

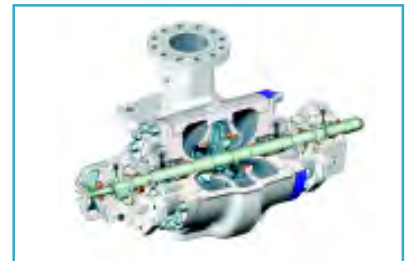


## 6. Pumps & Compressors

HCH knows your requirements for long service life, no re-lubrication, less friction, energy saving and low heat generation. For pumps and compressors, HCH high quality raw material as well as a range of optimized seals solutions are the major tools to optimize your applications. By working with HCH, you can gain the profound knowledge of HCH which has been used to develop solutions to meet the demands for high quality, lower noise levels, and outstanding water-proof support.

Take a good, hard look at virtually any industry and you'll find pumps and compressors in the mix. From oil and gas to chemical processing, water and waste treatment, medical, manufacturing, power generation, paper, and mining - there are pumps and compressors working behind the scenes and around the clock. For each of these industries, the requirement for greater Mean Time Between Failure (MTBF) places increasingly severe demands on the bearings being used.

HCH is the leading supplier of bearings and engineering solutions to the pump and compressor industry. Through decades of close cooperation with leading manufacturers, HCH research and development activities have led to innovative engineering solutions and advancements in bearing design. The incorporation of these solutions has led to better performing pumps and compressors for today and more reliable for tomorrow.



Expertise across all pump and compressor system in conjunction with bearings of the highest quality and customer proximity are the key to more power and higher productivity for pump and compressor industry. HCH achieve this due to our pump and compressor system solutions built by our experienced knowledge from long-term cooperation with leading manufacturers in these industries.



## General requirements for pumps and compressors

### Increase service life

Effective maintenance is critical to minimize life-cycle costs and downtime. Poor maintenance may result in a loss of 10 to 15% of pump efficiency. HCH can further assist with the integration of efficient maintenance and reliability plan into your maintenance practices as well as provide upgrading services. Thus, costly unplanned stops can be reduced which will finalize total economic improvement. Furthermore, pumps and compressors equipped with HCH sealed, greased-for-life bearings are considered to be maintenance-free.



### Lower energy consumption

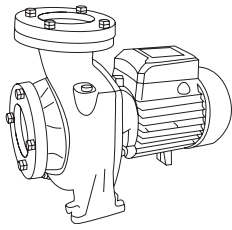
Pumping and compressing systems account for nearly 20% of the world's electrical energy demand and can range from 20-25% of the energy usage in an industrial plant operation. Energy consumption covers 45% of the total cost of owning a pump or compressor. HCH offers a range of excellent solutions and engineering services for reducing energy consumption in pumps and compressors. The most important for bearings is to reduce the friction inside, by choosing low-friction grease, optimized seals and shields design.



### Reduce vibration and noise levels

Excessive vibration and noise levels associated with industrial pumps are an increasing concern for optimum performance reasons as well as for compliance with legislation. Often the root cause of too high vibration and noise levels is related to poor shaft alignment, inadequate lubrication, poor mounting procedure and improper bearing arrangements or inefficient cooling. HCH offers a range of solutions for exceptionally quiet bearing operation spanning from selection of bearings and lubrication to advanced engineering services, such as dynamic simulation, virtual testing and design concepts.

### 6.1 Conventional Pumps



Conventional pumps usually refer to those deal with the clean fluid handling processes such as water treatment and supply, milk pasteurization and de-scaling. Reduced total cost of ownership is a critical issue for these pumps. High vibration levels increase energy consumption and can cause premature equipment failure and costly maintenance, often including unplanned downtime and loss of production. HCH offers application knowledge and high quality bearings for energy-efficient pumping systems that can reduce energy consumption in the entire process.

HCH's sealed bearings, food compatible greases and reliable high quality bearings' material offer maintenance-free and lubrication-free technology for submersible and seal-less pumps, reducing the risk of contamination of the fluid. This means vastly increased production efficiency and enhanced operational profitability.

Since these bearings are working mainly indoors, for example, the bearings in house hold pumps and milk workshop pumps, excessive vibration and noise levels are an increasing concern for optimum performance reasons as well as for compliance with legislation. Often the root cause of too high vibration and noise levels is related to poor shaft alignment, inadequate lubrication, poor mounting procedure or improper bearing arrangements.



