



FYH®





SPHERICAL ROLLER BEARING UNITS

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$d 2 \frac{7}{16} \sim 4$ inch 60 ~ 100 mm	



1 Structure and Features

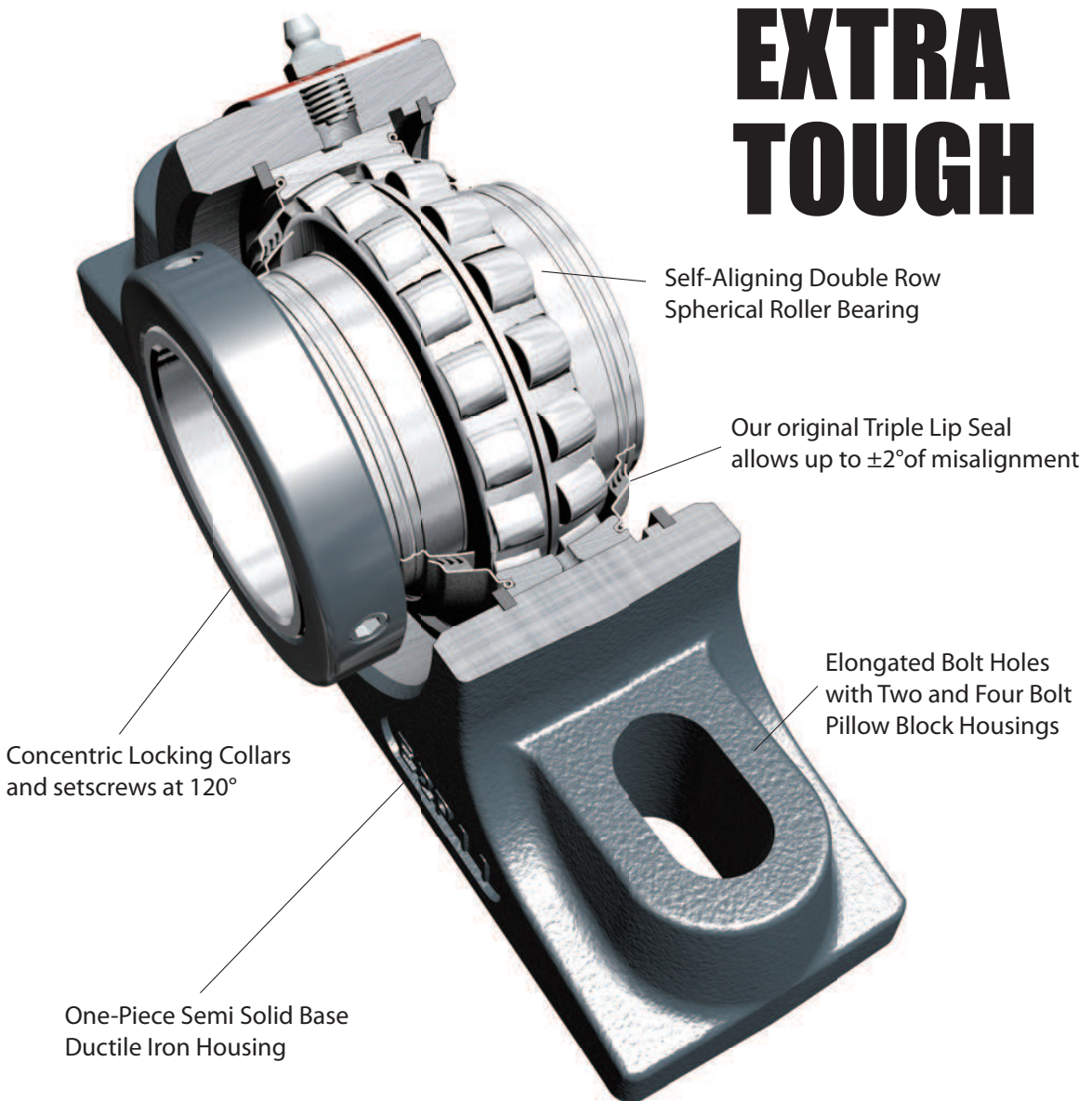
1 Structure and Features

1.1 Structure

More than sixty years of experience and innovation in the field of mounted ball bearing units has lead to the production of mounted spherical roller units that cater to a wide range of applications and industries. Bearing and housing production are accomplished entirely by FYH while utilizing only the highest quality materials available. Through meticulous design enhancements and careful material selection this heavy duty mounted roller series attains the designation of "EXTRA TOUGH".

1.2 Features

FYH spherical roller bearing units have many features and are available in various models. A wide selection of mounted units is offered to fit virtually any application.

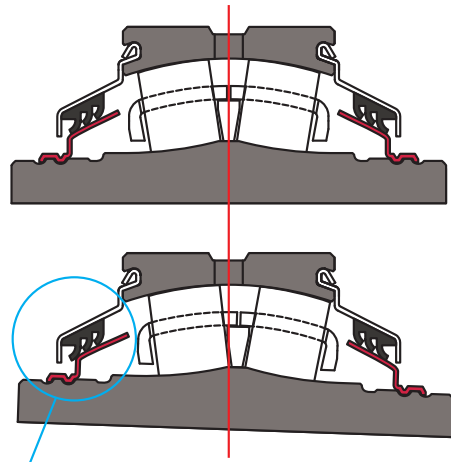




1 Triple Lip Seal

±2° Self Aligning capability

The triple-lip seal maintains positive contact with a special sealing ring at virtually any angle of shaft misalignment. Our new patent pending sealing design protects the bearing against a variety of wet and dry contaminants and dramatically improves bearing life. The ability to accommodate shaft expansion is also available.



Positive seal contact is maintained during mis-alignment at any angle.

2 Semi Solid Base

One piece ductile iron housings

Ductile iron housings are approximately twice as strong as cast iron, and the semi-solid base design provides an excellent mounting foundation and superior rigidity over competitive offerings. The standard housing material from FYH is ductile iron, and additional material options may also be available.



3 Lubrication

FYH Roller Grease is a calcium sulfonate complex thickened lubricating grease formulated in 100% synthetic hydrocarbon base oil. FYH Roller Grease has excellent low temperature and high temperature performance, and it provides excellent extreme pressure and anti-wear protection. FYH Roller Grease also provides excellent corrosion protection and water wash-out resistance. Grease temperature range: -40 to 340°F (-40 to 170°C) FYH Roller Grease is also available in automatic lubricators.

4 Designed to Interchange with the Competition

Units are designed to interchange with most spherical roller unit footprints. Elongated bolt holes are dimensioned to allow for a shortened or extended mounting pitch to accommodate practically any competitive tapered roller or spherical roller design.

5 Convertible from Non-expansion to Expansion

By simply moving a snap ring on the back of the unit the bearing can easily be converted from non-expansion to expansion or vice versa.

This procedure can be easily performed in the field even after the unit has been mounted.



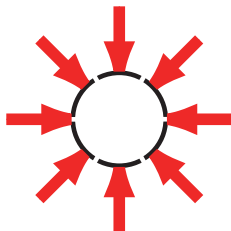
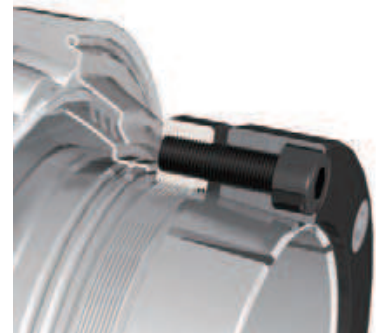
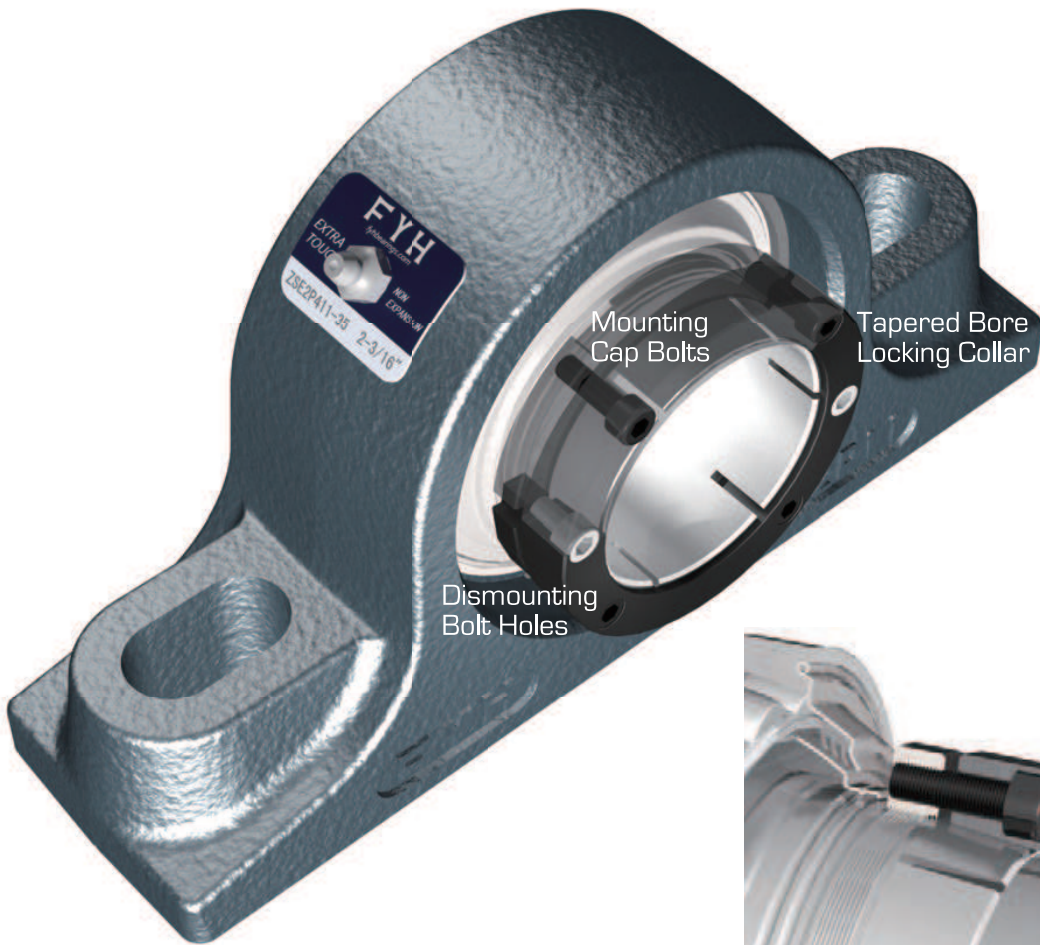


1 Structure and Features

6 Locking Style

The patent pending Z-Lock is the first ever tapered bore locking collar system. Just tighten the cap screws properly and the specialized tapered bore collar provides extreme holding power on the shaft without causing any damage. This is a true 360 degree locking mechanism.

Disassembly is easily accomplished with two threaded holes in the collar for standard withdrawal dismounting.



THE MOST REVOLUTIONARY
LOCKING SYSTEM
TRUE 360° GRIP





2 Models

2.1 Model List

Table 2.1 shows the models of FYH Spherical Roller Bearing Units.

Table 2.1 FYH Spherical Roller Bearing Units models

Model	Type	Bearing bore dia. Surface (fixing to shaft)	Model code	Shaft dia.				Dimension table
				(inch)		(mm)		
				min.	max.	min.	max.	
1 SPHERICAL ROLLER BEARING UNITS	(1) 2-Bolt Base Pillow Block Units	with set screw collar lock with Z-Lock	XS2P	1 3/8	4	40	100	P.338
			ZS2P	1 3/8	4	40	100	P.338
	(2) 2-Bolt Base Type E Pillow Units	with set screw collar lock with Z-Lock	XSE2P	1 3/8	4	40	100	P.340
			ZSE2P	1 3/8	4	40	100	P.340
	(3) 4-Bolt Flange Units	with set screw collar lock with Z-Lock	XS4F	1 3/8	4	40	100	P.342
			ZS4F	1 3/8	4	40	100	P.342
	(4) 4-Bolt Type E Flange Units	with set screw collar lock with Z-Lock	XSE4F	1 3/8	4	40	100	P.344
		ZSE4F	1 3/8	4	40	100	P.344	
	(5) Flange Cartridge Units	with set screw collar lock with Z-Lock	XS4FC	1 3/8	4	40	100	P.346
			ZS4FC	1 3/8	4	40	100	P.346
	(6) Take-Up Units	with set screw collar lock with Z-Lock	XST	1 15/16	3 1/2	50	90	P.348
			ZST	1 15/16	3 1/2	50	90	P.348
	(7) 4-Bolt Base Pillow Block Units	with set screw collar lock with Z-Lock	XS4P	2 7/16	4	60	100	P.350
			ZS4P	2 7/16	4	60	100	P.350
		with set screw collar lock (both) with Z-Lock (both)	XDS4P	2 7/16	4	60	100	P.352
			ZDS4P	2 7/16	4	60	100	P.352
2 SPHERICAL ROLLER BEARING INSERTS	(1) XS Inserts	with set screw collar lock	XS	1 3/8	4	40	100	P.354
	(2) ZS Inserts	with Z-Lock	ZS	1 3/8	4	40	100	P.354
	(3) XDS Inserts	with set screw collar lock (both)	XDS	2 7/16	4	60	100	P.355
	(4) ZDS Inserts	with Z-Lock (both)	ZDS	2 7/16	4	60	100	P.355



2 Models

2.2 Models and Features

1 SPHERICAL ROLLER BEARING UNITS

1 2-Bolt Base Pillow Block Units



XS2P
XSE2P



ZS2P
ZSE2P

XS2P is a two-bolt pillow block unit with a setscrew locking insert system. This unit is equivalent to many of our competitors SRB style housings.

XSE2P is with Type E mounting dimensions which has a footprint that can accommodate both a tapered roller unit and a spherical roller unit for most shaft sizes.

ZS2P and **ZSE2P** have the same housing dimensions as the above styles but utilize our revolutionary Z-Lock concentric locking collar system.

2 4-Bolt Flange Units



XS4F
XSE4F



ZS4F
ZSE4F

XS4F is a four-bolt flange unit with set screw locking system. It has standard spherical roller unit mounting dimensions and a compact footprint for areas with limited space.

XSE4F has Type E mounting dimensions with the same footprint as a tapered roller unit.

ZS4F and **ZSE4F** have the same housing dimensions as the above units but utilize our revolutionary Z-Lock concentric locking collar system.

3 Flange Cartridge Units



XS4FC



ZS4FC

XS4FC is a piloted flange cartridge unit with a setscrew locking insert system. Its pilot mounting dimensions are the same as the medium duty ball bearing units that allow for easy upgrades to a heavier duty series. The threaded withdrawal holes make for quick and easy dismounting.

ZS4FC carries as the same housing dimensions as the above unit but incorporate the revolutionary Z-Lock concentric locking collar system.

4 Take-Up Units



XST



ZST

XST is a take-up unit with set screw locking system.

It has rail slots that are compatible with many industrial frame sizes. This unit can safely handle high belt tension and heavy shock loads.

ZST has the same housing dimensions as the XST units but incorporates the revolutionary Z-Lock concentric locking collar system.

5 4-Bolt Base Pillow Block Units



XS4P



ZS4P

XS4P is a four-bolt base pillow block unit with standard spherical roller bearing mounting dimensions. Four mounting bolt-holes create a firm and secure fit to the mounting surface. The ends of the housing are flat to allow for mounting inside of a fixed frame assembly.

ZS4P is the Z-lock equivalent of the XS4P carrying the same housing dimensions but utilizing the revolutionary Z-Lock concentric locking collar system.



6 4-Bolt Base Pillow Block Units (Double Collar)



XDS4P



ZDS4P

XDS4P is the same as the XS4P above but utilizes a double lock. This insert has a setscrew locking mechanism on both the front and back of the inner ring. This additional locking mechanism is helpful in applications where the bearing experiences some thrust loads on the inner ring that could cause a single locking unit to slip.

ZDS4P is the Z-lock equivalent of the XDS4P carrying the same housing dimensions but utilizing the revolutionary Z-Lock concentric locking collar system.

2 SPHERICAL ROLLER BEARING INSERTS

1 Spherical Roller Bearing Inserts (Single Collar)



XS



ZS

XS is a setscrew locking insert that utilizes the patented Bullet Point setscrews at 120 degrees apart to hold shafting firmly in place. This is the most economical type of SRB insert and can be utilized in a wide variety of industrial and agricultural applications.

ZS is a concentric locking insert that utilizes a tapered collar that allows for fast mounting while avoiding damage to shafting that a setscrew unit can cause. The tapered collar keeps the 100% true concentric holding power and does not remove any clearance in the insert by over tightening like the adaptor sleeve locking system can. The unit is tightened down using a hex wrench on the cap screws in a star pattern. The insert can be uninstalled by removing all cap screws and using two of them in the withdrawal holes to disengage the collar.

