter		No. Teeth	Ratchet Type
in		mm	in		
$\frac{3}{8}$	29826	34	1.3	36	Push Through
$\frac{3}{8}$	29829	30.5	1.2	72	Reversible
$\frac{1}{2}$	29825	40	1.6	72	Push Through
$\frac{1}{2}$	29830	40	1.6	72	Reversible

Accessories for 16mm Spigot

Part No.	Description
29832	Blank End Fitting for In-line Open End
85242	Blank End Fitting for Open End
11343	Blank End Fitting for Ring End
72000	Spigot Adaptor 16mm to 22mm



Part No. 29832



Part No. 85242



Part No. 11343



Part No. 72000

Fittings for 22mm Spigot

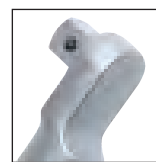
Spanner End Fittings



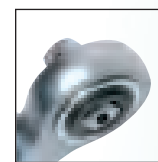

A/F Size mm	Open End Part No.	Ring End Part No.
22	29963.22	29960.22
24	29963.24	29960.24
27	29963.27	29960.27
30	29963.30	29960.30
32	29963.32	29960.32
36	29963.36	29960.36
41	29963.41	29960.41
46	29963.46	29960.46
Imperial - in		
$1\frac{1}{8}$	-	29962.18
$1\frac{3}{8}$	-	29962.19
$1\frac{1}{4}$	-	29962.20
$1\frac{5}{8}$	-	29962.21
$1\frac{7}{8}$	29964.23	-
$1\frac{1}{2}$	29964.24	-

Accessories for 22mm Spigot

Part No.	Description
29969	$\frac{3}{4}$ " Fixed Head
29972	$\frac{3}{4}$ " Ratchet
85719	Blank End Fitting for Open End
85720	Blank End Fitting for Ring End



Part No. 29969



Part No. 29972



Part No. 85719



Part No. 85720

Torque Angle Protractor

A widely accepted method of obtaining more consistent bolt loads involves tightening the fastener to a bedding torque followed by a further specified angle. Norbar's Torque Angle Protractor can be fitted to a ½" square drive torque wrench and allows this torque / angle method to be easily achieved.

Part no: 29975



Ratchet Repair Kits and Square Drives

Ratchet Repair Kits

Part No.	Square Drive	Description	No. of Teeth*	To Suit Torque Wrench
	in			
13407	⅜	Reversible/Push Through	60	TruTorque 100 N.m, 75 lbf.ft
13409	½	Reversible/Push Through	60	TruTorque 100/150 N.m, 75/110 lbf.ft
13408	½	Reversible/Push Through	60	TruTorque 200 - 300 N.m, 150 - 250 lbf.ft
11598	⅜	'Automotive Ratchet' - Beta Reversible	72	Model 60 & 100
13212	⅜	'Industrial Ratchet' - Push Through	24	Model 60 & 100
11618	½	'Automotive Ratchet' - Beta Reversible	72	Model 60 & 100
13213	½	'Industrial Ratchet' - Push Through	24	Model 60 & 100
11622	½	'Automotive Ratchet' - Beta Reversible	72	Model 200 & 300
11623	½	'Automotive Ratchet' - Beta Push Through	72	Model 200 & 300
13214	½	'Industrial Ratchet' - Push Through	24	Model 200
13215	½	'Industrial Ratchet' - Push Through	30	Model 300 & 330 (13047, 13049 & 13057)
13216	¾	'Industrial Ratchet' - Push Through	30	Model 400 (13050 & 13056)
11691	½	Push Through	24	Model 330
14195	¾	Push Through	60	Model 550
14196	¾	Push Through	60	Model 800 - 1500
14197	1	Push Through	60	Model 800 - 1500
11811	¼	Reversible	72	SL0
11812	⅜	Reversible	72	SL0
11801	⅜	Push Through	24	SL1
11905	½	Narrow (13mm) - Push Through	24	SL1 & SL2
11906	½	Wide (19mm) - Push Through	24	SL3
12307	-	Does not include square drive 12297	36	Industrial

* Please count the teeth in the ratchet annulus. Please note: this does not always correspond with the number of 'clicks' per revolution.

Square Drive Assemblies

Part No.	Square Drive	To Suit Torque Wrench
	in	
11914	⅜	SL0 Fixed Head
11941	⅜	SL1
29682	½ to ⅜	SL1
29684	½	SL1 and SL2
29683	½	SL3
12297	¾	Industrials and Professional Model 550
12299	1	Industrials and Professional Model 550
14157	¾	Professionals Models 800 - 1500
14165	1	Professionals Models 800 - 1500

Electrode Wrenches

The correct tightening of carbon/graphite electrodes is known to increase the energy efficiency of electric arc furnaces and prevents electrode sections from being lost in the furnace.

Norbar Electrode Wrenches are based on two well proven torque wrench designs: electrodes up to 8 inches use the 'Professional' type, 9 inches and upwards are based on the 'Industrial' wrench.

- Positive torque control increases energy efficiency.
- Self-clamping action speeds the tightening operation.
- Unmistakable signal when the set torque is reached.
- A wide range of electrode sizes, 8 to 24 inches, can be tightened.



200mm to 300mm Electrodes

Diameter		Part No.	Max Torque		Length	Torque Radius	Weight
mm	in		N.m	lbf.ft			
200	8	12506	312	230	928	723	3.2
250	10	12530	542	400	1140	890	6.8
300	12	12531	780	575	1280	990	8.4

350mm to 600mm Electrodes - High Range Torques

Diameter		Part No.	Max Torque		Length	Torque Radius	Weight
mm	in		N.m	lbf.ft			
350	14	12532	1140	840	1767	1451	13.8
400	16	12533	1300	950	1810	1480	14.3
450	18	12535	1500	1110	1720	1355	16.5
500	20	12536	2000	1475	2200	1805	20
550	22	12537	2370	1750	2555	2135	25.4
600	24	12538	2370	1750	2590	2135	26.1
600.HD	24	12538.HD	3200	2360	3335	2880	31.7



Handtorque™ Multipliers

What is a Torque Multiplier?

A torque multiplier is a device that increases the torque that can be applied by an operator. Because the power output can not exceed the power input, the number of output revolutions will be lower than the number of input revolutions ($\text{Torque} \times \text{rpm} = \text{Power}$).

How Handtorque Torque Multipliers Work

Handtorque multipliers incorporate an 'epicyclic' or 'planetary' gear train having one or more stages. Each stage of gearing increases the torque applied by a factor of 5, allowing Norbar to offer multipliers typically in ratios of 5:1, 25:1 and 125:1.

In the planetary gear system, torque is applied to the input gear or 'sun' gear. Three or four planet gears whose teeth are engaged with the sun gear therefore rotate. The outside casing of the multiplier, or 'annulus' is also engaged with the planet gear teeth, and would normally rotate in the opposite direction to the sun gear. A reaction arm prevents the annulus from rotating, and this causes the planet gears to orbit around the sun. The planet gears are held in a 'planetary' carrier which also holds the output square drive. Therefore as the planet gears orbit around the sun gear, the carrier and so the square drive turns.

Without the reaction arm to keep the annulus stationary, the output square will not apply torque.

Why use a Handtorque Torque Multiplier?

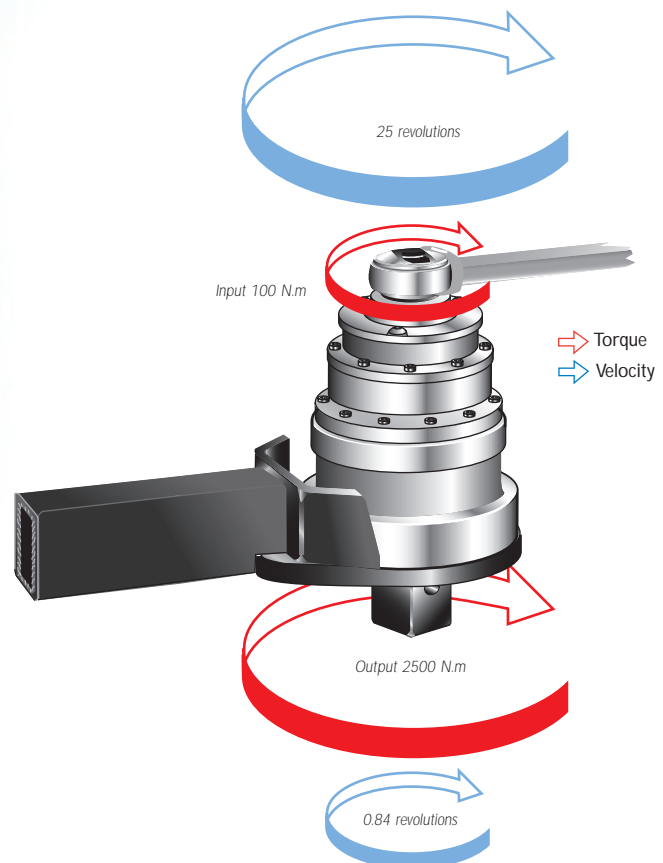
- **Safety** – use of long levers can be dangerous. Torque multipliers mean a reduction in the lever length or operator effort by a factor of 5, 25 or 125.
- **Space limitation** – the use of a long lever may be impossible due to the available space.
- **Accuracy** – torque will be applied most accurately when it is applied smoothly and slowly. Torque multipliers enable this by removing much of the physical effort from the tightening task.



Without a torque multiplier



With a torque multiplier



Advantages of the Norbar Handtorque System

Norbar gearboxes are built to an extremely high standard of precision. All gears rotate on needle roller bearings about hardened and ground journal pins. As a result, Norbar Handtorques can be relied upon to have a torque multiplication accuracy of $\pm 4\%$, throughout the operating range, taking the uncertainty out of high torque tightening.

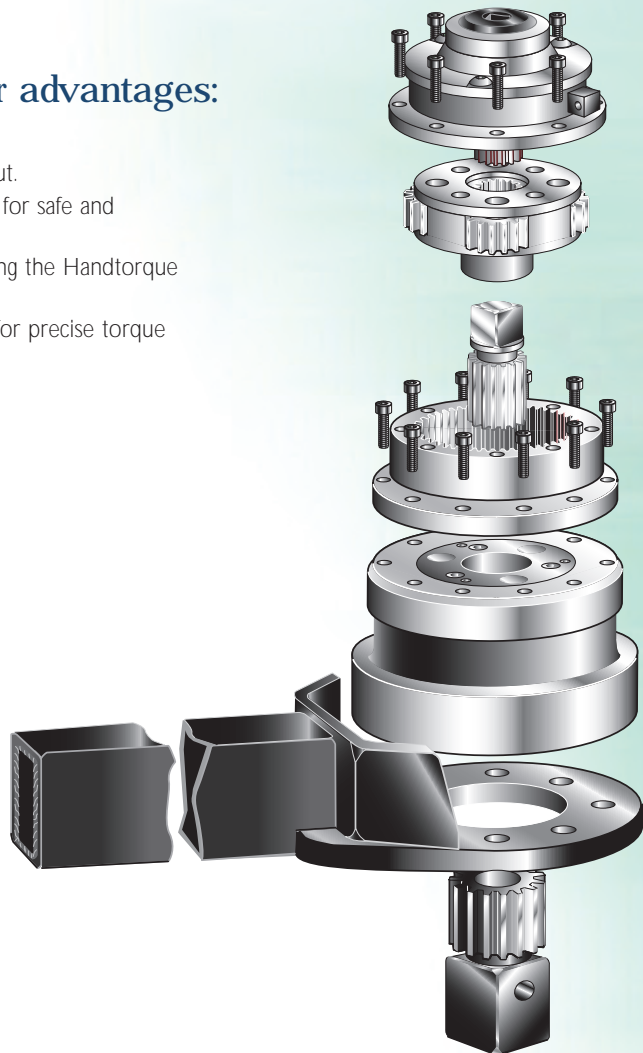
No gearbox is 100% efficient and so the velocity ratio (the number of turns that the input has to make to achieve one revolution of the output) is not the same as the torque multiplication ratio. Norbar multipliers are engineered such that each gear stage has a velocity ratio of typically 5.45:1 which results in a true torque multiplication factor of 5:1.

Torque output calculations are therefore a matter of simple arithmetic with little risk of incorrect bolt loading due to conversion errors. Other manufacturer's multipliers often require graphs or formulae to calculate the input torque to achieve a particular output.

The Norbar Handtorque is the most comprehensive multiplier range available. Standard products are available up to 47,500 N.m (35,000 lbf.ft) and 'specials' to 100,000 N.m (73,000 lbf.ft). A range of 'nose extensions' for reaching difficult to access bolts and a full range of torque transducers for highly accurate torque monitoring are available.

Summary of Norbar torque multiplier advantages:

- The ratio stated is the true torque multiplication factor.
- No correction charts are needed to determine torque output.
- Strong, safe Anti Wind-Up Ratchet available on most models for safe and comfortable operation.
- A wide range of alternative reaction styles are available making the Handtorque adaptable to many applications.
- Electronic torque transducers are available on most models for precise torque control.



Norbar Anti Wind-Up Ratchet

With any high ratio gearbox (25:1 or more) a certain amount of wind-up (backlash) has to be taken up before any useful tightening work is applied to the nut.

Each time the input device is released, the wind-up will rotate it back against the direction of operation.

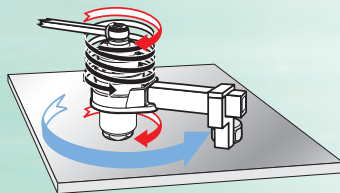
The Anti Wind-Up Ratchet retains all of the wind-up forces as they are created with the following benefits:

1. The torque input device can not fly backwards against the direction of operation if it is suddenly released.
2. Without an Anti Wind-Up Ratchet, it will often be necessary to continue to make 360° sweeps with the torque input device otherwise the multiplier will 'unwind'. However, obstructions will often make this impossible.
3. With an Anti Wind-Up Ratchet fitted, the multiplier becomes locked onto the nut because the reaction plate is held hard against the reaction point. This means that even used upside down, the multiplier will support its own weight.

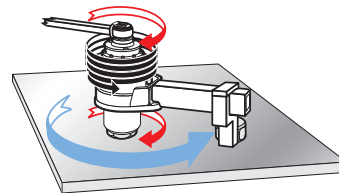
HT52, HT72, HT4, HT45 and HT12



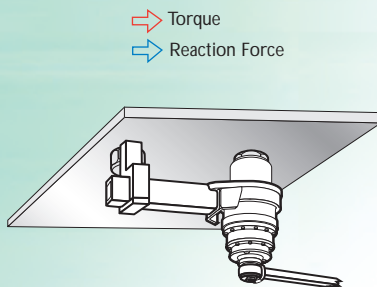
HT Small Diameter and
HT Standard Series (except HT12)



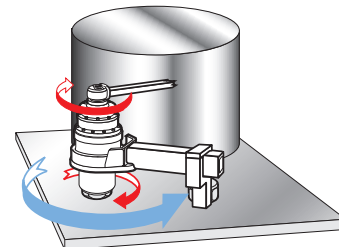
Multiplier behaves like a very stiff 'spring'



Multiplier will achieve maximum torque only after the 'spring' has been taken up



In this application the Multiplier is used upside down and is able to support its own weight because the reaction plate is held hard against the reaction point



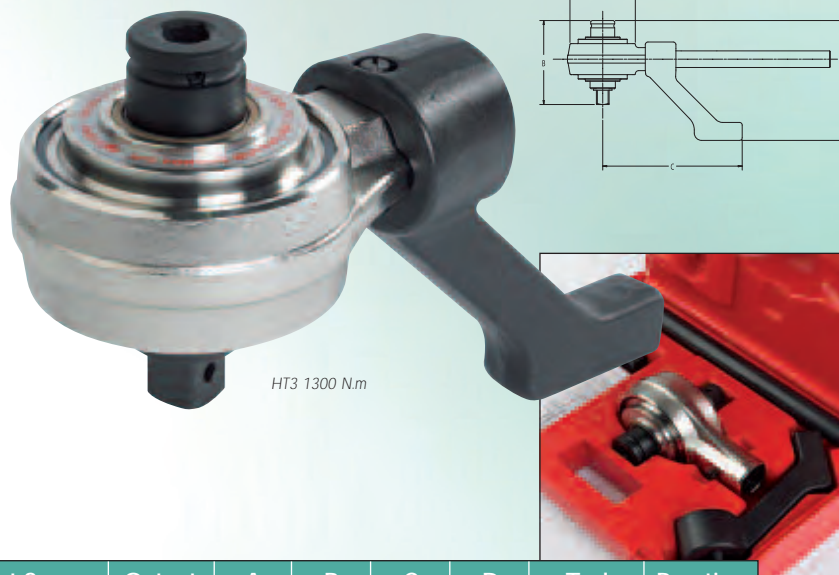
In this application, if it takes more than 180° to take up the wind-up at the required torque, this tightening operation will be impossible without an 'Anti Wind-Up Ratchet'

Safety Note:

Additional support is recommended as failure in the bolt, socket or multiplier will release the wind-up forces and cause the multiplier to drop.

HT3 Torque Multiplier

- 5:1 torque multiplication, accuracy guaranteed better than $\pm 4\%$.
- Supplied with two reaction bar styles for maximum versatility.
- Robust construction means minimal maintenance and long life.
- Supplied in a carrying case, the Highwayman is ideal for inclusion in the heavy vehicle tool kit.
- 1300 N.m version has a spare 3/4" output square included in the kit.
- Multiplier head only (no reaction bars or plastic box) also available. 1300 N.m version, part no. 17218. 2700 N.m version, part no. 17219.



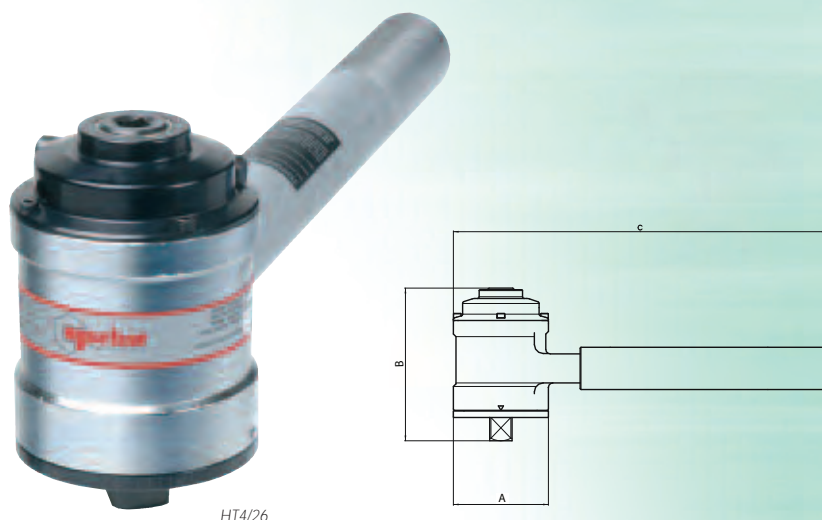
HT3 Torque Multiplier

Model	Part No.	Range		Ratio	Input Square	Output Square	A	B	C	D	Tool Weight	Reaction Weight
		N.m	lbf.ft				mm	mm	mm	mm		
HT3 1300 N.m Version Kit	17220	1300	960	5:1	½	¾	108	126	210	180	3.8	1.3
HT3 2700 N.m Version Kit	17221	2700	2000	5:1	¾	1	108	128	210	186	3.8	1.3

Weight of entire kit, 7.1kg.

HT4 Torque Multiplier

- True 15.5:1 or 26:1 torque multiplication, accuracy guaranteed better than $\pm 4\%$.
- High ratios allow the use of a small torque wrench.
- Robust construction means minimal maintenance and long life.
- Supplied in carrying case with replacement square drive.
- Anti Wind-Up Ratchet (Anti Backlash) fitted to allow safer and more practical operation.
- Angle protractor for easy torque and angle tightening.



HT4/26

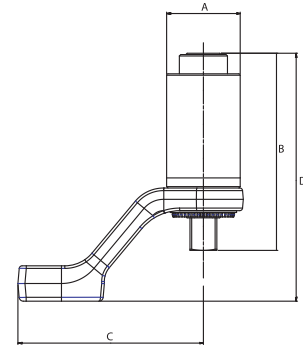
HT4 Torque Multiplier

Model	Part No.	Range		Ratio	Input Square	Output Square	A	B	C	Tool Weight	Reaction Weight
		N.m	lbf.ft				mm	mm	mm		
HT4/15.5	17022	3000	2200	15.5:1	½	1	108	156	450	6.1	1.9
HT4/26	17021	4500	3300	26:1	½	1	108	173	450	7.0	1.9



Handtorque™ HT-52 and HT-72 Series

- Compact dimensions allow excellent access and easy, safe handling.
- Guaranteed accuracy of better than $\pm 4\%$.
- Anti Wind-Up Ratchet available, for easier and safer operation.
- HT-72 features a light weight aluminium reaction arm.
- A variety of alternative reaction styles are available for maximum versatility.
- Electronic torque transducers can be fitted to the HT-72 for precise torque monitoring. See page 81.
- Available in a variety of ratios and output square drive sizes.



HT-52/22

HT-72/25

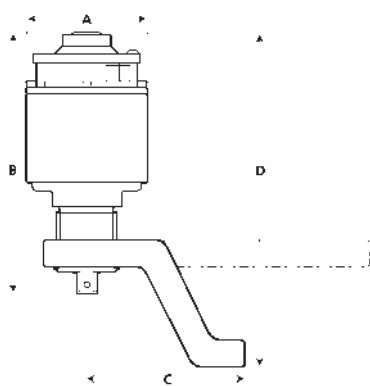
HT-52 and HT-72 Series

Model	Part No.	Range		Ratio	Input Square		A	B	C	D	Tool Weight kg	Reaction Weight kg
		N.m	lbf.ft		in	in						
HT-52/22	18051	1000	740	22:1	$\frac{3}{8}$	$\frac{3}{8}$	52	139	131	175	1.4	0.85
HT-52/22	18052	1000	740	22:1	$\frac{1}{2}$	$\frac{3}{8}$	52	139	131	175	1.4	0.85
HT-52/22 Fitted with AWUR	18083	1000	740	22:1	$\frac{3}{8}$	$\frac{3}{8}$	52	150.1	131	186.3	1.6	0.85
HT-52/22 Fitted with AWUR	18084	1000	740	22:1	$\frac{1}{2}$	$\frac{3}{8}$	52	150.1	131	186.3	1.6	0.85
HT-72/5	18014	1000	740	5:1	$\frac{1}{2}$	$\frac{3}{8}$	72	144	165	188	2.4	0.66
HT-72/5	18015	1500	1100	5:1	$\frac{1}{2}$	1	72	144	165	188	2.4	0.66
HT-72/5	18017	2000	1450	5:1	$\frac{3}{4}$	1	72	144	165	188	2.4	0.66
HT-72/25	18018	1000	740	25:1	$\frac{1}{2}$	$\frac{3}{8}$	72	165	165	188	2.7	0.66
HT-72/25	18019	2000	1450	25:1	$\frac{1}{2}$	1	72	165	165	188	2.7	0.66
HT-72/25 Fitted with AWUR	18081	1000	740	25:1	$\frac{1}{2}$	$\frac{3}{8}$	72	174	165	218	3.0	0.66
HT-72/25 Fitted with AWUR	18082	2000	1450	25:1	$\frac{1}{2}$	1	72	174	165	218	3.0	0.66

Handtorque™ Small Diameter Series

Handtorque models HT30, 45 and 60 have all the features of the Standard Series, but have a higher torque output for a given gearbox diameter.

