



## Subject

- Bearing selection for Hammer Mill

## Customer Information

Company : KM 18 Engineering  
Contact Name : Khun Anuthep  
Khun Sathit (Hung Seng Huat)

## General Information

- Machine : Hammer Mill
- Speed : 3000 rpm
- Motor : 110 kW
- Transmission : Flexible Coupling
- Ambient temperature : 35 °C
- Operating temperature : N/A (estimated to be 50-70 °C)
- Lubrication system : Grease
- Lubricant : to be studied
- Customer requirement : Bearing and grease selection
- Machine configuration is shown in Attachment I.

## Result of technical study

A calculation to select bearing of a hammer mill was done, according to guideline for fan load calculation SKF PI 113 E publication 1987.

### Bearing load calculation

#### 1) Masses of shaft and rotor

$$\begin{aligned} F_w &= 350 \text{ kg} * 9.8 \text{ m/s}^2 \\ &= 3430 \text{ N} \end{aligned}$$

#### 2) Radial force when a semi flexible coupling is used.

$$F_r = 5600 \times (P/n)^{1/2}$$

$$F_r = \text{radial force, N}$$

$$P = \text{rating, kW}$$

$$n = \text{rotational speed, r/min}$$

$$\begin{aligned}
 F_r &= 5600 \times (110/3000)^{1/2} \\
 &= 1072 \text{ N}
 \end{aligned}$$

3) Unbalance of shaft

**Assumed** unbalance force 90% of shaft mass

$$\begin{aligned}
 F_u &= 0.9 \times 3430 \\
 &= 3087 \text{ N}
 \end{aligned}$$

All calculated loads could be illustrated in a FBD as shown below.

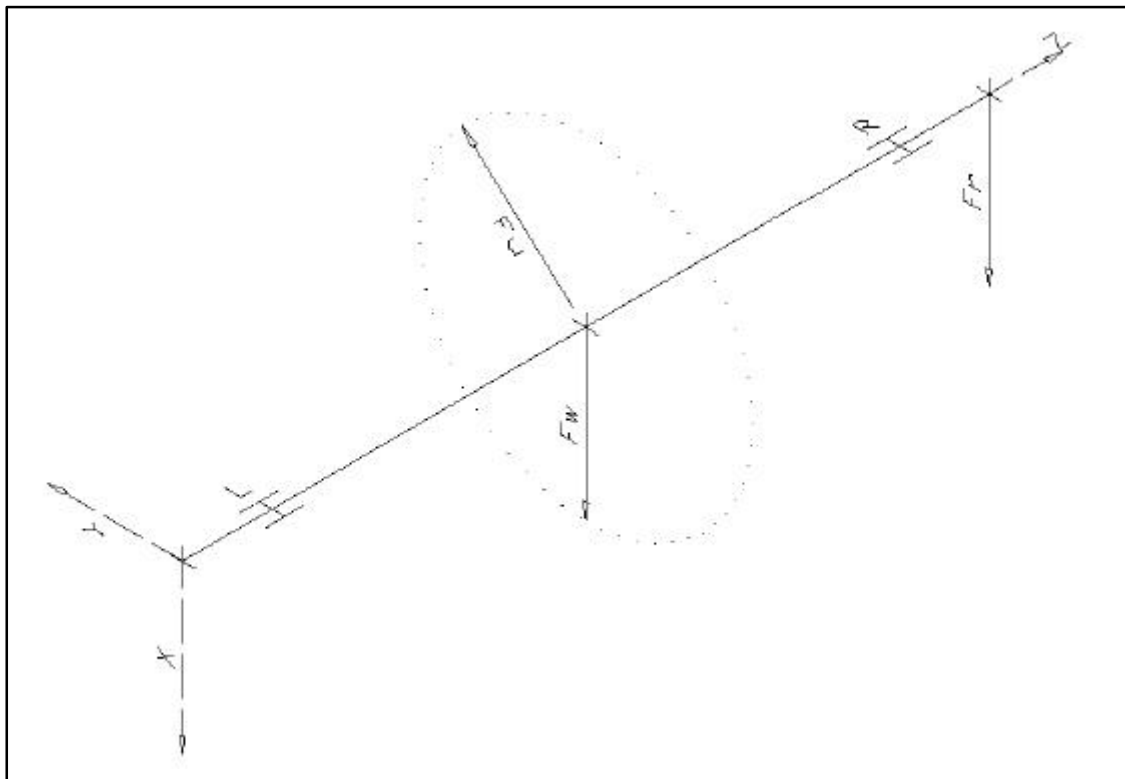


Fig. 1 Separator FBD

Specifying the drive-end bearing as a locating end accommodating thrust load. The resulting loads of locating and non-locating end bearings can be calculated as follows.