2 Spherical Roller Bearing Inserts (Double Collar)



XDS



ZDS

XDS is the same as the XS above but utilizes a double lock. This insert has a setscrew locking mechanism on both the front and back of the inner ring. This additional locking mechanism is helpful in applications where the bearing experiences some thrust loads on the inner ring that could cause a single locking unit to slip.

ZDS is the same as the ZS above but utilizes a double lock. This insert has a concentric tapered collar on both the front and back of the inner ring. This additional locking mechanism is helpful in applications where a bearing experiences some thrust loads on the inner ring that could cause a single locking unit to slip.



3 Nomenclature

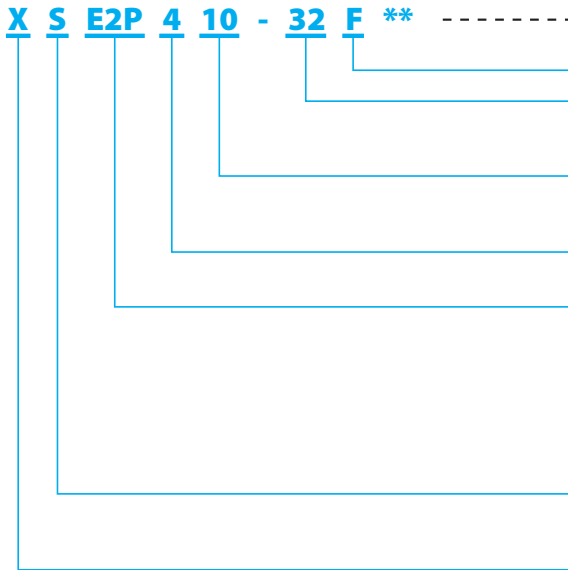
3 Nomenclature

The nomenclature of a FYH Spherical Roller Unit is comprised of the roller bearing unit model code which is made up using the bearing model code and the housing model code. This in combination with the diameter series code, bore diameter code, accessory code and any special

code for individual applications determines the FYH Spherical Roller Units part number.



http://www.fyhbearings.com/html/nomenclature_r.html



Bearing No.	_____	XS410-32
Housing No.	_____	E2P10

EXPANSION Type

Bore Size (inch)

Number of $\frac{1}{16}$ " of Inches
(ex. 39 = $2\frac{7}{16}$ ")

Bore Size (base)

Metric type x 5 mm of Number
(ex. 13 = 65 mm)

Series code

4 Spherical Roller

Housing model code

- 2P 2 - Bolt Pillow Block
- 4P 4 - Bolt Pillow Block
- 4F 4 - Bolt Flange
- 4FC Flange Cartridge
- T Take - Up
- E2P 2 - Bolt Pillow Block : TYPE E (inch)
- E4F 4 - Bolt Flange : TYPE E (inch)

INSERT-2 model code

- S Spherical Roller
- T Taper Roller

INSERT-1 Locking Type code

- X Set Screw Collar Lock
- XD Set Screw Collar Lock (Double Collar)
- Z Z - Lock Concentric Locking System

4 Engineering Information

Spherical Roller Bearing Life Calculations

The relationship between the basic rating life, the basic dynamic load rating, and the dynamic equivalent load of the spherical roller bearing is indicated in Formula A. If the spherical roller bearing unit is being used at a fixed rotating speed, the life is indicated as time. This is shown in Formula B.

$$A. L_{10} = \left(\frac{C_r}{P_r} \right)^{\frac{10}{3}}$$

$$B. L_{10h} = \frac{10^6 L_{10}}{60n} = \frac{10^6}{60n} \left(\frac{C_r}{P_r} \right)^{\frac{10}{3}}$$

L_{10} : Basic Rating Life 10^6 rotations

L_{10h} : Rated Life (hr)

C_r : Basic Dynamic Load Rating (lbf)

P_r : Dynamic equivalent Load (lbf)

n : Speed (min^{-1})

Basic Loads (lbf)		
Size Code	Dynamic C_r	Static C_{or}
XS408	19967	22744
XS409	20834	24491
XS410	21683	26306
XS411	27191	33029
XS413	39006	49591
XS415	42032	54986
XS418	63910	86343
XS420	81897	111863

Limiting Speed for Seals		
Size Code	Standard Triple Lip Seal Limiting Speeds ($dn=110,000$) RPM	Non Contact Seal Limiting Speeds ($dn=130,000$) RPM
XS408	2750	3200
XS409	2450	2800
XS410	2200	2600
XS411	2000	2360
XS413	1692	2000
XS415	1460	1730
XS418	1220	1440
XS420	1100	1300



Allowable Radial Load (lbf) at Various RPM																				
Shaft Size	Size	L ₁₀ hours	RPM																	
			50	100	150	300	500	750	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
1 3/8" 1 7/16" 1 1/2" 40 mm	XS408	10000	7197	5846	5177	4205	3607	3194	2930	2774	2649	2545	2456	2380	2313	2253	2200	2151	2107	2067
		25000	5468	4441	3932	3194	2740	2426	2226	2107	2012	1933	1866	1808	1757	1712	1671	1634	1601	1570
		50000	4441	3607	3194	2594	2226	1971	1808	1712	1634	1570	1516	1468	1427	1390	1357	1327	1300	1275
		70000	4015	3261	2887	2345	2012	1782	1634	1547	1477	1419	1370	1327	1290	1257	1227	1200	1175	1153
		100000	3607	2930	2594	2107	1808	1601	1468	1390	1327	1275	1231	1193	1159	1129	1102	1078	1056	1036
1 11/16" 1 3/4" 45 mm	XS409	10000	7510	6100	5401	4387	3764	3333	3057	2894	2764	2655	2563	2483	2413	2351	2295	2245		
		25000	5705	4634	4103	3333	2859	2532	2322	2199	2099	2017	1947	1886	1833	1786	1744	1705		
		50000	4634	3764	3333	2707	2322	2056	1886	1786	1705	1638	1581	1532	1489	1451	1416	1385		
		70000	4189	3402	3013	2447	2099	1859	1705	1615	1542	1481	1430	1385	1346	1311	1280	1252		
		100000	3764	3057	2707	2199	1886	1670	1532	1451	1385	1331	1285	1245	1209	1178	1150	1125		
1 15/16" 2" 50 mm	XS410	10000	7816	6349	5621	4566	3917	3469	3182	3012	2876	2763	2667	2584	2512	2447	2389			
		25000	5937	4823	4270	3469	2976	2635	2417	2288	2185	2099	2026	1963	1908	1859	1815			
		50000	4823	3917	3469	2817	2417	2140	1963	1859	1775	1705	1646	1595	1550	1510	1474			
		70000	4360	3541	3136	2547	2185	1935	1775	1680	1604	1541	1488	1442	1401	1365	1332			
		100000	3917	3182	2817	2288	1963	1738	1595	1510	1442	1385	1337	1295	1259	1226	1197			
2 3/16" 55 mm	XS411	10000	9801	7961	7049	5726	4912	4350	3990	3778	3607	3465	3345	3241	3150					
		25000	7446	6048	5355	4350	3732	3304	3031	2870	2740	2632	2541	2462	2393					
		50000	6048	4912	4350	3533	3031	2684	2462	2331	2226	2138	2064	2000	1943					
		70000	5467	4441	3932	3194	2740	2426	2226	2107	2012	1933	1866	1808	1757					
		100000	4912	3990	3533	2870	2462	2180	2000	1893	1808	1737	1676	1624	1579					
2 7/16" 65 mm	XS413	10000	14060	11421	10113	8214	7047	6240	5724	5419	5174	4971	4798	4649						
		25000	10681	8676	7682	6240	5353	4740	4348	4117	3931	3776	3645	3532						
		50000	8676	7047	6240	5068	4348	3850	3532	3344	3193	3067	2961	2869						
		70000	7843	6370	5641	4582	3931	3480	3193	3023	2886	2773	2677	2593						
		100000	7047	5724	5068	4117	3532	3127	2869	2716	2593	2491	2405	2330						
2 11/16" 2 15/16" 75 mm	XS415	10000	15151	12307	10897	8851	7594	6724	6168	5840	5576	5357								
		25000	11510	9349	8278	6724	5768	5108	4685	4436	4236	4069								
		50000	9349	7594	6724	5461	4685	4149	3806	3603	3440	3305								
		70000	8451	6864	6078	4937	4236	3750	3440	3257	3110	2988								
		100000	7594	6168	5461	4436	3806	3370	3091	2927	2794	2685								
3 7/16" 90 mm	XS418	10000	23037	18712	16569	13458	11546	10224	9378	8879	8478									
		25000	17500	14215	12587	10224	8771	7766	7124	6745	6440									
		50000	14215	11546	10224	8304	7124	6308	5787	5479	5231									
		70000	12850	10437	9242	7507	6440	5703	5231	4953	4729									
		100000	11546	9378	8304	6745	5787	5124	4700	4450	4249									
3 15/16" 100 mm	XS420	10000	29521	23979	21232	17246	14796	13101	12018	11378	10864									
		25000	22426	18215	16129	13101	11240	9952	9129	8643	8253									
		50000	18215	14796	13101	10641	9129	8084	7415	7021	6703									
		70000	16467	13375	11843	9620	8253	7308	6703	6347	6060									
		100000	14796	12018	10641	8643	7415	6566	6023	5703	5445									

- Blue area: The Standard Triple Lip Seal is used.
- Green area: A non-contact seal is used.





5 Installation Guide

5 Installation Guide

5.1 Precautions

- Read the entire installation guide prior to beginning.
- Bearings are precision instruments and they must always be handled carefully to prevent damage.
- Store bearings in a cool and dry location, and always leave bearings in original packaging until ready for installation.
- Bearing life calculations should be performed prior to installation to ensure that the selected unit is acceptable for the application.
- The use of more than two bearings on a single shaft is not recommended.
- To maximize the life of the bearing avoid mis-alignment and pre-loading by carefully following these instructions.
- Always lock out the power source and adhere closely to industry safety standards before performing any work on the equipment.

5.2 Preparation

The mounting surface and housing base must be clean, flat, and of sufficient thickness to support the weight of the entire assembly without deflecting or breaking. Make sure that the mounting surface is parallel to the plane of the shaft for pillow blocks, and perpendicular to the shaft for flanges and take-up units. FYH mounted bearings can accommodate up to ± 2 degrees of mis-alignment, however longer bearing life can be achieved if mis-alignment can be minimized during installation.

Check the shaft diameter and make sure that it is within tolerance as indicated in Table 1. Check that the shaft is straight, clean, and free of burrs or other imperfections. Use emery cloth or a fine file to smooth the surface as necessary. A small amount of lubricant may be applied to both the shaft and the bore of the bearing; however lubricant should not be applied to the areas where the bearing locking mechanism contacts the shaft. To ensure adequate locking power between the bearing and shaft the hardness of the shaft should not exceed Rc 45.

Shaft Size (mm)		h6		h7	
		Shaft Speed Greater Than 50% of Max RPM Rating		Shaft Speed Less Than 50% of Max RPM Rating	
Over	Incl.	Max (mm)	Min (mm)	Max (mm)	Min (mm)
30	50	+0	-0.016	+0	-0.025
50	80	+0	-0.019	+0	-0.03
80	120	+0	-0.022	+0	-0.035
120	180	+0	-0.025	+0	-0.04

Converting units from fixed to expansion

FYH mounted roller units are capable of operating in both a fixed or expansion configuration.

Before bearing installation

On the back side of the unit (opposite the housing markings), remove the bearing retaining ring located on the inner diameter of the housing and move it back to the groove on the outer position of the housing. Slide the bearing insert rearward within the housing until it sits against the retaining ring that was just relocated. When ready for installation, slide the insert forward in the housing approximately one thirty-second of an inch ($1/32''$) and alternately tighten the set screws onto the shaft to the specified torque setting as shown in Table 4.

After bearing installation

Before performing any work on the bearing, lock out the power source and allow the shaft and adjacent machinery to cool down to ambient temperature. Loosen the set screws or other locking mechanism to allow the shaft to move freely within the bore then follow the same procedures explained in the "Before bearing installation" section.



5.3 Installation

- Slide the unit onto the shaft while holding the inner ring of the bearing.

Position the unit on the mounting surface so that the plane of the shaft is perpendicular to the face of the housing, and alternately tighten the mounting bolts to the specified torque as shown in Table 2.

Make sure to use bolts, washers, and nuts of sufficient strength and grade rating for the application.

- Check the final position of the shaft and alternately tighten the set screws of the non-expansion unit onto the shaft to the specified torque setting as shown in Table 3. The set screws in the bearing on the opposite side of the shaft should line up with the set screws of the bearing that was installed first (See Figure A). Expansion bearings should be installed only after the shaft and adjacent machinery has cooled down to the ambient temperature.

After positioning the expansion unit on the shaft slide the insert to the rearmost position within the housing until it seats against the retaining ring. Then slide the insert forward in the housing approximately one thirty second of an inch (1/32") and alternately tighten the set screws onto the shaft to the specified torque setting as shown in Table 3. Allowable shaft expansion and expansion calculation data can be found in Table 4 and Formula 1 respectively.

- Once installed, slowly rotate the bearing by hand to confirm that it turns smoothly and without resistance, vibration, or any other abnormalities.

Bolt Size		Tightening Torque		
mm	inch	N-m	in-lbf	ft-lbf
M6	1/4	5	43	4
M8	5/16	10	92	8
M10	3/8	22	196	17
M12	1/2	38	334	27
M16	5/8	95	840	70
M18	—	139	1231	103
M20	3/4	189	1664	139
M22	7/8	260	2301	192
M27	1	484	4277	358

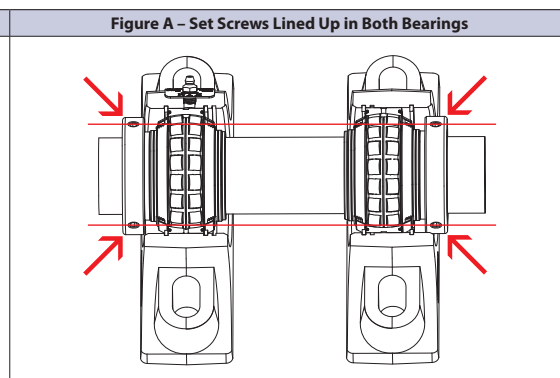
Size Code	Set Screw Size	N-m	in-lbf	ft-lbf
XS408	5/16-28 UNF x 1/2	14.5	128	11
XS409				
XS410				
XS411	3/8-24 UNF x 5/8	25.5	226	19
XS413				
XS415				
XS418	1/2-20 UNF x 3/4	56.5	500	42
XS420				

Size Code	mm	inch
XS408	5	13/64
XS409	5	13/64
XS410	5	13/64
XS411	6	15/64
XS413	6	15/64
XS415	6	15/64
XS418	6	15/64
XS420	6	15/64

Formula 1 – Linear Shaft Expansion

$$L = A \cdot T \cdot D$$

L : Expansion of shaft (mm)
A : Linear expansion coefficient of shaft for ordinary steel (11.5 x 10⁻⁶)
T : Temperature increase (°C)
D : Installation distance between bearing units (mm)



VIDEO ON INSTALLATION



Please scan the QR code with your mobile phone and watch an installation video. If you don't have the reader, get the QR Reader app at the app store. Or you can find it at our website as well.





5 Installation Guide

5.4 Lubrication

Proper lubrication practices will greatly extend the life of the bearing.

Bearings are factory lubricated with the proper amount and type of lubricant for most general purpose applications as well as many highly demanding operating environments, and except as recommended by FYH, no further lubrication is required upon installation.

Lubrication tips:

- The factory standard lubricant is a **Calcium Sulfonate** grease. Always use the same type of lubricant to avoid compatibility issues and other potential problems.
- When adding lubricant do so slowly and while the bearing is rotating until a small amount of lubricant can be seen coming out of the seals.
- At low speeds (below 200 RPM) it is acceptable to completely fill the bearing with grease.
- At moderate to high speeds it is not advisable to completely fill the bearing with grease as it could lead to overheating and reduced bearing life.
- It is generally better to use less lubrication more frequently than more lubricant less often.
- If the unit will not be operated for an extended period of time extra lubricant should be added to prevent corrosion.
- If the unit has not been operated for an extended period of time fresh lubricant should be added prior to start-up.
- If the unit becomes too hot during operation from over-lubrication remove the grease fitting and operate the unit for approximately thirty minutes to allow excess grease to purge.

Appropriate lubrication intervals can be determined by referring to Table 5; however experience should largely determine the actual lubrication regimen for a particular application. Consult with an FYH representative for assistance.

If a suitable Calcium Sulfonate lubricant is not available for re-lubrication then the following compatible lubricants may also be used:

Barium Complex, Calcium Stearate, Lithium Complex, Polyurea (Shear Stable)

The use of any other type of lubricant should be avoided to prevent compatibility issues with the Calcium Sulfonate grease that is originally supplied.

