

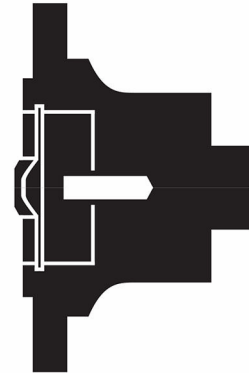
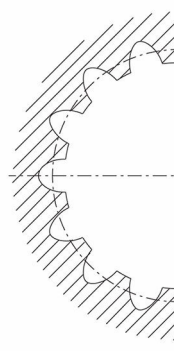
Data Sheet

Lubrication of Spline Shafts

Technical Specifications

A high percentage of transmitted power in the mobile market is through splined pump and motor shafts and couplings. Most of the Danfoss transmissions are produced with splined shafts. It is necessary to use proper installation and maintenance procedure to expect normal life.

The life expectancy of any splined drive is dependent on many factors. Length of the spline engagement, alignment, transmitted torque, duty cycle, material hardness, class of fit, and lubrication are a few of these factors.



Let's give some consideration to the lubrication needs. Good lubrication is readily achieved if the spline is submerged in oil or if it has "splash" lubrication, as in most gear boxes. Pump input and motor output spline wear can usually be controlled with proper care. These splines are often exposed to the elements and maintaining proper lubrication is often a problem. Spline wear caused by fretting corrosion is usually due to inadequate lubrication and is characterized by a red dust like deposit in the splined joint. Conditions that lead to this type of wear are: small relative motion between the mating splines, localized loading, insufficient lubrication and oxygen present at the joint.

Controlling fretting corrosion by stopping relative motion is usually not practical. Contact stresses below 35 N/mm², when poorly lubricated, help reduce wear, but most drives would typically have higher contact stresses than 35 N/mm². Danfoss customer end splines are generally alloy carbon steels surface hardened. Mating couplings should have a suitable surface hardness to minimize wear.

Applying a lubricant to the splined joint, when not running in flooded oil or if splashed oil is not possible, reduces friction

and restricts the presence of oxygen. A recommended spline lubricant is a 50/50 compound of a high temperature grease and a molybdenum disulphide powder. When applied initially and re-applied at proper intervals, it will help prevent fretting corrosion and premature wear. This lubricant is not soluble in oil and should be used accordingly. Further products which may be recommended are Molycote, Metaflux, Never Seeze, Optimol and similar.

Another method of stopping fretting corrosion is to use a clamped coupling. With a clamped coupling it is possible to vary the fit from sliding to solid.

A tight fit can also be achieved by the use of adhesives. Through careful application a durable connection of splined joints is achievable. During application special attention should be given to thorough cleaning and degreasing of the splines, to keeping to the permitted clearances and to even wetting of the joints with adhesive. As adhesive such as Delo ML 115 is recommended.

Spline drives are each unique and generalizing on solutions is difficult. Proper attention to the factors influencing acceptable spline life such as alignment,

torque limits and lubrication with regular maintenance will pay dividends in providing a longer application life.

For applications where problems with fretting corrosion are foreseeable tapered shafts should be used. For most of Danfoss products such shafts are in production.

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