- Reduced diameter allows better access, particularly on pipe flanges.
- Reaction taken from high strength spline.
- Reaction foot can slide on the spline to allow for sockets of various lengths (except HT45).
- Anti Wind-Up Ratchet available on all models (except 5:1 ratios), allowing safer and more practical operation.
- HT45 has integral angle protractor for easy torque and angle tightening.



Alternative 350mm long, straight reaction plate; may be modified by customer to suit their applications.

HT30 Part No. 16686
HT45 and HT60 Part No. 16687



Small Diameter Series

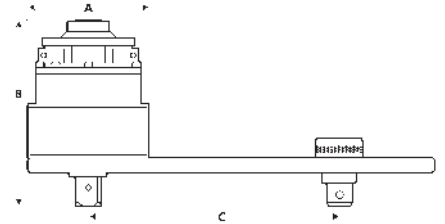
Model	Part No.	Range		Ratio	Input Square	Output Square	A	B	C	D min	D max	Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in	mm	mm	mm	mm	mm	kg	kg
30/5	18003	3000	2200	5:1	$\frac{3}{8}$	1	108	190.4	141	223	251.4	5.0	2
30/15 Fitted with AWUR	18004	3000	2200	15:1	$\frac{1}{2}$	1	108	224	141	256	285	7.0	2
30/25 Fitted with AWUR	18006	3000	2200	25:1	$\frac{1}{2}$	1	108	224	141	256	285	7.0	2
45/26 Fitted with AWUR	18037	4500	3300	26:1	$\frac{1}{2}$	1	108*	224	175	-	318	8.7	4
60/25 Fitted with AWUR	18008	6000	4400	25:1	$\frac{1}{2}$	1½	119	271	154	320	351	10.6	4
60/125 Fitted with AWUR	18012	6000	4400	125:1	$\frac{1}{2}$	1½	119	301	172	350	381	12.1	4

*Maximum width 140mm.



Handtorque™ Standard Series Models to 3400 N.m

- True torque multiplication guaranteed better than $\pm 4\%$.
- High ratios allow the use of a small torque wrench, multipliers can be used where access is limited.
- Anti Wind-Up Ratchet available on models of 25:1 ratio.
- Other reaction styles can be designed to suit specific applications.
- Electronic torque transducers can be fitted for precise torque monitoring. See page 81.



Standard Series to 3400 N.m

Model	Part No.	Range		Ratio	Input Square	Output Square	A	B	C min	C max	Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in	mm	mm	mm	mm	kg	kg
1	16010	1700	1250	5:1	½	¾	108	106	83	217	3	2.2
2/5	16012	1700	1250	5:1	¾	1	108	126	83	217	3	2.2
2/25 Fitted with AWUR	16089	1700	1250	25:1	½	1	108	156	83	217	5.6	2.2
5/5	16014	3400	2500	5:1	¾	1	119	143	86	264	4.7	2.5
5/25 Fitted with AWUR	16090	3400	2500	25:1	½	1	119	187	86	264	7.5	2.5
6/5	16016	3400	2500	5:1	¾	1½	119	149	86	264	4.7	2.5
6/25 Fitted with AWUR	16092	3400	2500	25:1	½	1½	119	195	86	264	7.5	2.5

Handtorque™ Standard Series Models to 47500 N.m

- True torque multiplication guaranteed better than $\pm 4\%$.
- High ratios allow the use of a small torque wrench, multipliers can be used where access is limited.
- Anti Wind-Up Ratchet available on models of 25:1 ratio and above.
- Electronic torque transducers can be fitted for precise torque monitoring. See page 81.



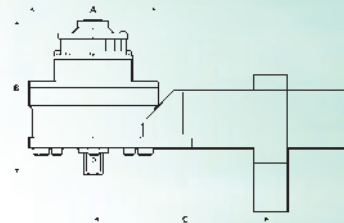
HT13/125



HT11/125



HT7/25



Standard Series to 47500 N.m

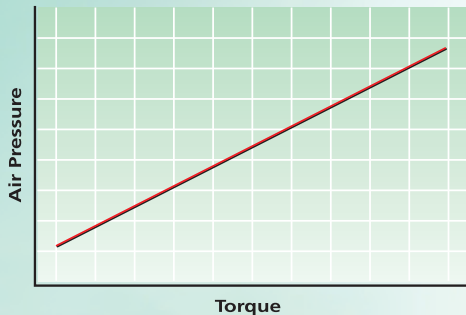
Model	Part No.	Range		Ratio	Input Square	Output Square	A	B	C min	C max	Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in	mm	mm	mm	mm	kg	kg
7/5	16067	6000	4500	5:1	$\frac{3}{4}$	1 $\frac{1}{2}$	144	165	146	333	8.1	6.3
7/25 Fitted with AWUR	16065	6000	4500	25:1	$\frac{1}{2}$	1 $\frac{1}{2}$	144	225.5	146	333	10.7	6.3
7/25 Sm. Dia Fitted with AWUR	16095	6000	4500	25:1	$\frac{1}{2}$	1 $\frac{1}{2}$	130	211	163.4	337	10.6	4.9
7/125 Fitted with AWUR	16068	6000	4500	125:1	$\frac{1}{2}$	1 $\frac{1}{2}$	144	239.5	146	333	12.2	6.3
7/125 Sm. Dia Fitted with AWUR	16096	6000	4500	125:1	$\frac{1}{2}$	1 $\frac{1}{2}$	130	238	163.4	337	12.1	4.9
9/25 Fitted with AWUR	16070	9500	7000	25:1	$\frac{3}{4}$	1 $\frac{1}{2}$	184	209	171	351	17.4	8.3
9/125 Fitted with AWUR	16071	9500	7000	125:1	$\frac{1}{2}$	1 $\frac{1}{2}$	184	234	171	351	18.9	8.3
11/25	16082	20000	14700	25:1	$\frac{3}{4}$	2 $\frac{1}{2}$	212	267	-	500	30.1	13.3
11/125 Fitted with AWUR	16049	20000	14700	125:1	$\frac{1}{2}$	2 $\frac{1}{2}$	212	307	-	500	32.1	13.3
12/87.5 Fitted with AWUR	18085	34,000	25000	87.5:1	$\frac{3}{4}$	2 $\frac{1}{2}$	240	337	-	-	41.5	6.5
13/125 Fitted with AWUR	16053	47500	35000	125:1	$\frac{3}{4}$	2 $\frac{1}{2}$	315	366	-	-	95.2	6.9

Pneutorque® Pneumatic Multipliers

What is a Pneutorque Pneumatic Wrench?

The Pneutorque consists of a robust air motor driving a Norbar multiplier with three or more stages of epicyclic gearing.

Torque control is achieved by adjustment of the air pressure. An air pressure versus torque graph and a calibration certificate is supplied with each tool and allows specific torque values to be set. For more critical applications, Pneutorques can be fitted with a torque transducer and the precise torque output displayed. The tool can then be shut off at the desired torque either manually or automatically using suitable control circuitry.



Air pressure graph supplied with each tool.



The Lubro Control Unit, 16036, is Norbar's filter / regulator / lubricator. It is supplied with 3m of high quality steel braided air hose and a 100mm pressure gauge for accurate setting.

Why use Pneutorque Pneumatic Wrenches?

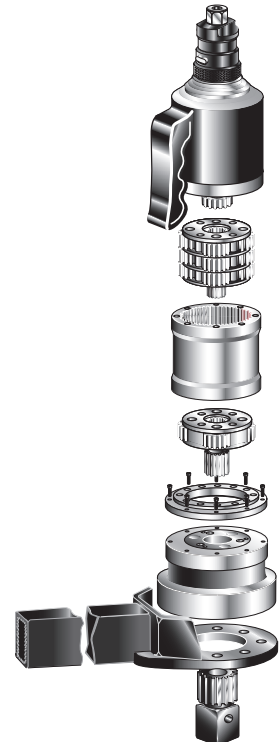
Hand operated torque multipliers are ideal for low volume or intermittent use or when there is no power source available. However, for production lines or whenever a large number of bolts is involved, a powered multiplier will save a considerable amount of time.

Pneutorque operation is quiet – less than 85dB(A) with absolutely no impacting. These two factors make Pneutorques comfortable for the operator to use, reducing fatigue and consequently increasing safety.

Pneutorques provide accurate torque control – on a given joint they will stall repeatedly to within $\pm 5\%$. Using electronic shut off, this repeatability can be improved to $\pm 2\%$.

Summary of Pneutorque Advantages

- Sound pressure level does not exceed 85dB(A) when tested in accordance with ISO3744:1994.
- No impacting means less damage to the tool, socket and bolted assembly.
- Less operator fatigue, results in increased safety.
- Powerful – models available up to 300,000 N.m (220,000 lbf.ft).
- Repeatability of $\pm 5\%$ for accurate torque control.
- A wide range of attachments and accessories make Pneutorques adaptable to many applications.





Pneutorque Applications

The smooth and continuous torque output of the Pneutorque makes these tools suitable for a wide range of bolting and non-bolting applications.

Bolting

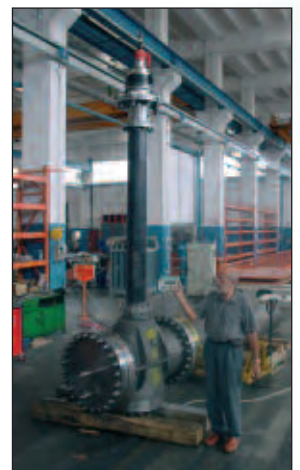
Pneutorques are ideally suitable for tightening and untightening bolts of up to 150mm diameter. The following is just a small selection of applications:

- Wheel nuts on trucks, buses and large machinery.
- Structural steelwork.
- High pressure joints eg. Pipelines, boiler feed pumps and pressure vessels.
- Engine head bolts.
- Injector heads on plastic injection moulding machines.
- Heat exchangers.
- Heavy vehicle production eg. Chassis and suspension bolts.

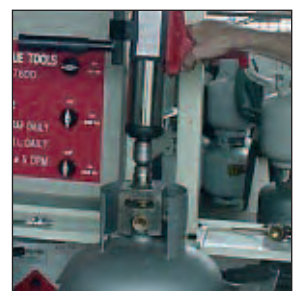
Non-bolting

Whenever a high continuous torque is needed, Pneutorques can be used as the power source. Typical applications include:

- Ball valve operation.
- Powering wagons and gantries.
- Barring of large diesel engines (turning the crankshaft) during build.
- Weld testing by applying test torques.
- Roller adjustment in steel mills and paper mills.
- Valving of gas bottles.



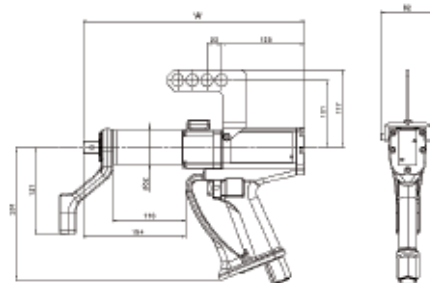
Ball valve actuation using PT13



Gas bottle valving and de-valving using PT1500

Pneutorque® PTM-52 Series Stall Models

The PTM-52 is engineered to be one of the lightest and fastest tools of its type on the market. The exceptionally compact 52mm diameter gearbox means that the tool is well balanced, light weight and provides excellent access to bolts.



PTM-52-800-F

- Fast – 800 N.m version has a free speed of 175 rpm for rapid bolt run-down.
- Light weight – single direction stall tool weighs just 3.8 kg.
- Quiet – less than 85 dB(A) when under load.
- Non impacting – low vibration levels make these tools comfortable and safe to use.
- Square drive is quickly and easily replaceable.
- On Bi-directional tools, the direction control knob is locked while the tool is running to prevent accidental damage to the gearbox.
- 'Soft Start' trigger control aids socket location and allows gradual and safe reaction location.
- For safety, gearbox can rotate independently from the handle so that reaction forces are not transmitted back to the operator.
- 1" square drive available, Part No. 18545.

500 and 800 N.m Tools - Stall

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-52-500-F	Forward only	¾	18100.F06	100-500	74-370	245	284	3.8	0.85
PTM-52-500-B	Bi-directional	¾	18100.B06	100-500	74-370	245	333	4.1	0.85
PTM-52-800-F	Forward only	¾	18101.F06	160-800	118-590	175	284	3.8	0.85
PTM-52-800-B	Bi-directional	¾	18101.B06	160-800	118-590	175	333	4.1	0.85

† Speed at maximum air pressure.

Pneutorque® PTM-52 Series Internal Control and External Control Models

The integration of electronic torque measurement and control into the PTM-52 Series is achieved with the minimum impact on overall tool size and weight. The actual applied torque is accurately measured at the output of the tool meaning that a repeatability of +/-2% can be guaranteed.

Shut-Off, Internal Control – these tools include a torque transducer, easy to read LED display, control panel and a solenoid valve to shut off the air supply once the desired torque has been reached. The tolerance band within which the bolt must be tightened can be set on the tool handle control panel. When the tool is operated, the actual applied torque is displayed along with one of three coloured LEDs to indicate a low, within tolerance or high result. The tool can be operated in either N.m or lbf.ft.

Shut-Off, External Control – this version of the PTM-52 incorporates a transducer, solenoid valve and three coloured LEDs for the indication of low, within tolerance or high results. However, all control functions and torque display are housed in an external controller unit (purchased separately). External controllers can give a much greater range of functionality than is possible on the 'Internal Control' version of the tool.



PTM-52-800-B-IC

Tool controller in wall box for external control versions.
Part No. 60244 without printer or 60254 with printer.
Cable for use with PTM tools, Part No. 61127.600.



500 and 800 N.m Tools - Shut-Off, Internal

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-52-500-B-IC	Bi-directional	3/4	18110.B06	100-500	74-370	245	397	4.9	0.85
PTM-52-800-B-IC	Bi-directional	3/4	18111.B06	160-800	118-590	175	397	4.9	0.85

500 and 800 N.m Tools - Shut-Off, External

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-52-500-B-EC	Bi-directional	3/4	18120.B06	100-500	74-370	245	397	4.9	0.85
PTM-52-800-B-EC	Bi-directional	3/4	18121.B06	160-800	118-590	175	397	4.9	0.85

† Speed at maximum air pressure.

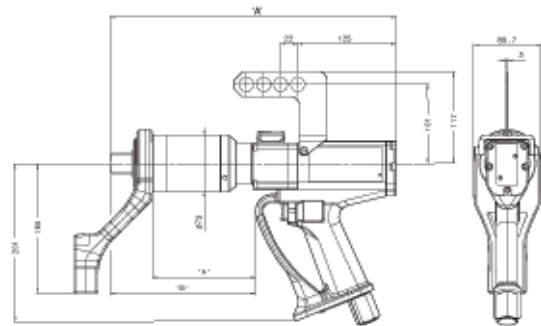
Pneutorque® PTM-72 Series Stall Models

PTM-72 tools use the same 'twin motor' handle as the PTM-52 but fitted with a durable 72mm gearbox to allow higher torque outputs. The 'twin motor' concept gives the benefit of high run-down speeds while adding very little to the size and weight of the tool.



PTM-72-1000-B

- Fast - 1000 N.m version has a free speed of 140 rpm for rapid bolt run-down.
- Light weight - single direction 2000 N.m stall tool weighs just 6.2 kg
- Quiet - less than 85 db(A) when under load.
- Non impacting - low vibration levels make these tools comfortable and safe to use.
- Square drive is quickly and easily replaceable.
- On Bi-directional tools, the direction control knob is locked while the tool is running to prevent accidental damage to the gearbox.
- 'Soft Start' trigger control aids socket location and allows gradual and safe reaction location.
- For safety, gearbox can rotate independently from the handle so that reaction forces are not transmitted back to the operator.
- 1" square drive available for the 1000 N.m version, Part No. 18492.



1000, 1350 and 2000 N.m Tools - Stall

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed [†]	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-72-1000-F	Forward only	¾	18102.F06	200-1000	147-738	140	316	5.8	0.7
PTM-72-1000-B	Bi-directional	¾	18102.B06	200-1000	147-738	140	365	6.1	0.7
PTM-72-1350-F	Forward only	1	18103.F08	270-1350	200-1000	105	316	5.8	0.7
PTM-72-1350-B	Bi-directional	1	18103.B08	270-1350	200-1000	105	365	6.1	0.7
PTM-72-2000-F	Forward only	1	18104.F08	400-2000	295-1475	70	349	6.2	0.7
PTM-72-2000-B	Bi-directional	1	18104.B08	400-2000	295-1475	70	398	6.5	0.7

† Speed at maximum air pressure.

Pneutorque® PTM-72 Series Internal Control and External Control Models

The integration of electronic torque measurement and control into the PTM-72 Series is achieved with the minimum impact on overall tool size and weight. The actual applied torque is accurately measured at the output of the tool meaning that a repeatability of +/-2% can be guaranteed.

Shut-Off, Internal Control - these tools include a torque transducer, easy to read LED display, control panel and a solenoid valve to shut off the air supply once the desired torque has been reached. The tolerance band within which the bolt must be tightened can be set on the tool handle control panel. When the tool is operated, the actual applied torque is displayed along with one of three coloured LEDs to indicate a low, within tolerance or high result. The tool can be operated in either N.m or lbf.ft.

Shut-Off, External Control - this version of the PTM-72 incorporates a transducer, solenoid valve and three coloured LEDs for the indication of low, within tolerance or high results. However, all control functions and torque display are housed in an external controller unit (purchased separately), see page 43 for details. External controllers can give a much greater range of functionality than is possible on the 'Internal Control' version of the tool.



PTM-72-2000-B-EC

1000, 1350 and 2000 N.m Tools - Shut-Off, Internal

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-72-1000-B-IC	Bi-directional	¾	18112.B06	200-1000	147-738	140	422	7.4	0.7
PTM-72-1350-B-IC	Bi-directional	1	18113.B08	270-1350	200-1000	105	422	7.4	0.7
PTM-72-2000-B-IC	Bi-directional	1	18114.B08	400-2000	295-1475	70	453	7.8	0.7

1000, 1350 and 2000 N.m Tools - Shut-Off, External

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTM-72-1000-B-EC	Bi-directional	¾	18122.B06	200-1000	147-738	140	422	7.4	0.7
PTM-72-1350-B-EC	Bi-directional	1	18123.B08	270-1350	200-1000	105	422	7.4	0.7
PTM-72-2000-B-EC	Bi-directional	1	18124.B08	400-2000	295-1475	70	453	7.8	0.7

† Speed at maximum air pressure.

Pneutorque® PTME-72 Series Stall Models

The PTME-72 series of tools was designed to meet the needs of the commercial vehicle wheel market.

The integrated reaction foot is designed specifically to reach recessed wheel bolts and the 72mm diameter gearbox is selected to cope with the high frequency of use demanded by busy tyre shops.

- Fast - 1000 N.m version has a free speed of 140 rpm for rapid bolt run-down time.
- Light weight, for ease of handling.
- Extended reaction is ideal for reaching recessed nuts.
- Quiet - less than 85 db(A) when under load.
- Non-impacting - low vibration levels make these tools comfortable and safe to use.
- Square drive is quickly and easily replaceable.
- On Bi-directional tools, the direction control knob is locked while the tool is running to prevent accidental damage to the gearbox.
- 'Soft Start' trigger control aids socket location and allows gradual and safe reaction location.
- For safety, gearbox can rotate independently from the handle so that reaction forces are not transmitted back to the operator.



PTME-72-1000-B



1000 and 2000 N.m Tools - Stall

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTME-72-1000-F	Forward only	¾	18140.F06	200-1000	147-738	140	484	6.9	n/a
PTME-72-1000-B	Bi-directional	¾	18140.B06	200-1000	147-738	140	484	7.2	n/a
PTME-72-2000-F	Forward only	1	18141.F08	400-2000	295-1475	70	506	7.4	n/a
PTME-72-2000-B	Bi-directional	1	18141.B08	400-2000	295-1475	70	506	7.7	n/a

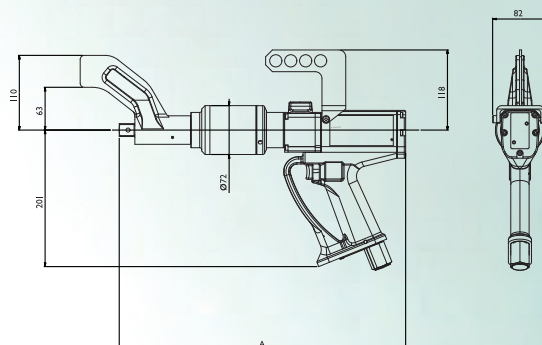
† Speed at maximum air pressure.

Pneutorque® PTME-72 Series Internal Control and External Control Models

The integration of electronic torque measurement and control into the PTME-72 Series is achieved with the minimum impact on overall tool size and weight. The actual applied torque is accurately measured at the output of the tool meaning that a repeatability of $\pm 2\%$ can be guaranteed.

Shut-Off, Internal Control - these tools include a torque transducer, easy to read LED display, control panel and a solenoid valve to shut off the air supply once the desired torque has been reached. The tolerance band within which the bolt must be tightened can be set on the tool handle control panel. When the tool is operated, the actual applied torque is displayed along with one of three coloured LEDs to indicate a low, within tolerance or high result. The tool can be operated in either N.m or lbf.ft.

Shut-Off, External Control - this version of the PTME-72 incorporates a transducer, solenoid transducer, solenoid valve and three coloured LEDs for the indication of low, within tolerance or high results. However, all control functions and torque display are housed in an external controller unit (purchased separately), see page 43 for details. External controllers can give a much greater range of functionality than is possible on the 'Internal Control' version of the tool.



PTME-72
External
Control

1000 and 2000 N.m Tools - Shut-Off, Internal

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTME-72-1000-B-IC	Bi-directional	¾	18142.B06	200-1000	147-738	140	555	8.5	n/a
PTME-72-2000-B-IC	Bi-directional	1	18143.B08	400-2000	295-1475	70	559	9	n/a

1000 and 2000 N.m Tools - Shut-Off, External

Model	Direction of Operation	Square Drive	Part No.	Range		Free Speed †	Length 'A'	Tool Weight	Reaction Weight
		in		N.m	lbf.ft	rpm	mm	kg	kg
PTME-72-1000-B-EC	Bi-directional	¾	18144.B06	200-1000	147-738	140	555	8.5	n/a
PTME-72-2000-B-EC	Bi-directional	1	18145.B08	400-2000	295-1475	70	559	9	n/a

† Speed at maximum air pressure.



Pneutorque® PTM-92 and PTM-119 Series Stall Models

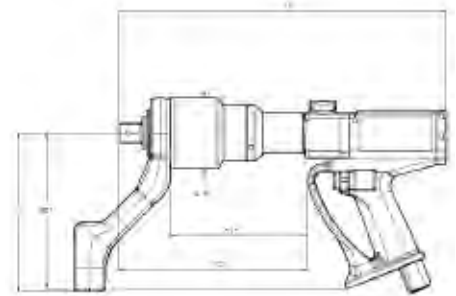
The latest extension to the PTM tool range brings the speed advantage of the twin motor handle to higher capacity Pneutorque models.

Coupled with new gearbox designs, these new models deliver an ideal balance between robustness, speed and weight.