To find the proper lubrication interval in Table 5 obtain the relevant percentage of max allowable RPM by referring to Table 6. Example: XS411 with positive contact seals has a max RPM rating of 2000. If the application has an RPM of 600 then the percentage of max RPM is 30% ($600/2000 = .30$).

The amount of grease for replenishment can be found in Table 7.

Environment	Clean to Moderately Dirty				Clean to Moderately Dirty			Dirty to Very Dirty
Temperature (°C)	Under 120 degrees				Over 120 degrees			From -20 to 200
% of max allowable RPM	0 - 25%	25 - 50%	50 - 75%	75 - 100%	0 - 25%	25 - 50%	50 - 100%	0 - 100%
Lubrication interval	From three to eight months	From one to three months	From one week to one month	Daily to once per week	From two to six weeks	From one week to one month	Daily to once per week	Daily to once per week



Table 6 - Limiting Speed for Seals		
Size Code	Standard Triple Lip Seal Limiting	Non Contact Seal Limiting
XS408	2750	3200
XS409	2450	2800
XS410	2200	2600
XS411	2000	2360
XS413	1692	2000
XS415	1460	1730
XS418	1220	1440
XS420	1100	1300

Table 7 - Grease Amount for Replenishment	
Size Code	Amount of Grease (grams)
XS408	7-8
XS409	7-9
XS410	8-9
XS411	10-12
XS413	19-22
XS415	22-26
XS418	40-46
XS420	50-59



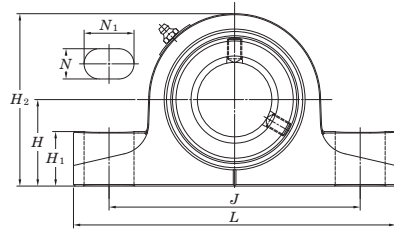
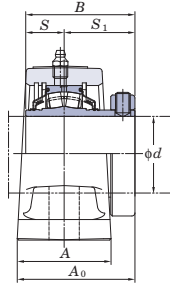
http://www.fyhbearings.com/html/tech_info.html#roller





**Cylindrical bore
(with set screw collar lock)**

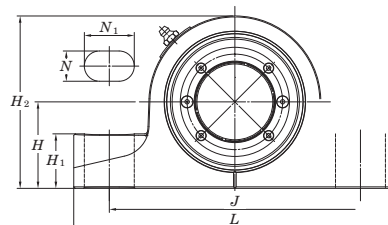
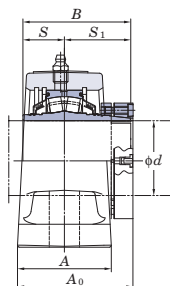
**d 1 3/8 ~ 4 inch
40 ~ 100 mm**



d	Dimensions inch mm											
	H	L	A	J	N	N_1	H_1	H_2	A_0	B	S	S_1
1 7/8 47.6	6 7/8 175	2 5/32 55	5 9/32 134	19/32 15	1 3/32 28	1 1/4 32	3 25/32 96	2 5/8 66.4	2.531	1 25.4	1.531 38.9	
2 1/8 54	7 3/8 187	2 3/8 60	5 25/32 147	19/32 15	1 3/32 28	1 5/16 33	4 1/4 108	2 27/32 72.1	2.657	1 25.4	1.657 42.1	
2 1/4 57.2	8 3/8 213	2 7/16 62	6 17/32 166	25/32 20	1 5/16 33	1 3/8 35	4 1/2 114	3 1/16 77.8	2.843	1 25.4	1.843 46.8	
2 1/2 63.5	8 7/8 225	2 5/8 67	6 7/8 175	25/32 20	1 3/16 30	1 5/8 41	4 31/32 126	3 1/8 79.5	2.937	1.126 28.6	1.811 46	
2 3/4 69.8	9 1/4 235	2 7/8 73	7 9/32 185	25/32 20	1 3/16 30	1 25/32 45	5 19/32 142	3 3/8 86.1	3.205	1.252 31.8	1.953 49.6	
3 1/4 82.6	10 7/16 265	3 76	8 9/32 210	15/16 24	1 9/32 32	1 7/8 48	6 3/8 162	3 13/16 97	3.594	1.252 31.8	2.343 59.5	
3 3/4 95.2	13 330	3 3/8 86	10 5/16 262	1 1/16 27	1 23/32 44	2 1/4 57	7 15/32 190	4 1/4 108.1	4.079	1.516 38.5	2.563 65.1	
4 1/4 108	15 1/4 387	3 3/4 95	11 1/4 286	1 5/32 29	2 5/16 59	2 17/32 64	8 11/32 212	4 23/32 120.1	4.484	1.626 41.3	2.858 72.6	



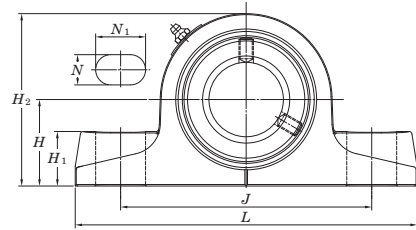
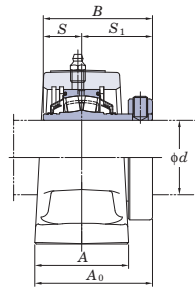
ZS2P
Cylindrical bore
(with Z-Lock)
 $d 1\frac{3}{8} \sim 4$ inch
40 ~ 100 mm



	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size inch mm
	XS2P408-22	XS408-22	ZS2P408-22	ZS408-22	1/2 M12
	XS2P408-23	XS408-23	ZS2P408-23	ZS408-23	
	XS2P408-24	XS408-24	ZS2P408-24	ZS408-24	
	XS2P408	XS408	ZS2P408	ZS408	
	XS2P409-27	XS409-27	ZS2P409-27	ZS409-27	1/2 M12
	XS2P409-28	XS409-28	ZS2P409-28	ZS409-28	
	XS2P409	XS409	ZS2P409	ZS409	
	XS2P410-31	XS410-31	ZS2P410-31	ZS410-31	
	XS2P410	XS410	ZS2P410	ZS410	5/8 M16
	XS2P410-32	XS410-32	ZS2P410-32	ZS410-32	
	XS2P411	XS411	ZS2P411	ZS411	
	XS2P411-35	XS411-35	ZS2P411-35	ZS411-35	5/8 M16
	XS2P411-36	XS411-36	ZS2P411-36	ZS411-36	
	XS2P412	XS412	ZS2P412	ZS412	
	XS2P413-39	XS413-39	ZS2P413-39	ZS413-39	5/8 M16
	XS2P413-40	XS413-40	ZS2P413-40	ZS413-40	
	XS2P413	XS413	ZS2P413	ZS413	
	XS2P414	XS414	ZS2P414	ZS414	
	XS2P415-43	XS415-43	ZS2P415-43	ZS415-43	3/4 M20
	XS2P415-44	XS415-44	ZS2P415-44	ZS415-44	
	XS2P415-47	XS415-47	ZS2P415-47	ZS415-47	
	XS2P415	XS415	ZS2P415	ZS415	
	XS2P415-48	XS415-48	ZS2P415-48	ZS415-48	
	XS2P416	XS416	ZS2P416	ZS416	7/8 M22
	XS2P417-52	XS417-52	ZS2P417-52	ZS417-52	
	XS2P417	XS417	ZS2P417	ZS417	
	XS2P418-55	XS418-55	ZS2P418-55	ZS418-55	
	XS2P418-56	XS418-56	ZS2P418-56	ZS418-56	
	XS2P418	XS418	ZS2P418	ZS418	1 M27
	XS2P420	XS420	ZS2P420	ZS420	
	XS2P420-63	XS420-63	ZS2P420-63	ZS420-63	
	XS2P420-64	XS420-64	ZS2P420-64	ZS420-64	



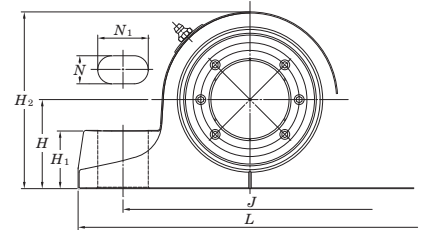
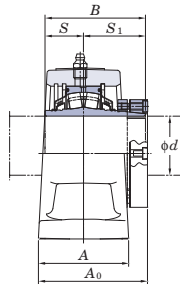
**Cylindrical bore
(with set screw collar lock)**
**4 inch
100 mm**



<i>d</i>	Dimensions											
	<i>H</i>	<i>L</i>	<i>A</i>	<i>J</i>	<i>N</i>	<i>N</i> ₁	<i>H</i> ₁	<i>H</i> ₂	<i>A</i> ₀	<i>B</i>	<i>S</i>	<i>S</i> ₁
1 7/8 47.6	7 3/8 187	2 5/32 55	5 9/32 134	1 3/32 15	28	1 1/4 32	3 25/32 96	2 5/8 66.4	2.531	1	1.531	
2 1/8 54	7 7/8 200	2 3/8 60	5 25/32 147	1 3/32 15	28	1 5/16 33	4 1/4 108	2 27/32 72.1	2.657	1	1.657	
2 1/4 57.2	8 29/32 226	2 7/16 62	6 17/32 166	2 5/32 20	33	1 3/8 35	4 1/2 114	3 1/16 77.8	2.843	1	1.843	
2 1/2 63.5	9 21/32 245	2 5/8 67	7 1/8 181	2 5/32 20	36	1 13/32 41	4 31/32 126	3 1/8 79.5	2.937	1.126	1.811	
2 3/4 69.8	10 1/4 260	2 7/8 73	7 11/16 195	2 5/32 20	40	1 9/16 45	5 19/32 142	3 3/8 86.1	3.205	1.252	1.953	
3 1/8 79.5	11 5/8 295	3 76	8 11/16 221	1 5/16 24	43	1 25/32 45	6 1/4 159	3 13/16 97	3.594	1.252	2.343	
3 3/4 95.2	13 1/2 343	3 3/8 86	10 5/16 262	1 1/16 27	44	2 1/4 57	7 15/32 190	4 1/4 108.1	4.079	1.516	2.563	
4 1/8 104.9	15 1/4 387	3 3/4 95	11 1/4 286	1 5/32 29	59	2 13/32 61	8 7/32 209	4 23/32 120.1	4.484	1.626	2.858	



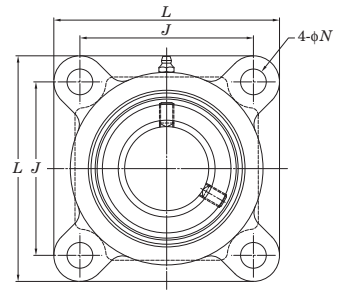
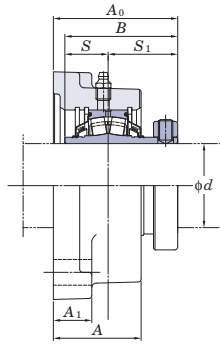
ZSE2P
Cylindrical bore
(with Z-Lock)
d 1 3/8 ~ 4 inch
40 ~ 100 mm



	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size
					inch mm
	XSE2P408-22	XS408-22	ZSE2P408-22	ZS408-22	1/2 M12
	XSE2P408-23	XS408-23	ZSE2P408-23	ZS408-23	
	XSE2P408-24	XS408-24	ZSE2P408-24	ZS408-24	
	XSE2P408	XS408	ZSE2P408	ZS408	
	XSE2P409-27	XS409-27	ZSE2P409-27	ZS409-27	1/2 M12
	XSE2P409-28	XS409-28	ZSE2P409-28	ZS409-28	
	XSE2P409	XS409	ZSE2P409	ZS409	
	XSE2P410-31	XS410-31	ZSE2P410-31	ZS410-31	
	XSE2P410	XS410	ZSE2P410	ZS410	5/8 M16
	XSE2P410-32	XS410-32	ZSE2P410-32	ZS410-32	
	XSE2P411	XS411	ZSE2P411	ZS411	
	XSE2P411-35	XS411-35	ZSE2P411-35	ZS411-35	5/8 M16
	XSE2P411-36	XS411-36	ZSE2P411-36	ZS411-36	
	XSE2P412	XS412	ZSE2P412	ZS412	
	XSE2P413-39	XS413-39	ZSE2P413-39	ZS413-39	5/8 M16
	XSE2P413-40	XS413-40	ZSE2P413-40	ZS413-40	
	XSE2P413	XS413	ZSE2P413	ZS413	
	XSE2P414	XS414	ZSE2P414	ZS414	
	XSE2P415-43	XS415-43	ZSE2P415-43	ZS415-43	3/4 M20
	XSE2P415-44	XS415-44	ZSE2P415-44	ZS415-44	
	XSE2P415-47	XS415-47	ZSE2P415-47	ZS415-47	
	XSE2P415	XS415	ZSE2P415	ZS415	
	XSE2P415-48	XS415-48	ZSE2P415-48	ZS415-48	
	XSE2P416	XS416	ZSE2P416	ZS416	7/8 M22
	XSE2P417-52	XS417-52	ZSE2P417-52	ZS417-52	
	XSE2P417	XS417	ZSE2P417	ZS417	
	XSE2P418-55	XS418-55	ZSE2P418-55	ZS418-55	
	XSE2P418-56	XS418-56	ZSE2P418-56	ZS418-56	
	XSE2P418	XS418	ZSE2P418	ZS418	
	XSE2P420	XS420	ZSE2P420	ZS420	
	XSE2P420-63	XS420-63	ZSE2P420-63	ZS420-63	1 M27
	XSE2P420-64	XS420-64	ZSE2P420-64	ZS420-64	



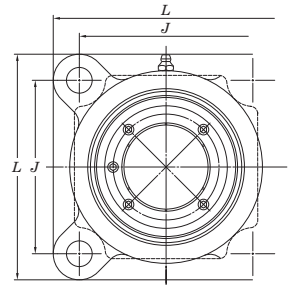
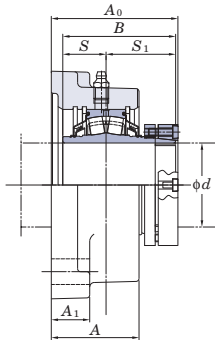
**Cylindrical bore
(with set screw collar lock)**
4 inch
100 mm



<i>d</i>	Dimensions								
	<i>L</i>	<i>A</i>	<i>J</i>	<i>N</i>	<i>A</i> ₁	<i>A</i> ₀	<i>B</i>	<i>S</i>	<i>S</i> ₁
	inch mm								
	4 3/4 121	2 3/32 53	3 17/32 89.7	35/64 14	3/4 19	2 3/4 70.2	2.531 64.3	1 25.4	1.531 38.9
	5 1/8 130	2 5/32 55	3 57/64 98.8	35/64 14	3/4 19	2 31/32 75.4	2.657 67.5	1 25.4	1.657 42.1
	5 5/16 135	2 5/32 55	4 1/16 103.2	35/64 14	3/4 19	3 5/32 80.2	2.843 72.2	1 25.4	1.843 46.8
	5 29/32 150	2 9/32 58	4 33/64 114.7	21/32 17	1 1/32 26	3 1/4 82.2	2.937 74.6	1.126 28.6	1.811 46
	6 1/8 156	2 9/16 65	4 25/32 121.4	21/32 17	1 1/32 26	3 17/32 89.3	3.205 81.4	1.252 31.8	1.953 49.6
	7 7/32 183	2 5/8 67	5 9/16 141.3	7/8 22	1 1/32 26	3 29/32 99.2	3.594 91.3	1.252 31.8	2.343 59.5
	8 9/32 210	3 5/32 80	6 23/32 170.7	7/8 22	1 5/32 29	4 3/8 111.5	4.079 103.6	1.516 38.5	2.563 65.1
	9 1/4 235	3 19/32 91	7 39/64 193.3	63/64 25	1 3/16 30	4 27/32 123	4.484 113.9	1.626 41.3	2.858 72.6



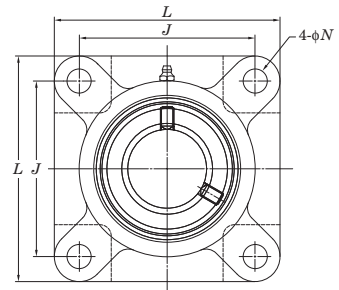
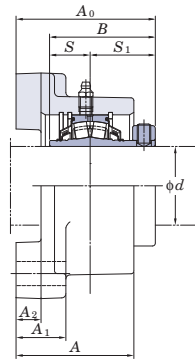
ZS4F
Cylindrical bore
(with Z-Lock)
d 1 3/8 ~ 4 inch
40 ~ 100 mm