#### HCH bearings for conventional pumps

For conventional pumps, bearings are important factors in the development towards higher pump performance. HCH deep groove ball bearings are often used. They are usually rubber-sealed or metal-shielded. In order to maintain vibration levels within acceptable limits, the internal radial clearance is optimized to suit operating conditions. Bearings are lubricated for life with grease having properties including noise dampening qualities, good humidity and corrosion resistance together with high service life at medium temperature to meet the needs of low noise and resistance to adverse environmental conditions. The filling quantity of grease is dependent upon the application needs.

Through advanced technology and knowledge, HCH can support pump designers to meet these challenges with a number of proven quality solutions including:

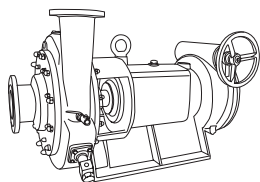
- > Maintenance free solutions
- > Advanced engineering calculation tools
- > Food compatible lubricants
- > High performing sealing solutions

HCH offers a range of special executions for these applications. For further information, please contact your HCH application specialist to ensure best results.



The challenge is to enhance performance, while enabling cost-effective, modular production. Bearings and components for these demanding applications must be extremely reliable and efficient. We offer comprehensive range of HCH products for traditional pumps application.

## 6.2 Industrial Pumps



Industrial pumps often operate under harsh and remote conditions with demanding duty cycles. The operating difficulties for the bearing arrangements may result in reduced uptime, performance and service life. For pumps that handle chemical fluid handling process, for instance, in the chemical industry and pulp & paper processes, design engineers and pump owners face a multitude of challenges. Crucial requirements include the ability to comply with industry standards and legislation and to improve energy efficiency. The problem is also faced by pumps that doing mineral fluid handling process, for instance, slurry pumping in mines, sub sea applications or coolant systems. To address these challenges, besides offering the high quality and reliable bearings for these demands, HCH also can help analyze operating conditions and select the appropriate bearing solutions to ensure high reliability, increased efficiency and extended service life.

For industrial pumps, other critical attention should be paid to the safety and environmental issues. Industry and safety standards, as well as government and environmental legislation are becoming more stringent day by day. Industrial pumping systems are the vascular apparatus of several industry processes where hazardous materials such as flammable hydrocarbons, toxic chemicals and thermally reactive chemicals are constantly moved. Any leakage of a material in the pumps could represent a serious risk for workers and for the environment. Through advanced material and manufacturing technology and application knowledge, HCH contributeS safe and high reliable bearings for industrial pump manufacturers to reach working and safety requirement. All bearings produced by HCH conform to RoHS directive and have passed SGS testing, so you can use them with full confidence.



Our application engineering experts can help you design rolling bearings quickly but carefully. It takes a lot of experience to realize reliable and cost effective bearings for industrial pumps, taking into account all operating conditions.



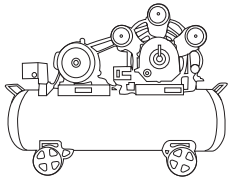
### HCH bearings for industrial pumps

To meet the challenges of industrial pump applications, HCH has developed a variety of deep groove ball bearings and tapered roller bearings. These bearings are engineered to withstand heavy radial loads, perform longer and more efficiently, operate smoother with less noise and vibration, and last longer for maximum productivity and minimal downtime.

HCH provides bearings with following characteristics:

- > Noise free operation
- > Superior heat, chemical, and wear resistance
- > Increased dent resistance
- > Improved lubrication performance

### 6.3 Reciprocating Compressors



Although one of the earliest compressor models, reciprocating, or piston compressors are still commonly used today in many applications where there are low volume and high pressure requirements. By design, reciprocating compressors produce high pressures in small volumes and are generally used for home and light industrial applications.

#### Reciprocating air compressors

In reciprocating air compressors, air is compressed in a chamber defined by a cylinder wall and piston. The piston, connected to a connecting rod, has its position in the cylinder controlled by a crankshaft. As the crankshaft turns, the piston moves downward increasing the chamber size and draws air through a suction valve into the chamber. When the piston reaches its bottom position in the cylinder, it reverses direction and moves upward, decreasing the chamber size. When the piston reaches its top position in the cylinder, the compressed air is discharged through a discharge valve in the housing.