PTM-92-3500

- Fast - 2700 N.m version has a free speed of 57 rpm for rapid bolt run-down time.
- Light weight - PTM-92-2700 weighs just 8.5kg. All models are fitted as standard with a light but robust aluminium reaction plate.
- Other reaction styles are available for maximum versatility.
- Quiet - less than 85 db(A) when under load.
- Non impacting - low vibration levels make these tools comfortable and safe to use.
- Square drive is quickly and easily replaceable.
- Bi-directional. The direction control knob is locked while the tool is running to prevent accidental damage to the gearbox.
- 'Soft Start' trigger control aids socket location and allows gradual and safe reaction location.
- For safety, gearbox can rotate independently from the handle so that reaction forces are not transmitted back to the operator.



2700, 3500, 4500 and 6000 N.m Tools - Stall

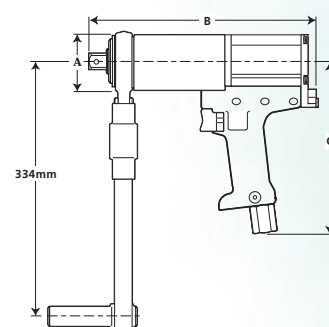
Model	Square Drive	Part No.	Range		Free Speed †	Length 'A'	B	C	D	E	Tool Weight	Reaction Weight
	in		N.m	lbf.ft								
PTM-92-2700-B	1	18106.B08	540-2700	400-2000	57	387	178	243	205	92	8.5	1.35
PTM-92-3500-B	1	18107.B08	700-3500	520-2600	41	387	178	243	205	92	8.5	1.35
PTM-119-4500-B	1½	18108.B12	900-4500	660-3300	32	456	197	277	200	119	12.5	2.1
PTM-119-6000-B	1½	18109.B12	1200-6000	885-4500	25	456	197	277	200	119	12.5	2.1

† Speed at maximum air pressure.

Pneutorque® 72mm Series Single Speed and Automatic Two Speed Models



- 72mm gearbox diameter allows excellent access.
- Powerful – up to 2000 N.m output.
- Switchable forward and reverse operation.
- Quiet – less than 81dB(A), and non impacting for low operator fatigue.
- 'Soft Start' trigger control aids socket location and allows gradual and safe reaction take up.
- For safety, gearbox can turn independently from the handle. Torque reaction is never transmitted back to the operator.
- All torques can be achieved at less than 6 bar (90 psi).
- Automatic Two Speed models offer all of the advantages of the single speed versions but with the additional benefit of a run down speed five times greater than the final torque speed.



72mm Series, Single Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	Tool Weight	Reaction Weight
	in		N.m	lbf.ft						
PT 72/500	3/4	18023	90-500	66-370	35	72	301	223	6.4	1.7
PT 72/1000	3/4	18022	190-1000	140-740	15	72	301	223	6.4	1.7
PT 72/1000	1	18026	190-1000	140-740	15	72	301	223	6.4	1.7
PT 72/1500	1	18021	300-1500	220-1110	9	72	301	223	6.4	1.7
PT 72/2000	1	18033	400-2000	300-1450	6	72	301	223	6.4	1.7

† Speed at maximum air pressure.

72mm Series, Automatic Two Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	Tool Weight	Reaction Weight
	in		N.m	lbf.ft						
PT 72/500 AUT	3/4	18023.AUT	203-500	150-370	170	72	373	223	8.7	1.7
PT 72/1000 AUT	3/4	18022.AUT	488-1000	360-740	75	72	373	223	8.7	1.7
PT 72/1000 AUT	1	18026.AUT	488-1000	360-740	75	72	373	223	8.7	1.7
PT 72/1500 AUT	1	18021.AUT	760-1500	560-1110	45	72	373	223	8.7	1.7
PT 72/2000 AUT	1	18033.AUT	1000-2000	750-1450	30	72	373	223	8.7	1.7

† Speed at maximum air pressure and in high gear.



Pneutorque® Small Diameter Series Single Speed Models

These Pneutorque models share the same features as the 'Standard' Series, but have a higher torque output for a given gearbox diameter.

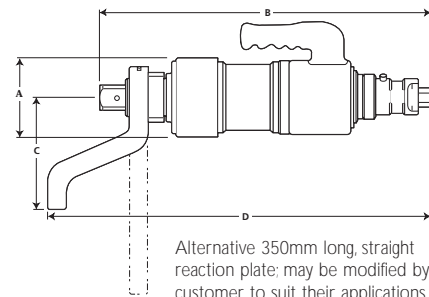
- Reduced diameter allows improved access.
- High torque output – up to 5500 N.m.
- Reversible – Pneutorques can be used for tightening and untightening.
- Reaction foot can slide on the spline to allow for sockets of various lengths (except PT4500).
- Electronic torque transducers can be fitted for precise torque monitoring.
- PT4500 has integral angle protractor for easy torque and angle tightening.
- PT4500 employs a pistol grip style motor.



PT5500



PT4500



Alternative 350mm long, straight reaction plate; may be modified by customer to suit their applications.

PT2700 Part No. 16686

PT4500 and PT5500 Part No. 16687

Small Diameter Series, Single Speed

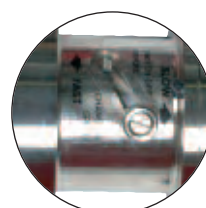
Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	D min	D max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm	mm		
PT 2700	1	18027	880-2700	650-2000	5	108	437	140	469	498	14.5	2
PT 4500	1	18038	900-4500	660-3300	4	108*	390	175	-	484	13.7	4
PT 5500	1½	18028	1200-5500	885-4000	2.5	119	512	154	566	592	17.9	4

† Speed at maximum air pressure.

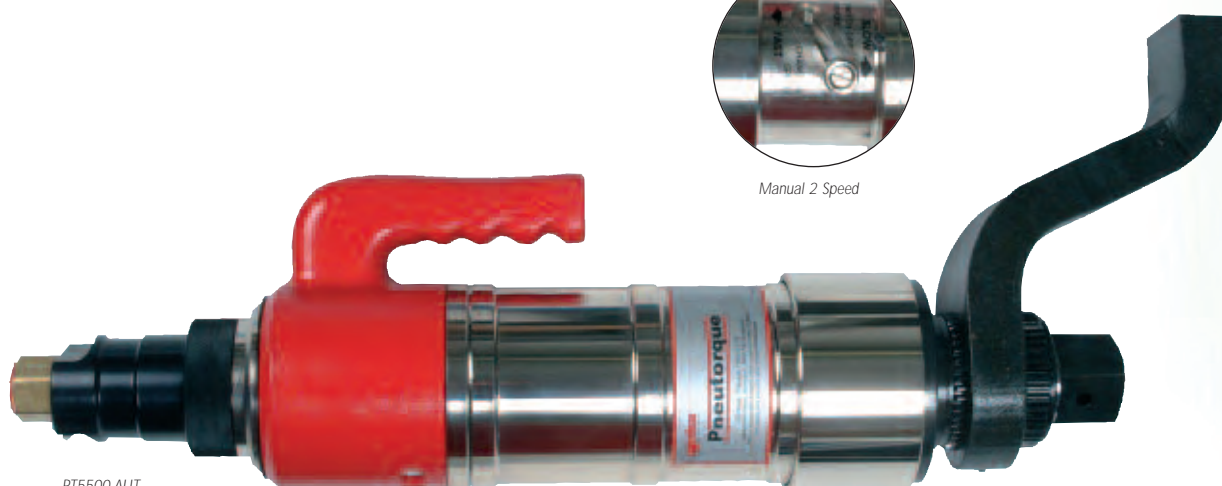
* Maximum width 140mm.

Pneutorque® Small Diameter Series Two Speed Models

- Two Speed Models offer all of the advantages of single speed versions but with the additional benefit of a run down speed five times greater than the final torque speed.
- Reduced diameter allows improved access.
- High torque output – up to 5500 N.m.
- Reversible – Pneutorques can be used for tightening and untightening.
- Reaction foot can slide on the spline to allow for sockets of various lengths (except PT4500).
- Electronic torque transducers can be fitted for precise torque monitoring.
- PT4500 has integral angle protractor for easy torque and angle tightening.
- PT4500 employs a pistol grip style motor.



Manual 2 Speed



PT5500 AUT

Small Diameter Series, Manual Two Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	D min	D max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft	rpm	mm	mm	mm	mm	mm	kg	kg
PT 2700 MTS	1	18027.MTS	880-2700	650-2000	25	108	524	140	556	585	18.0	2
PT 5500 MTS	1½	18028.MTS	1200-5500	885-4000	12.5	119	598	154	652	678	21.4	4

Small Diameter Series, Automatic Two Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	D min	D max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft	rpm	mm	mm	mm	mm	mm	kg	kg
PT 2700 AUT	1	18027.AUT	880-2700	650-2000	25	108	506	140	538	567	18	2
PT 4500 AUT	1	18038.AUT	2400-4500	1750-3300	13.5	108*	462	175	-	556	16	4
PT 5500 AUT	1½	18028.AUT	1762-5500	1300-4000	12.5	119	581	154	635	661	21.4	4

† Speed at maximum air pressure and in high gear

* Maximum width 140mm.



Pneutorque® Standard Series

Models to 3400 N.m, Single Speed

Based on the original Pneutorque, the 'Standard Series' Range is a direct result of over 40 years of refinement and development necessary to keep pace with industry's requirements today.

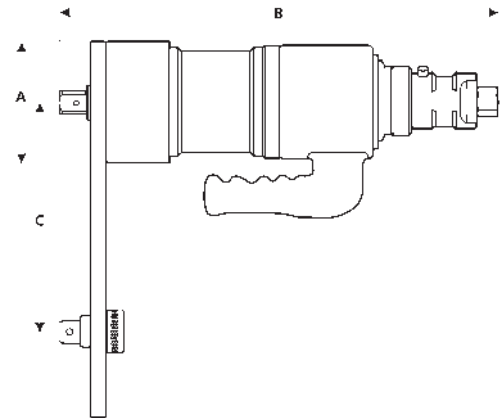
In use on many thousands of applications worldwide, Pneutorque Wrenches continue to represent the foundation of Norbar's powered tool range.

- Models available for almost every bolting application.
- Forward and reverse operation.
- Low operator fatigue – quiet, non impacting or pulsing.
- Repeatability of $\pm 5\%$.
- Other reaction styles can be designed to suit specific applications.
- Electronic torque transducers can be fitted for precise torque monitoring.



PT5

PT2



Standard Series to 3400 N.m, Single Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 1	¾	16031	160-680	120-500	30	108	368	83	217	10.6	2.2
PT 1	1	16011	160-680	120-500	30	108	373	83	217	10.6	2.2
PT 1A	1	16097	270-1200	200-900	15	108	373	83	217	11.1	2.2
PT 2	1	16013	515-1700	380-1250	9	108	373	83	217	11.1	2.2
PT 5	1	16015	880-3400	650-2500	5	119	424	83	264	14	2.5
PT 6	1½	16017	880-3400	650-2500	5	119	430	83	264	14	2.5

† Speed at maximum air pressure.

Pneutorque® Standard Series Models to 3400 N.m, Two Speed

Two Speed models offer all of the advantages of single speed versions but with the additional benefit of a run down speed five times greater than the final torque speed.

- Models available for almost every bolting application.
- Forward and reverse operation.
- Low operator fatigue – quiet, no impacting or pulsing.
- Repeatability of $\pm 5\%$.
- Other reaction styles can be designed to suit specific applications.
- Electronic torque transducers can be fitted for precise torque monitoring.



PT5 AUT

PT2 MTS

Standard Series to 3400 N.m, Manual Two Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 1 MTS	$\frac{3}{4}$	16031.MTS	160-680	120-500	150	108	454	83	217	14.1	2.2
PT 1 MTS	1	16011.MTS	160-680	120-500	150	108	459	83	217	14.1	2.2
PT 1A MTS	1	16097.MTS	270-1200	200-900	75	108	459	83	217	14.6	2.2
PT 2 MTS	1	16013.MTS	515-1700	380-1250	45	108	459	83	217	14.6	2.2
PT 5 MTS	1	16015.MTS	880-3400	650-2500	25	119	510	86	264	17.5	2.5
PT 6 MTS	1½	16017.MTS	880-3400	650-2500	25	119	516	86	264	17.5	2.5

Standard Series to 3400 N.m, Automatic Two Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 1 AUT	$\frac{3}{4}$	16031.AUT	160-680	120-500	150	108	437	83	217	14.1	2.2
PT 1 AUT	1	16011.AUT	160-680	120-500	150	108	442	83	217	14.1	2.2
PT 1A AUT	1	16097.AUT	270-1200	200-900	75	108	442	83	217	14.6	2.2
PT 2 AUT	1	16013.AUT	515-1700	380-1250	45	108	442	83	217	14.6	2.2
PT 5 AUT	1	16015.AUT	880-3400	650-2500	25	119	493	86	264	17.5	2.5
PT 6 AUT	1½	16017.AUT	880-3400	650-2500	25	119	499	86	264	17.5	2.5

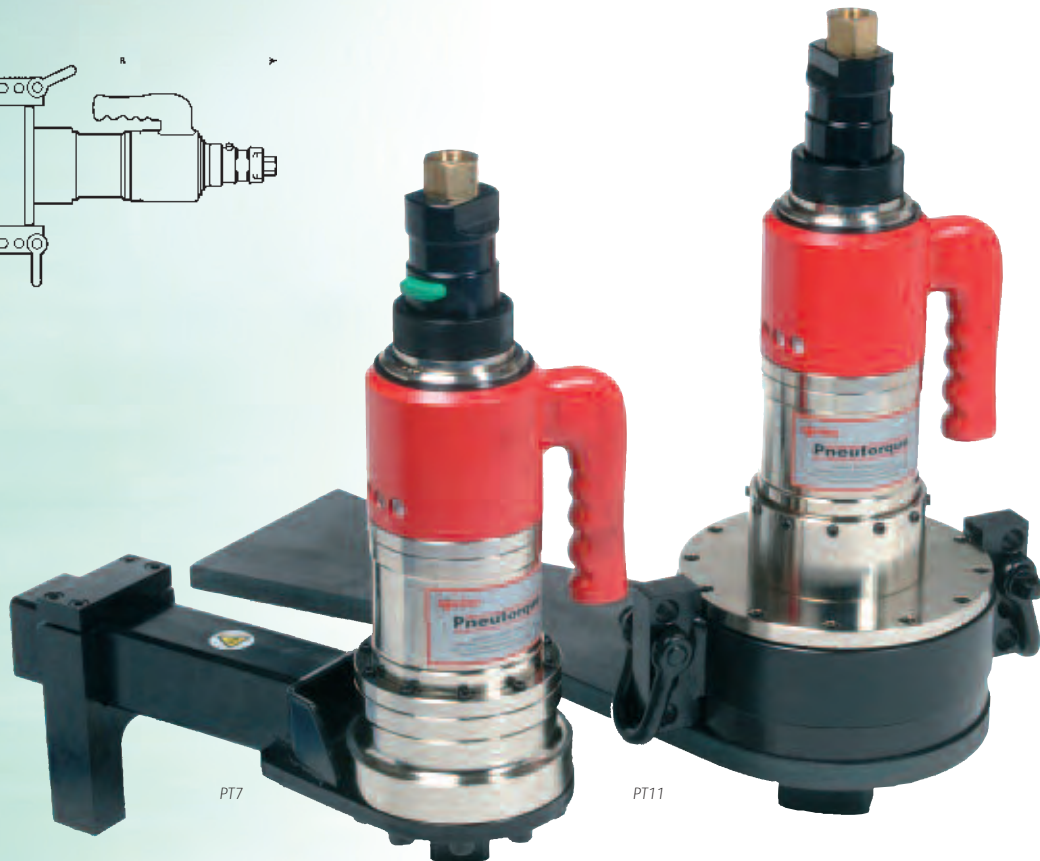
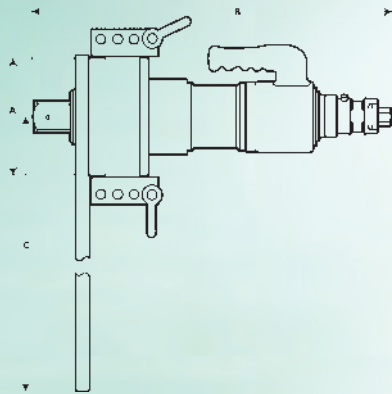
†Speed at maximum air pressure and in high gear



Pneutorque® Standard Series

Models to 100,000 N.m, Single Speed

- Models available for almost every bolting application, up to 100,000 N.m.
- Forward and reverse operation.
- Low operator fatigue – quiet, no impacting or pulsing.
- Repeatability of $\pm 5\%$.
- Other reaction styles can be designed to suit specific applications.
- Electronic torque transducers can be fitted for precise torque monitoring. See page 81.
- Models 13 and 14 supplied with blank reaction plate for fabrication to specific requirements.



Standard Series to 100,000 N.m, Single Speed

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 7	1½	16066	1762-6000	1300-4500	2.5	144	457	146	333	19.7	6.3
PT 9	1½	16072	2710-9500	2000-7000	1.8	184	452	169	351	24.4	8.3
PT 11	2½	16046	4400-20000	3250-14700	1.2	212	546.3	-	500	38.6	13.3
PT 12	2½	18086	9500-34000	7000-25000	0.5	240	593	Blank Plate		49.8	6.5
PT 13	2½	16052	13550-47000	10000-35000	0.3	315	629	Blank Plate		102.2	6.9
PT 14	3½	16045	22375-100000	16500-73500	0.2	315	726	Blank Plate		119.4	10.4

† Speed at maximum air pressure.

Pneutorque® Standard Series Models to 300,000 N.m, Two Speed

Two Speed Models offer all of the advantages of single speed versions but with the additional benefit of a run down speed five times greater than the final torque speed.

- Models available for almost every bolting and torque application, up to 300,000 N.m .
- Forward and reverse operation.
- Low operator fatigue – quiet, no impacting or pulsing.
- Repeatability of $\pm 5\%$.
- Other reaction styles can be designed to suit specific applications.
- Electronic torque transducers can be fitted for precise torque monitoring. See page 81.
- Models 13 and 14 supplied with blank reaction plate for fabrication to specific requirements.



PT13 and PT14 are supplied on a trolley and with a Lubro Control Unit

Standard Series to 300,000 N.m, Manual Two Speed

Model	Square Drive	Part No.	Range		Free Speed [†]	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 7 MTS	1½	16066.MTS	1762-6000	1300-4500	12.5	144	543	146	333	23.2	6.3
PT 9 MTS	1½	16072.MTS	2710-9500	2000-7000	9	184	538	169	351	27.9	8.3
PT 11 MTS	2½	16046.MTS	4400-20000	3250-14700	6	212	632	-	500	42.1	13.3
PT 12 MTS	2½	18086.MTS	9500-34000	7000-25000	2.5	240	679	Blank Plate		53.3	6.5
PT 13 MTS	2½	16052.MTS	13550-47000	10000-35000	1.5	315	716	Blank Plate		105.7	6.9
PT 14 MTS	3½	16045.MTS	22375-100000	16500-73500	1	315	800	Blank Plate		122.9	10.4
PT 15 MTS	-	16054.MTS	85000-300000	62500-220000	0.4	520	930	-		380	-

[†] Speed at maximum air pressure.

PT 15 part number does not include an output drive or reaction. These components will be engineered uniquely for each application.

Standard Series to 100,000 N.m, Automatic Two Speed

Model	Square Drive	Part No.	Range		Free Speed [†]	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 7 AUT	1½	16066.AUT	1762-6000	1300-4500	12.5	144	526	146	333	23.2	6.3
PT 9 AUT	1½	16072.AUT	2710-9500	2000-7000	9	184	521	169	351	27.9	8.3

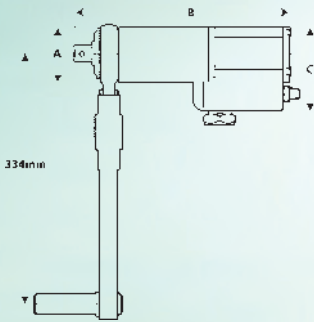
[†] Speed at maximum air pressure and in high gear



Pneutorque® Remote Control 72mm Series

Remote control versions have no direction/shut-off control on the tool but rely on external pneumatic circuitry to provide this function. This opens up numerous application possibilities for the Pneutorque ranging from simple stall shut-off in a hazardous working environment to sophisticated, multi-spindle torque and angle shut-off systems.

- Stall control gives repeatability of $\pm 5\%$ on a given joint.
- Torque transducers and angle encoders available for all models. These form the basis of sophisticated control systems giving repeatability of up to $\pm 2\%$. See page 80.
- Automatic Two Speed gearbox reduces run-down times.
- Each gearbox supplied with a standard reaction device or, on request, one specifically designed to suit the application.



PT1000 Remote

72mm Series, Remote Control

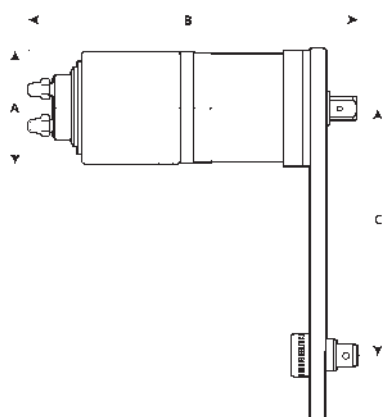
Model	Square Drive	Part No.	Range		Free Speed†	A	B	C	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm		
PT 500	$\frac{3}{4}$	18031	90-500	66-370	35	72	290.2	111	6.4	1.7
PT 500 AUT	$\frac{3}{4}$	18031.AUT	203-500	150-370	170	72	362.2	111	8.7	1.7
PT 1000	$\frac{3}{4}$	18030	190-1000	140-740	15	72	290.2	111	6.4	1.7
PT 1000 AUT	$\frac{3}{4}$	18030.AUT	488-1000	360-740	75	72	362.2	111	8.7	1.7
PT 1000	1	18032	190-1000	140-740	15	72	290.2	111	6.4	1.7
PT 1000 AUT	1	18032.AUT	488-1000	360-740	75	72	362.2	111	8.7	1.7
PT 1500	1	18029	300-1500	220-1110	9	72	290.2	111	6.4	1.7
PT 1500 AUT	1	18029.AUT	760-1500	560-1110	45	72	362.2	111	8.7	1.7
PT 2000	1	18034	400-2000	300-1450	6	72	290.2	111	6.4	1.7
PT 2000 AUT	1	18034.AUT	1000-2000	750-1450	30	72	362.2	111	8.7	1.7

†Speed at maximum air pressure and in high gear where applicable.

Pneutorque® Remote Control Standard Series

All Standard and Small Diameter Series Pneutorques are available fitted with the remote motor.

- Stall control gives repeatability of $\pm 5\%$ on a given joint.
- Torque transducers and angle encoders available for all models.
These form the basis of sophisticated control systems giving repeatability of up to $\pm 2\%$.
See page 81.
- Automatic Two Speed gearbox reduces run-down times.
- Each gearbox supplied with a standard reaction device or, on request, one specifically designed to suit the application.



PT2 Remote



Standard Series, Remote Control

Model	Square Drive	Part No.	Range		Free Speed†	A	B	C min	C max	Tool Weight	Reaction Weight
	in		N.m	lbf.ft		mm	mm	mm	mm		
PT 1	3/4	16031.X	160-680	120-500	30	108	292	83	217	10.6	2.2
PT 1 AUT	3/4	16031.XAUT	160-680	120-500	150	108	361	83	217	14.1	2.2
PT 1	1	16011.X	160-680	120-500	30	108	298	83	217	10.6	2.2
PT 1 AUT	1	16011.XAUT	160-680	120-500	150	108	366	83	217	14.1	2.2
PT 1A	1	16097.X	270-1200	200-900	15	108	298	83	217	11.1	2.2
PT 1A AUT	1	16097.XAUT	270-1200	200-900	75	108	366	83	217	14.6	2.2
PT 2	1	16013.X	515-1700	380-1250	9	108	298	83	217	11.1	2.2
PT 2 AUT	1	16013.XAUT	515-1700	380-1250	45	108	366	83	217	14.6	2.2
PT 5	1	16015.X	880-3400	650-2500	5	119	348	86	264	14	2.5
PT 5 AUT	1	16015.XAUT	880-3400	650-2500	25	119	417	86	264	17.5	2.5

†Speed at maximum air pressure and in high gear where applicable.