	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size inch mm
	XS4F408-22	XS408-22	ZS4F408-22	ZS408-22	1/2 M12
	XS4F408-23	XS408-23	ZS4F408-23	ZS408-23	
	XS4F408-24	XS408-24	ZS4F408-24	ZS408-24	
	XS4F408	XS408	ZS4F408	ZS408	
	XS4F409-27	XS409-27	ZS4F409-27	ZS409-27	1/2 M12
	XS4F409-28	XS409-28	ZS4F409-28	ZS409-28	
	XS4F409	XS409	ZS4F409	ZS409	
	XS4F410-31	XS410-31	ZS4F410-31	ZS410-31	1/2 M12
	XS4F410	XS410	ZS4F410	ZS410	
	XS4F410-32	XS410-32	ZS4F410-32	ZS410-32	
	XS4F411	XS411	ZS4F411	ZS411	5/8 M16
	XS4F411-35	XS411-35	ZS4F411-35	ZS411-35	
	XS4F411-36	XS411-36	ZS4F411-36	ZS411-36	
	XS4F412	XS412	ZS4F412	ZS412	5/8 M16
	XS4F413-39	XS413-39	ZS4F413-39	ZS413-39	
	XS4F413-40	XS413-40	ZS4F413-40	ZS413-40	
	XS4F413	XS413	ZS4F413	ZS413	
	XS4F414	XS414	ZS4F414	ZS414	3/4 M20
	XS4F415-43	XS415-43	ZS4F415-43	ZS415-43	
	XS4F415-44	XS415-44	ZS4F415-44	ZS415-44	
	XS4F415-47	XS415-47	ZS4F415-47	ZS415-47	
	XS4F415	XS415	ZS4F415	ZS415	
	XS4F415-48	XS415-48	ZS4F415-48	ZS415-48	
	XS4F416	XS416	ZS4F416	ZS416	3/4 M20
	XS4F417-52	XS417-52	ZS4F417-52	ZS417-52	
	XS4F417	XS417	ZS4F417	ZS417	
	XS4F418-55	XS418-55	ZS4F418-55	ZS418-55	
	XS4F418-56	XS418-56	ZS4F418-56	ZS418-56	
	XS4F418	XS418	ZS4F418	ZS418	
	XS4F420	XS420	ZS4F420	ZS420	
	XS4F420-63	XS420-63	ZS4F420-63	ZS420-63	7/8 M22
	XS4F420-64	XS420-64	ZS4F420-64	ZS420-64	



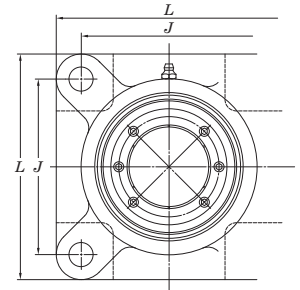
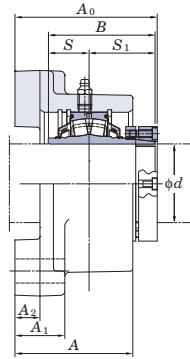
**Cylindrical bore
(with set screw collar lock)**
**4 inch
100 mm**



<i>d</i>	Dimensions										
	<i>L</i>	<i>A</i>	<i>J</i>	<i>N</i>	<i>A</i> ₁	<i>A</i> ₂	<i>A</i> ₀	<i>B</i>	<i>S</i>	<i>S</i> ₁	
	inch mm										
	4 19/32 117	2 15/32 63	3 1/2 88.9	35/64 14	1 1/16 27	1/2 13	3 1/16 77.8	2.531 64.3	1 25.4	1.531 38.9	
	5 11/32 136	2 15/16 75	4 1/8 104.9	35/64 14	1 3/16 30	5/8 16	3 1/2 88.8	2.657 67.5	1 25.4	1.657 42.1	
	5 5/8 143	2 15/16 75	4 3/8 111	35/64 14	1 3/16 30	5/8 16	3 5/8 92	2.843 72.2	1 25.4	1.843 46.8	
	6 1/4 159	3 9/32 83	4 7/8 123.7	21/32 17	1 3/8 35	23/32 18	3 7/8 98.2	2.937 74.6	1.126 28.6	1.811 46	
	6 7/8 175	3 11/32 85	5 3/8 136.4	21/32 17	1 1/2 38	25/32 20	4 3/16 106.3	3.205 81.4	1.252 31.8	1.953 49.6	
	7 3/4 197	3 13/16 97	6 152.4	7/8 22	1 5/8 41	15/16 24	4 11/16 119	3.594 91.3	1.252 31.8	2.343 59.5	
	9 1/4 235	4 9/32 109	7 177.8	7/8 22	1 7/8 48	31/32 24.5	5 5/16 135.1	4.079 103.6	1.516 38.5	2.563 65.1	
	10 1/4 260	5 1/2 140	7 3/4 196.9	63/64 25	2 1/8 54	1 3/32 28	6 1/2 165.2	4.484 113.9	1.626 41.3	2.858 72.6	



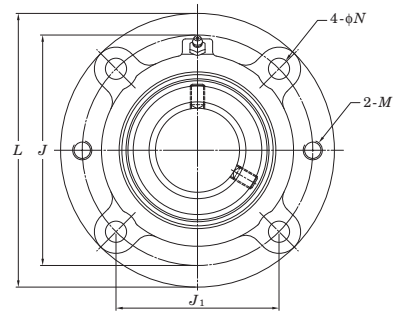
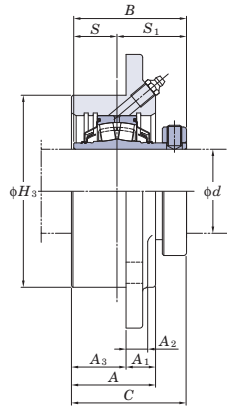
ZSE4F
Cylindrical bore
(with Z-Lock)
 $d \ 1 \frac{3}{8} \sim 4 \text{ inch}$
40 ~ 100 mm



	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size
					inch mm
	XSE4F408-22	XS408-22	ZSE4F408-22	ZS408-22	
	XSE4F408-23	XS408-23	ZSE4F408-23	ZS408-23	1/2
	XSE4F408-24	XS408-24	ZSE4F408-24	ZS408-24	M12
	XSE4F408	XS408	ZSE4F408	ZS408	
	XSE4F409-27	XS409-27	ZSE4F409-27	ZS409-27	1/2
	XSE4F409-28	XS409-28	ZSE4F409-28	ZS409-28	M12
	XSE4F409	XS409	ZSE4F409	ZS409	
	XSE4F410-31	XS410-31	ZSE4F410-31	ZS410-31	1/2
	XSE4F410	XS410	ZSE4F410	ZS410	M12
	XSE4F410-32	XS410-32	ZSE4F410-32	ZS410-32	
	XSE4F411	XS411	ZSE4F411	ZS411	5/8
	XSE4F411-35	XS411-35	ZSE4F411-35	ZS411-35	M16
	XSE4F411-36	XS411-36	ZSE4F411-36	ZS411-36	
	XSE4F412	XS412	ZSE4F412	ZS412	5/8
	XSE4F413-39	XS413-39	ZSE4F413-39	ZS413-39	M16
	XSE4F413-40	XS413-40	ZSE4F413-40	ZS413-40	
	XSE4F413	XS413	ZSE4F413	ZS413	
	XSE4F414	XS414	ZSE4F414	ZS414	3/4
	XSE4F415-43	XS415-43	ZSE4F415-43	ZS415-43	M20
	XSE4F415-44	XS415-44	ZSE4F415-44	ZS415-44	
	XSE4F415-47	XS415-47	ZSE4F415-47	ZS415-47	
	XSE4F415	XS415	ZSE4F415	ZS415	
	XSE4F415-48	XS415-48	ZSE4F415-48	ZS415-48	
	XSE4F416	XS416	ZSE4F416	ZS416	3/4
	XSE4F417-52	XS417-52	ZSE4F417-52	ZS417-52	M20
	XSE4F417	XS417	ZSE4F417	ZS417	
	XSE4F418-55	XS418-55	ZSE4F418-55	ZS418-55	
	XSE4F418-56	XS418-56	ZSE4F418-56	ZS418-56	
	XSE4F418	XS418	ZSE4F418	ZS418	
	XSE4F420	XS420	ZSE4F420	ZS420	7/8
	XSE4F420-63	XS420-63	ZSE4F420-63	ZS420-63	M22
	XSE4F420-64	XS420-64	ZSE4F420-64	ZS420-64	



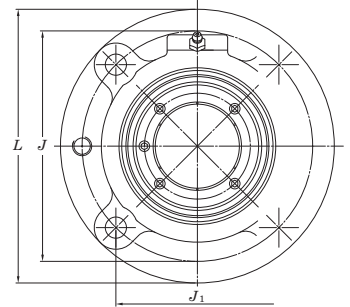
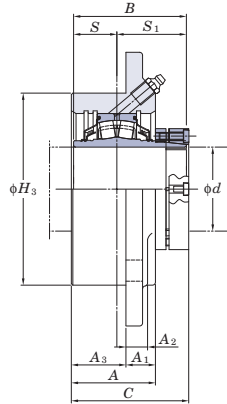
**Cylindrical bore
(with set screw collar lock)**
**4 inch
100 mm**



<i>d</i>	Dimensions													
	<i>L</i>	<i>H</i> ₃	<i>J</i>	<i>J</i> ₁	<i>N</i>	<i>A</i>	<i>A</i> ₁	<i>A</i> ₂	<i>A</i> ₃	<i>C</i>	<i>M</i>	<i>B</i>	<i>S</i>	<i>S</i> ₁
5 1/4 133	3.625 92.1	4 3/8 111.1	3 3/32 78.6	15/32 12	1 27/32 46.8	13/16 21	11/16 17.3	1 1/32 26	2 17/32 64.3	3/8-16UNC	2.531 64.3	1 25.4	1.531 38.9	
6 5/32 156	4.25 107.8	5 1/8 130.2	3 5/8 92.1	9/16 14	1 29/32 48.4	5/8 16	1/2 12.7	1 17/64 32.2	2 23/32 69.1	7/16-14UNC	2.657 67.5	1 25.4	1.657 42.1	
6 3/8 162	4.5 114.3	5 3/8 136.5	3 51/64 96.5	9/16 14	2 50.8	3/4 19	9/16 14.3	1 17/64 32.2	2 55/64 72.6	7/16-14UNC	2.843 72.2	1 25.4	1.843 46.8	
7 1/8 181	5 127	6 152.4	4 1/4 107.8	35/64 14	2 3/16 55.6	25/32 20	9/16 14.3	1 27/64 36.1	3 76.1	1/2-13UNC	2.937 74.6	1.126 28.6	1.811 46	
7 5/8 194	5.5 139.7	6 1/2 165.1	4 19/32 116.7	35/64 14	2 1/2 63.5	15/16 24	5/8 15.9	1 9/16 39.7	3 7/16 87.4	1/2-13UNC	3.205 81.4	1.252 31.8	1.953 49.6	
8 3/4 222	6.375 161.9	7 1/2 190.5	5 19/64 134.7	43/64 17	2 5/8 66.7	31/32 25	3/4 19.1	1 5/8 41.3	3 41/64 92.5	5/8-11UNC	3.594 91.3	1.252 31.8	2.343 59.5	
10 1/4 260	7.375 187.3	8 5/8 219.1	6 3/32 154.9	29/32 23	3 76.2	1 15/32 38	15/16 23.8	1 33/64 38.5	4 5/32 105.6	3/4-10UNC	4.079 103.6	1.516 38.5	2.563 65.1	
10 7/8 276	8.125 206.4	9 3/8 238.1	6 5/8 168.4	29/32 23	3 1/2 88.9	1 9/16 40	1 1/4 31.4	1 29/32 48.4	4 9/16 115.9	3/4-10UNC	4.484 113.9	1.626 41.3	2.858 72.6	



ZS4FC
Cylindrical bore
(with Z-Lock)
 $d \ 1\frac{3}{8} \sim 4 \text{ inch}$
40 ~ 100 mm

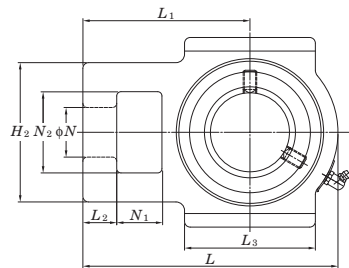
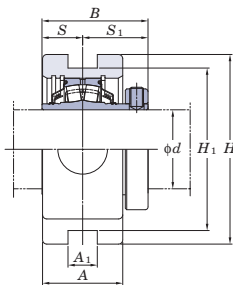


	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size inch mm
	XS4FC408-22	XS408-22	ZS4FC408-22	ZS408-22	1/2 M12
	XS4FC408-23	XS408-23	ZS4FC408-23	ZS408-23	
	XS4FC408-24	XS408-24	ZS4FC408-24	ZS408-24	
	XS4FC408	XS408	ZS4FC408	ZS408	
	XS4FC409-27	XS409-27	ZS4FC409-27	ZS409-27	1/2 M12
	XS4FC409-28	XS409-28	ZS4FC409-28	ZS409-28	
	XS4FC409	XS409	ZS4FC409	ZS409	
	XS4FC410-31	XS410-31	ZS4FC410-31	ZS410-31	5/8 M16
	XS4FC410	XS410	ZS4FC410	ZS410	
	XS4FC410-32	XS410-32	ZS4FC410-32	ZS410-32	
	XS4FC411	XS411	ZS4FC411	ZS411	5/8 M16
	XS4FC411-35	XS411-35	ZS4FC411-35	ZS411-35	
	XS4FC411-36	XS411-36	ZS4FC411-36	ZS411-36	
	XS4FC412	XS412	ZS4FC412	ZS412	5/8 M16
	XS4FC413-39	XS413-39	ZS4FC413-39	ZS413-39	
	XS4FC413-40	XS413-40	ZS4FC413-40	ZS413-40	
	XS4FC413	XS413	ZS4FC413	ZS413	
	XS4FC414	XS414	ZS4FC414	ZS414	3/4 M20
	XS4FC415-43	XS415-43	ZS4FC415-43	ZS415-43	
	XS4FC415-44	XS415-44	ZS4FC415-44	ZS415-44	
	XS4FC415-47	XS415-47	ZS4FC415-47	ZS415-47	
	XS4FC415	XS415	ZS4FC415	ZS415	
	XS4FC415-48	XS415-48	ZS4FC415-48	ZS415-48	
	XS4FC416	XS416	ZS4FC416	ZS416	7/8 M22
	XS4FC417-52	XS417-52	ZS4FC417-52	ZS417-52	
	XS4FC417	XS417	ZS4FC417	ZS417	
	XS4FC418-55	XS418-55	ZS4FC418-55	ZS418-55	
	XS4FC418-56	XS418-56	ZS4FC418-56	ZS418-56	
	XS4FC418	XS418	ZS4FC418	ZS418	1 M27
	XS4FC420	XS420	ZS4FC420	ZS420	
	XS4FC420-63	XS420-63	ZS4FC420-63	ZS420-63	
	XS4FC420-64	XS420-64	ZS4FC420-64	ZS420-64	



**Cylindrical bore
(with set screw collar lock)**

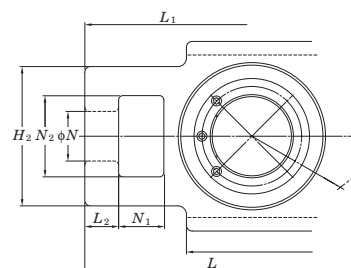
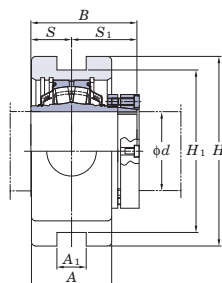
**3 1/2 inch
90 mm**



<i>d</i>	Dimensions														
	<i>A</i>	<i>A</i> ₁	<i>H</i>	<i>H</i> ₁	<i>H</i> ₂	<i>L</i>	<i>L</i> ₁	<i>L</i> ₂	<i>L</i> ₃	<i>N</i>	<i>N</i> ₁	<i>N</i> ₂	<i>B</i>	<i>S</i>	<i>S</i> ₁
	inch mm														
2 51	11/16 17.5	4 3/4 121	4 101.6	3 5/16 84	6 3/16 157.2	3 15/16 100	15/16 23.8	3 5/8 92	1 1/8 28.6	3/4 19.1	1 15/16 49.2	2.843	1 25.4	1.843	46.8
2 7/32 56	13/16 20.6	5 1/4 133	4 1/2 114.3	3 27/32 98	7 1/16 179.4	4 5/8 117.5	15/16 23.8	3 5/8 92	1 3/8 34.9	1 1/4 31.8	2 1/4 57.2	2.937	1.126 28.6	1.811	46
2 7/16 62	1 1/16 27	5 7/8 149	5 1/8 130.2	4 1/4 108	7 25/32 198	5 127	15/16 23.8	4 3/8 111	1 3/8 34.9	1 1/4 31.8	2 1/2 63.5	3.205	1.252 31.8	1.953	49.6
2 11/16 68	1 13/16 46	6 11/16 170	5 15/16 150.8	4 7/8 124	8 7/8 225.4	5 3/4 146.1	1 1/8 28.6	4 1/2 114.3	1 5/8 41.3	1 1/2 38.1	2 3/4 69.9	3.594	1.252 31.8	2.343	59.5
3 1/16 78	1 13/16 46	7 25/32 198	6 13/16 173	5 1/8 130	10 1/16 255.6	6 3/8 161.9	1 1/16 27	5 1/2 139.7	1 7/8 47.6	1 5/8 41.3	2 7/8 73	4.079	1.516 38.5	2.563	65.1



