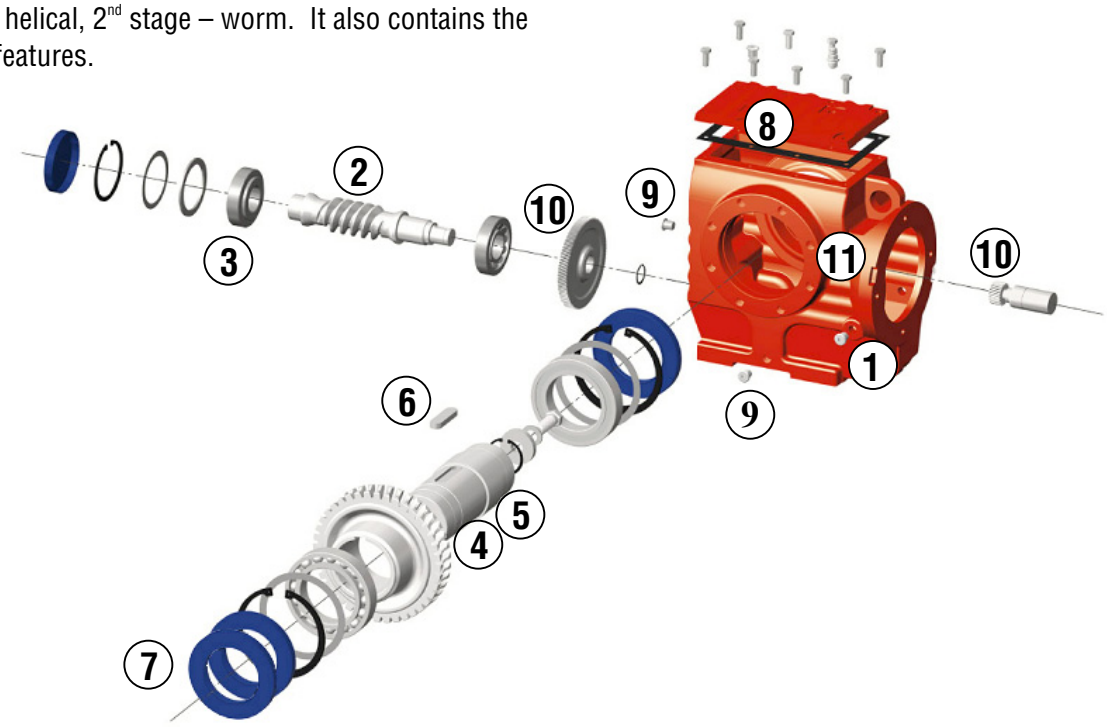
Technical Note

S-Series Gear Reducers

S-Series

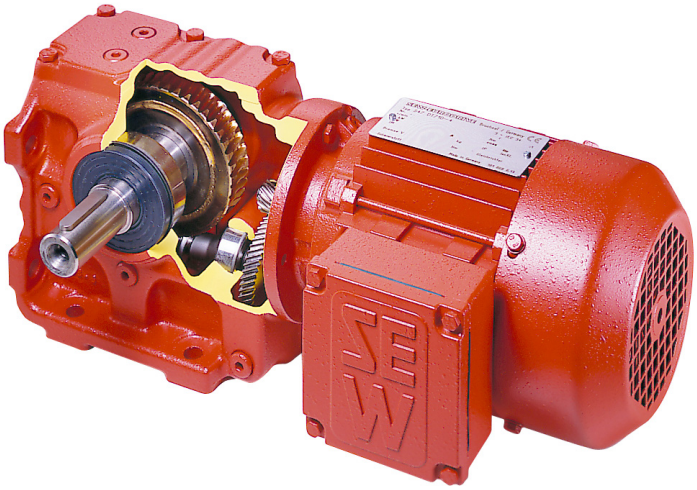
Features

The SEW-Eurodrive S-series gear reducer contains two gear stages: 1st stage – helical, 2nd stage – worm. It also contains the following features.



