1. Rolling bearing ranges and their features

Rolling bearings can be categorized as ball bearing and roller bearing by the roller shape or as radial and thrust bearing by force direction undertaking.

The overall rules of bearing selection are that roller bearings are applied for higher load and ball bearings for higher speed. The differences between radial bearing and thrust bearing is that radial bearings can take load from both radial and axial direction in most cases but thrust bearings can only take axial load. Based on above bearing categories, rolling bearings can also divided into radial ball bearings, radial roller bearings, thrust ball bearings and thrust roller bearings. Detailed rolling bearing ranges and their key features could found below table 1-1 and table 1-2.

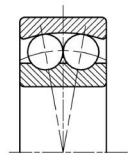
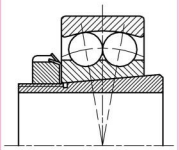
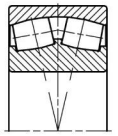
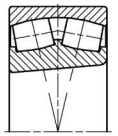
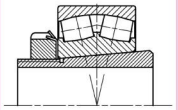
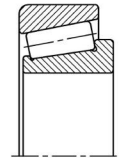
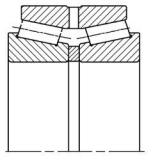
Table 1-1 Bearing ranges and their features

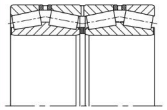
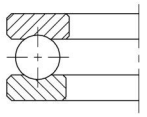
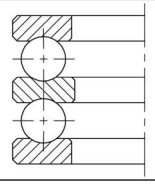
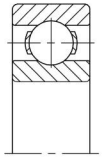
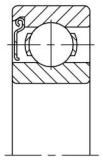
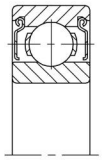
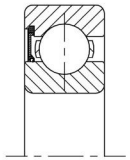
←	Single direction	√√√	Best
←→	Dual direction	√√	Good
×	Poor	√	Normal
××	Unappli-cable		

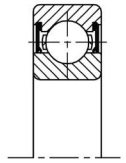
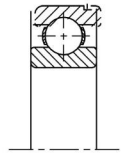
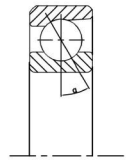
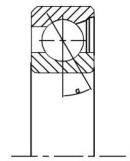
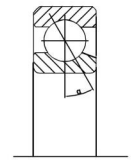
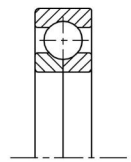
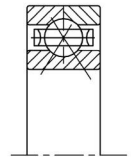
Bering Ranges					Axial load	Radial load	High speed	High rotating precision	Low noise	High stiffness	Self-alignment	Axial displacement	Locating end	Non-locating end
Radial bearings	Ball bearings	DGBB	Single row		√ ←→	√	√√√	√√√	√√√	√	××	××	√√	√
			Double row		√ ←→	√	√	√	√	√	××	××	√	√
			Spherical outside surface		√ ←→	√	√	√	√√	√	√√	××	√√	√
		ACBB	Single row		√ ←	√	√√√	√√√	√√	√	××	××	√√	××
			Double row		√ ←→	√√	√√	√√	√	√√	××	××	√√	√
		Self-aligning ball bearing			×	√	√	√√	√√	√	√√√	××	√	√
		4 points contact ball bearing			√ ←→	×	√√	√	√	√	××	××	√√	×
	Roller bearings	Cylinder roller bearings	Single row	Flangeless outer ring	××	√√	√√	√√	√√	√√	××	√√√	××	√√√
				One flange outer ring	√ ←	√√	√√	√√	√√	√√	××	√	√	√
				Flangeless inner ting	××	√√	√√	√√	√√	√√	××	√√√	××	√√√
				One flange inner ring	√ ←	√√	√√	√√	√√	√√	××	√	√	√
				Flat flange	√ ←→	√√	√√	√√	√√	√√	××	××	√	×
			Double row	Flangeless outer ring	××	√√√	√√	√√√	√√	√√√	××	√√√	××	√√√
				Flangeless inner ring	××	√√√	√√	√√√	√√	√√√	××	√√√	××	√√√

