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COPT-PUMP REPLACED WITH GEAR PUMP CONNECTED IN SERIES CONNECTION FOR THE IMPROVEMENT OF FLOW RATE IN SPECIFIC DURATION

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ABSTRACT

This report explores the replacement of the Central Oil Purifier Turbine (COPT) with a triple gear pump connected in series, focusing on its impact on system performance, reliability, and efficiency. The COPT, traditionally used for oil purification in various industrial applications, presents challenges such as high maintenance costs and potential inefficiencies in modern systems. To address these issues, a triple gear pump configuration was selected due to its robustness, ease of maintenance, and improved pressure handling capabilities.

The report details the design considerations, installation process, and performance analysis

of the new configuration. A comparative study was conducted, highlighting the advantages of the gear pump setup, including enhanced flow control, reduced downtime, and lower operational costs.

The findings suggest that the series connection of triple gear pumps not only meets the operational demands but also provides significant long-term benefits, making it a viable alternative to the traditional COPT system. The study concludes with recommendations for optimizing the new system and potential areas for future research

Keywords: Central oil purifier turbine (COPT), Broader context, World Sea, Robust, Fluid source

1-INTRODUCTION

The Cargo Oil Pump Turbine (COPT) is an essential component in the operation of oil tankers, playing a crucial role in the safe and efficient transfer of cargo oil between the ship's storage tanks and shore facilities. This turbine-driven pump system is specifically designed to handle the large volumes of crude oil or petroleum products that are transported by these vessels. The COPT's functionality is vital not only during loading and unloading operations but also in maintaining the stability and safety of the ship by managing the distribution of cargo within the tanks.

The COPT is typically powered by a steam turbine, which provides the high torque and variable speed required for handling oils of varying viscosities. This system's efficiency and reliability are paramount, as any failure or inefficiency can lead to significant delays, increased operational costs, or even environmental hazards due to spills or leaks.

This introduction outlines the fundamental aspects of the Cargo Oil Pump Turbine, including its role in maritime operations, the technological principles underlying its design, and its importance in the broader context of marine engineering. The following sections will delve into the specific components of the COPT, its operational principles, maintenance requirements, and the potential challenges faced during its operation. By understanding these elements, we can appreciate the significance of the COPT in ensuring the smooth and safe transport of oil across the world's oceans.

1-1.1 Overview of the Cargo Oil Pump Turbine (COPT)

The COPT is used to pump large volumes of crude oil or petroleum products from the storage tanks on a ship to shore facilities, or vice versa. It ensures that the oil is transferred efficiently, quickly, and safely, which is essential for the operation of oil tankers

Steam Turbine: The COPT is typically driven by a steam turbine. The turbine converts the thermal energy of steam into mechanical energy, which is used to drive the cargo oil pumps. Steam turbines are preferred in this application due to their ability to deliver high torque and variable speed, which is crucial for handling different types of cargo with varying viscosities.

Cargo Oil Pump: This is the pump that moves the oil. There are usually several of these pumps on a tanker, each driven by its own turbine. The pumps can be of different types, such as centrifugal pumps, which are commonly used due to their efficiency in handling large volumes of liquid

2. Working Principle

Steam Generation: Steam is generated in the ship's boilers, which is then directed to the steam turbine of the COPT.

Turbine Operation: As steam passes through the turbine blades, it causes the turbine rotor to spin. The speed of the turbine can be controlled by regulating the steam flow, allowing precise control over the pump's operation.

Pump Operation: The mechanical energy from the spinning turbine rotor is transferred to the cargo oil pump. As the pump operates, it creates the necessary pressure to move the oil from the cargo tanks through the ship's piping system to the desired location, either onboard or ashore.

3. Advantages of COPT

High Efficiency: Steam turbines are highly efficient, especially when handling large volumes of oil, which is essential for reducing loading and unloading times.

Flexibility: The ability to control the turbine speed allows for precise handling of different types of oil, including those with varying viscosities.

Reliability: COPT systems are robust and designed to operate under harsh conditions typical in marine environments, providing reliable performance over long periods.

4-4.1Challenges and Maintenance

Steam Management: Efficient steam management is crucial to ensure that the turbine operates at its optimal level. Any issues with steam quality or supply can impact the performance of the COPT.

Maintenance: Regular maintenance of both the steam turbine and the cargo oil pump is necessary to prevent breakdowns. This includes monitoring for wear and tear, checking for leaks, and ensuring that the steam and oil systems are clean and free of contaminants.

4-4.2 Alternatives

Electric Motors: In some modern tankers, electric motors have started to replace steam turbines as the primary driver for cargo oil pumps. These motors offer more precise control and easier integration with modern automated systems.

Hydraulic Systems: Hydraulic drives are another alternative, providing high torque at low speeds, which is beneficial for handling viscous cargoes.

4-COMPONENTS USING INTRIPPLE GEAR PUMP IN SERIES CONNECTION

4-1. Gear Pumps

Driving Gear: The primary gear that is connected to the power source (motor or engine) and drives the meshing gears.

Driven Gear: The gear that meshes with the driving gear, rotating in the opposite direction to facilitate fluid movement.

Pump Housing: Encloses the gears and maintains a tight seal to prevent fluid leakage, ensuring efficient operation.

Inlet and Outlet Ports: The inlet allows fluid to enter the pump, and the outlet allows the pressurized fluid to exit. In a series configuration, the outlet of the first pump is connected to the inlet of the second, and so on.

