

## 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?

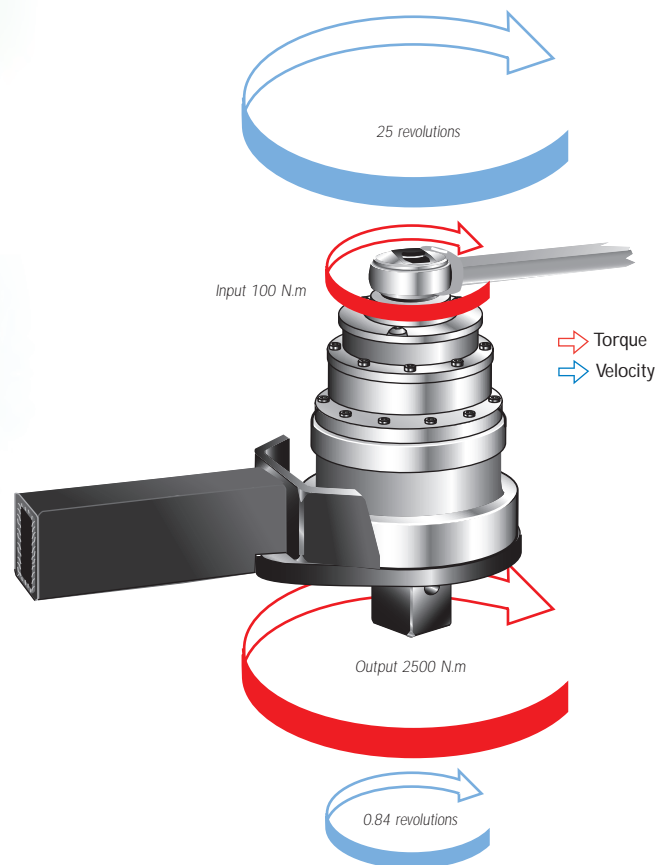
- **Safety** – use of long levers can be dangerous. Torque multipliers mean a reduction in the lever length or operator effort by a factor of 5, 25 or 125.
- **Space limitation** – the use of a long lever may be impossible due to the available space.
- **Accuracy** – torque will be applied most accurately 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  $\pm 4\%$ , throughout the operating range, taking the uncertainty out of high torque tightening.

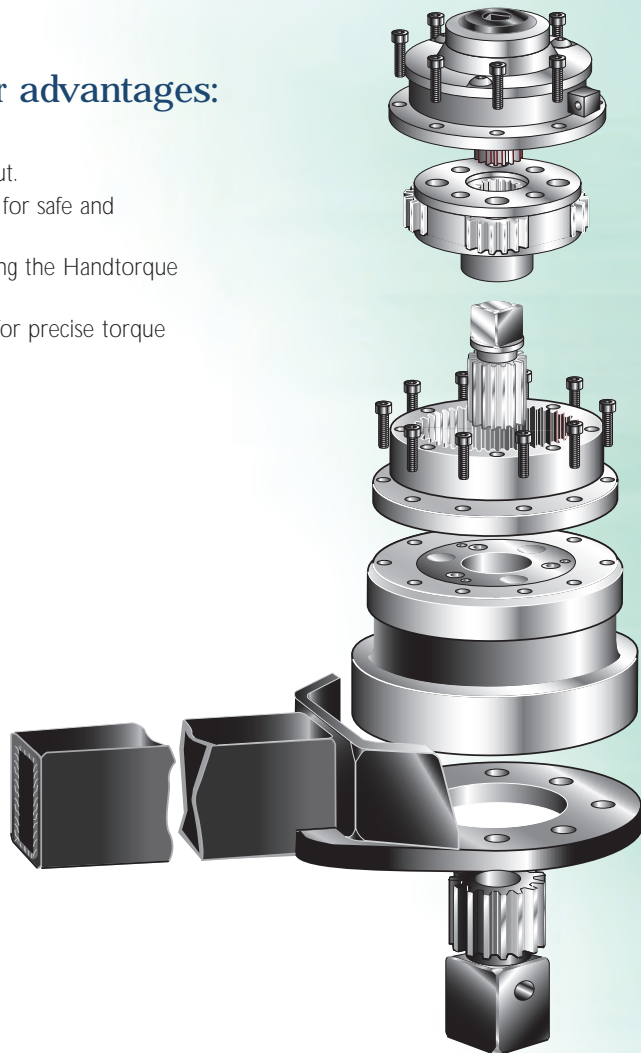
No gearbox is 100% efficient and so the velocity ratio (the number of turns that the input has to make to achieve one revolution of the output) is not the same as the torque multiplication ratio. Norbar multipliers are engineered such that each gear stage has a velocity ratio of typically 5.45:1 which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

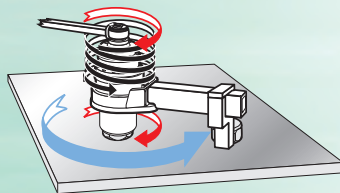
With any high ratio gearbox (25:1 or more) a certain amount of wind-up (backlash) has to be taken up before any useful tightening work is applied to the nut.

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

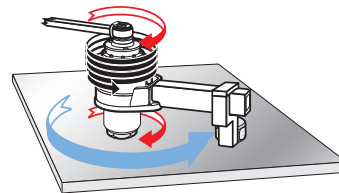
The Anti Wind-Up Ratchet retains all of the wind-up forces as they are created with the following benefits:

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 it's own weight.

Norbar's Anti Wind-Up Ratchet

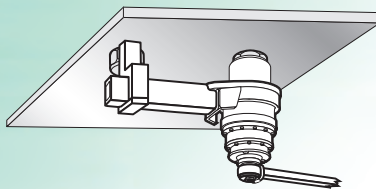


Multiplier behaves like a very stiff 'spring'

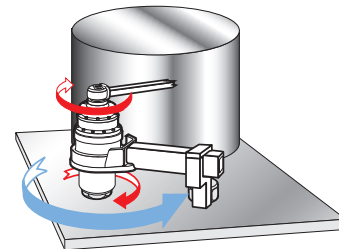


Multiplier will achieve maximum torque only after the 'spring' has been taken up

→ Torque  
→ Reaction Force



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.