Calculations of Type Selection of Slewing Bearing

1. Loading conditions of the slewing bearing

During the period of the slewing bearing operation, because of the difference for their working states and const=ructions of its main machine, the loading of axial force Fa, radial force Fr and resultant torque M may be acted as one factor only, or two and/or three factors jointly action respectively.

In general condition, the installing methods for slewing bearings are divided into two types of horizontal installation and suspended installation. See figure 1.

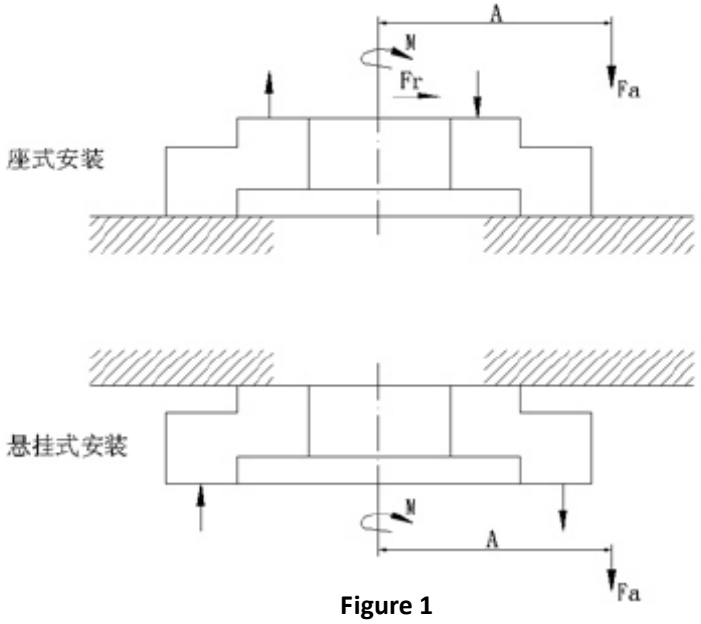


Figure 1

2. Technical Data for selecting the series of slewing bearing

1) Loading value that the slewing bearing should be support.
2) Time percentage of the every load may be occupied during the operation.
3) The rotation speed and rotation number of the slewing bearing at the operation condition.
4) Periphery forces that the gear should be supported on.
5) The installation dimensions.
6) Other technical references concerned.

Main machine manufacturer may select the proper series (See Section 3) of slewing bearing according to the curves listed in article 8 of our sample bulletin. Otherwise, it may fill the technical data according to Table Ⅰ or Table Ⅱ. And then, send them to us with their small gears' technical references (See Table Ⅲ). We would help you to select the proper slewing bearing and send the drawing to you for confirmation.

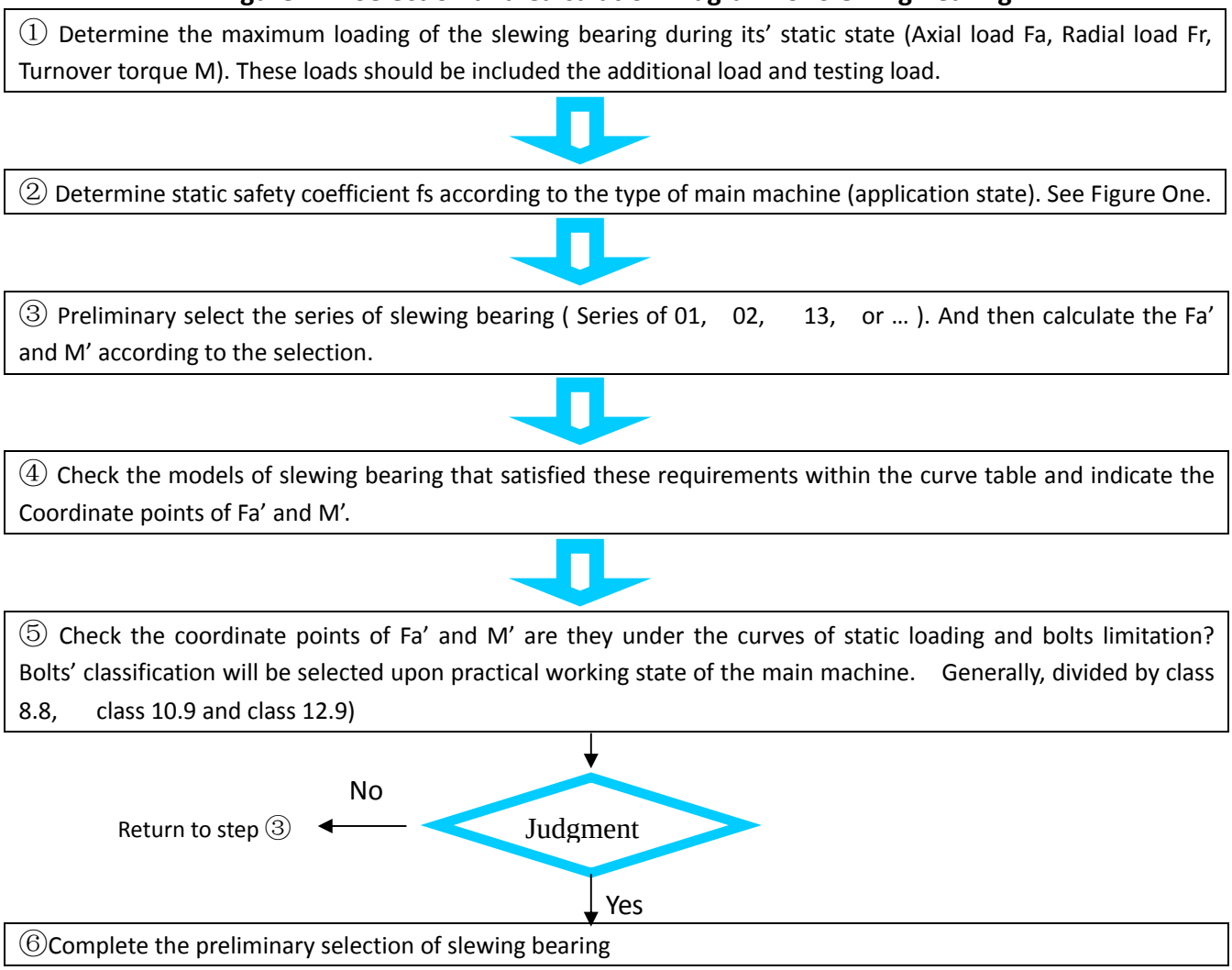
3. Selection the proper Series based on the loading curves