1. SAE Class 30 or equivalent (GG20) gray cast iron housing and flanges. No bolt-on bearing covers
2. Finish ground or shaved steel gears heat treated and hardened to 58-62 Rockwell C
3. ABEC-1 bearing tolerances
4. SAE 1045 steel shafts
5. Input and output shafts available in either inch or metric sizes; solid shafts (not pictured) contain a center tapped hole to ease the mounting of components onto the shaft
6. Captured keys on input and output shafts
7. Exclusive ***interlocking*** 2-piece seal design consisting of a patented bi-helix Viton® inner seal and a double-lip Nitrile (Buna N) outer seal to provide three sealing surfaces against contaminants
8. Removable inspection cover.
9. Oil level and breather plugs strategically placed according to the customer's mounting position
10. 1st stage helical gear set to increase total efficiency
11. Corrugated surface improves heat dissipation and reduces vibration

Additional Features:



- **Style**: Right-angle shaft orientation (output shaft at 90° to the motor shaft or to a solid input shaft)
- **Input Types**: Available with adapters to accommodate NEMA or IEC motor frames, solid input shafts, backstops, adjustable motor mounting platforms, and scoops. Also accepts an R-series reducer as the input (ex: S67R37) to attain higher ratios and lower speeds
- **Output Flanges**: Contain O-ring to minimize oil leakage that may result from mounting to a "flat" surface that exceeds acceptable tolerances. Contain a centering tenon (pilot). Available with either through holes (B5) or tapped holes (B14).
- **Output Shaft – Keyed**: Metric or inch shaft available in hollow or solid designs. Keyed hollow shaft supplied with special mounting paste and a retaining kit. Paste protects against corrosion as is available in regular or food grade. Retaining kit secures customer's solid shaft and contains bolt, washer, and protective cap.
- **Output Shaft – Keyless**: Available as a metric shrink disc or as an inch/metric tapered bushing (TorqLOC™)
- **Mounting**: Available as foot, flange, or shaft mount
- **Torque Ratings**: Based upon mechanical capacity under continuous duty operation
- **Torque Capacity**: From 380 lb-in to 37,710 lb-in
- **Shaft Rotation**: Unrestricted - clockwise or counterclockwise
- **Efficiency Range:** From 50% to 90% depending on ratio and speed. As a rule, the faster the speed, the higher the efficiency
- **Ratio Range – Single**: 6.80 to 288
- **Ratio Range – Compound**: 156 to 33,818
- **Fatigue Strength**: Shafts and gears designed for infinite fatigue strength
- **Shock Capacity**: Meets or exceeds AGMA 6009-A00, which states that reducer must be capable of withstanding 4 shock loads within an 8-hour period – each shock equal to 200% of the maximum rated torque for 2 seconds.

Housing Material

All SEW S-series reducers are manufactured from SAE 30 or equivalent (GG20) gray cast iron due to the following benefits:

1. Cast iron flows well, allowing it to be used on intricate castings.
2. Cast iron machines well.
3. Cast iron serves as an excellent damping material to minimize vibration, contributing to longer bearing and gear life.

Ductile iron (or nodular iron), a type of cast iron containing magnesium, is 2 to 4 times stiffer than gray cast iron. It is often used in applications involving heavy shock loads at low temperatures – when gray iron housings lose much of their shock absorbing strength.

Ductile iron housings are not available on S-series reducers.

Design

S-series reducers contain two gear stages and are more efficient than single worm reducers of the same ratio. The first stage is a helical gear set and is very efficient (98.5%) due to rolling friction. The second stage is a worm set and is less efficient due to sliding friction. The efficiency of the worm set depends on the number of turns on the worm – the more turns, the larger the ratio and the lower the efficiency.

Since a helical gear set is used on the input, less reduction is required from the worm set. Less reduction permits the use of a worm with fewer turns and higher efficiency. The result is a gear reducer with a greater overall efficiency than a single worm of equal ratio.

