

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 (Torque x rpm = 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?

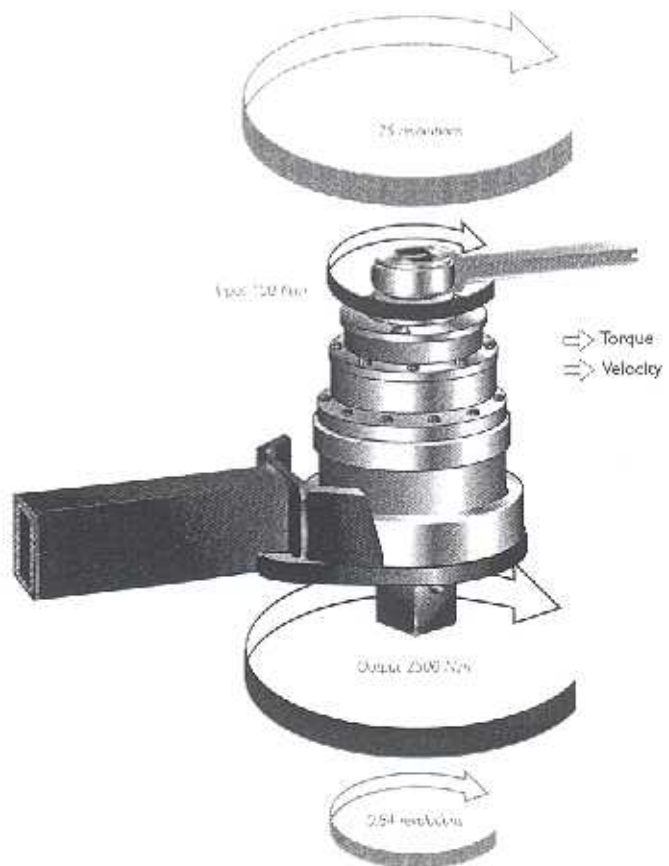
- **Safety** – use of long levers can be dangerous. Torque multipliers mean a reduction in the lever length or operator effort by a factor of 5, 25 or 125.
- **Space limitation** – the use of a long lever may be impossible due to the available space.
- **Accuracy** – torque will be applied most accurately 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



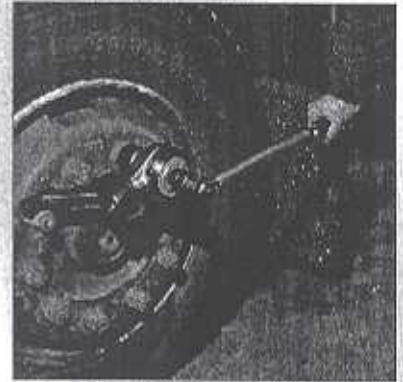
Advantages of the Norbar Handtorque System

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 $\pm 14\%$, 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.

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.

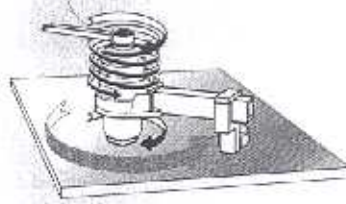
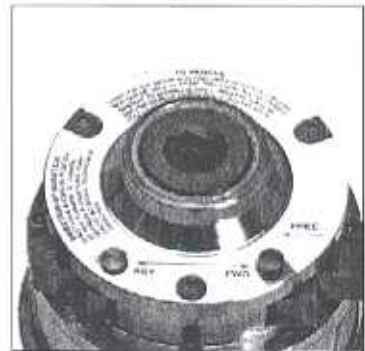
OFF



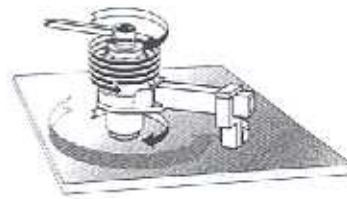
OFF/LOCKED



ON (Wind Up) and OFF (Release) Switch



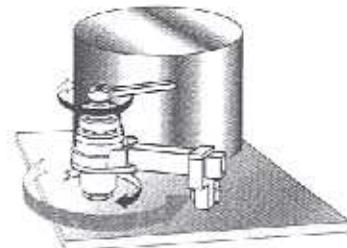
Multiplier behaves like a very stiff 'spring'