Every model of slewing bearing in our sample bulletin has its own loading capacity curve respectively. The curves might be initially helping customers to select the revolving support they needed.

The selection diagram as follows:

There are two curves within the curve diagram, which indicating the loading capability of the slewing bearing. The first is the static loading curve that indicates the maximum loading capability when slewing bearing is keeping static condition. The second is the dynamic loading curve that indicates the maximum loading capability when slewing bearing is running. Meanwhile, there are also the loading limit curves for bolts which are joining with the slewing bearing (Class 8.8, Class 10.9 and Class 12.9). The clamping length of the bolt is 5 times of its nominal diameters. The pre-tightening force of the bolt is determined by the materials' yield limit times 0.7.

Figure 1: Selection and Calculation Diagram for Slewing Bearing



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WUXI LIDA GEAR MANUFACTURING CO., LTD

Table Ⅰ Technical References Concerned for Selection of Slewing Bearing

无锡立达 Wuxi Lida	（适用低转速、恒定载荷工况下的回转支承选型） Series selection used for low speed and stable loading			
公司 Name of Company：		姓名 Contactor：		
地址 Address：		电话 Telephone：		
部门 Department：		传真 Fax：		
应用场合:(主机型号、名称) Using Condition (Model of Main Machine)	转动轴 Driving Spindle: 水平 Horizontal☐ 垂直 Vertical☐		支承安装方式 Installing Type 座式安装 Seating Install☐ 悬挂安装 Suspension Install☐	
载 荷 数 据				
负载情况 Load Condition 载荷性质 Loading Character	A 最大工作载荷 Working Load(Max)	B 最大试验载荷 Max Test Load 例:25%超载试验 Explame:25%Overload Test	C 灾难性载荷 Disaster Loading (关机状态) (No Working State)	单位 Unit
平行于转动轴的轴向载荷 Axial Loading Parallel to Driving Spindle				KN
垂直于转动轴的径向载荷 Radial Loading Parallel to Driving Spindle (不含齿轮啮合力)(No Gear engagement)				KN
轴向载荷引起的力矩 Torque Caused by Axial Loading				KN·m
径向载荷引起的力矩 Torque Caused by Radial Loading				KN·m
最终力矩 Final Torque				KN·m
支承所受驱动扭矩 Loading Driving Torque(KN·m) 正常 Normal: 最大 Maximum:		驱动小齿轮个数 Number of Small Driving Gear： 位置 Location： 相隔 Clearance 度 Degree：		

对回转支承形式及外形尺寸的要求 Type and Dimensional Requirement for Slewing Bearing：

回转支承型号(若能写出)Type of Revolving support(If you can write out.):

回 转 支 承 系 列 Revolving support series: 01※☐ 02※☐ 11※☐ 13※☐

HS※☐ HJ※☐ Q※☐ 22※☐ SL02※☐ 不限 No limitations☐

回转支承外形尺寸 Outer Dimension of Slewing Bearing:

外径 Outer Diameter: mm 或不限 or no limitations☐；

内径 Internal diameter: mm 或不限 or no limitations☐；

总高 Total height: mm 或不限 or no limitations☐.