Break-in Period

A 24-hour break-in period is required for the worm and wheel to seat to each other. During this period noise levels may be higher than normal and operating efficiency may be 2 – 12% lower than normal. The higher the gear ratio, the more apparent is this effect.

Rated efficiency is achieved after the break-in period under the following conditions:

1. Reducer has reached normal operating temperature.
2. Reducer contains the proper type and amount of lubrication.
3. Reducer is operating at or below its rated load.

Self-locking Drives

Certain applications, such as hoists, inclined conveyors, or high inertia loads require special consideration during stopping. When motor power is removed, either gravity or the load's high inertia creates a back-driving torque at the reducer's output shaft. This torque attempts to rotate the gear train from the output shaft rather than from the input shaft.

R, F, and K style reducers use gearing with rolling friction. Therefore, their efficiency is very high and their gear train rotates when subject to a back-driving torque. In contrast, worm gears contain sliding friction with lower efficiencies. Their ability to rotate via a back-driving load changes based upon their efficiency. As a general rule, if the efficiency is 50% or less, the pitch angle of the worm gear is too steep to permit the worm to rotate from the output shaft. Essentially, the reducer's gear train acts as a brake and the reducer is said to be "*self-locking.*" Attempting to back-drive a self-locking worm reducer causes the reducer's components and housing to absorb large amounts of stress that may lead to premature wear or catastrophic failure if not properly sized.

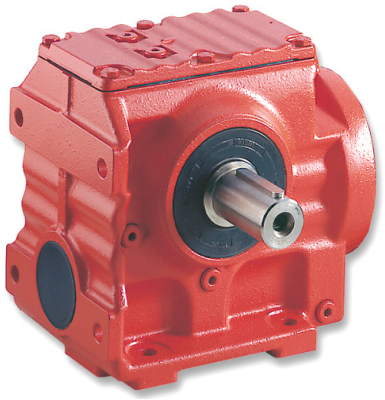
Since SEW's S-series reducers contain a helical input, the total efficiency is more than 50% for all ratios and sizes. Therefore, the S-series reducers are not considered self-locking. SEW recommends a reducer with an integral brakemotor for use in applications involving a back-driving load.

Foot Mounting

S-series units with solid output shafts are available with a footed housing that contains through-holes for mounting. The reducer may be mounted from the bottom or from the side since there are two footed surfaces (J-mount).

A footed housing is not available with a hollow output shaft. However, the non-footed housing that is normally supplied with a hollow shaft contains tapped holes on the bottom that may be used to mount the reducer, if necessary. Special care must be taken to ensure correct alignment.

See **Tech Note GM-019** for more information on mounting procedures for units with feet.



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Shaft Mounting – Tapped Holes

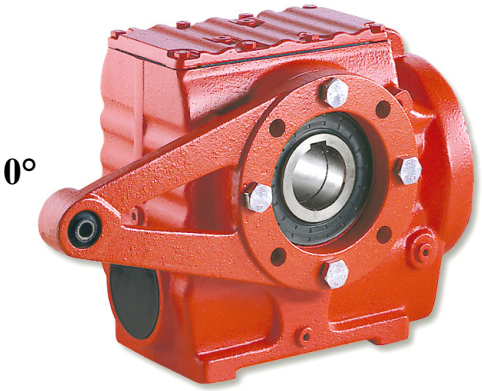
The S-series housing that is supplied with a keyed hollow shaft, shrink disc, TorqLOC, or DIN spline does not have feet. SEW strongly recommends using a torque arm mounted to the side of the reducer for the best assurance against problems due to misalignment.

However, the tapped holes that are used to mount a torque arm may be used without the torque arm to mount the reducer, if necessary. The application should contain ample space to allow the bolts to be thread from inside the mounting surface and into the housing. Often times, conveyors provide such access.

