Gear Pump Selection Guide

As a positive displacement fluid transfer device, the selection of a gear pump directly affects system efficiency and equipment service life. When selecting a gear pump, it is necessary to comprehensively consider the characteristics of the medium, operating conditions, and equipment performance, and achieve precise matching through systematic analysis. The following are the key points and practical steps for selecting a gear pump.

1.Medium Characteristics: The Fundamental Basis for Selection

The physical and chemical properties of the medium are the primary considerations for selection. The viscosity range determines the structural form of the gear pump: Low-viscosity media (1–50 cSt, such as diesel fuel) are suitable for standard straight-tooth gear pumps; medium-viscosity media (50–500 cSt, such as hydraulic oil) are suitable for helical or herringbone tooth structures; high-viscosity media (500–2000 cSt, such as heavy oil) require gear pumps with heating jackets to prevent efficiency loss due to excessive viscosity resistance during transportation.

Medium Corrosivity Determines Material Selection: For neutral oils, cast iron pump bodies can be used; for mildly corrosive media (e.g., sulfur-containing crude oil), ductile iron or cast steel materials should be used; for highly corrosive fluids, stainless steel (304 or 316 grade) pump bodies with fluor rubber seals are required. If the medium contains solid particles (particle size ≤5 mm), an open impeller design should be selected, along with an inlet filter.

In addition, the medium temperature range affects the selection of the sealing system: nitrile rubber seals are used for normal temperature conditions (-10°C to 60°C); fluorine rubber seals are required for medium to high temperatures (60°C to 120°C); and metal bellows mechanical seals are required for ultra-high temperatures (120°C to 200°C), while the pump body must be designed with a heat dissipation structure.

2.Operating conditions: Key indicators for determining equipment specifications

Flow rate requirements are a critical parameter for selection. The rated flow rate (unit: m^3/h or L/min) should be calculated based on the system's hourly delivery volume, with a 10%-20% margin reserved. The flow rate calculation formula for gear pumps is: Flow rate = Displacement (ml/r) × Speed (r/min) × Volume Efficiency (typically 0.85–0.95) ÷ 1000. This formula can be used to determine the required pump displacement specification (e.g., the P330 gear pump has a displacement of 330 ml/r).

The working pressure must match the system requirements. Gear pump rated pressures are typically classified into three grades: low pressure (≤10 MPa), medium pressure (10–20 MPa), and high pressure (20–31.5 MPa). When selecting a pump, the maximum operating pressure of the system must be clearly defined, and the pressure fluctuation factor (with a 1.2 safety factor) must be considered to avoid prolonged overloading. For example, high-pressure gear pumps should be selected for engineering machinery hydraulic systems, while low-pressure models can be chosen for lubrication systems.

Environmental conditions also influence selection: Portable gear pumps paired with diesel generator sets are required for outdoor or mobile equipment (such as agricultural machinery); explosion-proof motors compliant with ATEX or CLASS explosion-proof standards are required for explosion-proof environments (such as petrochemical workshops); dust-proof covers must be installed in dusty environments, and motors must have an IP54 or higher protection rating in humid environments.

3.Performance matching: optimizing system operational efficiency

Speed matching must consider the characteristics of both the motor and the pump. For standard gear pumps, the recommended operating speed is 1000–1800 rpm. Excessively high speeds may cause cavitation and noise, while excessively low speeds may result in difficulties in conveying high-viscosity media. Asynchronous motors are typically used with gearboxes to ensure the speed remains within the optimal range.

The suction and discharge conditions must meet the pump's self-priming capability. The maximum suction lift for a gear pump is generally 3–5 meters. If the system suction lift exceeds this range, a pre-pump must be installed or the installation height reduced. The diameter of the suction piping should not be less than the pump's inlet diameter to avoid excessive local resistance. For long-distance conveyance, the piping head loss must be calculated to ensure sufficient suction pressure.

Maintenance convenience is also a key consideration in pump selection: models with high standardization of wear-prone components (such as gears, bearings, and seals) should be chosen for ease of replacement; the pump housing design should include maintenance access space, with critical components (such as inlet/outlet flanges and bearing housings) designed for easy disassembly; models equipped with condition monitoring interfaces (such as pressure sensors and temperature sensors) enable preventive maintenance and are prioritized for continuous operation systems.

4.Selection Steps: Systematic Decision-Making Process

Define Medium Parameters: Record key indicators such as viscosity, density, temperature, corrosiveness, and solids content;

Calculate Operating Conditions: Determine flow rate based on delivery volume and calculate required pressure based on system resistance;

Initially select pump specifications: Screen models with suitable displacement and pressure ratings based on flow rate and pressure;

Verify material compatibility: Confirm that the materials of the pump body, gears, and seals are compatible with the medium;

Calculate operational efficiency: Calculate the shaft power under actual operating conditions and select a matching motor (with a 20% power margin);

Evaluate additional requirements: Determine whether custom configurations are needed for features such as explosion protection, heating, or monitoring.

By following the above steps, precise matching between the gear pump and the system can be achieved, avoiding energy waste from “over-sizing” and preventing equipment damage due to inadequate selection, ultimately ensuring the efficient and stable operation of the fluid transmission system. When selecting a model, it is recommended to refer to the performance curves provided by the equipment manufacturer, combine them with actual operating conditions for simulation verification, and conduct bench testing when necessary to confirm compatibility.

gear pump diagram

gear pump definition

gear pump working principle

external gear pump and internal
rotary pump
different types of pumps
gear pump with motor
gear pump types
gear pump characteristics
gear pump function
gear pump manufacturing
external gear pump diagram