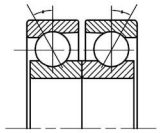
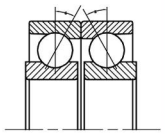
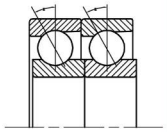
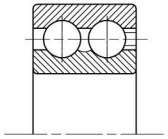
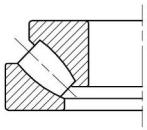
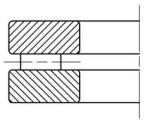
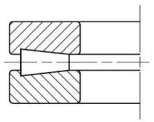
Radial bearings	Roller bearings	Taper roller bearing	Single row		√√ ←	√√	√	√√	√	√√	××	××	√√	××
			Double row	2 inner rings	√√√ ↔	√√√	√	√	√	√√√	××	××	√√√	××
				2 outer rings	√√√ ↔	√√√	√	√	√	√√√	××	××	√√√	××
			4 row	2 inner rings	√√√ ↔	√√√	√	√	√	√√√	××	××	√√√	××
		Self-aligning roller bearing			××	√√	√	√	√	√√	√√√	××	√√	√
		Needle roller bearing	Needles and cage assemblies		××	√	×	×	√	√√	××	√√√	××	√√√
			With inner ring		××	√	×	×	√	√√	××	√√√	××	√√√
			Without inner ring		××	√	×	×	√	√√	××	√√√	××	√√√
			Pressed outer ring		××	√	×	×	√	√√	××	√√√	××	√√√
Thrust bearings	Ball bearings	Thrust ball bearings	Single row	Flat	√ ←	××	√	√√	√√	√	××	××	√	××
				Spherical	√ ←	××	√	√√	√√	√	××	××	√	××
			Double row	Flat	√ ↔	××	√	√√	√√	√	××	××	√	××
				Spherical	√ ↔	××	√	√√	√√	√	××	××	√	××
	Roller bearings	cylindrical roller	Single row	Flat type	√√ ←	××	×	√√	√	√√	××	××	√	××
		taper roller			√√ ←	××	×	√	√	√√	××	××	√	××
		spherical roller			√√√ ←	××	×	√	√	√√	√√√	××	√√	××
	Needle bearings	Thrust needle and cage assembles			√ ↔	××	√	√	√	√√	××	××	√	××
Bearings for linear motions					××	√	××	×	√	√	××	√√√	√	√√√
Special bearings		Crane slider bearings			√ ↔	√√√	√	√	√	√√	××	√	××	√√√
		Slewing bearings			√√	√	×	√	√	√√	××	××	√	××

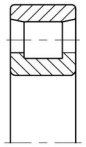
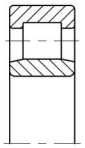
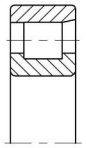
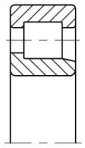
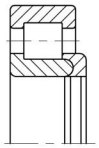
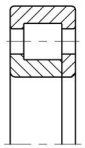
Table 1-2 Bearing categories, structure and characteristics

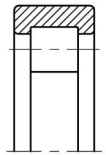
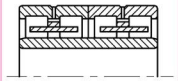
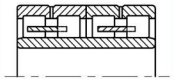
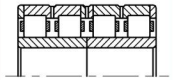
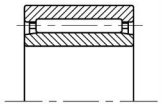
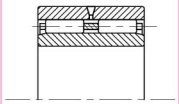
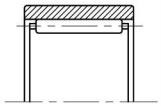
Bearing types		Sketch	Characteristics
Self-aligning ball bearing	Self-aligning ball bearing		Its inner ring bore could be tapered or cylindrical bore; Accommodating radial load and limited axial load; Maximum shaft axial displacement must be less than its clearance; Self-aligning property, the permissible angular between inner and outer ring is no bigger than 3 degree;
	Self-aligning ball bearing with adapter sleeves		As above Adapter sleeves can be applied for shafts without any shoulder and easy adjustment for the final internal clearance.
Self-aligning roller bearing	Self-aligning roller bearing		Accommodating high radial load and limited axial road; Good self-aligning property, the permissible angular between inner ring and outer ring is no less than 2.5 degree; Tapered inner ring bore is easy for clearance adjustment; Adapter sleeves can be applied for shafts without any shoulder and frequently dismounting; High lubrication efficiency with an annular groove and three lubrication holes in the outer ring, designation suffix W33.
	Self-aligning roller bearing with taper hole(1:12)		
	Self-aligning roller bearing with adapter sleeves		
Spherical roller bearing	Single row taper roller bearing		Accommodating combined (radial and axial) loads, bearings with big contact angle accommodating mainly axial loads combined radial loads; Additional axial load will generated by radial load, so two single bearings applied must be paired for combined loads. 313 Series bearing has big contact angle (27°~30°) for large axial and other series bearing with contact angle of 10°~18°
	Double row taper roller bearing		Consisted by an outer ring, two inner ring and an intermediate ring; Accommodating radial loads and bi-directional axial loads; Bearing clearance can be adjusted by width of space ring; Confining shaft displacement with bearing clearance.