说明:(例:特殊情况,温度,要求的精度,配合尺寸及精度,检验或认证要求,材料测试等)

Description： (For Example: Special Condition, Temperature, Accuracy Requirement, Tolerance, Inspection and Quality Certification Requirement and Material Testing etc.)

请完整填写好该表,以便能尽快向您提交准确而经济实用的回转支承选型方案。

Please fill the above table thoroughly so as to provide you economical and suitable selection of the slewing bearing as soon as we can.

如有问题请致电无锡立达齿轮制造有限公司

If you have some questions, please call Wuxi Lida Gear Manufacture Limited Company.

电话 Phone:0510-83957100 83958957 传真 Fax:0510-83951235 Email:lida88@188.com

签名 Signature: 日期 Date:

Table Ⅱ Technical References Concerned for Selection of Slewing Bearing

无锡立达 Wuxi Lida			（适用连续转动、载荷的变化的工况下的回转支承选型） Series selection used for continuing driving and changeable loading		
载荷工况描述 Description of Loading Status	轴向载荷(kN) Axial Load	径向载荷(kN) Radial Load	倾覆力矩(KN·m) Turnover Torque	转速(rpm) Rotation Speed	工作时间(%) Working Time
1)					
2)					
3)					
4)					
5)					
6)					
7)					
8)					
9)					
10)					
					100%
连续运转工况 Continue Working Condition: 寿命 Life(L10):在平均转速为 Under the Mean Speed of rpm 时,最少 Minimum 小时 Hour					
间歇运转工况 Interval Working Condition 需要的工作寿命:在角度为＋/－Satisfied Working Life when angular of＋/－ 度时 degree,最少 Minimum 循环 Circle					
签名 Signature: 日期 Date:					

Table Ⅲ Technical Reference Concerned for Selection of Slewing Bearing

无锡立达 Wuxi Lida （齿轮副啮合的技术参数表）(Technical Reference for Gear engagement)		
齿轮描述 Gear Description：外齿 Outer Gear ☐: 内齿 Internal Gear ☐: 渐开线齿形 Involutes Gear ☐:		
齿轮副啮合参数 Engagement Reference of the Gears		
	小齿轮 Small Gear	回转支承 Slewing Bearing
模数 Modulus（m）		
齿数 Gear Number (z)		
压力角 Forced Angle (α)		
螺旋角 Spiral Angle (β)		
变位系数 Changeable Coefficient (x)		
顶隙系数 Top-Clearance Coefficient (c*)		
齿宽 Gear Width (b)		
齿轮中心距 Center Distance of Gear （是否可调）(Adjustable or not)	是 Yes ☐:	否 No ☐:
精度等级 Precision Class	(通常情况下，精度等级为：10GK GB10095-88) (In general condition, precision Class is10GK GB10095-88)	
其它要求 Other Requirement：		
签名 Signature: 日期 Date:		

The calculation method of the forces of the axial load Fa' and turnover torque M' for their static loadings of slewing bearing:

1） **Single-row four ball contact type**

Selection and calculation for single-row four ball contact type slewing bearing is made according to their loading angle of 45 degree and 60 degree respectively.

Ⅰ、a = 45°

Fa'=(1.225×Fa＋2.676×Fr)×fs

M'=1.225×M×fs

Ⅱ、a = 60°

Fa'=(Fa＋5.046×Fr)×fs

M'= M×fs

2） **Single-row cross arranged roller type**

Fa'=（Fa＋2.05×Fr）×fs

M'= M×fs

3） **Couple-row different diameter ball type**

When selection and calculation of slewing bearing, the Fr could be ignored if the Fr ≤ 10 % Fa. But if Fr > 10 % Fa , it should be taken its changing of angular pressure of the rolling race. Please contact with us for these calculations.

Fa'= Fa×fs

M'= M×fs

4） **Triple-row roller type**

Fa'= Fa×fs

M'= M×fs

In the formulas above,

where: Fa—Total axial forces acted on the slewing bearing by main machine (KN);

Fr —Total radial forces acted on the slewing bearing by main machine (KN);

M —Total turnover torques acted on the slewing bearing revolving support by main machine (KN. m);

fs —Safety coefficient of the slewing bearing under static working condition, See table 1;

Fa'— Central axial forces acted on the slewing bearing (KN);

Fr'— Radial forces acted on the slewing bearing (KN);

M'— Turnover torques acted on the slewing bearing (KN.m)

Please contact with us for calculation of loadings under the dynamic conditions of slewing bearing!