Bearing	Fr	Fa
Drive-end bearing	2291 N	0 N
Nondrive-end bearing	3669 N	0 N

Note: Radial load below requisite minimum radial load

Table 1 Resulting Load



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Spherical roller bearings with adapter sleeve mounted in standard plummer block are selected to accommodate load and misalignment that can be occurred in this application. The bearing life of these bearing combinations and bearing operating temperature can be estimated as shown below:

Bearing	Shaft diameter	L10h	Bearing temperature
Drive-end bearing 22215 EK/C3 + H315	60	> 50,000 hr	80 - 98 °C
Nondrive-end bearing 22215 EK/C3 + H315	60	> 50,000 hr	80 - 98 °C

Table 2 Nominal life and temperature of bearings

## Lubrication

Based on the above operating temperature, the recommended grease is LGHP2. The detail of this grease can be found in ATTACHMENT II.

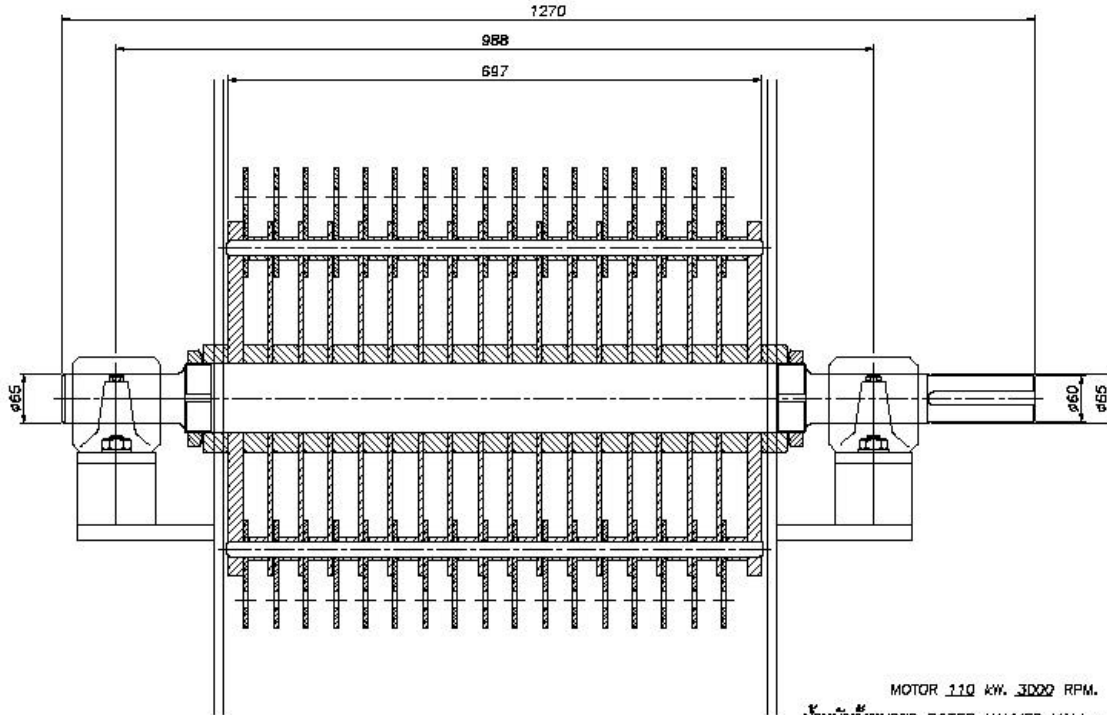
## Conclusion and recommendation

Based on given information, the recommended bearing arrangement is shown in the table as follow:

Bearing	Bearing	Housing	Locating ring
Drive-end bearing	22215 EK/C3 + H315	SNL 515-612	FRB 12.5/130
Nondrive-end bearing	22215 EK/C3 + H315	SNL 515-612	

The recommend grease is LGHP2. The relubrication interval is 680 hrs. The grease is high performance grease and can be used for high temperature. However, please be aware that this grease is not recommended for equipment in contact with food.

### ATTACHMENT I



MOTOR 110 kW, 3000 RPM.

น้ำหนักทั้งหมดของ ROTER HAMMER MILL = 350 Kg.

ขอสงวนลิขสิทธิ์ในชื่อผลิตภัณฑ์และเครื่องหมายการค้า

<p><b>คำอธิบาย</b></p> <ul style="list-style-type: none"> <li>- วัตถุประสงค์ของงาน: 1. 2. 3.</li> <li>- วัสดุที่ใช้: 1. 2. 3.</li> <li>- ระยะเวลาในการดำเนินงาน: 1. 2.</li> <li>- หน่วยงานที่รับผิดชอบ: 1. 2. 3.</li> </ul> <p>THIS DRAWING IS THE SOLE PROPERTY OF JAL IR ENGINEERING CO., LTD. IT IS TO BE RETURNED UPON REQUEST AND IS NOT TO BE COPIED OR CIRCULATED TO ANY THIRD PARTY WITHOUT THE EXPRESS WRITTEN PERMISSION.</p>	REV. 0	PART NAME	QTY.	PART NO.	DATE	INITIAL
	PRODUCT	APPROVED BY	DATE	DATE		
	DESIGNED BY	DATE	COMP. NO.	SCALE		
	CHECKED BY	DATE	SCALE	DWA.		
<p><b>APPROVED BY</b></p>		<p><b>K.M.18 ENGINEERING CO., LTD.</b> 112/3 Unit 7 Set Nakhonratchasima Design-Think Floor, Bangkok, Bangkok, Samprakhom 10999 (THAILAND) Tel: (662) 3371532-43 Fax: (662) 3371590</p>		<p><b>SHEET NO.</b> OF</p>		