Reaction Nose Extensions

Special nose extension reaction devices are available for use in situations where the tool access is restricted. A typical application is the rear wheel nuts on heavy vehicles.



PTM-52 fitted with Nose Extension

Nose Extensions for PTM-52mm and PTM-72 Series Multipliers

To Fit PT	Square Drive	Part No.	A	B	C	D	E	Weight
	in		mm	mm	mm	mm	mm	kg
PTM-52	$\frac{3}{4}$	18594.006	52	150	51	63	110	3.1
PTM-52	$\frac{3}{4}$	18594.009	52	228	51	63	110	3.5
PTM-52	$\frac{3}{4}$	18594.012	52	303	51	63	110	3.9
PTM-72	1	18755.006	72	181	60	67	110	3.25
PTM-72	1	18755.009	72	257	60	67	110	4.05
PTM-72	1	18755.012	72	327	60	67	110	5.00

Nose Extensions for 72mm Series Multipliers

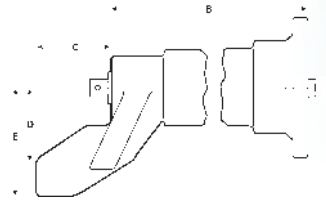
To Fit HT/PT	Square Drive	Part No.	A	B	C	D	E	Weight
	in		mm	mm	mm	mm	mm	kg
PT500 to PT2000 HT-72	Uses Square From Tool	18349.006	73	178	59	67	110	3.1
		18349.009	73	258	59	67	110	3.8
		18349.012	73	328	59	67	110	4.3
		18349.015	73	409	59	67	110	5.5
		18349.018	73	476.8	59	67	110	6.1

Reaction Nose Extensions

Nose Extensions for Standard Series Multipliers

To Fit HT/PT	Square Drive	Part No.	A	B	C	D	E	Weight
	in		mm	mm	mm	mm	mm	kg
1	$\frac{3}{4}$	16480.006	108	150.5	50	63	110	2.9
1	$\frac{3}{4}$	16480.009	108	226.5	50	63	110	3.7
1	$\frac{3}{4}$	16480.012	108	302.5	50	63	110	4.5
1 & 2	1	16542.006	108	146	74	81	124	5.1
1 & 2	1	16542.009	108	222	74	81	124	6.2
1 & 2	1	16542.012	108	298	74	81	124	7.4
5	1	16694.006	119	145	74	81	124	5.4
5	1	16694.009	119	221	74	81	124	6.8
5	1	16694.012	119	298	74	81	124	8.2

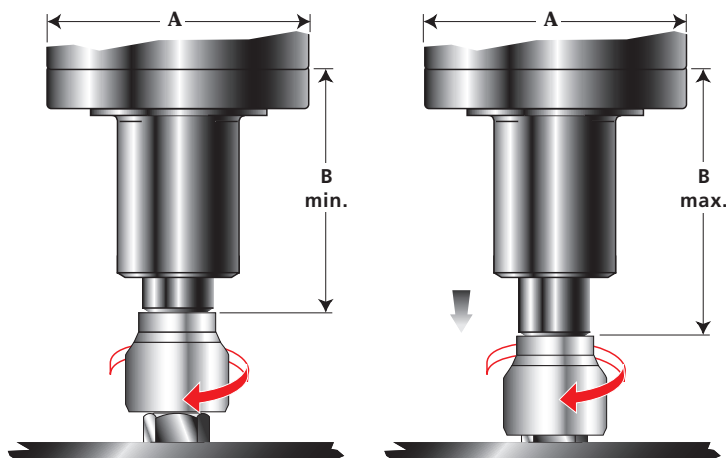
Special nose extension reaction devices are available for use in situations where the tool access is restricted. A typical application is the rear wheel nuts on heavy vehicles.



Telescopic Nose Assembly

The Telescopic Nose Assembly aids socket location in 'remote' applications and multi-spindle tools.

To Fit HT/PT	Square Drive	Part No.	A	B min	B max	Weight
	in		mm	mm	mm	kg
1 & 2	As Tool	16495	108	85.5	120.5	2
PT500 to PT2000	From Tool	18330.50	73	212	266.5	2.1



Operation of Telescopic
Nose Assembly



Geared Offsets

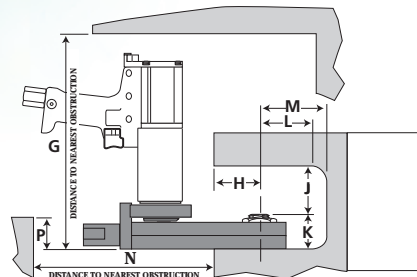
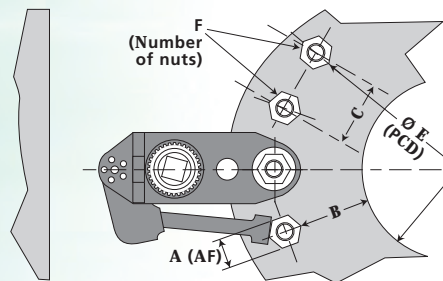
Originally designed to tighten plate heat exchangers where nuts have to rundown studs of up to 1 metre.

Offsets are invaluable in situations where access is limited due to headroom or tool diameter.

The Geared Offset has been developed to enable the tightening of fasteners in environments where access restrictions prevent the use of a standard multiplier or where excessive stud lengths prevent the tightening of a nut with standard sockets.

Each geared offset is manufactured to customers specifications and is therefore tailor-made to their application. For this reason it is essential that we obtain as much information as possible.

Please complete the diagram below and return to Norbar or your Norbar distributor.



A = H =

B = J =

C = K =

D = L =

E = M =

F = N =

G = P =

Max Torque Required

N.m lbf.ft

Pneutorque® Lifting Assemblies

A variety of lifting assemblies have been developed to ensure that Pneutorques can be manoeuvred and operated safely in a production environment.

Standard Series Pneutorques

Gearboxes with a capacity exceeding 9500 N.m are fitted with lifting brackets as standard. These tools are best handled with mechanical assistance.

For applications that require the smaller tools to be suspended by the use of a hoist or counterbalance, Norbar can supply a special purpose lifting bracket Part No. 16490.

72mm Series Pneutorques

Unlike the Standard Series Multipliers all 72mm Series tools are supplied with a lifting handle as standard. This handle is for manual use only and has no provision for alternative mounting such as a hoist or counterbalance.

For applications that require the tool to be suspended using a hoist or counterbalance Norbar can supply a special purpose lifting handle.

Customers requiring lifting handles for tools fitted with an Annular Transducer will require the longer Auto Two Speed versions.

Description	Part No.
To fit PT Single Speed	18344.148
To fit PT Auto Two Speed (and transducer tools)	18344.220



Part No. 16490



Part No. 18344.148

Gearbox Sub Assemblies

- Sub Assemblies include reaction arm but exclude lifting handle.
- If fitting a non Norbar motor to a gearbox, always consult Norbar or your distributor to establish whether the motor is compatible.
- Always re-calibrate the tool after exchanging a motor or gearbox.

72mm Series Gearboxes

Description	Square Drive	Part No.
PT 500 Single Speed Gearbox Sub Assembly	$\frac{3}{4}$	18369
PT 500 Auto Two Speed Gearbox Sub Assembly	$\frac{3}{4}$	18369.AUT
PT 1000 Single Speed Gearbox Sub Assembly	$\frac{3}{4}$	18370
PT 1000 Auto Two Speed Gearbox Sub Assembly	$\frac{3}{4}$	18370.AUT
PT 1000 Single Speed Gearbox Sub Assembly	1	18373
PT 1000 Auto Two Speed Gearbox Sub Assembly	1	18373.AUT
PT 1500 Single Speed Gearbox Sub Assembly	1	18371
PT 1500 Auto Two Speed Gearbox Sub Assembly	1	18371.AUT
PT 2000 Single Speed Gearbox Sub Assembly	1	18372
PT 2000 Auto Two Speed Gearbox Sub Assembly	1	18372.AUT

Gearbox Assemblies also available up to 100000 N.m



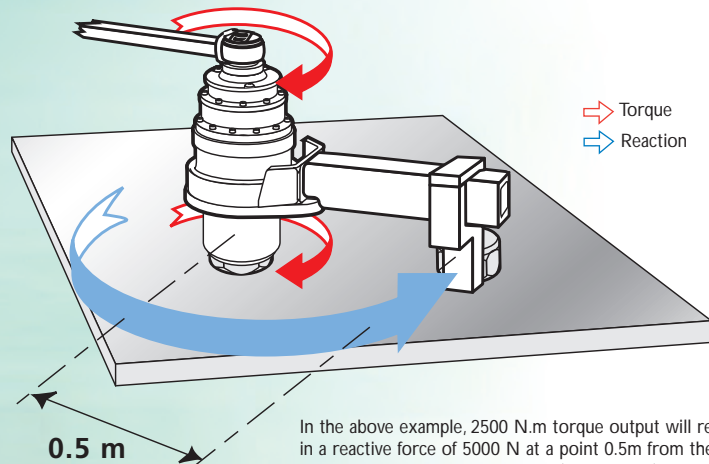
Torque Reaction

Principles of Torque Reaction

Newton's law dictates that for every applied force there is an equal and opposite reactive force. For applications requiring relatively low torques that can be applied with a torque wrench this does not present a problem as the reactive force is absorbed by the operator. However, if the desired torque necessitates the use of a multiplier, the resultant reactive force can only be absorbed using an appropriate reaction device.

For this reason all Norbar multipliers are supplied with a reaction plate or reaction foot fitted as standard.

All of the standard reaction plates and feet illustrated have been designed to enable the multiplier's use in a variety of environments but, due to an infinite number of bolting arrangements, it is impossible to have one reaction device that will satisfy every customer's requirement.

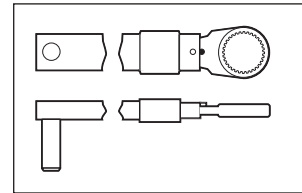


What to do if the standard reaction device is not suitable

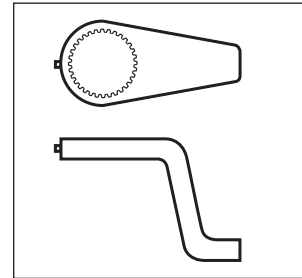
For those applications that do not permit the use of a standard reaction plate the customer has three options.

- Norbar or an authorised Norbar distributor will design and manufacture a special purpose reaction plate to the customer's requirements.
- The customer can modify the standard reaction plate to suit his requirements.
- The customer can fabricate his own reaction device after liaison with Norbar's technical department or a Norbar distributor.

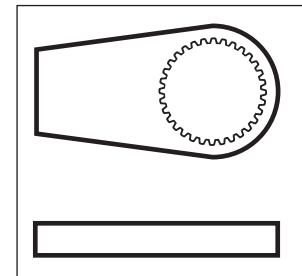
Customers wishing to either modify the original reaction plate or fabricate their own device should read the information on page 63 to avoid common torque reaction problems.



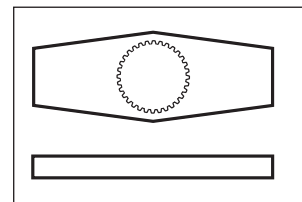
Optional on PTM-52 and PTM-72,
Standard on PT72mm Series



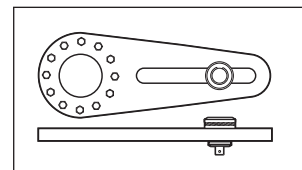
HT-52, HT-72, HT30/HT60,
PT2700/PT5500, PTM-52, PTM-72



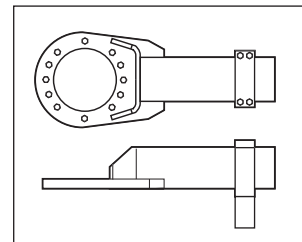
Optional Reaction Plate, 72mm
Series



Optional Double Ended Reaction
Plate, 72mm Series



Typical Reaction with sliding 'slave
square', PT/HT1 to PT/HT5



Typical Reaction with adjustable
reaction foot, PT/HT7 and PT/HT9

Torque Reaction

Avoiding Torque Reaction Problems

It has already been mentioned that the reaction force is equal to the force being applied. However, the magnitude of the reaction force is dependent upon the perpendicular distance between the point of reaction and the centre line of the multiplier, ie. the greater the distance the lower the force.

For this reason the point of reaction should be kept as far away from the centre line of the gearbox as is practical.

Customers using or modifying reaction plates for Standard Series multipliers up to a capacity of 3400 N.m should note that if the reaction is taken on the radiused part, the reaction force is perpendicular to the tangent of the curve. Consequently, the further around the radius the reaction is taken, the smaller the perpendicular distance and therefore the greater the force.

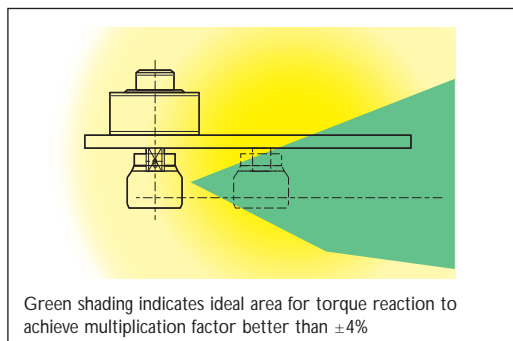
Although a longer reaction plate may mean lower forces, the bending moment close to the multiplier will increase.

Customers extending the length of Norbar's standard reaction plates should be aware that an increase in overall length will result in a larger induced bending stress and should not assume that because the reaction plate is strong enough at one length it will remain so when extended.

Excessive side loading, resulting from poor reaction, increases frictional forces inside the multiplier. This can lead to lower multiplication ratios (outside $\pm 4\%$).

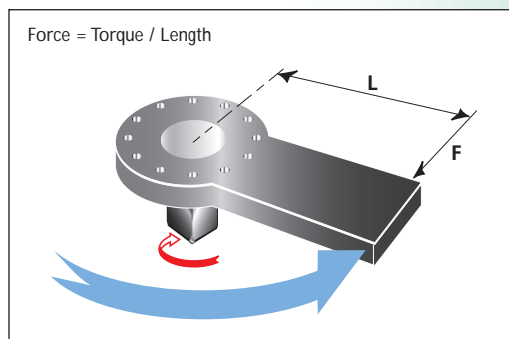
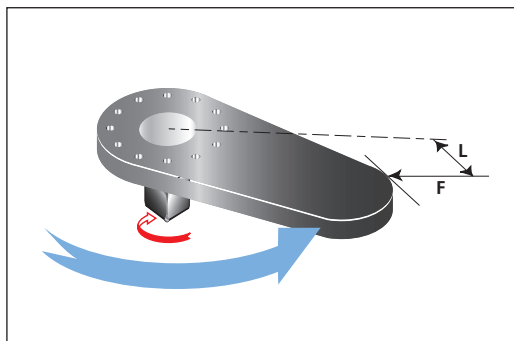


Signs of poor reaction are evident on this damaged foot. Reaction was taken at the wrong point on the foot and burring indicates that the foot was slipping off the reaction point.



Points to remember

- Take the reaction as far away from the multiplier as practical.
- Ensure that the reaction point remains square to the multiplier wherever possible as this will minimise any additional stress in the output square, which could result in premature failure. If the multiplier tilts under load, the reaction may not be square.
- For applications that do not allow the reaction to be taken securely it is advisable to use a double ended or balanced reaction plate.



Reaction Force

When using Multipliers and Pneuturques the reaction point must be capable of withstanding reaction force. Therefore, great care must be exercised where reaction is taken when applying high torques to studs and bolts.

By using the following formula you can calculate the force at the point of reaction. The greater the distance the lower the force.

$$\text{Formula to calculate Area of Stud} = \frac{\pi \times D^2}{4}$$

$$\text{Formula to calculate Shear Force: Shear Force} = \frac{\text{Reaction Force}}{\text{Area of Stud}}$$

Measurement and Calibration - Glossary of Terms

The following information may help in selecting the appropriate measuring device for your needs.

Accuracy

The precision of the instrument which can be reported in three ways.

1. By quoting the guaranteed tolerance as a percentage of the reading or indicated value, (eg. "0.5% of Reading").
2. By quoting the guaranteed tolerance as a percentage of the full scale value of the instrument, (eg. 0.1% FS or 0.1% FSD).
3. By quoting a 'class' of device in accordance with BS7882:2008 "Method for calibration and classification of torque measuring devices". (See page 90).

Modes of Operation

First Peak of Torque - when a "click type" torque wrench signals that the set torque has been achieved, the applied torque will momentarily drop before climbing again. Generally the fastener stops rotating at point 1, and from a standstill, the breakaway torque to achieve further rotation of the fastener will be higher than point 3b. Only if the operator is very insensitive to the break point will the final tightening effort be incorrect.

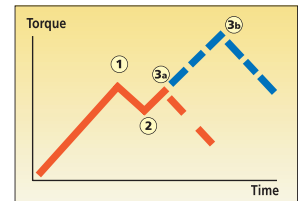
"First Peak of Torque" mode will detect the break point of the torque wrench, not the highest torque applied.

Peak Torque - this mode of operation will record the highest torque applied. In the case of a "click type" torque wrench this may be higher than the actual break point if the wrench continues to be loaded beyond the break.

Consequently, Peak Torque is more useful for calibrating devices without a break signal such as dial or electronic wrenches.

Track - this mode has no memory at all. When the load is removed the display will return to zero.

Track is used for calibrating the device itself or for monitoring a fluctuating torque.



- 1 = Torque wrench activates
- 2 = 'Click' heard
- 3a = Wrench released quickly
- 3b = Wrench released slowly

Resolution

The smallest measurement interval that can be determined on the indicating device.

This applies to analogue and digital devices.

Number of Digits

Digital displays are described as having a certain number of 'digits' or 'active digits'.

Half digits can be used to increase the resolution of a device without the expense of going to an additional full active digit.

Eg 1. 1000 N.m displayed on a 4 digit system would read 1000 (resolution = 1 N.m).

Eg 2. 1000 N.m displayed on a 4½ digit system would read 1000.0 (resolution = 0.1 N.m).

Active digits change as the torque changes. Non active digits only assist in showing the magnitude of the torque.

For example, 10,000 N.m requires 5 digits to display its magnitude.

Eg 3. With 4 active digits (and 1 passive digit), 10,000 N.m would change in steps of 10 N.m.

Eg 4. With 4½ or 5 active digits, 10,000 N.m would change in steps of 1 N.m.

Signal Processing

Electronic Circuitry falls broadly into two types, analogue and digital, with most electronic measurement systems comprising a mixture of the two. There are also whole analogue electronic systems, but these are rare in torque measurement. Most systems start with an analogue signal. The point at which the signal is converted defines the type.

Analogue systems – one in which the signal is processed before being converted to digital.

Digital systems – the original analogue signal is converted to digital before processing.

TruCheck

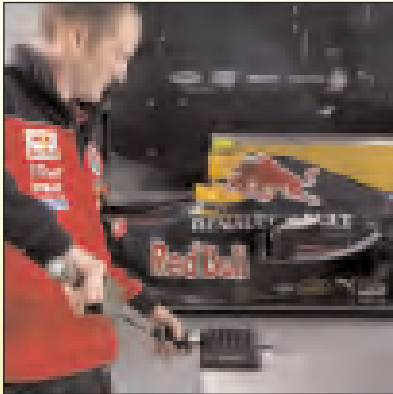
Simple, Cost Effective Torque Wrench Testing

The importance of keeping your torque tools in peak calibration condition is well established. Many businesses achieve this by using a third party calibration service. However, how much more convenient would it be to perform calibration checks in-house? Wrenches could be checked more frequently, immediately if a problem is suspected, and wrenches would not need to leave site unnecessarily.

The main reasons that more companies do not perform calibration checks on their own wrenches are the cost of testers and fears over the complexity of the testing equipment. Norbar's new 'TruCheck' torque wrench testers aim to sweep aside these concerns. They are very cost effective being significantly cheaper than most similar products on the market and the basic version of the TruCheck particularly is very simple to use.

The product comes in two versions: there is a basic version, simply called 'TruCheck' and a version with greater functionality called 'TruCheck Plus'.





TruCheck

One of the concerns in putting a torque tester into an environment where people are not calibration specialists is that incorrect selections will be made with the potential for incorrect tool setting and consequently tool failure. Norbar's solution is to remove all choices from the operator. The TruCheck is for click type torque wrenches and comes with a single measurement unit (N.m or lbf.ft). There is only one button on the device and that is to zero the display. Operation is simplicity itself and it is virtually impossible to go wrong!



TruCheck 10 - 350 N.m

TruCheck

Model	Part No.	Range
TruCheck 350 N.m	43221	10 - 350 N.m
TruCheck 250 lbf.ft	43226	10 - 250 lbf.ft
TruCheck 1000 N.m	43230	100 - 1000 N.m
TruCheck 750 lbf.ft	43237	75 - 750 lbf.ft

Technical Specification

Accuracy: +/-1%, +/-1 digit over the stated operating range.

Display: 4 digit, 7 segment LED.

TruCheck 350 N.m and 250 lbf.ft

Drive Size: 1/2" female square

Dimensions in mm: 145.5(d) x 150(w) x 85(h)

Weight: 3.2 kg shipping

TruCheck 1000 N.m and 750 lbf.ft

Drive Size: 27mm male hexagon supplied with 3/4" square drive socket

Dimensions in mm: 145.5(d) x 175(w) x 85(h)

Weight: 4.8 kg shipping

Materials/Finish: Self coloured rigid polypropylene case.

Stainless steel transducer shaft and zinc plated steel base plate.



Power Tool Test Fixture For TruCheck, 1000 N.m and 750 lbf.ft (Part Number 50757)

This Power Tool Test Fixture incorporates a Joint Simulation Rundown Assembly, base plate, reaction plate, drive adaptors and a reaction adaptor. This, when used in conjunction with a TruCheck Plus 1000, provides a cost effective means of testing Norbar's PTM-52, PTM-72, PTME and PT72 tools up to 1000 N.m (750 lbf.ft). The Joint Simulation element (part number 50758) can be purchased separately for customers wishing to design their own reaction fixtures. This joint simulator is not recommended for use with impact or impulse type wrenches.

TruCheck Plus

Accepting that some customers require more flexibility than the basic TruCheck provides, the 'Plus' adds a comprehensive range of features. With three modes of operation the TruCheck Plus is suitable for click wrenches, dial and electronic wrenches and in 'Track' mode will continuously monitor the torque signal.

There are three torque units - N.m, lbf.ft and lbf.in.

TruCheck Plus also has a user selectable 'limit' feature. The operator sets the target torque and tolerance and the instrument will calculate whether the reading is within tolerance and indicate the result by illuminating one of three coloured LEDs: yellow = low, green = OK, red = high.

Finally, TruCheck Plus has an RS-232 serial data output and comes complete with an RS-232 lead. The reading, measurement unit and limit status (Low, OK or High) are output via RS-232.