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



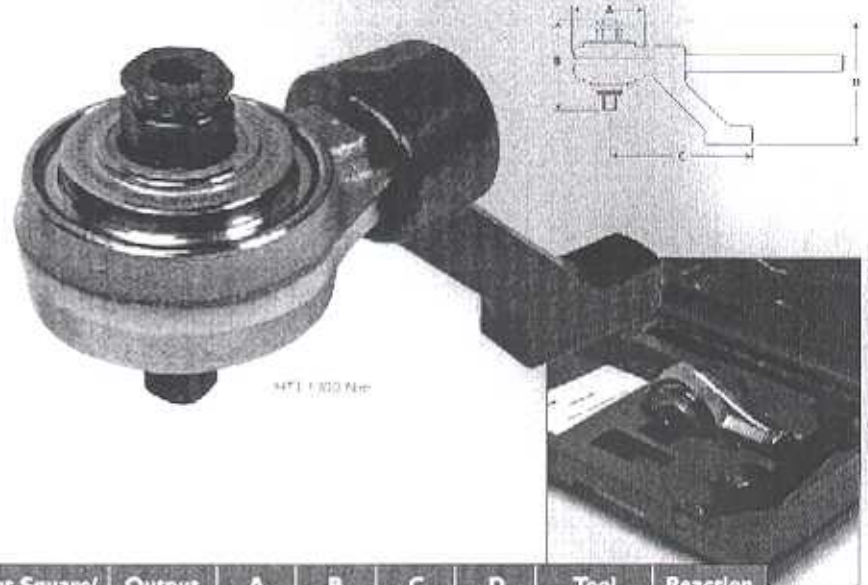
In this application the Multiplier is used upside down and is able to support its own weight because the reaction plate is held hard against the reaction point



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'

HT3 Torque Multiplier

- 5:1 torque multiplication, accuracy guaranteed better than ±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 code 17218, 2700 N.m version, part code 17219.



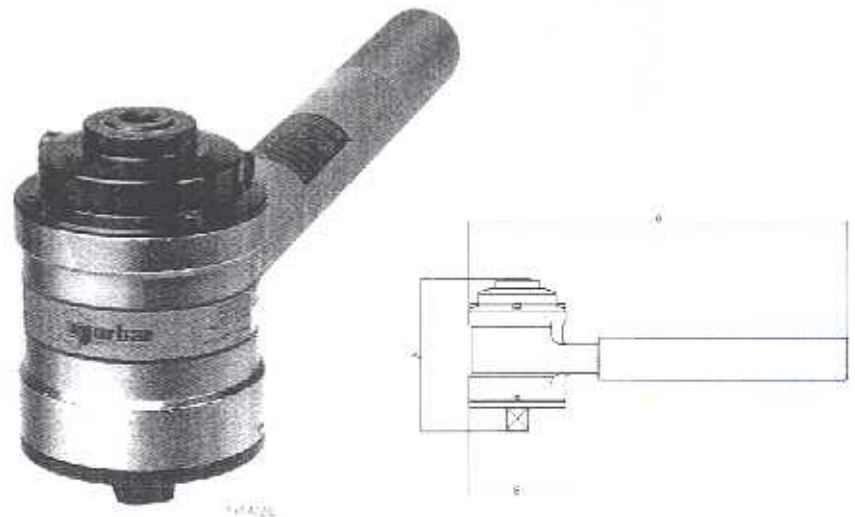
HT3 Torque Multiplier

Model	Part Code	Range		Ratio	Input Square/Hexagon	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	950	5:1	1 1/2" Female / 32mm A/F Male	1 1/2"	108	126	210	190	3.8	1.9
HT3 2700 N.m Version Kit	17221	2700	2000	5:1	2" Female / 36mm A/F Male	2"	108	128	210	186	3.8	1.9

Weight of entire kit / kg

HT4 Torque Multiplier

- True 15:1 or 26:1 torque multiplication, accuracy guaranteed better than ±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 Hatcher (Anti Backlash) fitted to allow safer and more practical operation.
- Angle protractor for easy torque and angle tightening.

