Glossary

Internal Gear Pump

Refer to Construction of CFD Analysis Technology for Internal Gear Pumps (page 31)

SUZUKI Kazunari Elemental Technology Sect., Basic Technology R&D Center, Engineering Div.

1 What is an Internal Gear Pump?

An internal gear pump is a type of positive displacement pump. Inside the pump body, an internal gear meshes with a part of an external gear, and they rotate together to move the displacement chamber formed by the gears and the body, thus providing the pumping action. There are two types of internal gear pumps: those with a crescent shaped partition separating the discharge area from the suction area and those without a partition. In general, both types have the advantages of a simple structure with a low number of parts, are available at reasonable prices, and can be used in a poor operating environment because they are unlikely to be affected by dirt (Figs. 1 and 2). Therefore, they are used in various fields, including construction, agricultural, and industrial machinery, as well as hydraulic power units.

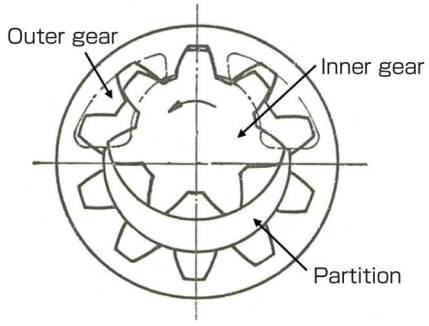

Fig. 1 Internal gear (with a partition) [1)]

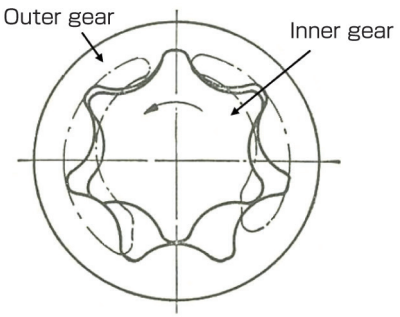

Fig. 2 Internal gear (without a partition) [1)]

2 Pump Efficiency

2. 1 Overall Efficiency

Overall efficiency is a measure of how effectively the power supplied to the pump is converted into fluid energy. It can be expressed as the product of the volume efficiency and the mechanical efficiency, etc. These efficiencies vary with oil viscosity μ, pressure difference between suction and discharge Δp, and pump speed n, as shown in Fig. 3.

2. 2 Volume Efficiency

Volume efficiency is calculated by dividing the actual discharge flow of the pump by the theoretical discharge flow. A higher volume efficiency means that the required flow rate can be achieved with less power. Volume efficiency can be reduced primarily by leakage or flow losses due to the inclusion/occurrence of bubbles in the pump.

2. 3 Mechanical Efficiency

Mechanical efficiency is calculated by dividing the theoretical pump torque by the actual shaft torque. A higher mechanical efficiency means that the pump can be driven with less power. Mechanical efficiency can be reduced primarily by friction losses due to solid or viscous friction inside and outside the pump.

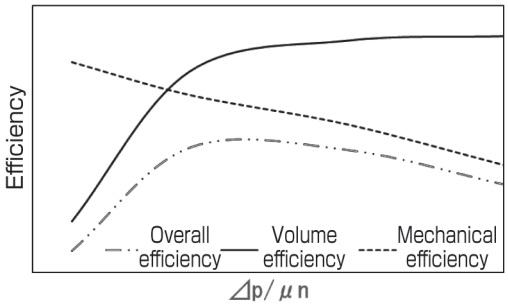

Fig. 3 Example of pump efficiency curves

1) ICHIKAWA Tsuneo, HIBI Akira, "Hydraulic Engineering", Asakura Publishing Co., Ltd. (1979).