Table1. Safety Coefficient Table of slewing bearing (fs = static, fd = dynamic)

应 用 主 机 Main Machine Used			回转支承形式 Type of slewing bearing					
			01		02		11、03	
			安全系数 Safety Coefficient					
			fs	fd	fs	fd	fs	fd
建筑用 塔式起重机 Tower Crane	上回转式 Top Revolving Type	Mf≤0.5M	1.25	1.36	1.25	1.00	1.25	1.00
		0.5M＜Mf＜0.8M		1.55		1.15		1.13
		Mf≥0.8M		1.71		1.26		1.23
	下回转式 Bottom Revolving Type			1.36		1.00		1.07
轮式起重机、堆取料机及各种工作台 Wheel Type Crane, Load and Unload Machine, and all kinds of Work-tables			1.10		1.10	1.10	1.10	1.00
悬臂式起重机、港口起重机、各种装卸机械 Suspending Crane, Harbor Crane, Varies of Load and Unload machinery			1.25	1.55	1.25	1.15	1.25	1.13
皮带运输机装卸用塔式起重机和履带起重机 Belt Conveyer used Tower Crane and Caterpillar Crane				1.71	1.10	1.26		1.23
抓斗及拉铲挖掘机、挖泥船、浮游起重机 Grab or Drawing Type Excavator, Dredger, Floating Crane			1.45	2.50	1.45	1.71		1.62
斗容量小于 1.6m³的挖掘机 Excavator its bucket volume ≤ 1.6 m3					1.25	1.26	1.45	1.45
斗容量大于或等于 1.6m³的挖掘机 Excavator its bucket volume ≥ 1.6 m3			1.75	3.00			1.75	
冶金用起重机、斗轮挖掘机、隧道掘进机 Crane for Metallurgy, Bucket Excavator, Tunneling Dig Machine			2.00	3.50	1.45	1.75		
注：Mf 为最小幅度时空载恢复力矩。 Remark: The Torque could be recovered when idle time if the Mf is at its minimums range								

- 4. **The calculation of the main machine, for example:**

  Crane (See figure Ⅱ)

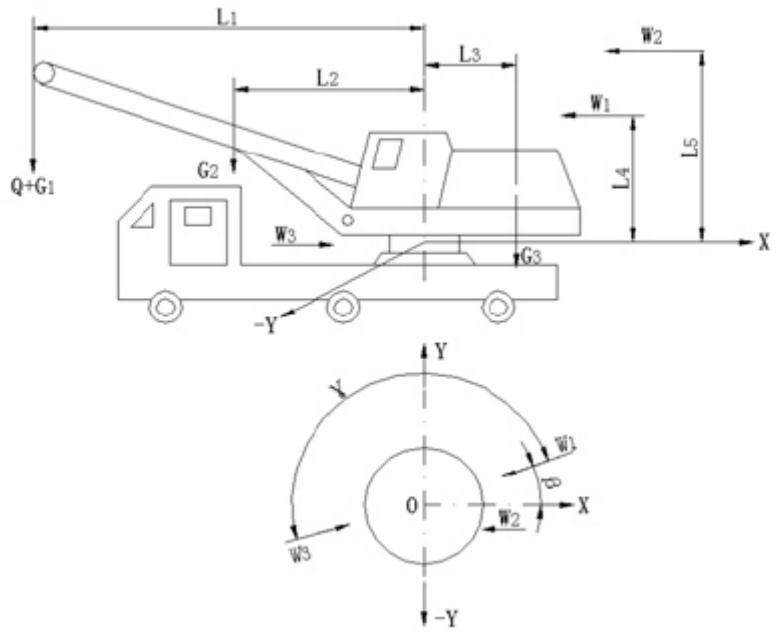

Figure Ⅱ

Total turnover torque M=K×（Q+G1）×L1+G2×L2-G3×L3+W1×L4×cosβ+W2×L5

Total axial forces Fa=K×（Q+G1）+G2+G3

Total radial forces Fr=W1×cosβ+W2+W3×cosγ

In above formulas, where:

Q—Rated loading (KN)

G1—Weight of the size changeable part.(KN)

G2—Weight of the lifting arm part (KN)

G3—Weight of the weight balancing block.(KN)

W1—Horizontal inertia force (KN)

W2—Wind force (KN)

W3—Engage force of the gear (KN)

L1—Rated working size (m)

L2—Parallel distance from the weighing center of the lifting arm part to the center of the slewing bearing. (m)

L3—Parallel distance from the weighing center of the weight balancing block to the center of the slewing bearing

L4—Parallel distance from the acting point of Horizontal inertia force W1 to the slewing bearing (m)

L5—Parallel distance from the acting point of wind force W2 to the slewing bearing (m)

β—The angle included between the horizontal inertia force W1 and the turnover torque M interacting with the X spindle.

γ—The angle included between the gear engaging force W3 and the turnover torque M interacting with the X spindle.

K—Working condition coefficient of the slewing bearing. (See table 1)