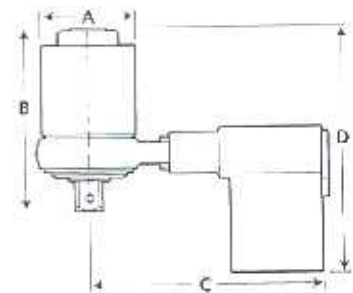
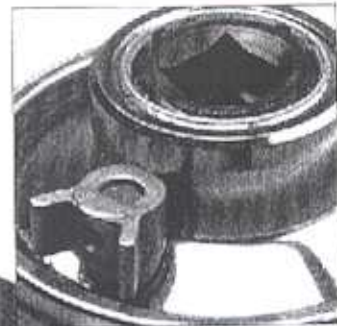


HT4 Torque Multiplier

Model	Part Code	Range		Ratio	Input Square	Output Square	A	B	C	Tool Weight	Reaction Weight
		N.m	lbf.ft				mm	mm	mm		
HT4/15:1	17022	7000	5200	15:1	1 1/2"	1 1/2"	108	158	430	6.1	1.9
HT4/26:1	17021	4500	3300	26:1	1 1/2"	1 1/2"	108	173	450	7.0	1.9

Handtorque™ HT15 Series

- 72mm diameter allows excellent access.
- Guaranteed accuracy of better than $\pm 4\%$.
- Anti Wind-Up Ratchet available on 25:1 models for easier and safer operation.
- A variety of reaction styles are available for maximum versatility.
- Electronic torque transducers can be fitted for precise torque monitoring. See page 74.
- Available in a variety of ratios and output square drive sizes.



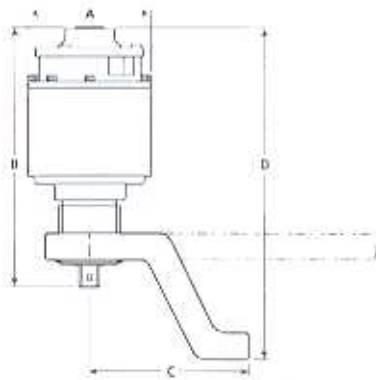
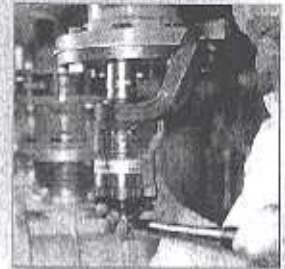
HT15 Series

Model	Part Code	Range		Ratio	Input Square		A	B	C	D	Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in						
15/5	18014	1000	740	5:1	1/2	3/8	72	144	143	175	2.4	1.7
15/5	18015	1500	1100	5:1	3/8	1	72	144	143	175	2.4	1.7
15/25	18018	1000	740	25:1	1/2	3/8	72	165	143	196	2.7	1.7
15/25	18019	2000	1450	25:1	3/8	1	72	165	143	196	2.7	1.7
15/25 Fitted with AVALR	18035	1000	740	25:1	1/2	3/8	72	166.3	143	197.3	2.8	1.7
15/25 Fitted with AVALR	18036	2000	1450	25:1	3/8	1	72	166.3	143	197.3	2.8	1.7

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 pole may be modified by customer to suit their applications.
HT30 Part Code 16606
HT45 and HT60 Part Code 16687