ZST
Cylindrical bore
(with Z-Lock)
 $d \ 1 \frac{15}{16} \sim 3 \frac{1}{2}$ inch
50 ~ 90 mm

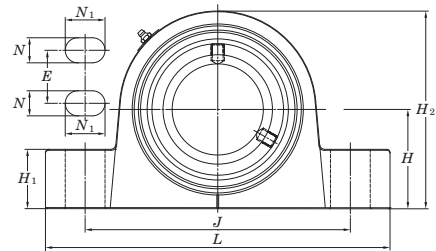
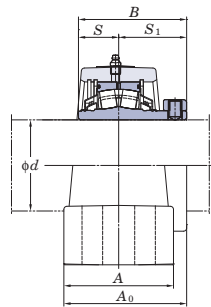
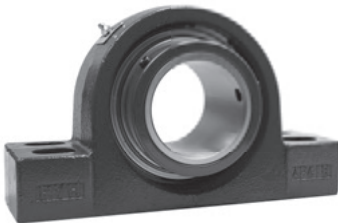


	Unit No.	Bearing No.	Unit No.	Bearing No.
	XST410-31	XS410-31	ZST410-31	ZS410-31
	XST410	XS410	ZST410	ZS410
	XST410-32	XS410-32	ZST410-32	ZS410-32
	XST411	XS411	ZST411	ZS411
	XST411-35	XS411-35	ZST411-35	ZS411-35
	XST411-36	XS411-36	ZST411-36	ZS411-36
	XST412	XS412	ZST412	ZS412
	XST413-39	XS413-39	ZST413-39	ZS413-39
	XST413-40	XS413-40	ZST413-40	ZS413-40
	XST413	XS413	ZST413	ZS413
	XST414	XS414	ZST414	ZS414
	XST415-43	XS415-43	ZST415-43	ZS415-43
	XST415-44	XS415-44	ZST415-44	ZS415-44
	XST415-47	XS415-47	ZST415-47	ZS415-47
	XST415	XS415	ZST415	ZS415
	XST415-48	XS415-48	ZST415-48	ZS415-48
	XST416	XS416	ZST416	ZS416
	XST417-52	XS417-52	ZST417-52	ZS417-52
	XST417	XS417	ZST417	ZS417
	XST418-55	XS418-55	ZST418-55	ZS418-55
	XST418-56	XS418-56	ZST418-56	ZS418-56
	XST418	XS418	ZST418	ZS418



**Cylindrical bore
(with set screw collar lock)**

**4 inch
100 mm**

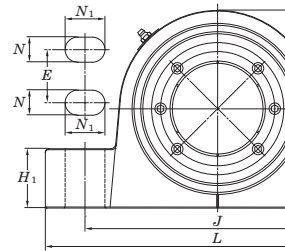
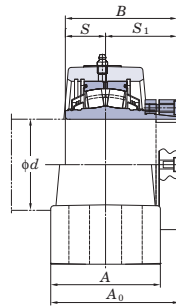


<i>d</i>	Dimensions												
	<i>H</i>	<i>L</i>	<i>A</i>	<i>J</i>	<i>N</i>	<i>N</i> ₁	<i>E</i>	<i>H</i> ₁	<i>H</i> ₂	<i>A</i> ₀	<i>B</i>	<i>S</i>	<i>S</i> ₁
2 3/4 69.8	9 1/4 235	3 3/8 86	7 1/8 181	19/32 15	13/16 21	1 3/4 44	1 5/8 41	5 19/32 142	3 21/32 92.6	3.205	1.252	1.953	49.6
3 1/4 82.6	10 7/16 265	3 3/4 95	8 1/8 206	25/32 20	15/16 24	1 7/8 48	1 7/8 48	6 3/8 162	4 7/32 107	3.594	1.252	2.343	59.5
3 3/4 95.2	13 330	4 1/8 105	10 254	15/16 24	1 1/2 38	2 50.8	2 1/4 57	7 9/16 192	4 5/8 117.6	4.079	1.516	2.563	65.1
4 1/4 108	15 1/4 387	4 1/2 114	12 1/2 318	15/16 24	1 17/32 39	2 1/4 57	2 7/16 62	8 3/8 213	5 3/32 129.6	4.484	1.626	2.858	72.6



ZS4P
Cylindrical bore
(with Z-Lock)

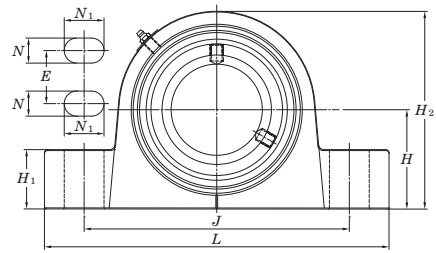
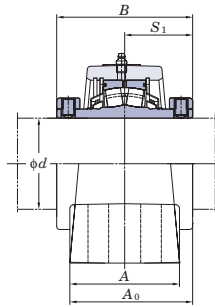
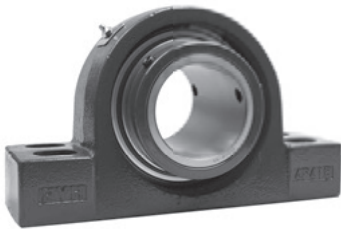
d 2 ⁷/₁₆ ~ 4 inch
60 ~ 100 mm



	Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size inch mm
	XS4P412	XS412	ZS4P412	ZS412	1/2 M12
	XS4P413-39	XS413-39	ZS4P413-39	ZS413-39	
	XS4P413-40	XS413-40	ZS4P413-40	ZS413-40	
	XS4P413	XS413	ZS4P413	ZS413	
	XS4P414	XS414	ZS4P414	ZS414	5/8 M16
	XS4P415-43	XS415-43	ZS4P415-43	ZS415-43	
	XS4P415-44	XS415-44	ZS4P415-44	ZS415-44	
	XS4P415-47	XS415-47	ZS4P415-47	ZS415-47	
	XS4P415	XS415	ZS4P415	ZS415	
	XS4P415-48	XS415-48	ZS4P415-48	ZS415-48	
	XS4P416	XS416	ZS4P416	ZS416	3/4 M20
	XS4P417-52	XS417-52	ZS4P417-52	ZS417-52	
	XS4P417	XS417	ZS4P417	ZS417	
	XS4P418-55	XS418-55	ZS4P418-55	ZS418-55	
	XS4P418-56	XS418-56	ZS4P418-56	ZS418-56	
	XS4P418	XS418	ZS4P418	ZS418	
	XS4P420	XS420	ZS4P420	ZS420	3/4 M20
	XS4P420-63	XS420-63	ZS4P420-63	ZS420-63	
	XS4P420-64	XS420-64	ZS4P420-64	ZS420-64	



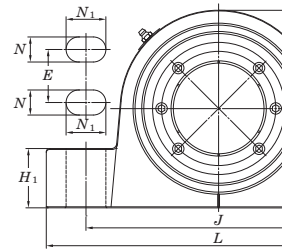
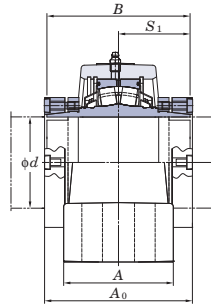
**Cylindrical bore
(with set screw collar lock)**
**4 inch
100 mm**



<i>d</i>	Dimensions											
	<i>H</i>	<i>L</i>	<i>A</i>	<i>J</i>	<i>N</i>	<i>N</i> ₁	<i>E</i>	<i>H</i> ₁	<i>H</i> ₂	<i>A</i> ₀	<i>B</i>	<i>S</i> ₁
2 3/4 69.8	9 1/4 235	3 3/8 86	7 1/8 181	19/32 15	13/16 21	1 3/4 44	1 5/8 41	5 19/32 142	3 21/32 92.6	3.906	1.953	49.6
3 1/4 82.6	10 7/16 265	3 3/4 95	8 1/8 206	25/32 20	15/16 24	1 7/8 48	1 7/8 48	6 3/8 162	4 7/32 107	4.686	2.343	59.5
3 3/4 95.2	13 330	4 1/8 105	10 254	15/16 24	1 1/2 38	2 50.8	2 1/4 57	7 9/16 192	4 5/8 117.6	5.126	2.563	65.1
4 1/4 108	15 1/4 387	4 1/2 114	12 1/2 318	15/16 24	1 17/32 39	2 1/4 57	2 7/16 62	8 3/8 213	5 3/32 129.6	5.716	2.858	72.6



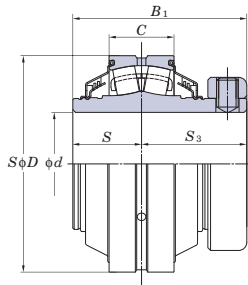
ZDS4P
Cylindrical bore
(with Z-Lock)
 $d \ 2\frac{7}{16} \sim 4 \text{ inch}$
60 ~ 100 mm



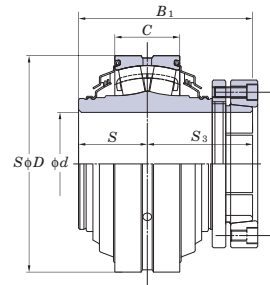
Unit No.	Bearing No.	Unit No.	Bearing No.	Bolt Size
XDS4P412	XDS412	ZDS4P412	ZDS412	1/2 M12
XDS4P413-39	XDS413-39	ZDS4P413-39	ZDS413-39	
XDS4P413-40	XDS413-40	ZDS4P413-40	ZDS413-40	
XDS4P413	XDS413	ZDS4P413	ZDS413	
XDS4P414	XDS414	ZDS4P414	ZDS414	5/8 M16
XDS4P415-43	XDS415-43	ZDS4P415-43	ZDS415-43	
XDS4P415-44	XDS415-44	ZDS4P415-44	ZDS415-44	
XDS4P415-47	XDS415-47	ZDS4P415-47	ZDS415-47	
XDS4P415	XDS415	ZDS4P415	ZDS415	
XDS4P415-48	XDS415-48	ZDS4P415-48	ZDS415-48	3/4 M20
XDS4P416	XDS416	ZDS4P416	ZDS416	
XDS4P417-52	XDS417-52	ZDS4P417-52	ZDS417-52	
XDS4P417	XDS417	ZDS4P417	ZDS417	
XDS4P418-55	XDS418-55	ZDS4P418-55	ZDS418-55	
XDS4P418-56	XDS418-56	ZDS4P418-56	ZDS418-56	
XDS4P418	XDS418	ZDS4P418	ZDS418	3/4 M20
XDS4P420	XDS420	ZDS4P420	ZDS420	
XDS4P420-63	XDS420-63	ZDS4P420-63	ZDS420-63	
XDS4P420-64	XDS420-64	ZDS4P420-64	ZDS420-64	



**Cylindrical bore
(with set screw collar lock)**
**4 inch
100 mm**



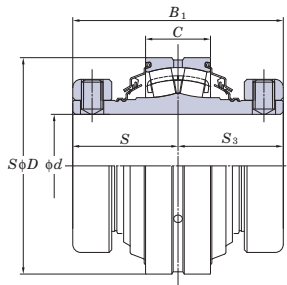
**ZS4
Cylindrical bore
(with Z-Lock)**



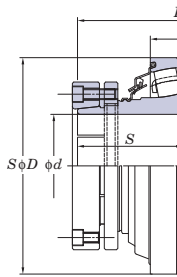
<i>d</i>	Dimensions					Bearing No.	Bearing No.
	<i>C</i>	<i>D</i>	<i>B</i> ₁	<i>S</i>	<i>S</i> ₃		
¹⁵ / ₁₆ 24	^{3 5} / ₃₂ 80	2.531 64.3	1 25.4	1.531 38.9	XS408-22 XS408-23 XS408-24 XS408	ZS408-22 ZS408-23 ZS408-24 ZS408	
¹⁵ / ₁₆ 24	^{3 11} / ₃₂ 85	2.657 67.5	1 25.4	1.657 42.1	XS409-27 XS409-28 XS409	ZS409-27 ZS409-28 ZS409	
¹⁵ / ₁₆ 24	^{3 17} / ₃₂ 90	2.843 72.2	1 25.4	1.843 46.8	XS410-31 XS410 XS410-32	ZS410-31 ZS410 ZS410-32	
^{1 1} / ₃₂ 26	^{3 15} / ₁₆ 100	2.937 74.6	1.126 28.6	1.811 46	XS411 XS411-35 XS411-36	ZS411 ZS411-35 ZS411-36	
^{1 1} / ₄ 32	^{4 23} / ₃₂ 120	3.205 81.4	1.252 31.8	1.953 49.6	XS412 XS413-39 XS413-40 XS413	ZS412 ZS413-39 ZS413-40 ZS413	
^{1 1} / ₄ 32	^{5 1} / ₈ 130	3.594 91.3	1.252 31.8	2.343 59.5	XS414 XS415-43 XS415-44 XS415-47 XS415 XS415-48	ZS414 ZS415-43 ZS415-44 ZS415-47 ZS415 ZS415-48	
^{1 5} / ₈ 41	^{6 5} / ₁₆ 160	4.079 103.6	1.516 38.5	2.563 65.1	XS416 XS417-52 XS417 XS418-55 XS418-56 XS418	ZS416 ZS417-52 ZS417 ZS418-55 ZS418-56 ZS418	
^{1 27} / ₃₂ 47	^{7 3} / ₃₂ 180	4.484 113.9	1.626 41.3	2.858 72.6	XS420 XS420-63 XS420-64	ZS420 ZS420-63 ZS420-64	



XDS4
Cylindrical bore
(with set screw collar lock (both))
 d $2 \frac{7}{16} \sim 4$ inch
60 ~ 100 mm



ZDS4
Cylindrical bore
(with Z-Lock (both))



Shaft Dia. inch mm d	Dimensions inch mm					Bearing No.	Bearing No.
	C	D	B_1	S	S_3		
60 $2 \frac{7}{16}$ $2 \frac{1}{2}$	$1 \frac{1}{4}$ 32	$4 \frac{23}{32}$ 120	3.905 99.2	1.953 49.6	1.953 49.6	XDS412 XDS413-39 XDS413-40 XDS413	ZDS412 ZDS413-39 ZDS413-40 ZDS413
65 $2 \frac{11}{16}$ $2 \frac{3}{4}$ $2 \frac{15}{16}$	$1 \frac{1}{4}$ 32	$5 \frac{1}{8}$ 130	4.685 119	2.343 59.5	2.343 59.5	XDS414 XDS415-43 XDS415-44 XDS415-47 XDS415	ZDS414 ZDS415-43 ZDS415-44 ZDS415-47 ZDS415
75 3						XDS415-48 XDS416	ZDS415-48 ZDS416
80 $3 \frac{1}{4}$						XDS417-52 XDS417	ZDS417-52 ZDS417
85 $3 \frac{7}{16}$ $3 \frac{1}{2}$	$1 \frac{5}{8}$ 41	$6 \frac{5}{16}$ 160	5.126 130.2	2.563 65.1	2.563 65.1	XDS418-55 XDS418-56 XDS418	ZDS418-55 ZDS418-56 ZDS418
90 $3 \frac{15}{16}$ 4	$1 \frac{27}{32}$ 47	$7 \frac{3}{32}$ 180	5.716 145.2	2.858 72.6	2.858 72.6	XDS420 XDS420-63 XDS420-64	ZDS420 ZDS420-63 ZDS420-64