ATTACHMENT II

**Details of selected grease LGHP2**

Calculated results:	
LubeSelect rating	91%
LubeSelect mismatch on	-
Viscosity ratio $\kappa$ (at 90°C)	2.0
Viscosity ratio $\kappa$ (at 98°C)	1.6
Grease L1 life (SKF relubrication interval), hrs	680
Grease quantity replenish from the side, grams	20
Grease quantity replenish through lubrication holes, grams	8
Calculated results for automated lubricator systems:	
Dial Set for <b>SYSTEM 24</b> , months	
replenish from side	11 for LAGD 125
replenish through lubrication holes	12 for LAGD 60
Feed rate for <b>SYSTEM MultiPoint</b> , grams/day	
replenish from side	0.7
replenish through lubrication holes	0.3

**Remark:**

- The mechanical stability of the grease has been taken into account, since severe vibrations become relevant for SRB and CARB running at high speed.
- The base-oil viscosity ratio ( $\kappa$ ) value can be used as a general indication, and hence is not used in the ranking of the greases.
- The grease life indication is based on the SKF General Catalogue. The exceptions are DGBB and Y-bearing for which it is based on research project results, and high-precision bearings for which it is based on the product catalogue.  
Grease life results are statistical values subject to confidence intervals. These values are adjusted for operating temperature, grease quality, shaft orientation, load and outer ring rotation. They may need further adjustment in view of vibration and environmental conditions (e.g., dust, humidity, and air-flow-through)
- Relubrication procedures:
  1. Replenishment (topping-up)  
The lubrication duct in the housing should feed grease adjacent to the outer ring side face or, better still, into the bearing through the lubrication holes (W33 feature) in spherical roller bearing and double row roller bearings.  
From the side of the bearing:
    - initial grease filling: 100% of bearing volume (including annular groove and relubrication holes)  
40% of housing volume



- supply grease quantity after lubrication interval (specified in the table above).
- replacement of complete grease fill when free space in housing becomes too small to accommodate the added grease. This will be after approximately 5 replenishments.

Through the annular groove and lubrication holes (W33 features):

- initial grease filling: 100% of bearing volume (including annular groove and relubrication holes)  
20% of housing volume
- supply grease quantity after lubrication interval (specified in the table above).
- replacement of complete grease fill when free space in housing becomes too small to accommodate the added grease. This will only be required in exceptional cases.

Notes:

- a grease nipple should be provided to facilitate the supply of grease using a grease gun.
- an exit hole should be provided to avoid build up of excessive grease amounts.
- the exit hole should be plugged during high pressure water cleaning.
- to be effective in replacing old grease, replenishment should be executed while rotating the bearing preferably during machine operation.

## 2. Renewal (replacement)

When renewal is made at the calculated interval or because of overfilling of the housing as a result of many replenishments, the used grease in the bearing arrangement should be completely removed and replaced by fresh grease. In order to be able to renew the grease manually, it is essential that the housing is easily accessible and easily opened.

Renewal filling: 100% of bearing volume and 40% of housing.

Notes:

- great care should be taken to see that contaminants are not introduced during renewal.
- the use of grease resistant gloves is recommended to prevent allergic skin reactions.
- renewal through lubrication holes requires relubricating several times in close succession until it can be assumed that all old grease has been pressed out of the housing. Consequently, more grease is required than for manual renewal.

## 3. Continuous relubrication

Continuous relubrication is only recommended at low operating speeds, i.e. at  $n \cdot dm$  values below 150.000 for ball bearings and below 75.000 for roller bearings. In that



case, the initial grease can be 100% and the relubrication quantity per time unit is determined by spreading the grease relubrication quantity (W33) over the relubrication interval (see table above).

#### 4. More information

- For available grease pack sizes, consult SKF Maintenance Products catalogue or contact SKF.
- For lubrication practices contact SKF Engineering & Research Centre or SKF Maintenance Products.

#### Additional product info:

Thickener type	Di-urea
Base-oil type	Mineral
Consistency (NLGI)	2-3
Base-oil viscosity, cSt at 40/100 °C	96.0 / 10.5
Dropping point (°C)	>240
Colour	Light brown
Supplier	SKF
Remarks	High Performance polyurea grease

#### Used selection conditions:

Bearing designation	Unknown
Filling Type	AfterMarket
Bearing type	SRB
Inner Diameter (mm)	75.0
Outer Diameter (mm)	130.0
Width Height (mm)	31.0
Typical operating temperature °C	90
Minimum temperature (start-up) °C	35
Maximum temperature (peak) °C	98
Speed RPM	3000
Load (C/P)	Low
Ambient Temperature (°C)	More than 35
Operating hours per day	24
Contamination	Low
Severe Vibrations	Not relevant

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