Small Diameter Series

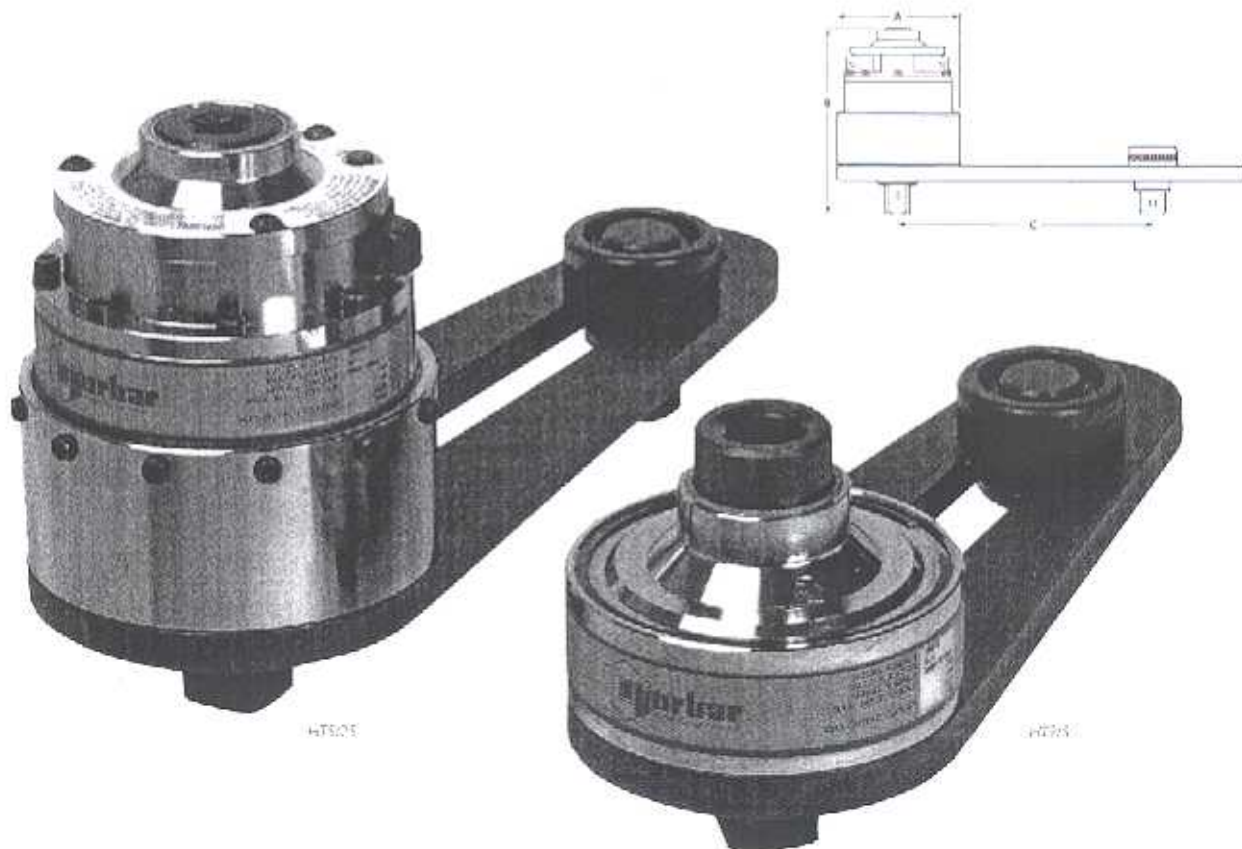
Model	Part Code	Range		Ratio	Input Square	Output Square	A	B	C	D min	D max	Tool Weight	Reaction Weight
		N.m	lbf.ft										
30/5	18003	3000	2200	5:1	8	1	108	190.4	141	223	251.4	5.0	2
30/15 <small>(Ratchet with AWU, R)</small>	18004	3000	2200	15:1	8	1	108	224	141	256	285	7.0	2
30/25 <small>(Ratchet with AWU, R)</small>	18006	3000	2200	25:1	8	1	108	224	141	256	285	7.0	2
45/26 <small>(Ratchet with AWU, R)</small>	18047	4500	3300	26:1	8	1	108*	224	175	-	318	6.7	4
60/25 <small>(Ratchet with AWU, R)</small>	18008	6000	4400	25:1	8	1.5	119	27	154	320	361	10.5	4
60/125 <small>(Ratchet with AWU, R)</small>	18012	6000	4400	125:1	8	1.5	119	30	172	350	381	12.1	4

*Maximum width 140mm



Handtorque™ Standard Series Models to 3400 N.m

- True torque multiplication guaranteed better than ±4%
- High ratios allow the use of a small torque wrench multipliers can be used where access is limited
- Anti-Wind-Up Ratchets available on models of 25:1 ratio
- A variety of reaction styles are available for maximum versatility
- Electronic torque transducers can be fitted for precise torque monitoring. See page 75