Since the reducer has no raised tenon to locate the exact center of the hollow shaft, extreme care is necessary to assure proper alignment and to avoid premature failure of the bearings. If a tenon is desired, SEW can supply an optional B14 flange that mounts to the face of the reducer while providing access to the tapped holes.

See **Tech Note GM-020** for more information on mounting procedures for reducers with a hollow shaft.

Shaft Mounting – Torque Arm



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SEW's preferred method of installing a hollow shaft reducer is to hang the reducer from a solid shaft and to allow the solid shaft to support the entire weight of the reducer and motor. Since this method does not require the use of feet or a flange, the reducer has a natural tendency to spin around the shaft if not restrained.

Therefore, SEW can provide an optional torque arm and rubber bushing that mount onto either side of the reducer. The torque arm has eight symmetrical holes; thus, there are eight possible mounting angles. 0° is shown at left. Positive angles occur in the clockwise direction. At 270°, the torque arm bushing is located at the bottom of the reducer.

When a torque arm is supplied, the letter "**T**" is added after the reducer size.

It is most important that the customer properly affix the torque arm. More information on torque arm installation is available within **Tech Note GM-021**.

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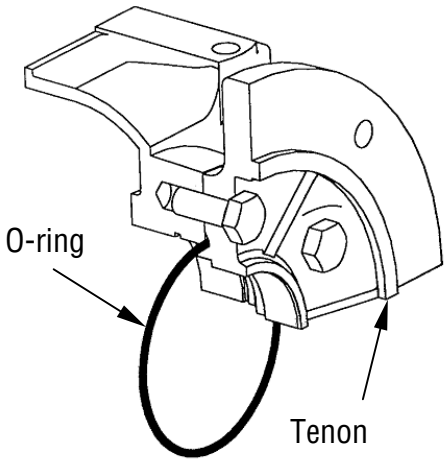
Flange Mounting



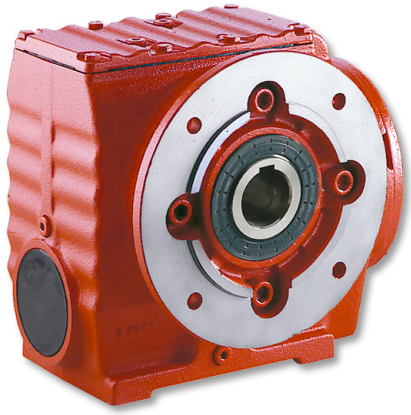
Two styles of flanges are available: **B5** and **B14**. Both flanges contain an O-ring and tenon (pilot) as shown at left.

The O-ring helps prevent oil leakage that could occur if the flange is mounted to a "flat" surface that exceeds the recommended flatness tolerance.

The tenon allows for easier installation as well as protects the reducer from shifting out of alignment if the mounting bolts were to loosen.

B5 Flange ("F")
A B5 flange bolts onto the reducer housing and contains through-holes (non-threaded) for mounting. These holes are intentionally made slightly larger than the bolts for which they are intended. The letter "**F**" is added to the nomenclature to designate this option.

SAF



B14 Flange ("Z")
A B14 flange bolts onto either side of the reducer and contains through holes to allow access to the tapped holes of the housing. Each threaded hole is spaced equally around the bolt circle at either 45° or 90° increments, depending upon the size of the reducer. The bolt circle and tenon diameters are smaller on the B14 than on the B5 flange of the same reducer. The letter "**Z**" is added to the nomenclature for this option.

SAZ

Please reference **Tech Note GM-020** for important additional information on mounting procedures for flanged units.

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Flange-Opposite-Shaft Mounting

An S-series solid shaft reducer is available with a 'flange-opposite-shaft' configuration, as shown below. The solid output shaft and mounting flange are located on opposite sides of the reducer. In this configuration, a small radial force (OHL) on the output shaft creates a large bending moment on the flange due to the long lever arm (distance L).

Without additional support, the allowable overhung load (OHL) must be reduced to **25%** of the published maximum OHL to avoid distorting or fracturing the flange. Contact SEW Regional Engineering for more information.