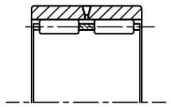
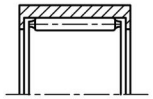
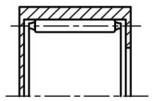
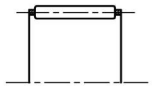
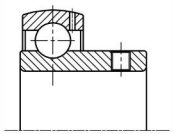
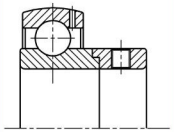
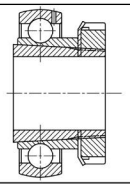
Bearing types		Sketch	Characteristics
Self-aligning ball bearing	Self-aligning ball bearing		An intermediate space ring between Inner ring and outer ring for clearance adjustment; Similar properties with double row taper roller bearing; High load capacity but lower limitingspeed; Applied for heavy machineries, ie rolling steel machine.
Self-aligning roller bearing	Single direction thrust ball bearing		Only accommodating axial load and confining shaft axial displacement; Low limiting speed; Bidirectional thrust bearing applied for bidirectional axial loads and confining shaft displacement; Low limiting speed.
	Bidirectional thrust ball bearing		
Spherical roller bearing	Single row deep groove ball bearing		Accommodating radial load and limited axial load, confining shaft axialdisplacement within bearing clearance; Permissible misalignment angle between inner and outer ring: 8'~15''
	Single row deep groove ball bearing with single shield		Similar to above; Better seal with one side shield; Narrow gaps between shield and inner ring flange; Low limiting speed; Lubricated by pre-filled grease during assembling; No washing and re-greasing needed
	Single row deep groove ball bearing with double shields		
	Single row deep groove ball bearing with single side seal		Similar with above; Contact sealing by suffix "RS" "2RS" and non-contact sealing by suffix "RZ""2RZ"; Better sealing but more friction.

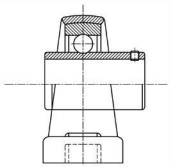
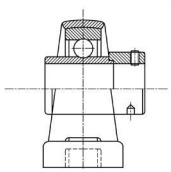
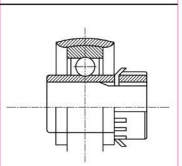
Bearing types		Sketch	Characteristics
Deep groove ball bearing	Single row deep groove ball bearing with double sides seal		Limiting speed with non-contact Seals equal to normal open bearings'; Lubricated by pre-filled grease during assembling; No washing and re-greasing needed.
	Deep groove ball bearing with snap ring		Similar to basic designations; Easy for axial locating in bearing housing with snap ring.
Angular contact ball bearing	Single row angular contact ball bearing (non-separable)		Carrying combined (axial and radial) loads or only axial load; Axial load carrying capacity increases with the contact angle α increases; High limiting speed; The shaft axial displacement will be limited if two same angular contact ball bearings are mounted against each other and two bearings must be paired; Inner ring and/or outer ring could be separated with each other for the limited mounted condition.
	Single row angular contact ball bearing (Separable)		
	Four-point contact ball bearing with inner ring lock up		
	Four-point contact ball bearing with double half inner rings		Inner ring and/or outer ring could be separated with each other with 35° contact angle; There're 4 contact points between ball and rings if only accommodating radial load; And 2 contact points between ball and rings if only accommodating radial load; Accommodating axial load from both direction and couple load; Must have 2 contact points internally;
	Four-point contact ball bearing with double half outer rings		