TruCheck Plus 1000 - 1000 N.m
3/4" socket is supplied

TruCheck Plus

Model	Part No.	Range
TruCheck Plus 350 N.m	43222	10 - 350 N.m
TruCheck Plus 1000 N.m	43231	100 - 1000 N.m

Calibration Options

TruCheck instruments are supplied as standard with a traceable calibration certificate for the clockwise direction. As an option, UKAS accredited calibration certificates from Norbar's laboratory can be supplied, either clockwise only or clockwise and counter clockwise.

Part No.	Description
TCACC.CW	UKAS accredited calibration clockwise
TCACC.CW+CCW	UKAS accredited calibration clockwise and counter clockwise

Note: UKAS accredited calibration is from 5% to 100% of full scale for TruCheck 350 N.m and 250 lbf.ft (part numbers 43221, 43226 and 43222) and 10% to 100% for TruCheck 1000 N.m and 750 lbf.ft (part numbers 43230, 43231 and 43237).

Professional Torque Tester (Pro-Test) – Series 2

The accuracy, ease of use and price competitiveness of the original Pro-Test instrument has made it the choice of many industrial, military and automotive customers worldwide. The 'Series 2' adds some unique features designed to make life easier and reduce the opportunities for error when calibrating torque wrenches.

New Features

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and high indication both on the screen, and by coloured LEDs. Limit status is also output via RS-232-C. Target torque and tolerance can be set by the operator.
- ISO 6789 calibration mode automatically calculates the torque wrench calibration points and tolerance. All the user has to do is set the maximum calibration point for the wrench – the instrument does the rest for you!
- Memory function displays the 5 previous readings taken by the operator. For operators creating manual calibration certificates, there is no need to stop and write after each reading, hence speeding the process.
- Carry case is now a standard feature.
- RS-232 cable included as standard.



Pro-Test display and transducer in carry case.

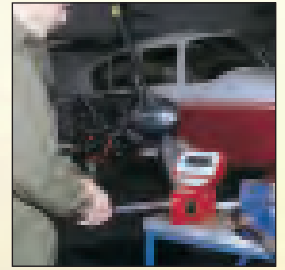


Flexible mounting options of Pro-Test on Bracket, Part No. 62198



Professional Torque Tester (Pro-Test) – Series 2

- Guaranteed classification to BS7882:2008, Class 1 or better over the primary calibration range (20% to 100% of full scale), Class 2 or better over the secondary calibration range (lowest calibrated value to 20% of full scale). Class 1 equates to $\pm 0.5\%$ of reading.
- Three transducers are available in the range, up to 1500 N.m (1100 lbf.ft).
- Three essential operating modes allow the Pro-Test to be used with all torque wrench types: 'Track' displays the live value, 'Peak Memory' records the highest value and 'First Peak Memory' records the first peak of torque (for click type torque wrenches). Both memory modes can be used with manual or automatic reset.
- Large back lit display is easily visible from a distance and in poor light.
- All common units of torque measurement are included.
- User can select the language they wish to work in (most European languages are included).
- Transducer can be mounted for torque wrench operation in the horizontal or vertical plane.
- RS-232-C is included for the output of reading to a printer, PC, data capture unit, SPC software etc.
- Optional mounting plate, Part No. 62198 gives greater flexibility of mounting options.
- All user settable parameters are menu selectable from the front panel.
- As standard, all transducers are calibrated in a clockwise direction. For additional anti clockwise direction order Part No. PROTEST.CCW.



Measure Screen



Limit type selection

Pro-Test

Model	Part No.	Operating Range	Calibrated Range	System Resolution	Input Hex A/F	Square Drive Adaptor
		N.m	N.m	N.m	mm	in
Pro-Test 60	43218	0 - 60	1.2 – 60	0.001	10	$\frac{1}{4} + \frac{3}{8} + \frac{1}{2}$
Pro-Test 400	43219	0 – 400	8 – 400	0.01	22	$\frac{3}{8} + \frac{1}{2} + \frac{3}{4}$
Pro-Test 1500	43220	0 – 1500	30 – 1500	0.1	36	$\frac{3}{4}$

Pro-Test Ancillaries

Part No.	Description
60253	12V DC Power Supply*
62198	Mounting Plate
PROTEST.CCW	Pro-Test Counter Clockwise Calibration

* Option only necessary when powering from a 12V DC vehicle battery.

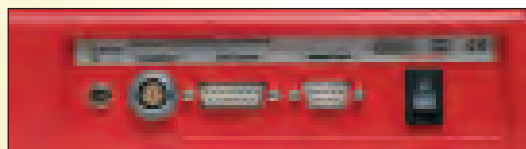
Torque Screwdriver Tester (TST) - Series 2

The TST combines simplicity with up to date technology to provide a high quality instrument for the testing and calibration of low capacity torque tools.

Featuring an internal transducer complete with Joint Simulation Rundown Assembly, the TST is available in 3 torque ranges, 0.04 to 2 N.m, 0.5 to 10 N.m and 1.25 to 25 N.m. Class 1 system accuracy over its Primary range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).

What makes the TST genuinely versatile is the interface for an external transducer. This interface, accessed by a 2 way switch in the TST, allows the connection of any transducer from Norbar's "SMART" range and most mV/V calibrated transducers from Norbar or other manufacturers.

Norbar is UKAS accredited for the calibration of electrical torque indicator displays and the TST is supplied with a calibration certificate. This ensures that each element of the system is fully traceable and interchangeable. The TST is also supplied with a UKAS torque calibration certificate for the complete system i.e. display and internal transducer.



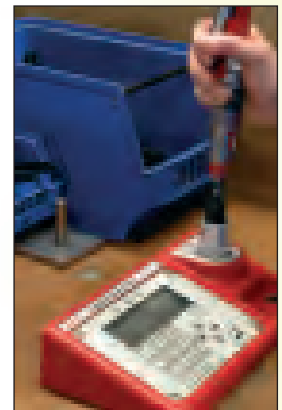
Back Panel



TST in standard carry case.

Torque Screwdriver Tester (TST) - Series 2

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and fail indication. Up to 12 target values can be set.
- Digital limit state output for control of external tools.
- Operation from fast charge internal battery pack (maximum time of 3 hours 20 minutes for full charge) or a.c. supply (90 to 264 Volts).
- RS-232-C serial data interface for connection to a printer or PC. Continuous RS 232 output when used in track mode (up to 11 readings per sec).
- Pulse count feature in Impulse mode and Clutch Tool mode.
- "SMART" intelligence for transducer recognition.
- Memory for calibration details of 20 non-"SMART" mV/V calibrated transducers.
- Analogue output allows the instrument to be used as part of a process control system for performance analysis.
- User selectable frequency response for each mode of operation.
- All user selectable features have password protection. The instrument can be issued to users with only the required modes of operation and units of measure enabled. This feature can virtually eliminate operator induced errors.
- Supplied in carry case.
- All common measurement units for torque are included plus users can configure their own units to interface with non torque transducers.



TST

Model	Part No.	Range	
		N.m	lbf.in
TST 2	43212	0.04-2	0.4-20
TST 10	43213	0.5-10	5-100
TST 25	43214	1.25-25	12.5-250

TST Ancillaries

Part No.	Description
60216.200	TST to 10 Way lead, for Norbar Rotary Transducers
60217.200	TST to 6 Way lead, for Norbar Static & Annular Transducers
TST.CCW	TST Counter Clockwise Calibration
50539*	Joint Simulation Rundown Assembly 2 N.m
50540*	Joint Simulation Rundown Assembly 10 N.m
50541*	Joint Simulation Rundown Assembly 25 N.m

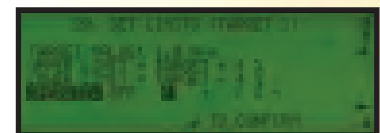
*The TST comes with a Joint Simulation Rundown Assembly as standard.
These Part No.s are for replacement or additional fixtures only.

Accuracy when used with external transducer port:

Input Voltage	Equivalent torque	Accuracy	Calibration uncertainty*
@0.5 mV	5% of full scale	±0.1% of reading	±0.13%
@1.0 mV	10% of full scale	±0.05% of reading	±0.08%
@2.0 to 18.9 mV	20% to 110% full scale	±0.05% of reading	±0.06%

*Using a coverage factor of k=2, to give a confidence level of approximately 95%.

Resolution: 5 digits for all Norbar transducers.
Weight: 2.2 kg (4.8 lb).
Dimensions: 160 mm deep x 288 mm wide x 72 mm high.



Limit Setting Screen



Measure Screen



Torque Tool Tester (TTT) - Series 3

The TTT shares all of the extensive features of the TST except that it has no internal transducer. Instead, the TTT offers not one but three external transducer interfaces allowing any three transducers to be simultaneously connected. Selection between the transducers is made by a rotary switch at the back of the instrument case.

Any transducer from Norbar's "SMART" range and most mV/V calibrated transducers from Norbar or other manufacturers can be connected to the TTT. The "SMART" feature means that once a transducer has been connected, the instrument will automatically recognise calibration details such as mV/V output, serial number and capacity.

Norbar is UKAS accredited for the calibration of electrical torque indicator displays and the TTT is supplied with a calibration certificate. This ensures that each element of the system is fully traceable and interchangeable.



Back panel



TTT in standard carry case.
STB1000 Transducer also shown.

Torque Tool Tester (TTT) - Series 3

- Pictorial display panel for easy mode selection.
- Limit detection with low, pass and fail indication. Up to 12 target values can be set.
- Digital limit state output for control of external tools.
- Operation from fast charge internal battery pack (maximum time of 3 hours 20 minutes for full charge) or a.c. supply (90 to 264 Volts).
- RS-232-C serial data interface for connection to a printer or PC. Continuous RS 232 output when used in track mode (up to 11 readings per sec).
- Pulse count feature in Impulse mode and Clutch Tool mode.
- "SMART" intelligence for transducer recognition.
- Memory for calibration details of 20 non-"SMART" mV/V calibrated transducers.
- Analogue output allows the instrument to be used as part of a process control system for performance analysis.
- User selectable frequency response for each mode of operation.
- All user selectable features have password protection. The instrument can be issued to users with only the required modes of operation and units of measure enabled. This feature can virtually eliminate operator induced errors.
- Supplied in carry case.
- All common measurement units for torque are included plus users can configure their own units to interface with non torque transducers.



TTT

Part No.	Description
43228	Torque Tool Tester

TTT Ancillaries

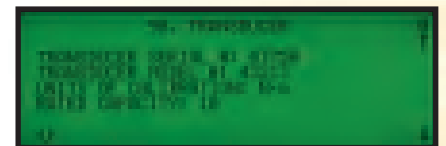
Part No.	Description
60216.200	TTT to 10 Way lead, for Norbar Rotary Transducers
60217.200	TTT to 6 Way lead, for Norbar Static & Annular Transducers
TTT.CCW	TTT Counter Clockwise Calibration

Accuracy:

Input Voltage	Equivalent torque	Accuracy	Calibration uncertainty*
@0.5 mV	5% of full scale	±0.1% of reading	±0.13%
@1.0 mV	10% of full scale	±0.05% of reading	±0.08%
@2.0 to 18.9 mV	20% to 110% full scale	±0.05% of reading	±0.06%

*Using a coverage factor of k=2, to give a confidence level of approximately 95%.

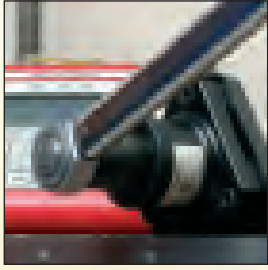
Resolution: 5 digits for all Norbar transducers.
 Weight: 1 Kg (2.2 lb).
 Dimensions: 150 mm high x 200 mm wide x 180 mm deep.



Details of connected transducer displayed by pressing # key.



Language setting



Flange Mounted Transducers - FMT

Flange Mounted Transducers incorporate mounting points for securely fixing the transducer to the working surface. The transducer lead is also included and is fitted with a high quality Lemo® connector, suitable for attachment to TST and TTT instruments.

- Classified to BS7882:2008, typically better than Class 1 for the primary classification range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).
- "SMART" – TST and TTT instruments will automatically recognise calibration details.
- Joint Simulation Rundown Assembly is included on transducers up to 150 N.m (100 lbf.ft) allowing joint simulation for power tool testing.
- Supplied with UKAS calibration certificate.
- Transducers are supplied with precision made square drive adaptors.



1500 N.m Transducer

S.I Calibrated Transducers

Capacity	Part No.	Range	Square Drives Supplied - in
2 N.m	50671.xxx	0.04-2 N.m	$\frac{1}{4}$
10 N.m	50672.xxx	0.5-10 N.m	$\frac{1}{4}$
25 N.m	50673.xxx	1.25-25 N.m	$\frac{1}{4} + \frac{3}{8}$
150 N.m	50674.xxx	7.5-150 N.m	$\frac{3}{8} + \frac{1}{2}$
400 N.m	50675.xxx	20-400 N.m	$\frac{1}{2} + \frac{3}{4}$
1500 N.m	50676.xxx	30-1500 N.m	$\frac{1}{2} + \frac{3}{4} + 1$

Imperial Calibrated Transducers

Capacity	Part No.	Range	Square Drives Supplied - in
20 lbf.in	50677.xxx	0.4-20 lbf.in	$\frac{1}{4}$
100 lbf.in	50678.xxx	5-100 lbf.in	$\frac{1}{4}$
250 lbf.in	50679.xxx	12.5-250 lbf.in	$\frac{1}{4} + \frac{3}{8}$
100 lbf.ft	50680.xxx	5-100 lbf.ft	$\frac{3}{8} + \frac{1}{2}$
250 lbf.ft	50681.xxx	12.5-250 lbf.ft	$\frac{1}{2} + \frac{3}{4}$
1000 lbf.ft	50682.xxx	20-1000 lbf.ft	$\frac{1}{2} + \frac{3}{4} + 1$

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50671.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

Joint Simulation Rundown Assemblies for Flange Mounted Transducers

Part No.	Range	A/F Size of Hex Screws
50539	0.04 – 2 N.m 0.4 – 20 lbf.in	$\frac{1}{4}$ "
50540	0.5 – 10 N.m 5 – 100 lbf.in	$\frac{1}{4}$ "
50541	1.25 – 25 N.m 12.5 – 250 lbf.in	$\frac{1}{4}$ "
50692	7.5 – 150 N.m 5 – 100 lbf.ft	14 mm

The above Joint Simulation Rundown Assemblies are supplied with the Flange Mounted Transducer as standard, but can also be ordered separately.



“SMART” Torque Block - STB

- Classified to BS7882:2008, typically better than Class 1 for the primary classification range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).
- “SMART” – TST and TTT instruments will automatically recognise calibration details.
- Supplied with UKAS accredited calibration certificate.

There are two models, STB1000 and STB3000. Transducer Lead is incorporated and is terminated in a Lemo® connector suitable for the TST and TTT.

S.I. Calibrated Transducers

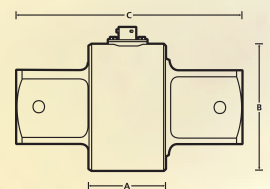
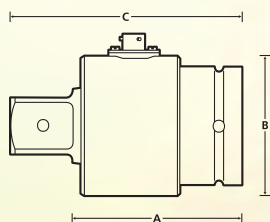
Model	Part No.	Range	Square Drives - in
STB1000	50683.xxx	20-1000 N.m	$\frac{1}{2} + \frac{3}{4}$
STB3000	50684.xxx	150-3000 N.m	$\frac{3}{4} + 1$

Select part no. suffix .LOG if the transducer is to be connected to TST and TTT (example: .LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

Joint Simulation Rundown Assemblies for STB1000

Part No.	Range	A/F Size of Hex Screws - mm
50693	10 – 140 N.m 10 – 100 lbf.ft	12
50694	100 – 700 N.m 70 – 500 lbf.ft	19





Static Torque Transducer

The accuracy and quality of the Norbar Static Torque Transducers has made them the first choice of many calibration laboratories throughout the world.

- Up to 5000 N.m (5000 lbf.ft) classified to BS7882:2008, typically better than Class 1 for the primary classification range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).
- Robust, heat treated, alloy steel torsion shaft design.
- Designed to ignore non torsional forces.
- Operates in clockwise and anti-clockwise directions.
- Calibration up to 5000 N.m (lbf.ft) with a UKAS accredited calibration certificate, above 5000 N.m (lbf.ft) with a traceable calibration certificate.
- Calibrated in clockwise direction as standard. Anti-clockwise calibration provided on request.
- 'SMART' transducers have built in memory circuit which contains essential information about the transducer. This information can be read by Norbar's TST and TTT instruments meaning that when the transducer is connected, it is immediately recognised and ready for use. When ordering for a TST or TTT, use part no. suffix 'LOG' (eg. 50659.LOG) if you require a torque units calibration certificate.
- 'SMART' transducers can also be used with many instruments not of Norbar manufacture. However, these will operate as normal ratio calibrated (mV/V) transducers – the 'SMART' data will not be read. For non Norbar instruments or for when a mV/V certificate is required, use part code suffix 'IND'.

S.I Calibrated Transducers

Capacity	Part No.	Sq. Drive	Dimensions (mm)			Bench Stand
		in	A	B Ø	C	
1 N.m	50587.IND*	¼ m/f	79	36.5	86	50211
2.5 N.m	50588.xxx	¼ m/f	79	36.5	86	50211
5 N.m	50589.xxx	¼ m/f	79	36.5	86	50211
10 N.m	50590.xxx	¼ m/f	79	36.5	86	50211
25 N.m	50591.xxx	⅜ m/f	79	36.5	89.5	50212
50 N.m	50592.xxx	⅜ m/f	79	36.5	89.5	50212
100 N.m	50593.xxx	½ m/f	79	36.5	92.8	50213
250 N.m	50594.xxx	½ m/f	79	36.5	92.8	-
250 N.m	50701.xxx	¾ m/f	118	54	141	50220
500 N.m	50596.xxx	¾ m/f	118	54	141	50220
1000 N.m	50597.xxx	1 m/f	118	54	146	50221
2500 N.m	50703.xxx	1½ m/f	117	95	160	50127
5000 N.m	50599.xxx	1½ m/f	117	95	160	50127
7000 N.m	50669.xxx	1½ m/f	117	95	160	50127
10000 N.m	50600.xxx	2½ m/f	125.5	124	189	-
25000 N.m	50603.xxx	2½ m/m	68.5	110	200	-
25000 N.m	50602.IND*	2½ m/f	125.5	127	189	-
50000 N.m	50604.xxx	2½ m/f	125.5	127	189	-
100000 N.m	50607.xxx	3½ m/m	98	165	271	-

*Not suitable for TST and TTT.

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50588.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

Static Torque Transducer



Imperial Calibrated Transducers

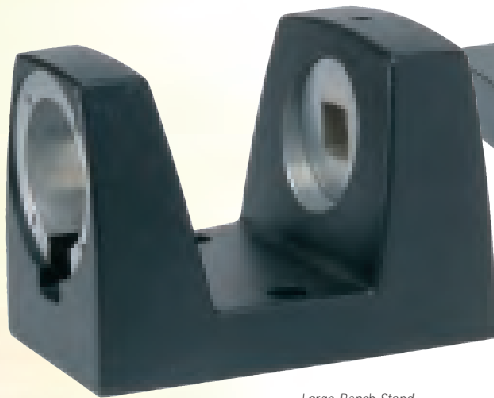
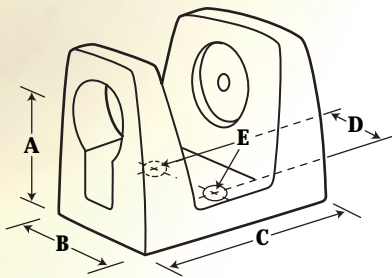
Capacity	Part No.	Sq. Drive	Dimensions (mm)			Bench Stand
		in	A	B Ø	C	
100 ozf.in	50609.IND*	¼ m/f	79	36.5	86	50211
1000 ozf.in	50616.xxx	¼ m/f	79	36.5	86	50211
10 lbf.in	50610.IND*	¼ m/f	79	36.5	86	50211
25 lbf.in	50612.xxx	¼ m/f	79	36.5	86	50211
50 lbf.in	50614.xxx	¼ m/f	79	36.5	86	50211
100 lbf.in	50617.xxx	¼ m/f	79	36.5	86	50211
250 lbf.in	50619.xxx	¾ m/f	79	36.5	89.5	50212
500 lbf.in	50621.xxx	¾ m/f	79	36.5	89.5	50212
1000 lbf.in	50623.xxx	½ m/f	79	36.5	92.8	50213
1 lbf.ft	50611.xxx	¼ m/f	79	36.5	86	50211
2.5 lbf.ft	50613.xxx	¼ m/f	79	36.5	86	50211
5 lbf.ft	50615.xxx	¼ m/f	79	36.5	86	50211
25 lbf.ft	50620.xxx	¾ m/f	79	36.5	89.5	50212
50 lbf.ft	50622.xxx	¾ m/f	79	36.5	89.5	50212
100 lbf.ft	50624.xxx	½ m/f	79	36.5	92.8	50213
250 lbf.ft	50625.xxx	½ m/f	79	36.5	92.8	-
250 lbf.ft	50702.xxx	¾ m/f	118	54	141	50220
500 lbf.ft	50627.xxx	¾ m/f	118	54	141	50220
1000 lbf.ft	50628.xxx	1 m/f	118	54	146	50221
2500 lbf.ft	50704.xxx	1½ m/f	117	95	160	50127
5000 lbf.ft	50630.xxx	1½ m/f	117	95	160	50127
10000 lbf.ft	50632.xxx	2½ m/f	125.5	124	189	-
25000 lbf.ft	50635.xxx	2½ m/m	68.5	110	200	-
25000 lbf.ft	50634.xxx	2½ m/f	125.5	127	189	-
50000 lbf.ft	50636.xxx	3½ m/m	98	165	271	-
100000 lbf.ft	50637.xxx	3½ m/m	98	165	271	-

* Not suitable for TST and TTT

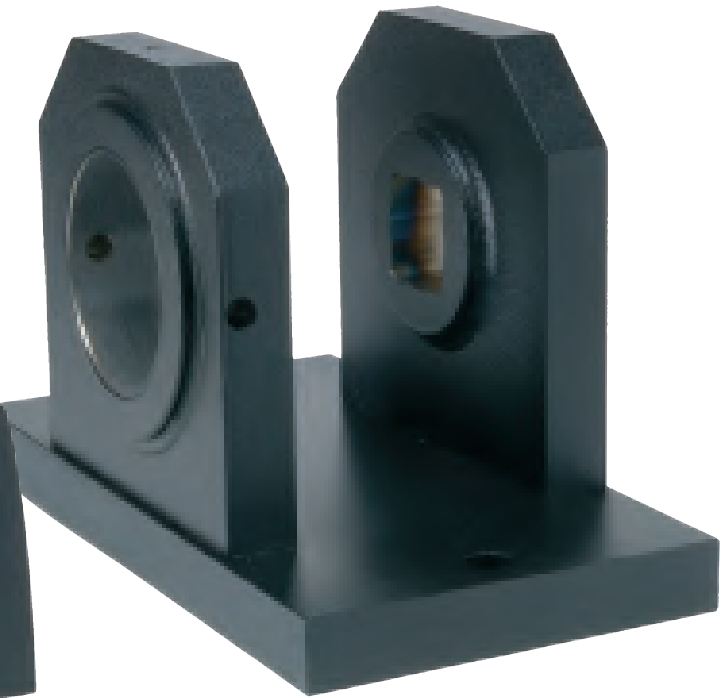
Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50616.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.