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Appendix Table

Appendix Table 1 Simplified Chart of Ball Bearing Unit Combinations

Type	Housing for units	Insert bearing units										
		Cylindrical bore (with set screws)					Tapered bore (with adapter)					
		UC200	UCX00	UC300	Stainless steel UC200S6	Plated UC200S7	UK200	UKX00	UK300			
 Pillow type	P200, PX00, P300, P300E PK200 P200H4, PX00H4, P300H4	UCP200 UCP200H4	UCPX00 UCPX00H4	UCP300 UCP300H4			UKP200 UKP200H4	UKPX200 UKPX200H4	UKP300 UKP300H4			
	IP200, IP300 IP200H4, IP300H4	UCIP200 UCIP200H4		UCIP300 UCIP300H4			UKIP200 UKIP200H4		UKIP300 UKIP300H4			
	PA200 PA200H4 PAN200	UCPA200 UCPA200H4 UCPAN200					UKPA200 UKPA200H4					
	PH200 PH200H4	UCPH200 UCPH200H4					UKPH200 UKPH200H4					
	LP200											
	SP200H1 SPA200H1 P000, SP000				UCSP200H1S6 UCSPA200H1S6							
	VP200 VP200E PP200				UCVP200S6	UCVP200E7						
	 Square four-bolt flange type	F200, FX00, F300 F200E, FX00E NF200 F200H4, FX00H4, F300H4	UCF200 UCF200E UCF200H4	UCFX00 UCFX00E UCFX00H4	UCF300 UCF300H4			UKF200 UKF200H4	UKFX00 UKFX00H4	UKF300 UKF300H4		
		FS300 FS300H4			UCFS300 UCFS300H4					UKFS300 UKFS300H4		
		SF200H1 SF200EH1 VF200 VF200E				UCSF200H1S6 UCSF200EH1S6 UCVF200S6	UCVF200E7					
		 Oval flange type	FL200, FLX00, FL300 FL200E FL200H4, FLX00H4, FL300H4	UCFL200 UCFL200E UCFL200H4	UCFLX00 UCFLX00H4	UCFL300 UCFL300H4			UKFL200 UKFL200H4	UKFLX00 UKFLX00H4	UKFL300 UKFL300H4	
			LF200									
			FL000, SFL000 SFL200H1 SFL200EH1 VFL200 VFL200E				UCSFL200H1S6 UCSFL200EH1S6 UCVFL200S6	UCVFL200E7				
			TFD200H4									
FA200 FB200 PFL200			UCFA200 UCFB200					UKFA200 UKFB200				
 Round flange cartridge type			FC200, FCX00 FC200H4, FCX00H4 FCX00E FCF200 SFC200H1	UCFC200 UCFC200H4 UCFCF200	UCFCX00 UCFCX00H4 UCFCX00E				UKFC200 UKFC200H4	UKFCX00 UKFCX00H4		
			 Stamped steel plate flange type	PF200								
	 Take-up type			T200, TX00, T300 T200E, TX00E T200H4, TX00H4, T300H4	UCT200 UCT200E UCT200H4	UCTX00 UCTX00E UCTX00H4	UCT300 UCT300H4			UKT200 UKT200H4	UKTX00 UKTX00H4	UKT300 UKT300H4
		ST200H1 VT200 VT200E					UCST200H1S6 UCVT200S6	UCVT200E7				
T200+H		UCTH200										
TL200 TU200, TU300		UCTL200 UCTU200		UCTU300			(UKTL200) (UKTU200)		(UKTU300)			
PTH200 NPTH200												
 Cartridge type		C200, CX00, C300	UCC200	UCCX00	UCC300			UKC200	UKCX00	UKC300		
	 Hanger type	HA200	UCHA200				UKHA200					



Insert bearing units									Housing for units	Type
Cylindrical bore										
NU-LOC	with set screws			with eccentric looking collar						
NC200	SU000	Stainless steel SU000S6	SB200	SA200	SA200F	NA200	NA300			
NCP200						NAP200 NAPK200	NAP300E	P200, PX00, P300, P300E PK200 P200H4, PX00H4, P300H4	Pillow type 	
NCPA200								IP200, IP300 IP200H4, IP300H4		
NCPAN200								PA200 PA200H4 PAN200		
NCPH200								PH200 PH200H4		
			BLP200	ALP200				LP200		
	UP000	USP000S6						SP200H1 SPA200H1 P000, SP000		
			SBPP200	SAPP200				VP200 VP200E PP200		
NCF200 NCF200E						NAF200 NANF200		F200, FX00, F300 F200E, FX00E NF200 F200H4, FX00H4, F300H4		Square four-bolt flange type
								FS300 FS300H4		
								SF200H1 SF200EH1 VF200 VF200E		
NCFL200 NCFL200E						NAFL200		FL200, FLX00, FL300 FL200E FL200H4, FLX00H4, FL300H4	Oval flange type 	
	UFL000	USFL000S6	BLF200	ALF200				LF200 FL000, SFL000 SFL200H1 SFL200EH1 VFL200 VFL200E		
						SATFD200FH4P9		TFD200H4		
NCFA200								FA200		
NCFB200								FB200		
			SBPFL200	SAPFL200				PFL200		
NCFC200						NAFC200		FC200, FCX00 FC200H4, FCX00H4 FCX00E FCF200 SFC200H1	Round flange cartridge type 	
			SBPF200	SAPF200				PF200	Stamped steel plate flange type 	
NCT200 NCT200E						NAT200 NAT200E		T200, TX00, T300 T200E, TX00E T200H4, TX00H4, T300H4	Take-up type 	
								ST200H1 VT200 VT200E		
								T200+H TL200 TU200, TU300		
			SBPTH200 SBNPTH200					PTH200 NPTH200		
NCC200						NAC200		C200, CX00, C300	Cartridge type 	
NCHA200								HA200	Hanger type 	



Appendix Table

Appendix Table 2 Tightening Torques of Housings and Cast Iron Cover Mounting Bolts

(1) Tightening torques of housings mounting bolts (recommended)

Nominal size of screws	Tightening torques N · m
M 6	2.6– 4.7
M 8	6 – 10
M10	12 – 21
M12	21 – 37
M14	34 – 60
M16	53 – 93
M18	77 – 137
M20	104 – 186
M22	143 – 256
M27	266 – 478
M30	360 – 645
M33	494 – 886
M36	631 –1,130

(2) Tightening torques of plastic housings mounting bolts (recommended)

Nominal size of screws	Tightening torques N · m
M10	17.7–24.5
M12	29.4–44.1

(3) Tightening torques of cast iron cover mounting bolts (recommended)

Nominal size of screws	Tightening torques, N · m	Part No. of applicable cast iron covers (reference)		
		200 series	X00 series	300 series
M3	0.3– 0.6	204, 205	–	–
M4	0.8– 1.4	204FC3 (FD3), 205FC3 (FD3), 206–215	–	305–307
M5	1.5– 2.8	216–218	X18, X20	308–324
M8	6 –10	–	–	326, 328

Appendix Table 3 Tightening Torques of Inner Rings and Eccentric Locking Collar Set Screws

(1) Tightening torques of inner rings and eccentric locking collar set screws (metric series) (recommended)

Nominal size of screws	Tightening torques, N · m	Part No. of applicable bearings						
		UC2, RB	UCX	UC3	NA	SB	SU	ER
M 3X0.35	0.7						08, 000, 001	
M 4X0.5	1.8	–				–	002, 003	
M 5X0.5	3	201X–203X	–	–		201–203	004–006	–
M 6X0.75	4	201–206	X05	305, 306	204, 205	204–207	–	201–206
M 8X1	8.5	207–209	X06–X08	307	206–210	208		207–209
M10X1.25	17.5	210–212	X09–X11	308, 309	211, 212	–		210–212
M12X1.5	28	213–218	X12–X17	310–314	–			–
M14X1.5	35	–	X18	315, 316				
M16X1.5	56		X20	317–319				
M18X1.5	62		–	320–324				
M20X1.5	83			326, 328				

Remarks 1) Tightening torques of set screws for UC2-S6 are identical to that of UC2. As for UC210S6, tightening torque of the set screw M8 × 1 should be applied.
2) When the application will be exposed to vibration and shock load additional tightening will be required. The maximum torque tightening should not exceed 1.5 times the normal torque tightening specifications.



(2) Tightening torques of inner rings and eccentric locking collar set screws (inch series) (recommended)

Nominal size of screws	Tightening torques, N · m	Part No. of applicable bearings		
		UC2-, ER2-, RB2-	UCX-	SB-
10-32UNF	3	–	–	201, 202
1/4-28UNF	4	201–206	X05	204–207
5/16-24UNF	8.5	207–209	X06–X08	208
3/8-24UNF	17.5	210–212	X09–X11	–
1/2-20UNF	28	213–218	X12–X18	
5/8-18UNF	56	–	X20	

Remark When the application will be exposed to vibration and shock load additional tightening will be required. The maximum torque tightening should not exceed 1.5 times the normal torque tightening specifications.

(3) NC concentric cap screw tightening torque

Nominal size of screws	Tightening torques, N · m
M4	7.4– 8.2
M5	10.2–11.2
M6	17.6–19.4
M8	41.6–46
No.8-32UNC	7.4– 8.2
No.10-24UNC	10.2–11.2
1/4-20UNC	17.6–19.4
5/16-18UNC	41.6–46

Remark When the application will be exposed to vibration and shock load additional tightening will be required. The maximum torque tightening should not exceed 1.5 times the normal torque tightening specifications.

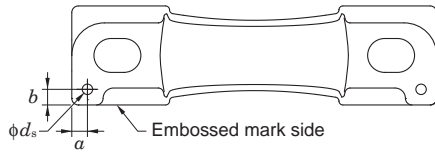
Appendix Table 4 Tightening Torques of Adapter Lock Nuts (reference)

Bore code	Tightening torques, N · m								
	UK200			UKX00			UK300		
	Standard load		Heavy load	Standard load		Heavy load	Standard load		Heavy load
	min.	Max.	(Max. × 1.5)	min.	Max.	(Max. × 1.5)	min.	Max.	(Max. × 1.5)
05	25	38	56	35	53	79	30	45	68
06	30	45	68	40	60	90	45	68	101
07	40	60	90	50	75	113	60	90	135
08	50	75	113	75	113	169	80	120	180
09	60	90	135	75	113	169	120	180	270
10	75	113	169	110	165	248	150	225	338
11	100	150	225	140	210	315	180	270	405
12	130	195	293	165	248	371	225	338	506
13	150	225	338	195	293	439	265	398	596
15	170	255	383	215	323	484	375	563	844
16	200	300	450	255	383	574	450	675	1,013
17	220	330	495	295	443	664	530	795	1,193
18	260	390	585	340	510	765	610	915	1,373
19	–	–	–	–	–	–	710	1,065	1,598
20	–	–	–	490	735	1,103	885	1,328	1,991
22	–	–	–	–	–	–	1,220	1,830	2,745
24	–	–	–	–	–	–	1,470	2,205	3,308
26	–	–	–	–	–	–	1,770	2,655	3,983
28	–	–	–	–	–	–	2,150	3,225	4,838

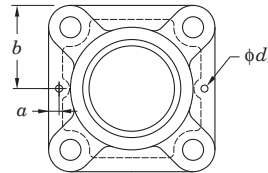
Appendix Table

Appendix Table 5 Machining Dimensions of Holes of Housing Dowel Pins

(1) Machining dimensions of holes of pillow type housing (P) dowel pins (recommended)



(2) Machining dimensions of holes of square flange type housing (F) dowel pins (recommended)



Unit: mm

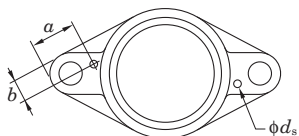
Nominal code	a	b	d _s (reference)	Pin seat thickness
P203	6	6	4	16
P204	6	6	4	16
P205	6	6	4	16
P206	6	6	4	17
P207	8	8	5	18
P208	8	8	5	18
P209	8	8	5	20
P210	10	10	5	21
P211	10	10	6	23
P212	10	10	6	25
P213	10	10	6	27
P214	10	10	8	27
P215	12.5	12.5	8	28
P216	12	12	8	30
P217	12	12	8	32
P218	14	14	8	33
PX05	7	7	5	16
PX06	8	8	5	17
PX07	8	8	5	19
PX08	8	8	5	21
PX09	8	8	5	21
PX10	9	9	6	22
PX11	9	9	6	28
PX12	9	9	6	28
PX13	10	10	8	28
PX14	10	10	8	32
PX15	10	10	8	32
PX16	12	12	8	34
PX17	12	12	8	34
PX18	15	15	10	38
PX20	19	19	10	45
P305	8	8	5	16
P306	10	10	5	17
P307	10	10	5	19
P308	11	11	6	19
P309	11	11	6	21
P310	11	11	6	24
P311	12	12	8	27
P312	12	12	8	29
P313	12	12	8	32
P314	12	12	10	35
P315	14	14	10	35
P316	15	15	10	35
P317	15	15	10	40
P318	15	15	10	40
P319	15	15	10	46
P320	17	17	13	46
P321	17	17	13	46
P322	17	17	13	50
P324	17	17	13	50
P326	20	20	13	50
P328	20	20	13	60

Unit: mm

Nominal code	a	b	d _s (reference)	Pin seat thickness
F204	6	43	4	11
F205	6	47.5	4	13
F206	7.5	54	4	13
F207	7.5	58.5	5	15
F208	7.5	65	5	15
F209	7.5	68.5	5	16
F210	7.5	71.5	5	16
F211	9	81	6	18
F212	9	87.5	6	18
F213	9	93.5	6	22
F214	10	96.5	8	22
F215	10	100	8	22
F216	10	104	8	22
F217	10	110	8	24
F218	10	117.5	8	25
FX05	7.5	54	5	13
FX06	7.5	58.5	5	14
FX07	7.5	65	5	14
FX08	7.5	68.5	5	14
FX09	7.5	71.5	5	14
FX10	9	81	6	20
FX11	9	87.5	6	20
FX12	9	93.5	6	21
FX13	10	93.5	8	21
FX14	10	98.5	8	22
FX15	10	142	8	24
FX16	10	107	8	24
FX17	10	155	8	24
FX18	12	155	10	24
FX20	12	134	10	28
F305	7.5	55	5	13
F306	7.5	62.5	5	15
F307	7.5	67.5	5	16
F308	9	75	6	17
F309	9	80	6	18
F310	9	87.5	6	19
F311	10	92.5	8	20
F312	10	97.5	8	22
F313	10	104	8	22
F314	12	113	10	25
F315	12	118	10	25
F316	12	125	10	27
F317	12	130	10	27
F318	12	140	10	30
F319	12	145	10	30
F320	16	155	13	32
F321	16	155	13	32
F322	16	170	13	35
F324	16	185	13	40
F326	16	205	13	45
F328	16	225	13	55



(3) Machining dimensions of holes of oval flange type housing (FL) dowel pins (recommended)



Unit: mm

Nominal code	<i>a</i>	<i>b</i>	<i>d_s</i> (reference)	Pin seat thickness
FL204	26	9	4	11
FL205	32	10	4	13
FL206	34	12	4	13
FL207	34	14	5	14
FL208	35	15	5	14
FL209	40	15	5	15
FL210	41	16	5	15
FL211	43	19	6	18
FL212	52	22	6	18
FL213	50	21	6	20
FL214	52	22	8	20
FL215	53	23	8	20
FL216	56	23	8	20
FL217	57	25	8	22
FL218	57	26	8	23
FLX05	27	12	5	13
FLX06	30	14	5	14
FLX07	32	15	5	14
FLX08	33	15	5	14
FLX09	35	16	5	14
FLX10	37	19	6	20
FL305	32	12	5	13
FL306	46	14	5	15
FL307	44	14	5	16
FL308	45	17	6	17
FL309	53	19	6	18
FL310	53	19	6	19
FL311	52	20	8	20
FL312	60	21	8	22
FL313	60	25	8	25
FL314	68	26	10	28
FL315	64	26	10	30
FL316	74	29	10	32
FL317	75	31	10	32
FL318	74	32	10	36
FL319	80	32	10	40
FL320	86	34	13	40
FL322	86	36	13	42
FL324	94	41	13	48



