

# Speed Reducer Efficiency and Run-in

## Speed Reducer Efficiency

The efficiency of an SE Encore series worm gear speed reducer depends on many factors such as the lead angle of the worm threads, input speed to the reducer, operating load, and the temperature of the Mobil Glygoyle 460 lubricant.

The efficiencies published in this catalog are in accordance with ISO/DIS 14521.2 and are based on rated output torque, an operating temperature reflecting continuous operation, and Mobil Glygoyle 460 synthetic lubricant. If the operating temperature is not reached (such as with intermittent service), the operating efficiency will be less than rated efficiency. Speed reducer efficiency is optimized by performing a proper run-in during the initial use of a worm gear speed reducer.

When the rated efficiency is not listed in the catalog, it may be easily calculated in the following manner:

$$\text{Efficiency} = \text{Output Horsepower} / \text{Input Horsepower}$$

In order to establish the efficiencies of reducers where only the output torque and input horsepower are given, the output torque is converted to output horsepower by the following formula:

$$\text{Output Horsepower} = [\text{Output Torque (lbf-in)} \times \text{Output RPM}] / 63,025$$

## Speed Reducer Run-In

“Run-in,” sometimes referred to as “break-in,” is an important process required to optimize worm gear speed reducer service life. In many applications, concern or care relative to worm gear speed reducer run-in is not necessary. However, in some applications, properly addressing the interaction of the composite speed reducer materials may be critical to achieving desired service life expectations.

There are two significant elements of run-in. The first element is the run-in of the radial shaft lip seals and the respective mating shafts. Seal service life is dependent on many application and environmental factors; it can vary from 12 months to more than 10 years. However, the radial shaft lip seals in a speed reducer will reach their designed level of performance after an initial break-in period. It is normal and should be expected that the seal may permit some weepage of lubricant along the rotating shaft during the break-in period. After several hours of run-in, the seal and shaft will develop a conformal running surface with each other that will provide leak free operation throughout the components expected service life.

The second element is the run-in of the bronze gear and the case hardened worm input shaft. Worm gears operate using some degree of sliding action between

the bronze gear and steel worm-on-shaft. Therefore, achieving the rated efficiency requires run-in time to obtain a work hardened surface on the bronze. Experience indicates that completing a run-in procedure lowers the initial friction in the gearset by 10 to 15 percent regardless of the bronze gear surface finish quality.

The gearing has a better chance of providing maximum performance and service life if part of the full working load is initially applied for a pre-set period of time. The first few hours of operation at gradually increasing loads will reduce the gearset friction. Gradually increasing to the full working load over 10 to 100 hours of operation will minimize the occurrence of any surface damage. Depending on the operating load and on the size and speed of the gearing, the efficiency will stabilize to a steady value during this period of run-in and the operating temperature will decrease (see Figure 1).

A reasonable run-in procedure consists of applying half the required load for a few hours and then increasing it to the full operating load in at least two stages. Applying the full load immediately concentrates high contact pressures on small areas. This may cause high local surface temperatures and some temporary damage to the surfaces. However, temporary damage to the bronze gear surfaces will often “heal” after continued running at full or less than full load.

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## Typical Worm Gear Run-in

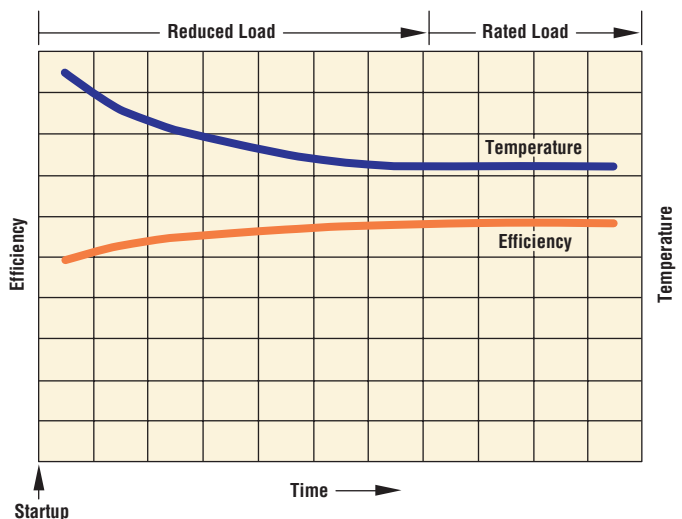


Figure 1. Operating temperature drop as a result of the increase in efficiency from a proper run-in procedure