Bench Stands

- Ensures the correct mounting of Norbar's Static Torque Transducers up to 5000 N.m (5000 lbf.ft).
- All bench stands (except Extra Large) are machined to accept Norbar Joint Simulation Rundown Assemblies for power tool testing and calibration.
- For transducers in the range 1 N.m to 10 N.m (100 ozf.in to 100 lbf.in), Torque Limiting Bench stands are available. These are designed to prevent transducer over-load.
- All 'Small Frame Size' Bench Stands can be mounted horizontally or vertically.



Large Bench Stand



Extra Large Bench Stand

Transducer Bench Stands

Part No.	Model Description	Sq. Drive	Dimensions (mm)				
		in	A	B	C	D	EØ
60210	Torque Limiting (set to 1.6 N.m)	¼	50	65	96	56	8.5
60211	Torque Limiting (set to 8.1 N.m)	¼	50	65	96	56	8.5
60212	Torque Limiting (set to 16 N.m)	¼	50	65	96	56	8.5
50211	Small Frame Size (10 N.m)	¼	50	65	96	56	8.5
50212	Small Frame Size (50 N.m)	¾	50	65	96	56	8.5
50213	Small Frame Size (100 N.m)	½	50	65	96	56	8.5
50220	Large Frame Size (500 N.m)	¾	70	87	150	79	13.5
50221	Large Frame Size (1000 N.m)	1	70	87	150	79	13.5
50127	Extra Large Size (5000 N.m)	1½	105	280	152	240	16.5

Joint Simulation Rundown Assemblies

The Norbar Joint Simulation Rundown Assemblies are designed to simulate the working conditions of screwed or bolted joints. Used in conjunction with a Norbar transducer, bench stand and display instrument, the output of torque controlled power tools can be measured against a range of simulated joint rates, from hard through to soft.

- Suitable for a wide variety of power tools including pneumatic/electric screwdriver and angle wrenches with either clutch or stall torque control.
- Models available for torques from 0.2 N.m to 500 N.m (2 lbf.in to 500 lbf.ft).
- Spring washers and full instructions are provided to simulate a wide range of joint types as detailed in: BS6268:1982 , BS6544:1981, ISO5393:1981.



Joint Simulation Rundown Assemblies for Static Transducers

Part No.	Socket	Range	Bench Stand Required	A/F Size of Hex Screws - mm
	in			
50313	¼	0.2 - 2 N.m 2 - 20 N.m	50211	5
50251	¼	2 - 10 N.m 20 - 100 lbf.in	50211	5
50252	⅜	5 - 50 N.m 5 - 50 lbf.ft	50212	8
50253	½	10 - 100 N.m 10 - 100 lbf.ft	50213	10
50254	¾	100 - 500 N.m 100 - 500 lbf.ft	50220	19

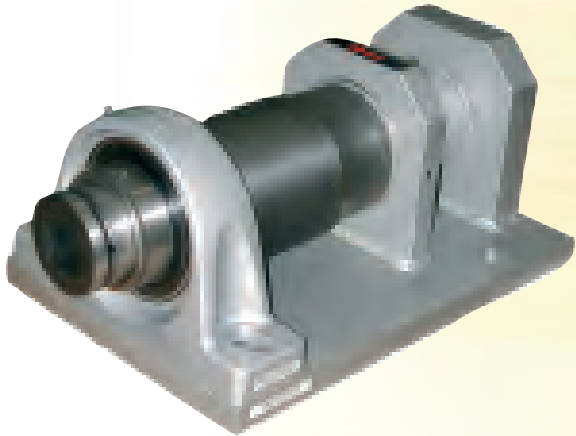


Power Tool Test Fixture RD 5000

The RD5000 is designed for testing the output of powered torque controlled tools up to 5000 lbf.ft (6800 N.m). A suitable 1½" square drive Norbar Static Transducer, Lead and Display Instrument are also required for a complete system. For testing tools up to 1500 N.m, please order the alternative washer stack, part number 50548.2.

RD 5000 and Ancillaries

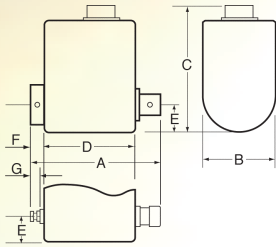
Part No.	Description
50548	135 - 6780 N.m (100 - 5000 lbf.ft) Power Tool Test Fixture
50548.1	Nut and Bolt Kit UNC
50548.2	Washer Stack 1500 N.m



Rotary Torque Transducer

These transducers are designed to measure the torque output from rotating shafts, particularly torque controlled power tools including impulse wrenches.

- Classified to BS7882:2008, typically better than Class 1 for the primary classification range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).
- "SMART" – TST and TTT instruments will automatically recognise calibration details.
- Supplied with a UKAS accredited calibration certificate.
- Designed to give excellent performance with impulse tools.
- Optional angle measurement – contact Norbar for details.



Rotary Torque Transducers – S.I. Calibration

Capacity	Part No.	Sq. Drive	Maximum RPM*		Dimensions (mm)						
		in	Continuous	Intermittent	A	B	C	D	E	F	G
5 N.m	50708.xxx	¼" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
20 N.m	50709.xxx	¼" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
20 N.m	50710.xxx	¼" m/f	5000	11000	71.5	30	71.5	56	13	6	-
75 N.m	50711.xxx	⅜" m/f	5000	11000	77	30	74	56	15	8	-
200 N.m	50712.xxx	½" m/f	2500	7600	87	42	82.5	58	21	12	-
250 N.m	50713.xxx	¾" m/f	2000	5000	106	52	93.5	60	26	21	-
500 N.m	50714.xxx	¾" m/f	2000	5000	106	52	93.5	60	26	21	-
1500 N.m	50715.xxx	1" m/f	1000	4400	125	63	104	64.5	31.5	29	-

Rotary Torque Transducers – Imperial Calibration

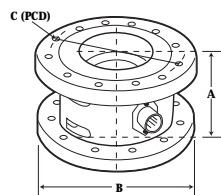
Capacity	Part No.	Sq. Drive	Maximum RPM*		Dimensions (mm)						
		in	Continuous	Intermittent	A	B	C	D	E	F	G
50 lbf.in	50717.xxx	¼" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
15 lbf.ft	50718.xxx	¼" m/f Hex	5000	11000	116	30	68	56	13	39	25.5
15 lbf.ft	50719.xxx	¼" m/f	5000	11000	71.5	30	71.5	56	13	6	-
50 lbf.ft	50720.xxx	⅜" m/f	5000	11000	77	30	74	56	15	8	-
150 lbf.ft	50721.xxx	½" m/f	2500	7600	87	42	82.5	58	21	12	-
200 lbf.ft	50722.xxx	¾" m/f	2000	5000	106	52	93.5	60	26	21	-
300 lbf.ft	50723.xxx	¾" m/f	2000	5000	106	52	93.5	60	26	21	-
1000 lbf.ft	50724.xxx	1" m/f	1000	4400	125	63	104	64.5	31.5	29	-

* Continuous is defined as 100% usage at the given speed in either direction and intermittent as usage 10% of the total time at the given speed.

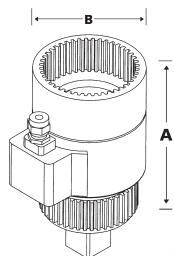
Annular Torque Transducer 72mm Series, Standard Series and Small Diameter Series

These Annular transducers are designed to fit directly to Norbar gearboxes (Pneutorque and Handtorque) and will accurately measure the torque output via a display instrument.

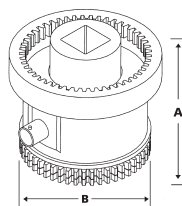
Up to 5000 N.m (5000 lbf.ft) classified to BS7882:2008, typically better than Class 1 for the primary classification range ($\pm 0.5\%$ of reading from 20% to 100% of full scale).



Standard Series



PT72, PT4500 & HT45 type



Small Diameter Series

Transducers for Remote 72mm Series and HT-72 Multipliers

Capacity	Part No.	Dimensions (mm)		
		A	B	C
1000 N.m	50666.xxx	73	117	64.30
1500 N.m	50667.xxx	73	117	64.30
2000 N.m	50668.xxx	73	117	64.30

Annular Torque Transducers – S.I. Calibration

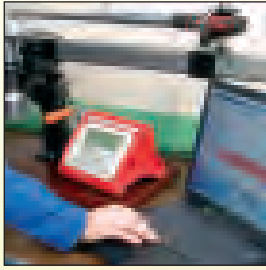
Capacity	Part No.	Sq. Drive	To Fit Tool	Dimensions (mm)		
		in	(HT/PT)	A	B Ø	C
1000 N.m	50638.xxx	$\frac{3}{4}$	1, 1A & 2	61	108	99.06
1500 N.m	50639.xxx	1	1,1A & 2 (All HD Type*)	61	108	99.06
2500 N.m	50640.xxx	1	5	79.5	119	99.06
2500 N.m	50642.xxx	1½	6	79.5	119	99.06
3000 N.m	50662.xxx	1	HT30 & PT2700	82	108	-
3500 N.m	50641.xxx	1	5	79.5	119	99.06
3500 N.m	50700.xxx	1½	6	79.5	119	99.06
4500 N.m	50664.xxx	1	HT45 & PT4500	128.5	85	-
5000 N.m	50643.xxx	1½	7	83	144	125.00
6000 N.m	50663.xxx	1½	HT60 & PT5500	88	120	-
10000 N.m	50644.xxx	1½	9	90	184	152.40
20000 N.m	50645.xxx	2½	11	97	212	195.00
50000 N.m	50646.xxx	2½	13	126	315	290.00
100000 N.m	50647.xxx	3½	14	126	315	290.00

Annular Torque Transducers – Imperial Calibration

Capacity	Part No.	Sq. Drive	To Fit Tool	Dimensions (mm)		
		in	(HT/PT)	A	B Ø	C
1000 lbf.ft	50648.xxx	$\frac{3}{4}$	1, 1A & 2	61	108	99.06
1500 lbf.ft	50649.xxx	1	1,1A & 2 (All HD Type*)	61	108	99.06
2500 lbf.ft	50650.xxx	1	5	79.5	119	99.06
2500 lbf.ft	50651.xxx	1½	6	79.5	119	99.06
5000 lbf.ft	50652.xxx	1½	7	83	144	125.00
7000 lbf.ft	50653.xxx	1½	9	90	184	152.40
15000 lbf.ft	50654.xxx	2½	11	97	212	195.00
50000 lbf.ft	50655.xxx	2½	13	126	315	290.00
50000 lbf.ft	50656.xxx	3½	14	126	315	290.00
75000 lbf.ft	50657.xxx	3½	14	126	315	290.00

*Gearbox must be fitted with Heavy Duty (HD) final carrier.

Select part no. suffix .LOG if the transducer is to be connected to TST or TTT (example: 50638.LOG). For connection to a non Norbar instrument or when a mV/V certificate is required, select .IND.



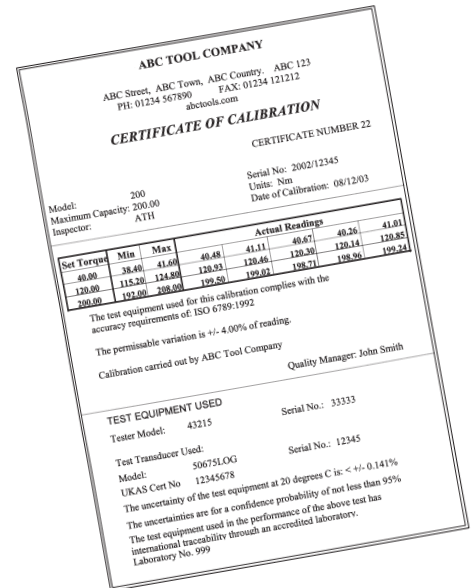
Calibration Certificate Software

This easy to use software allows data from a Norbar torque measuring instrument to be downloaded onto a PC and formatted as a torque calibration certificate. This software can be downloaded free of charge from Norbar's website, www.norbar.com.

- Certificate can be customised with the laboratory's own name and contact details.
- The certificate format complies with the requirements of ISO 6789.
- The software steps the operator through the calibration process making it very simple to use.
- A certification number is automatically generated. Certificates are filed and can be easily retrieved.

Note: Because the best way to enter data onto the certificate is via the RS232 output of the measurement instrument, it is strongly recommended that a Serial Data Lead Kit, Part number 60248, is purchased, see details below.

Certificate Software Part No.: 37705



Serial Data Lead Kit

This kit enables Norbar Pro-Test, TST and TTT instruments to connect to most PCs and RS232 printers.

Kit contains 1 of each of the following:

- 9 way 'D' socket to 9 way 'D' socket, null modem.
- 25 way 'D' plug to 9 way 'D' socket.
- 25 pin gender changer, socket to socket.
- 9 pin gender changer, plug to plug.

A Guide Book, Part No. 34256, is available on the Norbar Web Site, www.norbar.com (select Frequently Asked Questions, FAQs). It provides comprehensive information on RS-232 data transmission both in general and specifically how it is applied to Norbar instruments.

Lead Kit Part No.: 60248.

Transducer Leads

Part No.	Description	For use with
60152.225	ETS to 6 way transducer	Post 1994 ETS and 5 way Switch Box Model 60163
51067.225	ETS to 6 way transducer	Pre 1994 ETS and 5 Way Switch Box Model 60055
60217.200	Pro-Log, TST & TTT to 6 way transducer	All 'Smart' Static and Annular transducers
60216.200	Pro-Log, TST & TTT to 10 way transducer	All Rotary transducers with .IND or .LOG Part No. suffix
60223.200	Pro-Log, TST & TTT to no connector	Non Norbar transducers
60225.200	6 way transducer to no connector	Norbar 6 way connector to a non Norbar instrument
60224.200	10 way to no connector	Norbar Rotary transducer to a non Norbar instrument

The Part No. suffix indicates the length of the cable, i.e. .225 is 225cm (2.25m). Other cable lengths available on request. Please use suffix to indicate required length (preferably in whole meter increments).

Harsh Environment Range (HE)

Norbar has developed a range of measurement and calibration equipment that has been tested to conform with EN 60529: 1992.

Rated to IP65/IP67 the products are aimed specifically for use in harsh environments.

Particularly suited for use in the Offshore and Power Generation industries, the combination of high quality components, sound design and many years field experience allow calibration and control in previously restrictive areas.

The IP65/IP67 rating gives the product protection against dust ingress, pressurised water jet and complete water immersion to a 1 metre depth for a 30 minute period.

The HE range provides a fully traceable system to National calibration standards through Norbar's own UKAS accredited laboratory.

Key features

- IP65/67 rated.
- Stainless steel transducer design with 'SMART' intelligence.
- Bi-Direction calibration for both instrument and transducer.
- Class 1 accuracy over the 'Primary' classification range (+/-0.5% of reading from 20 to 100% of full scale).
- Battery power for use in harsh environments (mains supply for charging).
- Continuous RS-232 output.
- Analogue output.
- Limit indication for up to 8 user defined target values.
- HE transducers are available in both static and annular transducer designs.
- Supplied in a water tight carry case.

HE Transducers

Part No.	Description
50736.xxx	500 N.m Static Transducer 3/4" M/F sq. dr.
50737.xxx	500 lbf.ft Static Transducer 3/4" M/F sq. dr.
50738.xxx	1000 N.m Static Transducer 3/4" M/F sq. dr.
50739.xxx	1000 lbf.ft Static Transducer 3/4" M/F sq. dr.
50705.xxx	5000 N.m Static Transducer 1 1/2" M/F sq. dr.
50729.xxx	5000 N.m Static Transducer 1 1/2" M/M sq. dr.
50706.xxx	5000 lbf.ft Static Transducer 1 1/2" M/F sq. dr.
50730.xxx	5000 lbf.ft Static Transducer 1 1/2" M/M sq. dr.
50726.xxx	25000 N.m Static Transducer 3 1/2" M/M sq. dr.
50727.xxx	40000 N.m Static Transducer 3 1/2" M/M sq. dr.
50744.xxx	100000 N.m Static Transducer 3 1/2" M/M sq. dr.
50743.xxx	100000 lbf.ft Static Transducer 3 1/2" M/M sq. dr.
50745.xxx	3500 N.m Annular Transducer
50725.xxx	10000 N.m Annular Transducer

Other Transducers available on request.



5000 N.m Static Transducer



Back panel. Two connector covers removed for illustration.



HE Instrument and Ancillaries

Part No.	Description
43217	TTL-HE instrument
60245.200	HE transducer Lead
60250.200	HE Inst to Standard Smart Static TD Lead
60263.200	HE Inst to Standard Smart Rotary TD Lead
60266.200	HE Transducer to TTT/TST Lead
60256.200	Serial Data Lead for TTL-HE to no connector
60257.200	Ancillaries output lead for TTL-HE to no connector

Torque Wrench Loader TWL1500

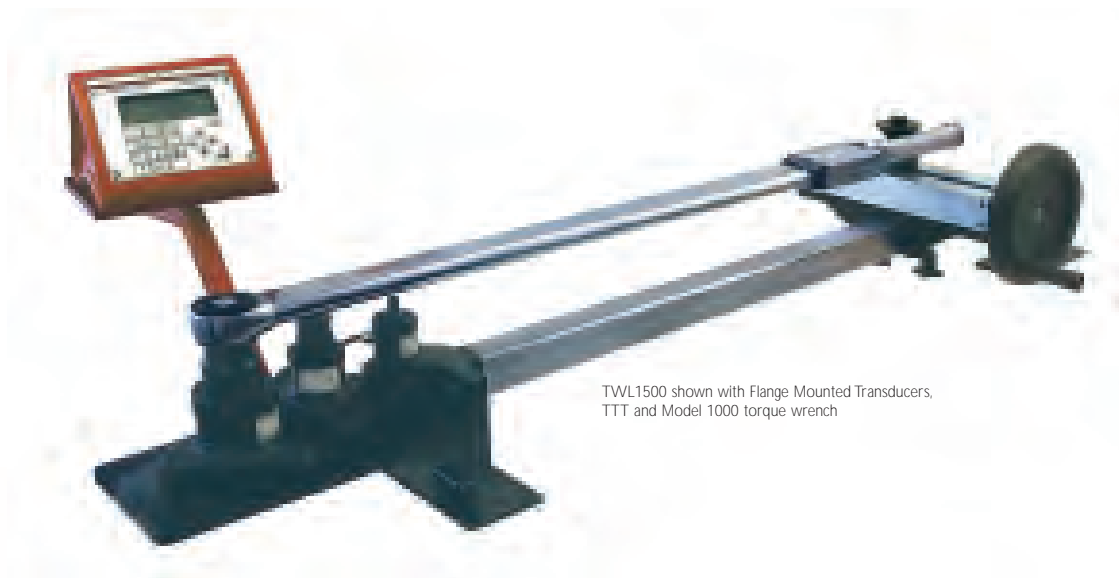
The design of the TWL1500 includes features that will provide an accurate and cost effective method for the calibration or testing of torque wrenches.

Designed to suit the majority of torque wrenches available with a torque value between 1 to 1500 N.m, the TWL1500 has been manufactured using quality materials that will provide many years of continuous, trouble-free operation.

The most significant feature of the TWL1500 is its compatibility with our wide range of Flange Mounted, Pro-Test and Smart Torque Block transducers. All fixtures, fastener kits and instructions are supplied allowing for complete flexibility and functionality.



With Pro-Test



TWL1500 shown with Flange Mounted Transducers, TTT and Model 1000 torque wrench

TWL1500 Torque Wrench Loader - Part No. 60246

Transducer Mounting Position	Transducer Options	Transducer Part No.	Calibrated Range	Torque Wrench	
				min	max
With FMT Range (see main photograph)					
Position 1	FMT10	50672.LOG	0.5-10 N.m	145mm	1310mm
-	FMT25	50673.LOG	1.25-25 N.m	145mm	1310mm
Position 2	FMT150	50674.LOG	7.5-150 N.m	240mm	1405mm
-	FMT400	50675.LOG	20-400 N.m	240mm	1405mm
Position 3	FMT1500	50676.LOG	30-1500 N.m	336mm	1500mm
With Pro-Test					
Position 1	Pro-Test 400	43219	8-400 N.m	240mm	1405mm
-	Pro-Test 1500	43220	30-1500 N.m	240mm	1405mm
Position 2	Pro-Test 1500	43220	30-1500 N.m	336mm	1500mm
With STB1000					
Position 1	STB1000	50683.LOG	20-1000 N.m	240mm	1405mm
Position 2	STB1000	50683.LOG	20-1000 N.m	336mm	1500mm

Note 1: Min and Max torque wrench lengths are from the square drive to the centre of the handle.

Note 2: Position 1 is closest to the loading carriage and position 3 is furthest away.



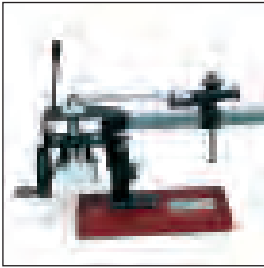
With STB1000

Dimensions

Max Width: 753 mm
(inc. handle & instrument tray)

Max Height: 342 mm
(excluding instrument)

Max Length: 1721 mm



ISO 1000



ISO 1000 fitted with Small Reaction Plate, Part No. 20588.

Torque Wrench Loader ISO 1000 and 2000

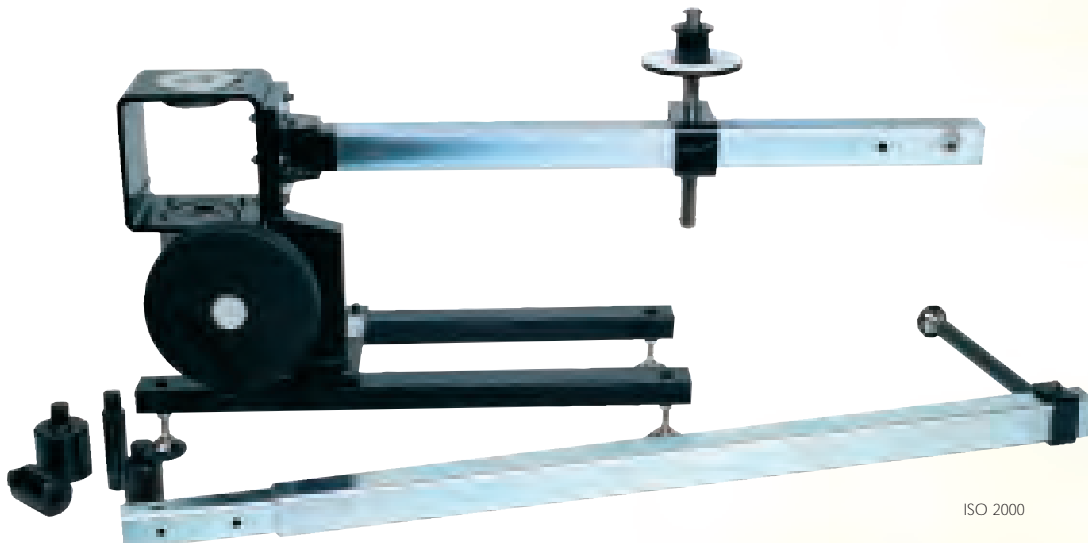
These loaders allow torque wrenches to be calibrated or tested in accordance with ISO 6789:2003, BS EN 26789:2003 and American military standard GGG-W-686. Their function is to take full advantage of the accuracy of Norbar's torque measuring system by reducing operator induced variations in the calibration process.