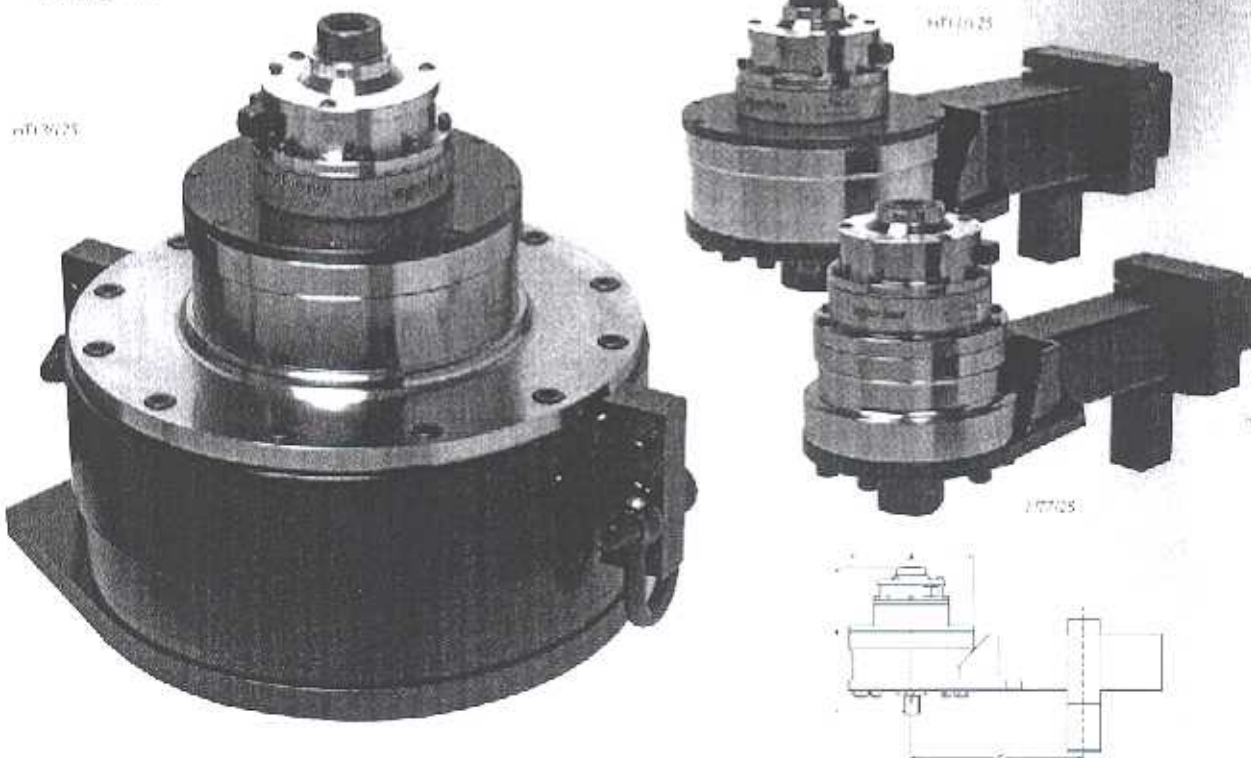


Standard Series to 3400 N.m

Model	Part Code	Range		Ratio	Input Square		Output Square		A	B	C min	C max	Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in	mm	mm						
1	16010	1700	1250	5:1	8	12	108	106	83	217	3	2.2		
2/5	16012	1700	1250	5:1	8	12	108	126	83	217	3	2.2		
2/25 <i>Ratchet with UP</i>	16089	1700	1250	25:1	8	12	108	136	83	217	5.6	2.2		
5/5	16014	3400	2500	5:1	12	18	119	143	86	264	4.7	2.5		
5/25 <i>Ratchet with UP</i>	16090	3400	2500	25:1	12	18	119	167	86	264	7.5	2.5		
6/5	16016	3400	2500	5:1	12	18	119	149	86	264	4.7	2.5		
6/25 <i>Ratchet with UP</i>	16092	3400	2500	25:1	12	18	119	195	86	264	7.5	2.5		

Handtorque™ Standard Series Models to 47,500 N.m

- True torque multiplication guaranteed better than $\pm 1\%$.
- 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 75.



Standard Series to 47500 N.m

Model	Part Code	Range		Ratio	Input Square		A	B	C		Tool Weight	Reaction Weight
		N.m	lbf.ft		in	in			min	max		
7:5	6067	6000	4500	5:1	3/8	1/2	101	165	115	333	8	6.8
7:7.25 <i>Fitted with AWUR</i>	6065	6000	4500	7.5:1	3/8	1/2	144	223.5	146	333	10.7	6.3
7:7.25 Sm. Dia. <i>Fitted with AWUR</i>	6093	6000	4500	25:1	3/8	1/2	130	21	163.4	337	10.6	4.9
7:12.5	6068	6000	4500	12.5:1	3/8	1/2	144	239.5	146	333	12.2	6.3
7:12.5 Sm. Dia. <i>Fitted with AWUR</i>	6096	6000	4500	12.5:1	3/8	1/2	130	238	163.4	337	12	4.9
9:7.5 <i>Fitted with AWUR</i>	6070	9500	7000	25:1	3/8	1/2	184	209	171	351	17.4	8.3
9:12.5 <i>Fitted with AWUR</i>	6071	9500	7000	12.5:1	3/8	1/2	91	421	17	351	18.9	9.3
11:25 <i>Fitted with AWUR</i>	6098	20000	14700	25:1	3/4	2.4	212	325.4	-	500	30.6	13.3
1:112.5 <i>Fitted with AWUR</i>	6049	20000	14700	125:1	3/4	2.4	212	307	-	500	32.1	13.7
13:125 <i>Fitted with AWUR</i>	16053	47500	35000	125:1	3/4	2.4	313	366	-	-	95.2	42.7