4-2. Coupling or Shaft Connection

Flexible Coupling: Connects the output shaft of one gear pump to the input shaft of the next, ensuring smooth torque transmission while accommodating minor misalignments.

Shafts: Transmit mechanical power between the gear pumps and also to the motor or prime mover.

4-3. Prime Mover

Electric Motor: Commonly used as the power source to drive the gear pumps, providing consistent torque and speed.

Internal Combustion Engine: In some applications, an engine may be used to drive the pumps, especially in mobile or remote installations.

4-4. Pressure Relief Valves

Safety Relief Valve: Installed to protect the system from excessive pressure buildup. It releases fluid if the pressure exceeds a predetermined limit, preventing damage to the pumps and piping.

Pump-Specific Relief Valve: Each pump might have its own relief valve to protect against localized overpressure conditions.

4-5. Piping and Connectors

Suction Lines: Piping that connects the fluid source to the inlet of the first gear pump.

Discharge Lines: Piping that connects the outlet of one pump to the inlet of the next in series.

Connectors and Fittings: Used to join the pipes and ensure a secure and leak-proof connection between the pumps.

4-6. Filters and Strainers

Suction Strainer: Installed before the first pump to filter out large particles and debris from the fluid, preventing damage to the pump gears.

Inline Filters: May be installed between pumps or at specific points in the system to remove finer particles and contaminants.

4-7. Control Systems

Pressure Gauges: Installed at various points to monitor the pressure within the system, ensuring that each pump operates within its design limits.

Flow Meters: Measure the flow rate of the fluid to monitor the system's performance.

Control Valves: Used to regulate the flow and pressure within the system, ensuring optimal operation of the pumps.

4-8. Reservoir

Fluid Reservoir: Stores the fluid that the gear pumps will circulate through the system. The reservoir is usually equipped with a level sensor to monitor fluid levels and ensure a constant supply to the pumps.

4-9. **Mounting Base**

Pump Baseplate: A common baseplate or individual mounts for each pump ensure stability and alignment of the pumps, reducing vibration and noise during operation.

4-10. Seals and Bearings

Shaft Seals: Prevent fluid from leaking out of the pump housing where the shaft exits the pump.'

5-COPT- TRIPILE SCREW PUMP

Figure 1. COPT-TRIPLE SCREW PUMP

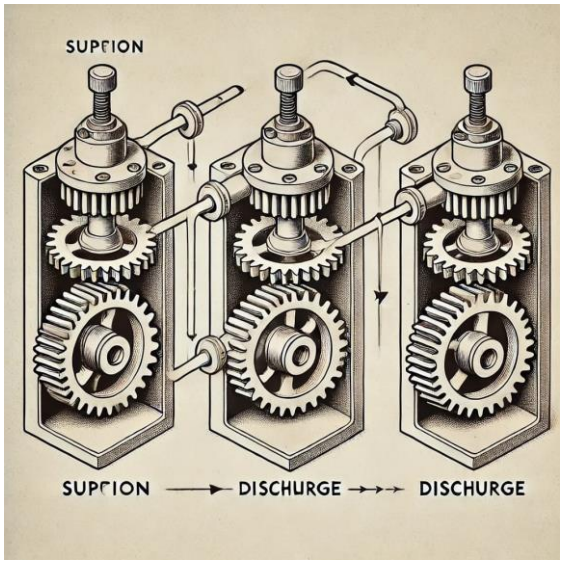

Figure 2. OVER VIEW OF TRIPLE SCREW PUMP

6-Conclusion:

In a triple screw pump, the conclusion of the COPT (Cut-Off Pressure Test) is a critical aspect that ensures the proper operation and safety of the pump system. Here's a summary of what this typically involves.

The COPT ensures that the pump can handle the maximum operational pressure without leakage or failure. It verifies that the pressure control mechanisms are functioning correctly. The test confirms that the pump's internal components, like the screws and housing, can withstand the pressures encountered

during normal and extreme operating conditions. The successful completion of a COPT indicates that the pump will not over-pressurize the system, which could otherwise lead to potential hazards such as bursting of the pipeline or damage to the pump. The test also ensures that the pump maintains its efficiency under varying pressures, which is crucial for energy savings and operational cost-effectiveness.

In conclusion, the COPT in a triple screw pump is essential for verifying the pump's safety, integrity, and efficiency, ensuring reliable operation within its designed pressure limits.

7-Reference

[1] Brennan, J. R. "Screw Pumps Cost Effective for Heavy Crude Operations", Oil and Gas Journal 90 (S1), dec. 1992.

[2] Buren in, V. V. & Gauvin, D. T. "New Designs of Screw Pumps: Survey of Foreign Patents", Chemical and Petroleum Engineering, vol. 12, 1977.

[3] Mimmi, G. & Peniche, P. "Flow Rate Regularity in Rotary Trochoidal-Lobe Pumps", in Machine Elements and Machine Dynamics (ed G. Pennock) DE-Vol. 71, ASME, New York.

[4] Okorokov, V. M., Verizhnikov, P. P. & Ryazantsev, V. M. "New Triple-Screw Pumps for Pumping High-Viscosity Liquids", Chemical and Petroleum Engineering, vol. 22.b, 1987.

[5] Olivari, V. Quando il giusto non è nel mezzo, (I Parte) Oleodinamica-pneumatica, may 1991.

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