- The high ratio, 1200:1 (ISO 2000, 1250:1) gearbox allows high torques to be applied, whilst ensuring that the operator does not exceed the rate of increase of torque specified in the standards.
- The design allows for easy interchange of transducers using the Norbar Static Transducer system.
- The ISO 1000 90° facility allows performance of torque wrenches to be checked in two planes. Many wrenches give different torque values according to their orientation in use.
- Floating reaction point minimises side loads on wrench.
- ISO 2000 reaction extension bar allows wrenches up to 2250mm to be tested. This can be removed to save space. Wrenches up to 1045mm can be tested when the extension bar is not fitted
- Optional Small Reaction Plate (part no. 20588) allows torque wrenches down to 100 mm in length (centre of square to centre of handle) to be tested.
- Motorised version with speed control is available for the ISO 1000. This can be purchased as a kit to motorise an existing ISO or as a complete ISO 1000 Motorised Torque Wrench Loader.

ISO 1000 and 2000 Torque Wrench Loaders

Part No.	Description	Range		Torque Wrench Length (mm)		Adaptors
		N.m	lbf.ft	min	max	
60118	ISO 1000 with 90° rotation	1-1350	1-1000	200	1200	¼, ⅜, ½, ¾
60193	ISO 1000 Motorised Torque Wrench Tester	1-1350	1-1000	200	1200	¼, ⅜, ½, ¾
60194	Kit to motorise an ISO 1000	-	-	-	-	-
20502	ISO 2000	1-2500	1-2000	200	2250	¼, ⅜, ½, ¾, 1, 1½
20588	Small Reaction Plate	-	-	100	180	-

Note: Min and Max torque wrench lengths are from the centre of the square drive to the centre of the handle.



ISO 2000

Calibration Beams and Weights Principles of Operation

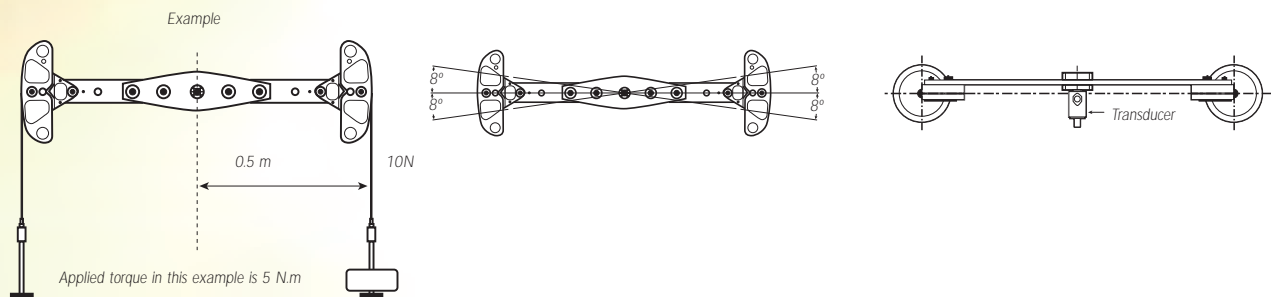
Norbar's Test Beams are designed for the static calibration of Torque Transducers. They are ideally suited to Norbar's transducers, but can be employed on other manufacturer's equipment.

Torque is generated by the application of a known force at a known radius from the centre of rotation of the torque transducer.

The Beams are designed with square drives machined to the top limit of ISO 2725. This minimises any play between the beam and the transducer. However, a combination of square drive tolerances, misalignment of fittings and elastic rotation of the transducer shaft inevitably cause the beam to rotate from the horizontal under load.

Norbar's Radius Ended Beams are designed with a ± 8 degree usable arc within which the calibration accuracy is unaffected.

Additionally the beams are designed to apply load on a vertical plane which cuts through the square drive inside the transducer. This minimises bending moments on the transducer and, for safe operation, ensures that the beam will not fall out of the transducer.



Gravitational Effects

It is very important that the gravitational value for the Laboratory is established. The effect of not doing this could be a variation in the force produced by the weight of perhaps 0.5% of reading.

It is therefore strongly recommended that you establish the local value of gravity (g) for your Laboratory and use weights that have been calibrated at that gravitational constant.

Norbar will supply weights calibrated to gravitational constants specified by the customer. However, if the customer does not specify a value for ' g ' they will have been calibrated at an estimated gravitational constant for the customers' location.

Buoyancy Effects

The Norbar system uses calibrated weights to generate a downwards force.

This means that Archimedes principle applies, ie. air pressure under the weights causes an upwards force. This reduces the effective force generated by the weights and therefore the mass must be increased to allow for this.

Under standard conditions (ie. Air density 1.2 kg/m^3 and 20 degrees centigrade and working in conventional mass terms) the increase required is by a factor of 0.015%.

Weights purchased from Norbar will already have this factor taken into account.

Weights that are calibrated to standard procedures do not have this factor taken into account because the air buoyancy affects both sides of the mass balance and can be ignored. It is important that weights used for torque transducer calibration are adjusted for air buoyancy.

It should also be noted that the double ended beam design employed by Norbar means that each half of the beam is balanced with regard to buoyancy of the beam. This is a significant advantage over single-arm counterbalanced systems.

Calibration Disc

Designed to remove potential sources of measurement error, these Discs can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The $< 0.04\%$ uncertainty of applied torque achievable with this disc allows calibration to the high classes of accuracy specified by BS7882:2008.
- Machined to $\pm 0.03\%$ from aircraft alloys.
- Clockwise and counter-clockwise operation.
- Capable of SI or Imperial calibrations.
- Compatible with male and female $1/4"$ square transducer drives.
- No bearings to cause energy loss during loading.
- Brass weights with an accuracy better than $\pm 0.01\%$ are available in five sets to achieve a variety of calibration ranges.
- Special weight sets can be specified up to a maximum torque of 2.5N.m.

NOTE: A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.



Calibration Discs – S.I and Imperial

Range		Disc Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F in
Minimum	Maximum						
0.05 N.m	0.50 N.m	21400	100 mm	21452	10 x 0.5 N	4 mm	$\frac{1}{4}$
0.10 N.m	1.00 N.m	21400	100 mm	21450	10 x 1.0 N	4 mm	$\frac{1}{4}$
0.25 N.m	2.5 N.m	21400	100 mm	21479	10 x 2.5 N	4 mm	$\frac{1}{4}$
5 ozf.in	50 ozf.in	21400	100 mm	21455	10 x 1.27 ozf	4 mm	$\frac{1}{4}$
10 ozf.in	100 ozf.in	21400	100 mm	21453	10 x 2.54 ozf	4 mm	$\frac{1}{4}$
16 ozf.in (1 lbf.in)	160 ozf.in (10 lbf.in)	21400	100 mm	21451	10 x 4.064 ozf	4 mm	$\frac{1}{4}$

Radius Ended Beam

Designed to remove potential sources of measurement error, these beams can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The < 0.02% uncertainty of applied torque achievable with these beams allows calibration to the highest class of accuracy specified by BS7882:2008.
- Machined to $\pm 0.01\%$ (100 microns per meter) from aircraft alloys.
- Clockwise and counter-clockwise operation.
- All have interchangeable square drive to increase flexibility of use.
- Torque radius maintained throughout ± 8 degrees of rotation from horizontal.
- No bearings to cause energy loss during loading.
- Balanced to maximise energy transfer to transducer during loading.
- Loading point offset to reduce bending moments on the transducer.
- High torque radius accuracy allows use of cast iron weights rather than stainless steel.
- Weight accuracy is required to be equal to or better than $\pm 0.01\%$.



NOTE: A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.

Radius Ended Beams - S.I. Calibration

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
0.5 N.m	5.0 N.m	21420	250 mm	21476	10 x 2 N	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
1 N.m	10 N.m	21420	250 mm	21454	10 x 4 N	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
5 N.m	50 N.m	21420	250 mm	21458	10 x 20 N	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
5 N.m	50 N.m	21421	500 mm	21477	10 x 10 N	9.5 mm	$\frac{3}{8}, \frac{1}{2}$
10 N.m	100 N.m	21421	500 mm	21458	10 x 20 N	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
5 N.m	250 N.m	21427	500 mm	21459	1 x 10 N 10 x 50 N	9.5 mm	$\frac{1}{2}, \frac{3}{4}$
5 N.m	500 N.m	21427	500 mm	21460	1 x 10 N 10 x 100 N	9.5 mm	$\frac{1}{2}, \frac{3}{4}$
10 N.m	500 N.m	21428	1000 mm	21459	1 x 10 N 10 x 50 N	9.5 mm	$\frac{1}{2}, \frac{3}{4}, 1$
10 N.m	1000 N.m	21428	1000 mm	21460	1 x 10 N 10 x 100 N	9.5 mm	$\frac{1}{2}, \frac{3}{4}, 1$
10 N.m	1500 N.m	21428	1000 mm	21483	14 x 100 N 1 x 50 N 2 x 20 N 1 x 10 N	9.5 mm	$\frac{1}{2}, \frac{3}{4}, 1$

Radius Ended Beams - Imperial Calibration

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
10 lbf.in	100 lbf.in	21423	10"	21465	10 x 1 lbf	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
50 lbf.in	500 lbf.in	21423	10"	21466	10 x 5 lbf	9.5 mm	$\frac{1}{4}, \frac{3}{8}$
10 lbf.ft	100 lbf.ft	21424	12"	21467	10 x 10 lbf	9.5 mm	$\frac{3}{8}, \frac{1}{2}$
50 lbf.ft	500 lbf.ft	21425	24"	21468	10 x 25 lbf	9.5 mm	$\frac{1}{2}, \frac{3}{4}$
100 lbf.ft	1000 lbf.ft	21426	48"	21468	10 x 25 lbf	9.5 mm	$\frac{3}{4}, 1$

5000 lbf.ft Calibration Beam

Designed to remove potential sources of measurement error, these beams can be used to calibrate Norbar torque transducers, and torque transducers from other manufacturers (where design permits), as well as mechanical test devices. A UKAS accredited certificate for the measurement of torque radius is supplied with each beam.

- The < 0.04% uncertainty of applied torque achievable with this beam allows calibration to the high classes of accuracy specified by BS7882:2008.
- Beam length machined to +/-0.01% (100 microns per meter).
- Clockwise and counter-clockwise operation.
- Beams balanced to maximise energy transfer to transducer during loading.
- High beam accuracy allows use of cast iron weights rather than stainless steel. Weight accuracy is required to be equal to or better than 0.01%.
- High quality bearings to reduce energy losses.
- Gearbox provided to level beam and remove cosine errors.
- SI and Imperial Calibration possible with one beam (using different weights).

NOTE: A temperature controlled environment is essential for use of these beams. The selection of weights will be influenced by gravitational constant and air buoyancy values at the proposed laboratory site. See page 86.

5000 lbf.ft Calibration Beam

Range		Beam Part No.	Radius to Centre Line of Hanger	Weight Set Part No.s	Weight Set Comprising	Diameter of Weight Hanger Rod	Drive Square A/F (in)
Minimum	Maximum						
500 N.m	5000 N.m	21842	1275 mm	21469	20 x 50 lbf	12 mm	1½
500 lbf.ft	5000 lbf.ft	21842	60 in	21469	20 x 50 lbf	12 mm	1½





Instrument calibration bench

Calibration Certificates

As a UKAS accredited calibration Laboratory No. 0256, Norbar is required to calibrate torque measuring devices that are within the Laboratory's scope, in accordance with BS 7882:2008. See the 'UKAS Schedule of Accreditation' on the 'Calibration Services' page of our website, www.norbar.com.

Norbar can provide a comprehensive range of calibrations including increasing and decreasing torques; clockwise and counter-clockwise; in either SI or English torque units, or in mV/V or Volts.

The sections below summarise the main features of BS 7882:2008, but purchase and careful study of the standard is advised for those who wish more detailed information.

Procedure

- The "device" is defined as all parts of a system, e.g. Display, Transducer Cable, and Transducer. Transducer cables will therefore be serial numbered if they are separate items.
- The output of the device is defined as "deflection".
- It is preferable to calibrate all parts of a system together. If a transducer is sent for calibration without its normal display unit, an equivalent calibrated display held in the laboratory will be used. The normal display must also be in a calibrated state or the certification for the transducer is invalidated.
- Norbar is currently the only laboratory accredited by UKAS for the calibration of Electrical Torque Measuring Indicators.
- Before any calibration or recalibration the torque measuring device is preloaded three times in succession to the maximum applied torque of the device. Each preload is maintained for between 1 and 1½ minutes to exercise the device and stabilise it in the calibration fixture.
- The device is calibrated with at least five approximately equal steps from 20% to 100% of maximum torque. Lower values are allowed as long as they meet certain criteria for resolution.
- For Classes 0.05 and 0.1, it is mandatory to calibrate the torque measuring device in four different mounting positions each rotated 90° about the measurement axis. For all other classes the device is calibrated at a minimum of two different mounting position at least 90° apart.
- Two series of readings are taken, and the device is then disturbed, generally by being disconnected from the calibration fixture and rotated through 90°. The device is then preloaded once to full scale. A third series of readings are then taken. This process is repeated until readings have been recorded in all required orientations.
- If reversibility is required, a single series of decreasing torques are applied at the end of the last increasing series.
- Should calibration be required in both directions, the series of readings are repeated in the opposite direction.
- The calibration data is then analysed to establish the following parameters.

Repeatability

The variation between the indicated deflection from series 1 and 2, expressed as a percentage of the mean of the two readings.

Reproducibility

The maximum variation between series 1, 2 and 3, or series 1, 2, 3, 4 and 5 expressed as a percentage of the mean indicated deflection calculated from series 1, 3 or series 1, 3, 4, and 5.

Error of Indication

Where the results are expressed in units of torque, the errors of indication are the variation between each applied torque and the mean indicated deflection at that torque.

Error of Zero Torque

The maximum zero reading recorded after each loading series is expressed as a percentage of the maximum mean indicated deflection.

Error of Interpolation

Where the results are expressed in volts or units other than torque units, a 2nd order polynomial equation (best fit line) is established and the difference in deflection from the computed value is expressed as a percentage of the computed value.

Reversibility

The variation between the readings from the last torque series applied in an increasing mode and the readings for the same given torque applied in a decreasing mode. Reversibility is expressed as a percentage of the deflection of the last increasing series for the given torque.

Classification

- The parameters are each compared with a table to establish the device's classification. Class 0.05 is the highest performance, and class 5 is the lowest defined by the standard. The overall class reported will be that of the lowest performing parameter. For example reproducibility may be a class 1 when all other parameters meet class 0.5. The device will be classified as 1.
- Additionally the uncertainty of measurement of the applied torque must be five times better than the overall class reported. Norbar's uncertainty of measurement (typically 0.02%) allows classification to Class 0.1 devices.
- Different classes may be quoted for ranges below 20% of maximum capacity.



Calibration office

CERTIFICATE OF CALIBRATION
UKAS ACCREDITED CALIBRATION LABORATORY No. 6206
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CERTIFICATE NUMBER: 141445

Expression of Uncertainties (as found)

The estimated expanded uncertainty of the torque measuring device under the conditions of calibration, for increasing and decreasing torque:

Increasing Torque	Decreasing Torque
at 10.00 N.m $\pm 0.24\%$ $k=2.0$	at 10.00 N.m $\pm 0.24\%$ $k=2.0$
at 20.00 N.m $\pm 0.19\%$ $k=2.0$	at 20.00 N.m $\pm 0.19\%$ $k=2.0$
at 40.00 N.m $\pm 0.13\%$ $k=2.0$	at 40.00 N.m $\pm 0.13\%$ $k=2.0$
at 60.00 N.m $\pm 0.13\%$ $k=2.0$	at 60.00 N.m $\pm 0.13\%$ $k=2.0$
at 80.00 N.m $\pm 0.13\%$ $k=2.0$	at 80.00 N.m $\pm 0.13\%$ $k=2.0$
at 100.00 N.m $\pm 0.13\%$ $k=2.0$	at 100.00 N.m $\pm 0.13\%$ $k=2.0$

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Observations

As found by the laboratory on receipt, i.e. no adjustments were made.

Calibration Method

The above torque measuring device has been statically calibrated by the application of known torques, which were generated by the interpolation of masses, calibrated to produce forces, at the known radius of an unsupported length.

The torque measuring system was switched on and allowed to warm up for at least 10 minutes before commencing the calibration. The electrical output from the torque measuring device was measured and displayed in N.m. by the calibration. The electrical output from the torque measuring device was measured and displayed in N.m. by the calibration. The electrical output from the torque measuring device was measured and displayed in N.m. by the calibration.

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Classification

The torque measuring device satisfies the requirements of BS 7882-2008 for the following classification ranges:

Class	From	To
Class 0.2	from 100.00 N.m	to 10.00 N.m

Calibration Results

Indicated Reading	Indicated Reading	Indicated Reading	Indicated Reading
0.00	0.00	0.00	0.00
10.00	10.00	10.00	10.00
20.00	20.00	20.00	20.00
30.00	30.00	30.00	30.00
40.00	40.00	40.00	40.00
50.00	50.00	50.00	50.00
60.00	60.00	60.00	60.00
70.00	70.00	70.00	70.00
80.00	80.00	80.00	80.00
90.00	90.00	90.00	90.00
100.00	100.00	100.00	100.00

Notes

The calibration was performed at an ambient temperature within the range 20°C Celsius \pm 2°C Celsius and did not result.

The uncertainty of the applied torque is $\pm 0.02\%$ $k=2$. The estimated uncertainty of the device under the conditions of calibration is inclusive of the value.

The indicated readings obtained in the loading series and the calculated parameters are given overall. The indicated readings obtained in the unloading series are given overall. The lower limit of calibration as required by clause 3.4 of BS 7882-2008 may be obtained by the use of the indicated readings obtained in the unloading series.

A deflection of 1.9811 mV is produced by the torque measuring device at its rated capacity. The indicated readings are inclusive of any voltage loading effects caused by the device and the connection cable. Connection cables that cause the device to be classified outside the range of the same part number. The use of connection cables of other lengths or types than the one specified may affect the validity of the calibration.

Clause 3.2 of BS 7882-2008 requires that "The torque measuring device shall be recalibrated at least every 12 months and whenever it suffers any damage or its use is in an equivalent unit, a classification of between 1.0 and 0.05, with an uncertainty of less than 0.1% will meet the requirements of clause 3.1 of BS EN ISO 9001:2003.

When used with the display instrument detailed on page one or an equivalent unit, the requirements of clause 3.2.3 of BS 7882-2008 shall be fully met to ensure that the calibration is not invalidated.

CERTIFICATE OF CALIBRATION
UKAS ACCREDITED CALIBRATION LABORATORY No. 6206
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CERTIFICATE NUMBER: 141445

Classification

Class	From	To
Class 0.2 <td>from 100.00 N.m</td> <td>to 10.00 N.m</td>	from 100.00 N.m	to 10.00 N.m

Calibration Results

Indicated Reading	Indicated Reading	Indicated Reading	Indicated Reading
0.00	0.00	0.00	0.00
10.00	10.00	10.00	10.00
20.00	20.00	20.00	20.00
30.00	30.00	30.00	30.00
40.00	40.00	40.00	40.00
50.00	50.00	50.00	50.00
60.00	60.00	60.00	60.00
70.00	70.00	70.00	70.00
80.00	80.00	80.00	80.00
90.00	90.00	90.00	90.00
100.00	100.00	100.00	100.00

Notes

The calibration was performed at an ambient temperature within the range 20°C Celsius \pm 2°C Celsius and did not result.

The uncertainty of the applied torque is $\pm 0.02\%$ $k=2$. The estimated uncertainty of the device under the conditions of calibration is inclusive of the value.

The indicated readings obtained in the loading series and the calculated parameters are given overall. The indicated readings obtained in the unloading series are given overall. The lower limit of calibration as required by clause 3.4 of BS 7882-2008 may be obtained by the use of the indicated readings obtained in the unloading series.

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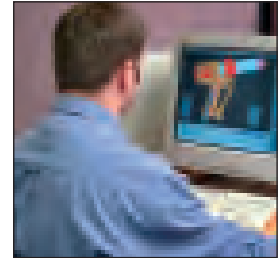
Clause 3.2 of BS 7882-2008 requires that "The torque measuring device shall be recalibrated at least every 12 months and whenever it suffers any damage or its use is in an equivalent unit, a classification of between 1.0 and 0.05, with an uncertainty of less than 0.1% will meet the requirements of clause 3.1 of BS EN ISO 9001:2003.

When used with the display instrument detailed on page one or an equivalent unit, the requirements of clause 3.2.3 of BS 7882-2008 shall be fully met to ensure that the calibration is not invalidated.

Norbar® Torque Tools, Banbury, UK

Banbury, in the centre of the United Kingdom, is where the original 'North Bar Tool Company' was founded and remains the company's primary manufacturing and stock holding location and head office.

Distributors and customers throughout Europe, Africa, Northern Asia, Canada and Latin America are serviced from this location.



Quality Standards

Norbar's quality assurance system has been certified to internationally recognised standards for nearly two decades. The Ministry of Defence standard AQAP4 was awarded in the mid 1980's followed by BS5750 Part 2 (ISO9002) in 1989 and then ISO9001 in 1995. Norbar successfully completed the transition to the latest version of the standard, ISO9000: 2000, in May 2003.

Most importantly, through continuous improvement, Norbar is dedicated to providing products and services that we are proud of.



Same Day Despatch

All standard torque wrenches and many of the Handtorque torque multipliers, in total over 200 items, are available to UK customers on a same day despatch basis. Quantity limits may apply so please contact Norbar for full details.



Service Replacement

Our aim is to give the highest quality and most rapid turnaround possible on Norbar torque wrenches returned for repair. To achieve this, any Norbar wrench of up to 400 N.m and Industrial torque wrenches requiring repair will be exchanged for a brand new 'service replacement' tool at an economical price. 'Service replacements' carry the same 12 month parts and labour warranty as other new products and come complete with a calibration certificate.

Repair Service

Items not covered by the 'service replacement' policy will be repaired as required. Every torque wrench, torque multiplier, instrument and transducer in this catalogue is manufactured by Norbar so you have the assurance that any repairs will be carried out to the highest standard using genuine components.

UKAS Calibration Service

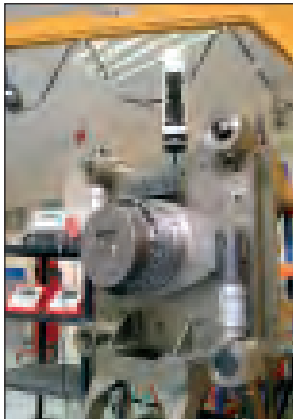
UKAS is the sole accreditation body recognised by the UK Government to assess, against internationally recognised standards, laboratories that provide test and calibration services. Furthermore, through 'mutual recognition agreements' with other accreditation bodies around the World, provision of a UKAS certificate is internationally recognised as demonstrating the competence, impartiality and performance capability of laboratories. For full details of UKAS, please visit their website; www.ukas.org.



0256

Norbar was the first torque equipment manufacturer to have an in-house UKAS calibration laboratory and continues to offer the most comprehensive service available. The laboratory has approval for torques between 0.05 N.m and 6800 N.m. A UKAS calibration service is available for all makes of torque wrenches, torque multipliers and torque measuring devices within this range.

Norbar's laboratory operates to BS EN ISO/IEC 17025:2000 which sets standards for the technical competence of the laboratory. This should not be confused with laboratories claiming ISO 9000:2000 which relates only to a laboratory's quality management systems.



