FAG Rolling Bearings and INA Linear Bearings in High Performance Mud Pumps

Examples of Application Engineering

WL 16 503 EA

Hex Pump 240 National Oilwell Varco

Photo: National Oilwell Varco

In oil drilling operations, mud pumps force the drilling fluid down the drill string and back up the well bore.
Up to now conventional three cylinder piston pumps (Triplex) have traditionally been used. Because of their size, weight and pressure pulsations a new pump has been developed, to improve drilling rig capabilities and economics.
The Hex Pump, a joint development project of National Oilwell Varco and the Schaeffler Group, is a true technical highlight.

The Hex 240 Pump (National Oilwell Varco patent) is designed to handle variable pressure and volume flows. Like the old pumps, it utilises axial pistons, but instead of a swashplate it has an asymmetric cam.
Significant advantages over triplex mud pumps are:

- 30% smaller
- 30% lower weight
- greater pumping capacity
- steady flow (no pressure pulsations)

In Nov 2000, the first contact was established between National Oilwell Varco and INA (linear bearings), as well as FAG (rolling bearings).
In May 2001, the first prototype bearings were ordered.
In 2004, the first series of bearings was produced.

INA/FAG supply all the bearing components for the Hex 240 Pump.

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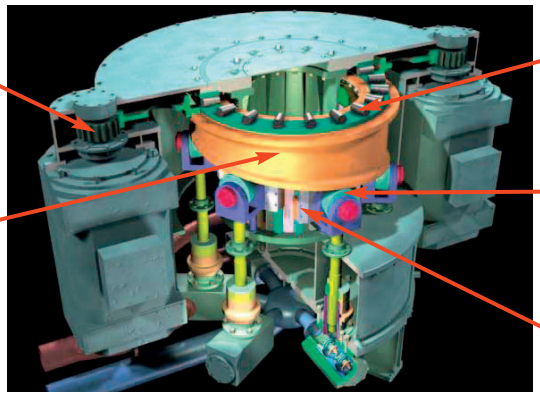
Pinion shaft bearings
2 FAG cyl. roller bearings
1 FAG four point bearing

Cam
Dimensions:
1196×1700×581 mm
Mass ca. 1740 kg



FAG tapered roller thrust bearing
1240×1540×140 mm
Mass ca. 630 kg

FAG cam roller
140×380×175/212,5 mm
Mass ca. 132 kg

INA roller type profiled rail units

Bearings - FAG components

Cam

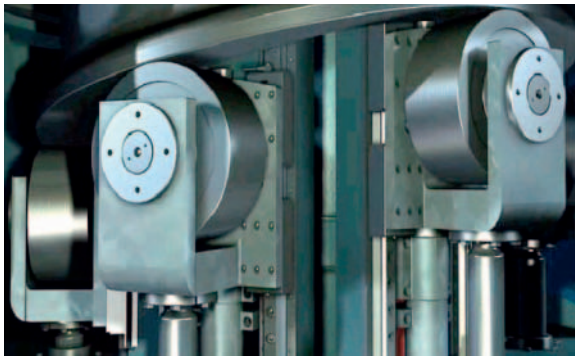
The cam, which rotates at a max. speed of 212 min^{-1}, is the heart of the pump. Thanks to its special profile, the cam produces a unique steady state flow, which minimizes pressure variations. The cam of special cast steel is manufactured on a machine with a multi-axis control system. It has a special heat treat running area to withstand the considerable cycling stress and to protect against surface wear.

Main bearing arrangement

The mainly axial forces are taken up at the upper position by a tapered roller thrust bearing.
Radial guidance is provided by a cylindrical roller bearing.
An angular contact thrust ball bearing serves as the counteracting bearing. To prevent slippage, the bearing is preloaded by means of springs via a thrust collar.
For easier handling and mounting, all large bearings are fitted with non separable cage assemblies and have threaded holes for eyebolts.

Cam rollers

The cam rollers are mounted in a clevis. They translate the motion of the rotating asymmetric cam into the linear motion of the pumping cylinders. The outer ring of the cam rollers has an optimized cross profile which prevents edge stressing. The cage is designed especially to withstand high radial accelerations.
The forces are taken up by a preloaded, premounted tapered roller bearing unit (patent pending).



Pinion shaft bearings

The pinion shaft is supported in two cylindrical roller bearings which take up the radial forces, and one four point bearing which takes up only the axial forces. All rolling bearings are lubricated by an oil circulating system.

Technical data of the Hex 240 Pump

Input power:	2×950 kW
max. pump rate:	3 900 l/min
max. speed:	212 min^{-1}
max. pressure:	517 bar
dimensions:	4,1×3×2,8 m (L/W/H)

Bearings – INA components

Linear bearings

They guide the clevis and the track roller. Robust roller type profiled rail units easily take up the forces and high accelerations. Perpendicular guides compensate thermal expansions. The bearings are lubricated by splash oil.
All rolling bearings and linear guides were designed using the bearing calculation program BEARINX®.

Rolling bearing monitoring – FAG Industrial Services

The F'IS online monitoring system measures and automatically analyses the vibrations of the Hex Pump. In this way, any irregularities in pump operation, any damage or defect can be detected at an early stage .
If an alarm is triggered , the data are automatically sent via satellite link to a remote diagnosis center where F'IS experts will make a detailed analysis.

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