

## USE OF LOW SPEED COMPRESSORS FOR VAPOR COMPRESSION DISTILLATION

Vapor compression (VC) distillation is conceptually similar in design to a heat pump or the more familiar mechanical refrigeration cycle. Major system components include the evaporator, compressor, heat exchangers, deaerator, and pumps. The compressor is typically a single-stage centrifugal type, with relatively low developed pressure.

Of all the components that make up the vapor compression system, the compressor is by far the most important of the components. Without a compressor the system will not function. Therefore, compressor reliability is a major concern to users of vapor compression distillation systems. There are essentially two types of compressors used in the industry today, a high-speed compressor (> 6000 RPM and < 12,000 RPM) and a low speed compressor (< 6000 RPM). The significance of the compressor speeds is in the seals and the bearing designs.

High speed compressors should not use ball bearings since they are designed for reliable use at speed less than 6000 RPM per the American Bearing Manufacturers Association (ABMA) standards. The most reliable bearings to use for a high-speed compressor are high strength journal bearings. The mean time between failure of a high-speed compressor using ball bearings is less than 3 years where the mean time between failure when using journal bearings is 7-10 years.

Low speed compressors can use standard ball bearings and have an expected life of 10 years per the ABMA when used in applications less than 6000 RPM. In the mid 1990's, Aqua-Chem designed a low speed compressor for use on its vapor compression distillation systems. As of this writing, there has not been one single failure of the ball bearings used in low speed compressors in over 15 years of continuous operation. With compressors, low speed typically translates into lower maintenance requirements.

Additional benefits of a low speed compressor are as follows:

### DIRECT DRIVE

All low speed compressors are direct drive with the motor or through a gear box. This in line configuration eliminates the side pull on the bearings caused by belts that have been historically used to drive compressors on vapor compression distillation systems. The bearings used for belt driven designs have additional forces that cause them to wear prematurely if the belt tension is too tight. With beltless low speed compressor designs, the costly down time required for belt adjustment and replacement is eliminated.

### EXTERNAL STEAM SEAL

The design of the low speed compressor with its separate bearing housing allows for an external steam seal for the compressor housing. In traditional belt driven compressor housings, the bearings are in a housing combined with the impeller and shaft. Replacing the steam seal in a belt driven compressor design requires that the impeller and shaft be removed. With the external design, the steam seal carbons can be replaced without having to disassemble the compressor and does not require removal of the shaft or compressor.