Appendix Table

Appendix Table 6 Dimensional Tolerances of Shafts

Classification of shaft (mm)		Tolerance range class of shaft															
Over	Incl.	d 6	e 6	f 6	g 5	g 6	h 5	h 6	h 7	h 8	h 9	h 10	js 5	js 6	js 7	j 5	j 6
3	6	-30 -38	-20 -28	-10 -18	-4 -9	-4 -12	0 -5	0 -8	0 -12	0 -18	0 -30	0 -48	± 2.5	± 4	± 6	+3 -2	+6 -2
6	10	-40 -49	-25 -34	-13 -22	-5 -11	-5 -14	0 -6	0 -9	0 -15	0 -22	0 -36	0 -58	± 3	± 4.5	± 7.5	+4 -2	+7 -2
10	18	-50 -61	-32 -43	-16 -27	-6 -14	-6 -17	0 -8	0 -11	0 -18	0 -27	0 -43	0 -70	± 4	± 5.5	± 9	+5 -3	+8 -3
18	30	-65 -78	-40 -53	-20 -33	-7 -16	-7 -20	0 -9	0 -13	0 -21	0 -33	0 -52	0 -84	± 4.5	± 6.5	±10.5	+5 -4	+9 -4
30	50	-80 -96	-50 -66	-25 -41	-9 -20	-9 -25	0 -11	0 -16	0 -25	0 -39	0 -62	0 -100	± 5.5	± 8	±12.5	+6 -5	+11 -5
50	80	-100 -119	-60 -79	-30 -49	-10 -23	-10 -29	0 -13	0 -19	0 -30	0 -46	0 -74	0 -120	± 6.5	± 9.5	±15	+6 -7	+12 -7
80	120	-120 -142	-72 -94	-36 -58	-12 -27	-12 -34	0 -15	0 -22	0 -35	0 -54	0 -87	0 -140	± 7.5	±11	±17.5	+6 -9	+13 -9
120	180	-145 -170	-85 -110	-43 -68	-14 -32	-14 -39	0 -18	0 -25	0 -40	0 -63	0 -100	0 -160	± 9	±12.5	±20	+7 -11	+14 -11
180	250	-170 -199	-100 -129	-50 -79	-15 -35	-15 -44	0 -20	0 -29	0 -46	0 -72	0 -115	0 -185	±10	±14.5	±23	+7 -13	+16 -13
250	315	-190 -222	-110 -142	-56 -88	-17 -40	-17 -49	0 -23	0 -32	0 -52	0 -81	0 -130	0 -210	±11.5	±16	±26	+7 -16	±16
315	400	-210 -246	-125 -161	-62 -98	-18 -43	-18 -54	0 -25	0 -36	0 -57	0 -89	0 -140	0 -230	±12.5	±18	±28.5	+7 -18	±18
400	500	-230 -270	-135 -175	-68 -108	-20 -47	-20 -60	0 -27	0 -40	0 -63	0 -97	0 -155	0 -250	±13.5	±20	±31.5	+7 -20	±20
500	630	-260 -304	-145 -189	-76 -120	-22 -54	-22 -66	0 -32	0 -44	0 -70	0 -110	0 -175	0 -280	±16	±22	±35	-	-
630	800	-290 -340	-160 -210	-80 -130	-24 -60	-24 -74	0 -36	0 -50	0 -80	0 -125	0 -200	0 -320	±18	±25	±40	-	-
800	1,000	-320 -376	-170 -226	-86 -142	-26 -66	-26 -82	0 -40	0 -56	0 -90	0 -140	0 -230	0 -360	±20	±28	±45	-	-

*Δ_{dmp}: Variation of tolerance of average bore diameter in plane



Unit: μm (Reference)

											Classification of shaft (mm)		Δ_{imp}^* of bearing (class 0)
											Over	Incl.	
+ 6 + 1	+ 9 + 1	+13 + 1	+ 9 + 4	+12 + 4	+ 16 + 4	+13 + 8	+ 16 + 8	+ 20 + 12	+ 23 + 15	+ 27 + 15	3	6	0 - 8
+ 7 + 1	+10 + 1	+16 + 1	+12 + 6	+15 + 6	+ 21 + 6	+16 + 10	+ 19 + 10	+ 24 + 15	+ 28 + 19	+ 34 + 19	6	10	0 - 8
+ 9 + 1	+12 + 1	+19 + 1	+15 + 7	+18 + 7	+ 25 + 7	+20 +12	+ 23 + 12	+ 29 + 18	+ 34 + 23	+ 41 + 23	10	18	0 - 8
+11 + 2	+15 + 2	+23 + 2	+17 + 8	+21 + 8	+ 29 + 8	+24 + 8	+ 28 + 15	+ 35 + 22	+ 41 + 28	+ 49 + 28	18	30	0 - 10
+13 + 2	+18 + 2	+27 + 2	+20 + 9	+25 + 9	+ 34 + 9	+28 +17	+ 33 + 17	+ 42 + 26	+ 50 + 34	+ 59 + 34	30	50	0 - 12
+15 + 2	+21 + 2	+32 + 2	+24 +11	+30 +11	+ 41 + 11	+33 +20	+ 39 + 20	+ 51 + 32	+ 60 + 41	+ 71 + 41	50	65	0 - 15
									+ 62 + 43	+ 73 + 43	65	80	
+18 + 3	+25 + 3	+38 + 3	+28 +13	+35 +13	+ 48 + 13	+38 +23	+ 45 + 23	+ 59 + 37	+ 73 + 51	+ 86 + 51	80	100	0 - 20
									+ 76 + 54	+ 89 + 54	100	120	
+21 + 3	+28 + 3	+43 + 3	+33 +15	+40 +15	+ 55 + 15	+45 +27	+ 52 + 27	+ 68 + 43	+ 88 + 63	+103 + 63	120	140	0 - 25
									+ 90 + 65	+105 + 65	140	160	
									+ 93 + 68	+108 + 68	160	180	
+24 + 4	+33 + 4	+50 + 4	+37 +17	+46 +17	+ 63 + 17	+51 +31	+ 60 + 31	+ 79 + 50	+106 + 77	+123 + 77	180	200	0 - 30
									+109 + 80	+126 + 80	200	225	
									+113 + 84	+130 + 84	225	250	
+27 + 4	+36 + 4	+56 + 4	+43 +20	+52 +20	+ 72 + 20	+57 +34	+ 66 + 34	+ 88 + 56	+126 + 94	+146 + 94	250	280	0 - 35
									+130 + 98	+150 + 98	280	315	
+29 + 4	+40 + 4	+61 + 4	+46 +21	+57 +21	+ 78 + 21	+62 +37	+ 73 + 37	+ 98 + 62	+144 +108	+165 +108	315	355	0 - 40
									+150 +114	+171 +114	355	400	
+32 + 5	+45 + 5	+68 + 5	+50 +23	+63 +23	+ 86 + 23	+67 +40	+ 80 + 40	+108 + 68	+166 +126	+189 +126	400	450	0 - 45
									+172 +132	+195 +132	450	500	
+32 0	+44 0	+70 0	+58 +26	+70 +26	+ 96 + 26	+76 +44	+ 88 + 44	+122 + 78	+194 +150	+220 +150	500	560	0 - 50
									+199 +155	+225 +155	560	630	
+36 0	+50 0	+80 0	+66 +30	+80 +30	+110 + 30	+86 +50	+100 + 50	+138 + 88	+225 +175	+255 +175	630	710	0 - 75
									+235 +185	+265 +185	710	800	
+40 0	+56 0	+90 0	+74 +34	+90 +34	+124 + 34	+96 +56	+112 + 56	+156 +100	+266 +210	+300 +210	800	900	0 -100
									+276 +220	+310 +220	900	1,000	



Appendix Table

Appendix Table 7 Dimensional Tolerances of Housing Bores

Classification of shaft (mm)		Tolerance range class of bore														
Over	Incl.	E 6	F 6	F 7	G 6	G 7	H 6	H 7	H 8	H 9	H 10	JS 5	JS 6	JS 7	J 6	J 7
10	18	+43 +32	+27 +16	+34 +16	+17 +6	+24 +6	+11 0	+18 0	+27 0	+43 0	+70 0	±4	±5.5	±9	+6 -5	+10 -8
18	30	+53 +40	+33 +20	+41 +20	+20 +7	+28 +7	+13 0	+21 0	+33 0	+52 0	+84 0	±4.5	±6.5	±10.5	+8 -5	+12 -9
30	50	+66 +50	+41 +25	+50 +25	+25 +9	+34 +9	+16 0	+25 0	+39 0	+62 0	+100 0	±5.5	±8	±12.5	+10 -6	+14 -11
50	80	+79 +60	+49 +30	+60 +30	+29 +10	+40 +10	+19 0	+30 0	+46 0	+74 0	+120 0	±6.5	±9.5	±15	+13 -6	+18 -12
80	120	+94 +72	+58 +36	+71 +36	+34 +12	+47 +12	+22 0	+35 0	+54 0	+87 0	+140 0	±7.5	±11	±17.5	+16 -6	+22 -13
120	180	+110 +85	+68 +43	+83 +43	+39 +14	+54 +14	+25 0	+40 0	+63 0	+100 0	+160 0	±9	±12.5	±20	+18 -7	+26 -14
180	250	+129 +100	+79 +50	+96 +50	+44 +15	+61 +15	+29 0	+46 0	+72 0	+115 0	+185 0	±10	±14.5	±23	+22 -7	+30 -16
250	315	+142 +110	+88 +56	+108 +56	+49 +17	+69 +17	+32 0	+52 0	+81 0	+130 0	+210 0	±11.5	±16	±26	+25 -7	+36 -16
315	400	+161 +125	+98 +62	+119 +62	+54 +18	+75 +18	+36 0	+57 0	+89 0	+140 0	+230 0	±12.5	±18	±28.5	+29 -7	+39 -18
400	500	+175 +135	+108 +68	+131 +68	+60 +20	+83 +20	+40 0	+63 0	+97 0	+155 0	+250 0	±13.5	±20	±31.5	+33 -7	+43 -20
500	630	+189 +145	+120 +76	+146 +76	+66 +22	+92 +22	+44 0	+70 0	+110 0	+175 0	+280 0	±16	±22	±35	-	-
630	800	+210 +160	+130 +80	+160 +80	+74 +24	+104 +24	+50 0	+80 0	+125 0	+200 0	+320 0	±18	±25	±40	-	-
800	1,000	+226 +170	+142 +86	+176 +86	+82 +26	+116 +26	+56 0	+90 0	+140 0	+230 0	+360 0	±20	±28	±45	-	-
1,000	1,250	+261 +195	+164 +98	+203 +98	+94 +28	+133 +28	+66 0	+105 0	+165 0	+260 0	+420 0	±23.5	±33	±52.5	-	-

*Δ_{Dmp}: Variation of tolerance of average outside diameter in plate



Unit: μm (Reference)

													Classification of basic size (mm)		ΔD_{mp} * of bearing (class 0)
K 5	K 6	K 7	M 5	M 6	M 7	N 5	N 6	N 7	P 6	P 7	R 7	Over	Incl.		
+ 2 - 6	+ 2 - 9	+ 6 - 12	- 4 - 12	- 4 - 15	0 - 18	- 9 - 17	- 9 - 20	- 5 - 23	- 15 - 26	- 11 - 29	- 16 - 34	10	18	0 - 8	
+ 1 - 8	+ 2 - 11	+ 6 - 15	- 5 - 14	- 4 - 17	0 - 21	- 12 - 21	- 11 - 24	- 7 - 28	- 18 - 31	- 14 - 35	- 20 - 41	18	30	0 - 9	
+ 2 - 9	+ 3 - 13	+ 7 - 18	- 5 - 16	- 4 - 20	0 - 25	- 13 - 24	- 12 - 28	- 8 - 33	- 21 - 37	- 17 - 42	- 25 - 50	30	50	0 - 11	
+ 3 - 10	+ 4 - 15	+ 9 - 21	- 6 - 19	- 5 - 24	0 - 30	- 15 - 28	- 14 - 33	- 9 - 39	- 26 - 45	- 21 - 51	- 30 - 60	50	65	0 - 13	
											- 32 - 62	65	80		
+ 2 - 13	+ 4 - 18	+ 10 - 25	- 8 - 23	- 6 - 28	0 - 35	- 18 - 33	- 16 - 38	- 10 - 45	- 30 - 52	- 24 - 59	- 38 - 73	80	100	0 - 15	
											- 41 - 76	100	120		
+ 3 - 15	+ 4 - 21	+ 12 - 28	- 9 - 27	- 8 - 33	0 - 40	- 21 - 39	- 20 - 45	- 12 - 52	- 36 - 61	- 28 - 68	- 48 - 88	120	140	(150 max.) 0 - 18 (Over 150) 0 - 25	
											- 50 - 90	140	160		
											- 53 - 93	160	180		
+ 2 - 18	+ 5 - 24	+ 13 - 33	- 11 - 31	- 8 - 37	0 - 46	- 25 - 45	- 22 - 51	- 14 - 60	- 41 - 70	- 33 - 79	- 60 - 106	180	200	0 - 30	
											- 63 - 109	200	225		
											- 67 - 113	225	250		
+ 3 - 20	+ 5 - 27	+ 16 - 36	- 13 - 36	- 9 - 41	0 - 52	- 27 - 50	- 25 - 57	- 14 - 66	- 47 - 79	- 36 - 88	- 74 - 126	250	280	0 - 35	
											- 78 - 130	280	315		
											- 87 - 144	315	355		
+ 3 - 22	+ 7 - 29	+ 17 - 40	- 14 - 39	- 10 - 46	0 - 57	- 30 - 55	- 26 - 62	- 16 - 73	- 51 - 87	- 41 - 98	- 93 - 150	355	400	0 - 40	
											- 103 - 166	400	450		
											- 109 - 172	450	500		
+ 2 - 25	+ 8 - 32	+ 18 - 45	- 16 - 43	- 10 - 50	0 - 63	- 33 - 60	- 27 - 67	- 17 - 80	- 55 - 95	- 45 - 108	- 150 - 220	500	560	0 - 45	
											- 155 - 225	560	630		
											- 175 - 255	630	710		
0 - 36	0 - 50	0 - 80	- 30 - 66	- 30 - 80	- 30 - 110	- 50 - 86	- 50 - 100	- 50 - 130	- 88 - 138	- 88 - 168	- 185 - 265	710	800	0 - 75	
											- 210 - 300	800	900		
											- 220 - 310	900	1,000		
0 - 40	0 - 56	0 - 90	- 34 - 74	- 34 - 90	- 34 - 124	- 56 - 96	- 56 - 112	- 56 - 146	- 100 - 156	- 100 - 190	- 250 - 355	1,000	1,120	0 - 100	
											- 260 - 365	1,120	1,250		
											- 260 - 365	1,120	1,250		



Appendix Table

Appendix Table 8 Basic Tolerance Values

Classification of basic size (mm)		Tolerance class (IT)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14 ¹⁾	15 ¹⁾	16 ¹⁾	17 ¹⁾	18 ¹⁾
Over	Incl.	Basic tolerance value (µm)											Basic tolerance value (mm)						
-	3	0.8	1.2	2	3	4	6	10	14	25	40	60	0.10	0.14	0.26	0.40	0.60	1.00	1.40
3	6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.30	0.48	0.75	1.20	1.80
6	10	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.90	1.50	2.20
10	18	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.70	1.10	1.80	2.70
18	30	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.30	2.10	3.30
30	50	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1.00	1.60	2.50	3.90
50	80	2	3	5	8	13	19	30	46	74	120	190	0.30	0.46	0.74	1.20	1.90	3.00	4.60
80	120	2.5	4	6	10	15	22	35	54	87	140	220	0.35	0.54	0.87	1.40	2.20	3.50	5.40
120	180	3.5	5	8	12	18	25	40	63	100	160	250	0.40	0.63	1.00	1.60	2.50	4.00	6.30
180	250	4.5	7	10	14	20	29	46	72	115	185	290	0.46	0.72	1.15	1.85	2.90	4.60	7.20
250	315	6	8	12	16	23	32	52	81	130	210	320	0.52	0.81	1.30	2.10	3.20	5.20	8.10
315	400	7	9	13	18	25	36	57	89	140	230	360	0.57	0.89	1.40	2.30	3.60	5.70	8.90
400	500	8	10	15	20	27	40	63	97	155	250	400	0.63	0.97	1.55	2.50	4.00	6.30	9.70
500	630	-	-	-	-	-	44	70	110	175	280	440	0.70	1.10	1.75	2.80	4.40	7.00	11.00
630	800	-	-	-	-	-	50	80	125	200	320	500	0.80	1.25	2.00	3.20	5.00	8.00	12.50
800	1,000	-	-	-	-	-	56	90	140	230	360	560	0.90	1.40	2.30	3.60	5.60	9.00	14.00
1,000	1,250	-	-	-	-	-	66	105	165	260	420	660	1.05	1.65	2.60	4.20	6.60	10.50	16.50
1,250	1,600	-	-	-	-	-	78	125	195	310	500	780	1.25	1.95	3.10	5.00	7.80	12.50	19.50
1,600	2,000	-	-	-	-	-	92	150	230	370	600	920	1.50	2.30	3.70	6.00	9.20	15.00	23.00
2,000	2,500	-	-	-	-	-	110	175	280	440	700	1,100	1.75	2.80	4.40	7.00	11.00	17.50	28.00
2,500	3,150	-	-	-	-	-	135	210	330	540	860	1,350	2.10	3.30	5.40	8.60	13.50	21.00	33.00

Note ¹⁾ Tolerance classes from IT14 to IT18 can not be applied to basic size 1 mm or less.