Bearing types		Sketch	Characteristics
Angular contact ball bearing	Paired mounting bearings with face to face arrangement		Mainly accommodating radial load and partly axial load of both directions; Tandem arrangement applied for accommodating both axial load of one direction and radial load; Supplied by manufacturer; Preloaded after mounted without the use of shims or similar devices to increase the supporting stiffness and rotating precision; Preload degree is determined by actual needs of applications.
	Paired mounting bearings with back to back arrangement		
	Paired mounting bearings with tandem arrange-ment		
	Double row angular contact ball bearing		Accommodating mainly radial load, partly axial load and couple load; Axial shaft displacement is limited.
Thrust roller bearing	Self-aligning thrust roller bearing		Accommodating mainly axial load and partly radial load, maximum radial load must be less than 55% of axial load; Accommodating only one directional axial load and shaft axial displacement is limited.
	Thrust cylinder roller Bearing		Accommodating high axial load only one direction; Shaft axial displacement is limited; Low limiting speed;
	Thrust taper roller bearing		Only for low speed applications

Bearing types		Sketch	Characteristics
Trust roller bearing	Thrust needle and cage assembles		Only for low speed applications
Cylinder roller bearing	Outer ring without integral flange		Inner ring and outer ring are separable; Mounted easily; Normally accommodating radial load only; Accommodating limited axial load by outer ring or inner ring with integral flanges; Bearings with single flange on inner ring or outer ring can only accommodate one directional axial load; Bearings without inner ring or outer ring can be applied for limited radial space where shaft journal or housing surface will be raceway of the bearing roller and the surface must be machined to similar quality of bearing inner ring or outer ring.
	Inner ring without integral flange		
	Outer ring with an integral flange		
	Inner ring with an integral flange		
	Inner ring with an integral flange and angle ring		
	Inner ring with an integral flange and a loose flange ring		

	Bearing types	Sketch	Characteristics
Cylinder roller bearings	Paired mounting bearings with face to face arrangement		As above
	Paired mounting bearings with back to back arrangement		Inner ring and outer ring are separable; Only accommodating radial load; Mainly applied for heavy machines i.e. rolling machine; Special designations differ to normal code rules: FC design: two outer rings FCD design: two outer rings and two inner rings; FCDP design: two outer rings and two inner rings with one loose flange ring
	Paired mounting bearings with tandem arrange-ment		
	Double row angular contact ball bearing		
Needle bearings	Self-aligning thrust roller bearing		Accommodating radial road with very small dimension; Special design for limited radial mounting space; High limiting speed; Bore diameter (d) of single row needle bearings ⩽ 32mm; If d⩽7mm, its outer ring has two lock rings; If d>7mm, its outer ring has two loose flange rings; The bore diameter of double row needle bearings > 32mm
	Thrust cylinder roller Bearing		
	Thrust taper roller bearing		Applied for limited mounting space; Shaft journal surface working as inner ring raceway and its hard -ness is among 68~64HRC;For single row bearings, if FW⩽10mm, its outer ring has two lock rings; if FW> 10mm, its outer ring has two integral flanges; For double row bearings, its FW⩾40mm; Only accommodating radial load; High limiting speed.

	Bearing types	Sketch	Characteristics
Trust roller bearing	Double row without inner ring		As above
	Drawn cap needle bearings with open ends		Low cost with high load carrying capacity; Applied for limited radial mounting space and use shaft journal surface as raceway; Directly press it into bearing housing; Avoid axial position adjustment; Lubricated with grease before mounting; BK design is for the shaft without extend shaft end and accommodates small axial guidance forces;
	Drawn cap needle bearings with close end		
	Needle roller and cage assembly		Very small radial dimension with high load carrying capacity; For extremely limited radial space; Both surfaces of shaft journal and housing working as bearing raceway and their surface hardness is around 58~64HRC;
Cylinder roller bearing	U-bearings with grub screws and spherical outer ring		Consisted by double shielded ball bearing and one cast iron housing; Internal structure is similar with ball bearing; The spherical outer ring can match with spherical housing for self-aligning; Often mounted the inning ring with shaft by grub crews or eccentric locking collar or adapter;
	U-bearings with eccentric locking collar		
	U-bearings with adapter sleeve		

	Bearing types	Sketch	Characteristics
U-bearings with spherical outer ring	U-bearing plummer block units with grub screws		For changing rotating direction of the machine shaft; Two designations with UC and UB; Various housing structures are available for different applications.
	U-bearing plummer block units with eccentric locking collar		For non-changed rotating direction of the machine shaft; Have two designations with UEL and UE; Various housing structures are available for different applications.
	U-bearing plummer block units with adapter sleeve		For changing rotating direction of the machine shaft and higher rotating speed; More stable than above two types; Various housing structures are available for different applications.