

Special Spherical Roller Bearings in Polysius “QM” Vertical Roller Mills



Examples of Application Engineering

WL 21 513 EA



Vertical roller mill QUADROPOL QM61/30 built by Polysius AG, Beckum, Germany

Courtesy of Polysius AG

The experts of FAG in Schweinfurt, members of the Schaeffler Group Industrial, have been working together successfully for years with Polysius AG in the development of large vertical roller mills of the “QM = Quadropol” series. These mills are mainly used for grinding the raw material for cement production. Since its trial in the year 2000, the QUADROPOL mill type has proved to be clearly more cost efficient than the “RM” roller mills. Even the first mill of this type has far surpassed expectations. These

constructions offer the advantage that the bearings supporting the rollers are not exposed to the conditions prevailing inside the mill such as large amounts of dust, high temperatures and air currents. Consequently, grease-lubricated bearings require no complex sealing system. Moreover, continuous relubrication increases uptime – and reduces downtime – considerably. The bearings in the further developed machines are lubricated by an oil circulation system. This offers the advantage of better and more even

lubricant distribution inside the bearings; at the same time the bearing temperature is reduced and the oil can be filtered. Some downtime periods can even be avoided completely – for inspections, wearing parts like roller bodies and bearings supporting two opposed roller systems can be taken completely out of the grinding process without having to interrupt production for an extended period. Production can continue with 2 rollers in partial load operation with a capacity of ca. 60%.

Building on the positive experience with the new mill type, development of increasingly larger machines is being stepped up at Polysius AG. As a new challenge, the machine size QM 61/30 was developed and built ("GULFFA" project). The QUADROPOL 61/30 mill will be delivered to the United Arab Emirates (UAE).

Performance data

Installed capacity	7 000 kW
Capacity	600 t of raw material/h
Daily capacity	7 200 t
Overall height	23 m
Separator/rotor diameter	5,6 m
Airflow	1 400 000 m ³ /h

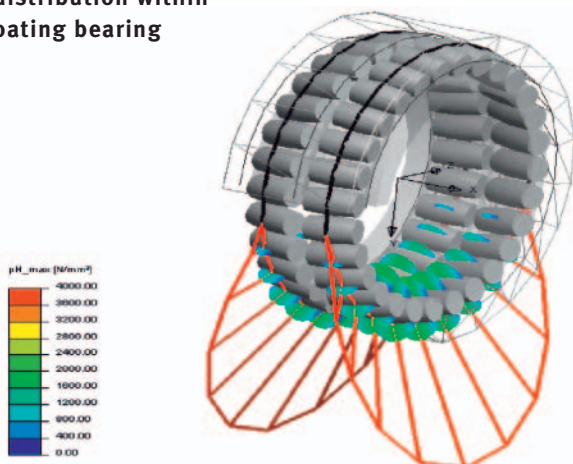
Demands on the bearings and on the bearing design

- Greater self-alignment capacity due to a wider outer ring
- Maximum load carrying capacity of the rolling bearings due to a maximum number of rolling elements
- Floating bearing function is ensured by a PTFE coating on the outer ring O.D.
- Threaded holes in the outer ring for handling, antirotation device, vibration pickup and temperature probe

FAG special spherical roller bearings featuring the following characteristics have been installed:
 The locating bearing **F-807608.PRL** has an outside diameter of 1420 mm, a mass of 3,4 t. and a dyn. load rating $C_r = 22\,800$ kN.
 The floating bearing **F-809143.02.PRL** has an outside diameter of 1620 mm, a mass of 4,5 t. and a dyn. load rating $C_r = 27\,000$ kN.

Both bearings were designed for a theoretical life of $L_{h10} 180\,000$ h.

Load distribution within the floating bearing



The floating bearing is positioned almost in the middle of the shaft. At dismantling the floating bearings from the shaft requires some complicated equipment will be required.

Jointly with FAG, they found a solution that facilitates dismantling of the bearing inner rings from the tapered shaft seat.

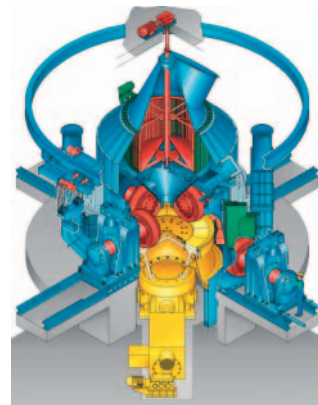
To this end, a number of threaded holes has been provided in the inner ring face for flange-mounting a hydraulic ring. By means of the hydraulic method, the inner ring is expanded, releasing its fit on the tapered seat.

The strength of the threads/threaded joints has been checked by means of an FEM analysis for the load case of mounting/dismounting and for operation under normal operating conditions based on the expansion due to the interference on the shaft.

Both special spherical roller bearings offer an extremely high load carrying capacity and are designed for a greater self-alignment capacity than is normally permissible. This was achieved by providing wider outer rings for the locating bearing and the floating bearing. Due to this measure, the so-called contact ellipse – the contact area zone – remains within the raceway, preventing the generation of edge stresses that could cause premature bearing failure.

Data of one roller unit in the QUADROPOL roller grinding mill "QM 61/30"

Length of the unit	4 955 mm
Height of the unit with hydr. system	4 940 mm
Grinding roller diameter	3 030 mm
Mass of one roller unit	180 t



Drawing by Polysius AG

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