- UKAS accredited laboratory for torque between 0.05 N.m and 6800 N.m.
- Calibration to 100,000 N.m, traceable to National Standards.
- UKAS accredited for the calibration of manual torque multiplying gearboxes to 6800 N.m.
- UKAS accredited for the calibration of electrical torque indicator displays. This ensures each element of the system is fully traceable and interchangeable.
- UKAS accredited for length certification of Norbar calibration beams.
- Other devices outside of the UKAS accreditation scope that can be calibrated include powered screwdrivers and pneumatic torque wrenches.

100,000 N.m calibration rig

Combined Calibration and Service

Most Norbar measurement products are handled under a 'combined calibration and service' price structure. This means that, provided that the product is in serviceable condition, we guarantee to carry out all calibration, function checks and repair work to bring the equipment back to its' original functionality at a fixed price. The advantage to the customer is that you know the price before you send the goods to us and turn around times are reduced by the removal of the quotation and approval stages of the process.

Non Norbar equipment can also be calibrated but will be handled by individual quotation.

Calibration to 100,000 N.m.

For torques exceeding Norbar's UKAS accredited range (6800 N.m), a calibration service providing traceability to national standards is offered.



Sales Department

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Email: sales@norbar.com

Calibration / Repairs Department

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Email: repairs@norbar.com



Norbar Torque Tools Pty Ltd, Adelaide, South Australia

Torque equipment is sold throughout the World but few companies specialise in both the sale and appropriate maintenance of these products. Increasingly, technology is creating tighter critical tolerances and an unprecedented need for sustainable accuracy in all enterprises.

At Norbar we understand this need and continue to build an enviable reputation in torque control by applying this expertise to our product maintenance, testing and support services throughout our network of state branches.



Torque Control Laboratory



Reg. No. 3800

Testing and Certification Facilities

Our fully accredited NATA laboratory is recognised by industry as being the most technologically advanced in its field allowing us to certify the most comprehensive range of electronic and mechanical torque equipment in the South East Asian Region.

- Accredited under BS EN ISO/IEC 17025:2000.
- NATA audited bi-annually.
- NCS International audited annually to AS/NZS ISO 9001:2000.
- Fully enclosed and temperature controlled environment.
- Electronic and mechanical torque equipment certification range – 0.5 to 6800 N.m.
- The only NATA accredited facility for the calibration of torque multiplying gearboxes to 6800 N.m.
- Highly trained technicians.
- Able to test to the same uncertainties as our UK manufacturing plant.

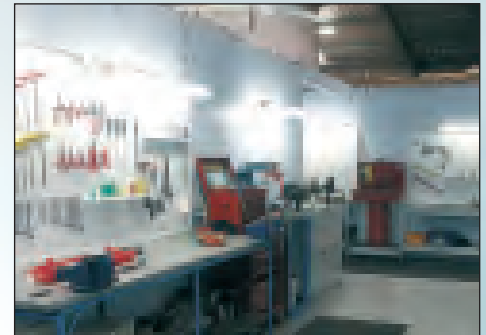


Service and Repair

To ensure the investment in your Norbar product is protected, we offer superior ongoing after sales service, maintenance, repair and calibration support from our wide network of offices.

All of our branches carry a comprehensive range of original spare parts.

- Original spare parts (25% of our complete stock holding).
- All products tested on the latest electronic equipment.
- Fully trained technicians and sales staff.
- Complete mobile service on request.
- Traceable certificate to NATA meeting the most stringent QA audits – NATA has reciprocal agreement with all the major world testing bodies ie UKAS, NIST & SINGLAS.
- Ability to provide hard and soft joint calibrations.
- Testing available to 50,000 lbf.ft (68,000 N.m) – highest torque value able to be tested in S.E. Asia.
- Properly maintained service and calibration details.
- Complete management plan available tailored to your particular quality standards.



Technical Services Available

Complete Torque Control Management Service

This service provides you with a calibration management plan to meet your particular quality standards. Simply tell us what torque equipment you own or are purchasing, specify the calibration period and Norbar will ensure the tools are kept within those specifications. You will be provided with certificates and a written report on the condition of the equipment at the time of each service.

Technical Support

At Norbar, we believe it is extremely important that the product fits the purpose for which it was designed. To ensure our customers receive the most comprehensive information regarding torque control equipment our Technical Support Manager works closely with our highly trained sales personnel to assist with specific product or system selection. The Technical Support Manager is also available for individual training or seminars on torque control.

Engineering and Design

As the manufacturer we have intimate knowledge of our products' capabilities. With 60 years experience in product design and engineering Norbar provides solutions to most torque control applications. Our In-house engineering and design service allows customers to purchase equipment with variations to standard products manufactured to their specification.

Norbar Services all Torque Wrenches, Torque Multipliers and Measurement and Calibration Equipment.

Head Office and NATA Calibration Laboratory

1. Adelaide

45-47 Raglan Avenue, Edwardstown, South Australia 5039
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2. Western Australia

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5. New South Wales

Unit 33/72-80 Percival Road, Smithfield, NSW 2164
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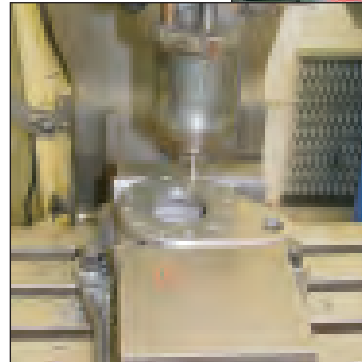
Norbar Torque Tools Incorporated, Willoughby, Ohio, USA

Even the best torque equipment is of no use if it is not available. Our inventory is constantly expanding to reflect your desire for the latest products. We have over \$500,000 of products ready to despatch in line with your needs.

When using any torque multiplier, the design of special reactions is key to giving you good torque accuracy. Norbar has skilled machinists and welders in house that can create suitable reaction plates. The support of design engineers in the UK factory ensures that especially complex designs can be engineered to your order.

Most other makes of hand torque wrenches can be repaired and recertified using original manufacturer's spare parts.

The huge Norbar spare parts inventory allows for fast repair of Norbar Pneutorque, Handtorque and Torque Wrench products when necessary. Naturally Norbar products sold under other brand names can also be repaired. High capacity torque test fixtures allow new certificates to be issued after repair.



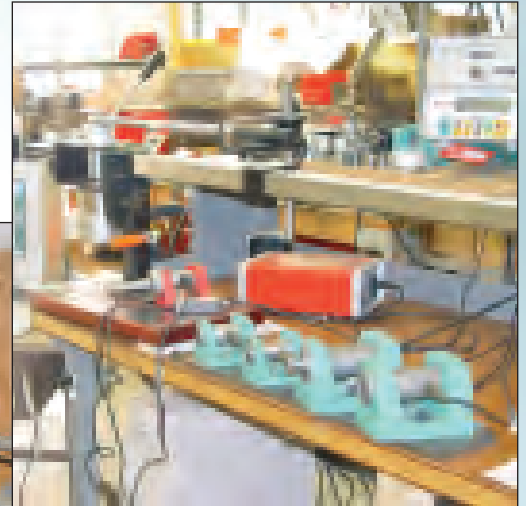
Head Office and NVLAP Calibration Laboratory

Norbar Torque Tool Inc.
36400 Biltmore Place
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Tel: +1 866 667 2272
Fax: +1 440 953 9336
Email: inquiry@norbar.us

Norbar Torque Tools Incorporated, Willoughby, Ohio, USA

This purpose built facility, just outside Cleveland Ohio, offers you comprehensive support for your Norbar products and calibration and repair support for your other torque equipment.



NVLAP Accredited Torque Calibration Laboratory

Norbar is the first torque manufacturer to be accredited by NVLAP, the accreditation department of NIST (National Institute of Standards and Technology).

This gives you

- International measurement traceability that mirrors the UKAS accredited certification produced by the factory in the UK.
- Accredited compliance with the BS EN ISO/IEC 17025:2000 calibration quality assurance standard.
- Calculation of measurement uncertainties that some other manufacturers hide.
- Our NVLAP accredited torque range for transducers is from 10 ozf.in to 5000 lbf.ft.
- Calibration of transducers to 100,000 N.m (73,756 lbf.ft) can be accommodated with international traceability at the factory in England.
- NVLAP accredited for the calibration of electrical torque indicator displays. This ensures each element of the system is fully traceable and interchangeable.
- Torque Multipliers and hydraulic wrenches can be calibrated using traceable transducers and purpose built calibration fixtures.

NVLAP – National Voluntary Laboratory Accreditation Program
(for more information go to www.nist.gov and click on “laboratory accreditation”)

UKAS – United Kingdom Accreditation Service
(for more information go to www.ukas.co.uk)



Norbar Torque Tools (Shanghai) Ltd, Shanghai, China

Norbar continues to develop the concept of Company offices with repair and calibration facilities controlling the quality of service levels in key markets. The growing desire for high quality product in China means that providing high levels of customer support is essential.

The purpose built Norbar office is in the High Technology Park in the Minhang district west of Shanghai and close to Hongqiao airport. The new Metro makes the office even more accessible to the many distributors who are receiving product training at the facility.

The office also acts as a base for the wide-ranging technical sales team that support distributors throughout the 32 provinces of China.



Head Office

Norbar Torque Tools (Shanghai) Ltd
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Minhang District
Shanghai
China 201103

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Calibration Laboratory

Norbar Torque Tools (Shanghai) Ltd, Shanghai, China

Service and Repair

The facility offers spares and service for Norbar torque wrenches, Handtorque multipliers and Pneutorque pneumatic torque wrenches. Electronics spares and service will soon be added once appropriate Government approvals can be agreed.

The repair technicians have been trained by Norbar factory technicians to ensure that product can be serviced back to Norbar standards without having to leave China. This increases the speed of response to customers.

Test equipment for torque wrenches, hand and powered multipliers are all to Norbar UK factory standards. Importantly the powered multipliers are tested on a state of the art tester that allows the tool to be calibrated for hard and soft joints.

Calibration

The torque calibration laboratory has now been accredited by the Taiwan Accreditation Foundation to ISO 17025. The CNAS accreditation is underway and should be achieved in 2009.

We can now offer certification to the same standards in Shanghai as in the UK factory. Once again our objective is to support customers in China with fast, well priced support for Norbar product.



Technical Support

Factory trained technical support personnel and a high level of qualifications among the technical staff mean that Norbar is able to help customers use the correct product for the job. We can advise where product requires modification to best suit the application.



Training

The office is designed to allow for comprehensive distributor training. This ensures that the best and most up to date advice is delivered to customers by their local distributor.

Norbar will also offer training on torque to customers. Details can be obtained on request.



Calibration Laboratory



Norbar Torque Tools (NZ) Ltd, Auckland, New Zealand

Established in 2002, our New Zealand office's primary role is to back up the many users of Norbar Products in the region. Product application and technical information is provided by Representatives who travel extensively from the top of the North Island to the bottom of the South Island as well as neighbouring Pacific Islands. Working with a broad range of industries, we provide solutions to all torque and tension applications. Our Regional Manager provides training as well as technical support for Norbar distributors. The entire Norbar range is supported through our workshops in Auckland. A large range of stock is held in New Zealand with back up from our Regional Head Office in Adelaide.

Service and Repair

An experienced, factory trained technician using only original spare parts provides repair and calibration services for torque wrenches up to 1500 N.m and torque multipliers. This service can either be provided at our facilities in Penrose or can be provided at customers' locations using a fully equipped service van. When service work is beyond the scope of our New Zealand facilities, we will arrange for it to be carried out in Adelaide where Norbar operates a NATA calibration laboratory – see page 94.



Head Office

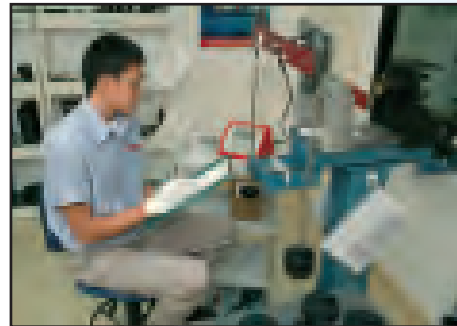
Norbar Torque Tools (NZ) Ltd
 65a O'Rourke Road
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 Email: nz@norbar.com.au



Norbar Torque Tools Pte Ltd, Singapore

In 2004 Norbar opened our office, laboratory and warehouse in Singapore with the purpose of providing outstanding levels of service to our customers in South East Asia. A broad cross section of Norbar products are stocked in Singapore for rapid delivery to customers in the region. Technical support by factory trained sales engineers is also available from this location for both Norbar distributors and end users.



Service and Repair

Our torque laboratory received the prestigious SAC-SINGLAS accreditation in April 2005. The laboratory is equipped and accredited to calibrate hand torque tools from 0.04 to 2500 N.m and mechanical and electronic torque measuring devices from 0.035 to 6800 N.m. The facilities include a calibration bench for Norbar torque measuring instruments so that independent, traceable calibration can be provided for both the instrument and transducer.

Repair services are available for Norbar torque wrenches and torque multipliers, drawing from a comprehensive stock of original spare parts. All service work is carried out by fully factory trained technicians.



Head Office

Norbar Torque Tools PTE Ltd
Eunos Tech-Park
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Part No.	Description	Page	Part No.	Description	Page	Part No.	Description	Page
11034	SLO ½" 1-20 N.m	24	13014	200 ½" Auto Ratchet	18	14012	550 TH 22mm Spigot	23
11035	SLO ½" Fixed 1-20 N.m	24	13018	60 TH 16mm Spigot	20	14013	550 THP 14x18	23
11036	SLO TH 16mm Spigot 1-20 N.m	25	13019	100 TH 16mm Spigot	20	14014	550 THP 22mm Spigot	23
11037	SLO ¼" 1-20 N.m	24	13020	200 TH 16mm Spigot	20	14015	800 ¾"	22
11066	SL1 ½"	24	13021	300 TH 16mm Spigot	20	14016	800 1"	22
11067	SL1 ½"	24	13022	60 TH 9x12	20	14017	800 P ¾"	23
11068	SL2 ½"	24	13023	100 TH 9x12	20	14018	800 P 1"	23
11069	SL3 ½"	24	13024	200 TH 9x12	20	14142	Extension Handle	22
11085	SLO P ¼" 1-20 N.m	25	13025	200 TH 14x18	20	14157	¾" Square Drive (Professional)	30
11086	SLO P ¾" 1-20 N.m	25	13026	300 TH 14x18	20	14165	1" Square Drive (Professional)	30
11087	SLO ¾" 4-20 N.m	24	13028	400 TH 14x18	20	14166	End Cap Kit and Locking Tool	
11088	SLO THP 9x12	25	13042	60 ¾" Ind. Ratchet	19		Model 550 - 1500P	23
11089	SLOP ¾" Fixed 1-20 N.m	25	13043	60 ½" Ind. Ratchet	19	14195	Ratchet Repair Kit Mdl 550	30
11090	SLO THP 1-20 N.m	25	13044	100 ¾" Ind. Ratchet	19	14196	Ratchet Repair Kit Mdl 800	
11117	300 THP 16mm Spigot	20	13045	100 ½" Ind. Ratchet	19		- 1500 (¾)"	30
11122	SLO TH 9x12 4 - 20 N.m	25	13046	200 ½" Ind. Ratchet	19	14197	Ratchet Repair Kit Mdl 800	
11123	SLO ¼" 4-20 N.m	24	13047	300 ½" Ind. Ratchet	19		- 1500 (1")	30
11125	SLO ¾" Fixed 4-20 N.m	24	13049	330 ½" Ind. Ratchet	19	16010	HT1	38
11126	SLO TH 16mm Spigot 4-20 N.m	25	13050	400 ¾" Ind. Ratchet	19	16011	PT1 1"	52
11138	100 P ¾" Auto Ratchet	21	13051	60 P ¾" Ind. Ratchet	21	16011.AUT	PT1 AUT 1"	53
11139	100 P ½" Auto Ratchet	21	13052	60 P ½" Ind. Ratchet	21	16011.MTS	PT1 MTS 1"	53
11140	200 P ½" Auto Ratchet	21	13053	100 P ¾" Ind. Ratchet	21	16011.X	PT1 1" Remote	57
11143	100 THP 16mm Spigot	20	13054	100 P ½" Ind. Ratchet	21	16011.XAUT	PT1 AUT 1" Remote	57
11144	200 THP 16mm Spigot	20	13055	200 P ½" Ind. Ratchet	21	16012	HT2/5	38
11150	100 THP 9x12	20	13056	400 P ¾" Ind. Ratchet	21	16013	PT2	52
11151	200 THP 9x12	20	13057	300 P ½" Ind. Ratchet	21	16013.AUT	PT2 AUT	53
11152	200 THP 14x18	20	13068	400 THP 14x18	20	16013.MTS	PT2 MTS	53
11153	300 THP 14x18	20	13122	Model 5 Stepless Ratchet	16	16013.X	PT2 Remote	57
11164	60 P ¾" Auto Ratchet	21	13212	Ratchet Repair Kit Mdl 60 &		16013.XAUT	PT2 AUT Remote	57
11167	60 THP 16mm Spigot	20		100 (¾" Ind Ratchet)	30	16014	HT5/5	38
11170	60 THP 9x12	20	13213	Ratchet Repair Kit Mdl 60 &		16015	PT5	52
11171	60 P ½" Auto Ratchet	21		100 (½" Ind Ratchet)	30	16015.AUT	PT5 AUT	53
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11598	Ratchet Repair Kit Mdl 60 &			(Ind Ratchet)	30	16015.X	PT5 Remote	57
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11618	Ratchet Repair Kit Mdl 60 &			330 (Ind Ratchet)	30	16016	HT6/5	38
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11623	Ratchet Repair Kit Mdl 200 &		13252	Tru-Torque 50 ½" N.m only	13	16031.AUT	PT1 AUT ¾"	53
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12006	4R ¾"	26	13270	Tru-Torque 250 ½" Dual Scale	15	16066.MTS	PT7 MTS	55
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29963.27	27mm Open End	29	50642.xxx	2500 N.m Annular TD	81	60212	Torque Limiting Bench Stand (16 N.m)	78
29963.30	30mm Open End	29	50643.xxx	5000 N.m Annular TD	81	60216.200	TST/TTT to 10 Way Lead for Rotary TD	71, 73 & 82
29963.32	32mm Open End	29	50644.xxx	10000 N.m Annular TD	81	60217.200	TST/TTT to 6 Way Lead for Static & Annular TD	71, 73 & 82
29963.36	36mm Open End	29	50645.xxx	20000 N.m Annular TD	81	60223.200	TD Lead Pro-Log, TST & TTT to no connector	82
29963.41	41mm Open End	29	50646.xxx	50000 N.m Annular TD	81	60224.200	TD Lead 10 way to no connector	82
29963.46	46mm Open End	29	50647.xxx	100000 N.m Annular TD	81	60225.200	TD Lead 6 way to no connector	82
29964.23	1 1/4" Open End	29	50648.xxx	1000 lbf.ft Annular TD	81	60244	Shut-off system in wall box	43
29964.24	1 1/2" Open End	29	50649.xxx	1500 lbf.ft Annular TD	81	60245.200	HE Transducer Lead	83
29969	3/4" Fixed Head	29	50650.xxx	2500 lbf.ft Annular TD	81	60246	TWL 1500	84
29972	3/4" Ratchet	29	50651.xxx	2500 lbf.ft Annular TD	81	60248	Serial Data Lead Kit	82
29975	Torque Angle Protractor	30	50652.xxx	5000 lbf.ft Annular TD	81	60250	HE Inst to Std Smart Static TD Lead	83
37705	Calibration Certificate Software	82	50653.xxx	7000 lbf.ft Annular TD	81	60253	12v DC Power Supply - Pro-Test	69
43212	TST 2	71	50654.xxx	15000 lbf.ft Annular TD	81	60254	Shut-off system in wall box with printer	43
43213	TST 10	71	50655.xxx	50000 lbf.ft Annular TD	81	60256	Serial Data Lead for TTL-HE to no connector	83
43214	TST 25	71	50656.xxx	50000 lbf.ft Annular TD	81	60257	Ancillaries output Lead for TTL-HE to no connector	83
43217	TTL-HE Instrument	83	50657.xxx	75000 lbf.ft Annular TD	81	60263	HE Inst Std Smart Rotary TD Lead	83
43218	Pro-Test 60	69	50662.xxx	3000 N.m Annular TD	81	60266	HE Transducer to TTT/TST Lead	83
43219	Pro-Test 400	69	50663.xxx	6000 N.m Annular TD	81	62198	Mounting Plate	69
43220	Pro-Test 1500	69	50664.xxx	4500 N.m Annular TD	81	62220	Large Mounting Bracket for FMT	75
43221	TruCheck 350 N.m	66	50666.xxx	1000 N.m Annular TD - Remote 72mm Series	81	62221	Small Mounting Bracket for FMT	75
43222	TruCheck Plus 350 N.m	67	50667.xxx	1500 N.m Annular TD - Remote 72mm Series	81	72000	Spigot Adaptor 16mm to 22mm	29
43226	TruCheck 250 lbf.ft	66	50668.xxx	2000 N.m Annular TD - Remote 72mm Series	81	85242	Blank End for Open End	29
43228	Torque Tool Tester	73	50669.xxx	7000 N.m Static TD	76	85719	Blank End for Open End	29
43230	TruCheck 1000 N.m	66	50671.xxx	2 N.m FMT	74	85720	Blank End for Ring End	29
43231	TruCheck Plus 1000 N.m	67	50672.xxx	10 N.m FMT	74	PROTEST.CCW	Pro-Test Counter Clockwise Cal.	69
43237	TruCheck 750 lbf.ft	66	50673.xxx	25 N.m FMT	74	S1921	1 1/4" Open End	28
50127	Extra Lge Bench Stand (5000 N.m)	78	50674.xxx	150 N.m FMT	74	TCUKAS.CW	TruCheck UKAS Clockwise Cal.	67
50211	Small Bench Stand (10 N.m)	78	50675.xxx	400 N.m FMT	74	TCUKAS.CW+CCW	TruCheck UKAS Clockwise and Counter Clockwise Cal.	67
50212	Small Bench Stand (50 N.m)	78	50676.xxx	1500 N.m FMT	74	TST.CCW	TST Counter Clockwise Cal.	71
50213	Small Bench Stand (100 N.m)	78	50677.xxx	20 lbf.in FMT	74	TTT.CCW	TTT Counter Clockwise Cal.	73
50220	Large Bench Stand (500 N.m)	78	50678.xxx	100 lbf.in FMT	74			
50221	Large Bench Stand (1000 N.m)	78	50679.xxx	250lbf.in FMT	74			
50251	10 N.m Joint Simulator	79	50680.xxx	100 lbf.ft FMT	74			
50252	50 N.m Joint Simulator	79	50681.xxx	250 lbf.ft FMT	74			
50253	100 N.m Joint Simulator	79	50682.xxx	1000 lbf.ft FMT	74			
50254	500 N.m Joint Simulator	79	50683.xxx	STB1000	75			
50313	2 N.m Joint Simulator	79	50684.xxx	STB3000	75			
50539	2 N.m Joint Simulator	71, 74	50692	150 N.m Joint Simulator (FMT)	74			
50540	10 N.m Joint Simulator	71, 74	50693	140 N.m Joint Simulator (STB1000)	75			
50541	25 N.m Joint Simulator	71, 74	50694	700 N.m Joint Simulator (STB1000)	75			
50548	RD 5000 Rundown Fixture	79						
50548.1	Nut and Bolt Kit UNC	79						
50548.2	Washer Stack 1500 N.m	79						
50587.IND	1 N.m Static TD	76						
50588.xxx	2.5 N.m Static TD	76						