#### Reciprocating refrigerant compressors

Reciprocating refrigerant compressors produce high pressures for small volumes and are generally used for air conditioning applications. In reciprocating refrigerant compressors, refrigerant is compressed in a chamber defined by a cylinder wall and piston. The piston, connected to a connecting rod, has its position in the cylinder controlled by a crankshaft. As the crankshaft turns, the piston moves downward increasing the chamber size and draws refrigerant gas through a suction valve into the chamber. When the piston reaches its bottom position in the cylinder, it reverses direction and moves upwards decreasing the chamber size. The working process is almost the same as reciprocating air compressors.

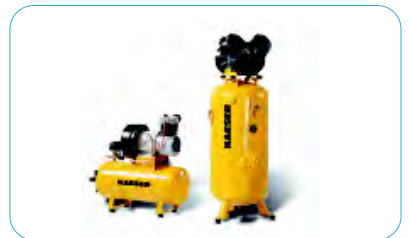


#### HCH bearings for reciprocating compressors

Two bearings are generally used as the main crankshaft bearings while other bearings are used at the connecting rod bearing positions. Bearings in reciprocating air compressors must be able to withstand very high temperatures; perform longer and more efficiently; operate smoother with less noise and vibration, and last longer for maximum productivity and minimal downtime.

Through advanced technology and vast experience, HCH can support reciprocating air compressors to meet these challenges with following characteristics:

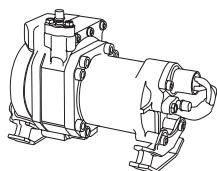
- > Long, trouble-free performance
- > Elimination of bearing creep
- > Superior heat and wear resistance
- > High temperature lubrication performance



Recently, low friction loss, high efficiency, and energy saving are increasingly required in correspond to the movement for environmentally friendliness. Current bearings are required to have low torque, low vibration, high load carrying capacity and high speed performance in the reciprocating compressor industry as well.



## 6.4 Scroll Compressors



Scroll compressors are a small but important segment of the overall compressor market. Their designs and capabilities make them ideal especially for home refrigerators and building comfort-cooling systems that do not require the high performance capabilities of larger twin screw or centrifugal compressor designs.

In a scroll compressor, an orbiting scroll-shaped component moves relative to a similar shaped stationary component inside a housing. On the suction side of the compressor, gas is drawn into the suction opening in the housing and into the cavity produced between the orbiting and stationary scroll components and the housing. As the shaft rotates and moves the orbiting scroll, the cavity begins to decrease in size as it continues to move inwards along the scroll walls. When the cavity reaches the discharge location of the compressor, the compressed gas is discharged through the discharge opening in the housing.



### HCH bearings for scroll compressors

The most commonly used bearings in scroll compressors are deep groove ball bearings. Scroll compressor bearings are exposed to refrigerant gases and need to be able to withstand high speeds and high loads while providing high running accuracy and reliability. Decades of research and development in the industry have produced several technological breakthroughs, setting new industry standards for performance.

- > Ultra long life
- > Increased load capacity
- > Long, trouble-free performance
- > Elimination of bearing creep



The basic function of the rolling bearing in this application is to support the rotating shaft under load. The performance required for bearing is becoming increasingly sophisticated, reflecting diversified applications and severer use conditions in each system. HCH can supply you the bearings with reliable material and low friction characteristics.

### ● Data of standard radial clearances for bearings under no load

| Bore |           | C2   |      | Normal |      | C3   |      | C4   |      | C5   |      |
|------|-----------|------|------|--------|------|------|------|------|------|------|------|
| Over | Including |      |      |        |      |      |      |      |      |      |      |
| mm   | mm        | min. | max. | min.   | max. | min. | max. | min. | max. | min. | max. |
| 2.5  | 10        | 0    | 7    | 2      | 13   | 8    | 23   | 14   | 29   | 20   | 37   |
| 10   | 18        | 0    | 9    | 3      | 18   | 11   | 25   | 18   | 33   | 25   | 45   |
| 18   | 24        | 0    | 10   | 5      | 20   | 13   | 28   | 20   | 36   | 28   | 48   |
| 24   | 30        | 1    | 11   | 5      | 20   | 13   | 28   | 23   | 41   | 30   | 53   |
| 30   | 40        | 1    | 11   | 6      | 20   | 15   | 33   | 28   | 46   | 40   | 64   |
| 40   | 50        | 1    | 11   | 6      | 23   | 18   | 36   | 30   | 51   | 45   | 73   |
| 50   | 65        | 1    | 15   | 8      | 28   | 23   | 43   | 38   | 61   | 55   | 90   |