Appendix Table 9 SI Unit Conversion Charts

Force

N	dyn	kgf
1	1×10^5	1.01972×10^{-1}
1×10^{-5}	1	1.01972×10^{-6}
9.80665	9.80665×10^5	1

Moment of force (torque)

N · m	mN · m	μ N · m	kgf · m	kgf · cm	gf · cm
1	1×10^3	1×10^6	1.01972×10^{-1}	1.01972×10	1.01972×10^4
1×10^{-3}	1	1×10^3	1.01972×10^{-4}	1.01972×10^{-2}	1.01972×10
1×10^{-6}	1×10^{-3}	1	1.01972×10^{-7}	1.01972×10^{-5}	1.01972×10^{-2}
9.80665	9.80665×10^3	9.80665×10^6	1	1×10^2	1×10^5
9.80665×10^{-2}	9.80665×10	9.80665×10^4	1×10^{-2}	1	1×10^3
9.80665×10^{-5}	9.80665×10^{-2}	9.80665×10	1×10^{-5}	1×10^{-3}	1

Stress

Pa or N/m ²	MPa or N/mm ²	kgf/mm ²	kgf/cm ²
1	1×10^{-6}	1.01972×10^{-7}	1.01972×10^{-5}
1×10^6	1	1.01972×10^{-1}	1.01972×10
9.80665×10^6	9.80665	1	1×10^2
9.80665×10^4	9.80665×10^{-2}	1×10^{-2}	1

Remark 1 Pa = 1 N/m², 1 MPa = 1 N/mm²

Pressure

Pa	kPa	MPa	bar	kgf/cm ²	atm	mmH ₂ O	mmHg or Torr
1	1×10^{-3}	1×10^{-6}	1×10^{-5}	1.01972×10^{-5}	9.86923×10^{-6}	1.01972×10^{-1}	7.50062×10^{-3}
1×10^3	1	1×10^{-3}	1×10^{-2}	1.01972×10^{-2}	9.86923×10^{-3}	1.01972×10^2	7.50062
1×10^6	1×10^3	1	1x10	1.01972×10	9.86923	1.01972×10^5	7.50062×10^3
1×10^5	1×10^2	1×10^{-1}	1	1.01972	9.86923×10^{-1}	1.01972×10^4	7.50062×10^2
9.80665×10^4	9.80665×10	9.80665×10^{-2}	9.80665×10^{-1}	1	9.67841×10^{-1}	1×10^4	7.35559×10^2
1.01325×10^5	1.01325×10^2	1.01325×10^{-1}	1.01325	1.03323	1	1.03323×10^4	7.60000×10^2
9.80665	9.80665×10^{-3}	9.80665×10^{-6}	9.80665×10^{-5}	1×10^{-4}	9.67841×10^{-5}	1	7.35559×10^{-2}
1.33322×10^2	1.33322×10^{-1}	1.33322×10^{-4}	1.33322×10^{-3}	1.35951×10^{-3}	1.31579×10^{-3}	1.35951×10	1

Remark 1 Pa = 1 N/m²

Kinematic viscosity

m ² /s	cSt	St
1	1×10^6	1×10^4
1×10^{-6}	1	1×10^{-2}
1×10^{-4}	1×10^2	1

Remark 1 cSt = 1 mm²/s, 1 St = 1 cm²/s



Appendix Table 11 Hardness Conversion Chart

Rockwell C scale 1,471.0 N (150 kgf)	Vickers	Brinell		Rockwell		Shore
		Standard steel ball	Tungsten carbide steel ball	A scale 588.4 N (60 kgf)	B scale 980.7 N (100 kgf)	
68	940			85.6		97
67	900			85.0		95
66	865			84.5		92
65	832		739	83.9		91
64	800		722	83.4		88
63	772		705	82.8		87
62	746		688	82.3		85
61	720		670	81.8		83
60	697		654	81.2		81
59	674		634	80.7		80
58	653		615	80.1		78
57	633		595	79.6		76
56	613		577	79.0		75
55	595	-	560	78.5		74
54	577	-	543	78.0		72
53	560	-	525	77.4		71
52	544	500	512	76.8		69
51	528	487	496	76.3		68
50	513	475	481	75.9		67
49	498	464	469	75.2		66
48	484	451	455	74.7		64
47	471	442	443	74.1		63
46	458	432	432	73.6		62
45	446		421	73.1		60
44	434		409	72.5		58
43	423		400	72.0		57
42	412		390	71.5		56
41	402		381	70.9		55
40	392		371	70.4	-	54
39	382		362	69.9	-	52
38	372		353	69.4	-	51
37	363		344	68.9	-	50
36	354		336	68.4	(109.0)	49
35	345		327	67.9	(108.5)	48
34	336		319	67.4	(108.0)	47
33	327		311	66.8	(107.5)	46
32	318		301	66.3	(107.0)	44
31	310		294	65.8	(106.0)	43
30	302		286	65.3	(105.5)	42
29	294		279	64.7	(104.5)	41
28	286		271	64.3	(104.0)	41
27	279		264	63.8	(103.0)	40
26	272		258	63.3	(102.5)	38
25	266		253	62.8	(101.5)	38
24	260		247	62.4	(101.0)	37
23	254		243	62.0	100.0	36
22	248		237	61.5	99.0	35
21	243		231	61.0	98.5	35
20	238		226	60.5	97.8	34
(18)	230		219	-	96.7	33
(16)	222		212	-	95.5	32
(14)	213		203	-	93.9	31
(12)	204		194	-	92.3	29
(10)	196		187		90.7	28
(8)	188		179		89.5	27
(6)	180		171		87.1	26
(4)	173		165		85.5	25
(2)	166		158		83.5	24
(0)	160		152		81.7	24



Appendix Table

Appendix Table 12 Viscosity Conversion Chart

Kinematic viscosity mm ² /s	Saybolt SUS (second)		Redwood R (second)		Engler E (degree)
	100 °F	210 °F	50 °C	100 °C	
	2	32.6	32.8	30.8	
3	36.0	36.3	33.3	33.7	1.22
4	39.1	39.4	35.9	36.5	1.31
5	42.3	42.6	38.5	39.1	1.40
6	45.5	45.8	41.1	41.7	1.48
7	48.7	49.0	43.7	44.3	1.56
8	52.0	52.4	46.3	47.0	1.65
9	55.4	55.8	49.1	50.0	1.75
10	58.8	59.2	52.1	52.9	1.84
11	62.3	62.7	55.1	56.0	1.93
12	65.9	66.4	58.2	59.1	2.02
13	69.6	70.1	61.4	62.3	2.12
14	73.4	73.9	64.7	65.6	2.22
15	77.2	77.7	68.0	69.1	2.32
16	81.1	81.7	71.5	72.6	2.43
17	85.1	85.7	75.0	76.1	2.54
18	89.2	89.8	78.6	79.7	2.64
19	93.3	94.0	82.1	83.6	2.76
20	97.5	98.2	85.8	87.4	2.87
21	102	102	89.5	91.3	2.98
22	106	107	93.3	95.1	3.10
23	110	111	97.1	98.9	3.22
24	115	115	101	103	3.34
25	119	120	105	107	3.46
26	123	124	109	111	3.58
27	128	129	112	115	3.70
28	132	133	116	119	3.82
29	137	138	120	123	3.95
30	141	142	124	127	4.07
31	145	146	128	131	4.20
32	150	150	132	135	4.32
33	154	155	136	139	4.45
34	159	160	140	143	4.57

Kinematic viscosity mm ² /s	Saybolt SUS (second)		Redwood R (second)		Engler E (degree)
	100 °F	210 °F	50 °C	100 °C	
	35	163	164	144	
36	168	170	148	151	4.83
37	172	173	153	155	4.96
38	177	178	156	159	5.08
39	181	183	160	164	5.21
40	186	187	164	168	5.34
41	190	192	168	172	5.47
42	195	196	172	176	5.59
43	199	201	176	180	5.72
44	204	205	180	185	5.85
45	208	210	184	189	5.98
46	213	215	188	193	6.11
47	218	219	193	197	6.24
48	222	224	197	202	6.37
49	227	228	201	206	6.50
50	231	233	205	210	6.63
55	254	256	225	231	7.24
60	277	279	245	252	7.90
65	300	302	266	273	8.55
70	323	326	286	294	9.21
75	346	349	306	315	9.89
80	371	373	326	336	10.5
85	394	397	347	357	11.2
90	417	420	367	378	11.8
95	440	443	387	399	12.5
100	464	467	408	420	13.2
120	556	560	490	504	15.8
140	649	653	571	588	18.4
160	742	747	653	672	21.1
180	834	840	734	757	23.7
200	927	933	816	841	26.3
250	1,159	1,167	1,020	1,051	32.9
300	1,391	1,400	1,224	1,241	39.5

Remark 1 mm²/s = 1 cSt (centistokes)



Appendix Table 13 Mechanical Properties of Metal Materials (reference)

(1) Modulus of longitudinal elasticity, elastic limit, and ultimate strength

Material	Main components and others	Specific gravity	Modulus of longitudinal elasticity (GPa)	Elastic limit σ_e (MPa)	Ultimate strength (MPa)		
					Tensile K_t	Compression K_c	Shear K_s
Gray cast iron (FC150)		7.1-7.3	69	29	118	590	108
(FC200)		7.1-7.3	98	88	137- 216	740	206
(FC250)		7.1-7.3	103	88	176- 314	880	206
White heart malleable cast iron	Residual carbon: 1.6% or less	7.1-7.3	158	196	314- 392	820	382
Black heart malleable cast iron		7.2-7.6	158	196	274- 392	820	382
Carbon steel	General	7.7-7.8	196-216	176-245	314- 830	Virtually identical to tensile strength, provided buckling can be ignored	-
Extra mild steel	C 0.05-0.15%	7.8	196	118	Over 372		0.8 K_t
Mild steel	C 0.15-0.25%	7.8	204	157	372- 392		0.75 K_t
Middle hard steel	C 0.25-0.40%	7.8	206	245-294	490- 590		0.75 K_t
Hard steel	C 0.40-0.50%	7.8	216	343	590- 690		0.7 K_t
Maximum hard steel	C 0.50-0.65%	7.8	216	372	690- 830		0.65 K_t
Mild steel	C 0.18% hot rolling	7.8	206	176	421		314
Hard steel	Oil hardening, tempering at 700 °C	7.8	206	343	590		461
Tool steel	C 0.60-1.50% hardening	7.8	216	441	660		820
Cast steel	General	7.8-7.9	206-211	176-245	343- 600		343-600
Cast steel (mild)	C 0.15-0.22%	7.8-7.9	206	196	363- 431	363-431	284
Cast steel (middle hard)	C 0.22-0.30%	7.8-7.9	211	225	392- 490	392-490	333
Cast steel (hard)	C 0.30-0.40%	7.9	211	245	490- 590	490-590	382
Nickel steel	C 0.25-0.35% Ni 2-5%	7.85	206-216	333	640- 830	640	401
Chrome steel	C 0.13-0.48% Cr 0.9-1.2%	7.85	206-216	-	780- 980	-	-
Nickel chrome steel	C, Ni, Cr included	7.85	206-216	-	740- 980	-	382-500
Chromium molybdenum steel	C, Cr, Mo included	7.85	206-216	-	830- 980	-	-
Manganese steel	C 0.2-0.46% Mn 1-1.4%	7.85	206-216	-	440-1,080	-	-
Spring steel		7.86	216	735	1,080-1,670	1,670	-
Stainless steel	C, Cr, Ni included	7.75	206-216	-	620	-	410
Brass casting	Cu 60% Zn 40%	8.5	69	-	176- 216	108	147
Brass (forged plate)	Cu 60% Zn 40%	8.4	78- 98	-	274- 392	314	206
Brass (forged rod)	Cu 60% Zn 40%	8.4	82	-	520	314	314
Phosphor bronze casting	Cu 90% Sn 10% P 0.1%	8.8	93-103	-	196- 294	137	176
Phosphor bronze (forging)	Cu 90% Sn 10% P 0.1%	8.8	132	-	294- 980	206	382
Tin		7.28	39- 54	-	27	-	-
Lead		11.34	15- 17	-	20	-	-
Zinc		7.1	78-127	-	78- 176	-	-

(2) Allowable stress

Unit: MPa

Material	Tensile K_t			Compression K_c		Bending K_b			Shear K_s			Torsion K_d		
	a	b	c	a	b	a	b	c	a	b	c	a	b	c
Cast iron (cast)	29- 34	20- 23	10-12	88- 98	59- 65	45- 59	30- 39	15-20	29- 34	20-23	10-12	26- 34	18-23	88-118
Cast iron (machined)	29- 34	20- 23	10-12	88- 98	59- 65	55- 71	-	-	29- 34	20-23	10-12	26- 34	18-23	88-118
Malleable cast iron	44- 69	29- 46	15-23	59- 88	39- 59	44- 98	29- 46	15-23	-	-	-	29- 39	20-26	10- 13
Cast steel	59-118	39- 78	20-39	88-147	59- 98	74-118	49- 78	25-39	47- 94	31-63	16-31	47- 94	31-63	16- 31
Mild steel	98-157	66-105	32-52	98-157	66-105	88-147	59- 98	35-49	78-127	52-85	26-42	78-137	52-91	26- 46
Middle hard steel	118-176	78-118	39-59	118-176	78-118	118-176	78-118	39-59	94-137	63-94	31-47	88-137	59-94	29- 47
Nickel steel	118-176	78-118	39-59	118-176	78-118	118-176	78-118	39-59	94-137	63-94	31-47	88-137	59-92	29- 47
Carbon steel casting	88-118	59- 78	29-39	88-118	59- 78	88-118	59- 78	29-39	71- 93	47-63	24-31	35- 47	24-31	12- 16
Brass (rolled)	10- 59	26- 35	13-20	39- 59	26- 39	39- 59	26- 39	13-20	34- 47	21-31	11-16	31- 47	21-31	11- 16
Bronze	29- 39	20- 26	10-13	29- 39	20- 26	29- 39	20- 26	10-13	-	-	-	-	-	-
Phosphor bronze	59- 88	39- 59	20-29	59- 88	39- 59	59- 88	39- 59	20-29	44- 69	29-46	15-23	44- 69	29-46	15- 23
Aluminum casting	10- 12	7- 8	2- 4	-	-	15- 20	10- 13	5- 7	-	-	-	-	-	-

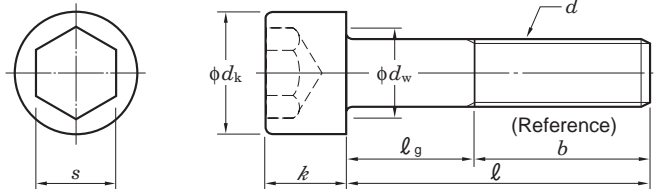
Remarks 1. a is applicable in the case of static load, b is applicable in the case of dynamic load, and c is applicable to in the case of repeated load.
2. Bending allowable stress K_b and torsion allowable stress K_d of cast iron are applicable when the cross section is round and safety factor is within a range from 5 to 6.



Appendix Table

Appendix Table 14 (1) Hexagon Socket Head Cap Screws (abstract from JIS B 1176: 1988)

M 1.6 – 24



Allowance of bolt length (ℓ)

Unit: mm

Bolt length (ℓ)		Allowance of length
Over	Incl.	
-	3	±0.2
3	6	±0.24
6	10	±0.29
10	16	±0.35
16	30	±0.42
30	50	±0.5
50	80	±0.6
80	120	±0.7
120	180	±0.8
180	240	±0.95
240	300	±1.05

(1) Parts class A M 1.6–24

Unit: mm

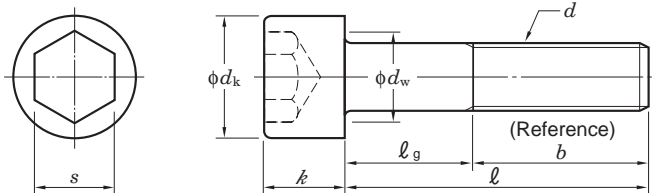
Nominal size of screw <i>d</i>	Coarse screw thread pitch	M 1.6	M 2	M 2.5	M 3	M 4	M 5	M 6	M 8	M 10	M 12	(M 14)	M 16	(M 18)	M 20	(M 22)	M 24
Head dia. <i>d_k</i>		3	3.8	4.5	5.5	7	8.5	10	13	16	18	21	24	27	30	33	36
Head height <i>k</i>		1.6	2	2.5	3	4	5	6	8	10	12	14	16	18	20	22	24
Bearing surface dia. <i>d_w</i> (min.)		2.72	3.4	4.18	5.07	6.53	8.03	9.38	12.33	15.33	17.23	20.17	23.17	25.87	28.87	31.81	34.81
Nominal size of hexagon socket <i>s</i>		1.5	1.5	2	2.5	3	4	5	6	8	10	12	14	14	17	17	19
Thread length <i>b</i> (reference)		15	16	17	18	20	22	24	28	32	36	40	44	48	52	56	60

Nominal length ℓ	M 1.6	Body length ℓ _g (max.)															
2.5																	
3		M 2															
4		M 2.5															
5		M 3															
6		M 4															
8		M 5															
10		M 6															
12		M 8															
16		M 10															
20		M 12															
25		M 14															
30		M 16															
35		M 18															
40		M 20															
45		M 22															
50		M 24															
55																	
60																	
65																	
70																	
80																	
90																	
100																	
110																	
120																	
130																	
140																	
150																	
160																	
180																	
200																	

- Remarks
- Priority is given to the nominal sizes of screws without parentheses.
 - Nominal lengths (ℓ) to be recommended for the nominal sizes of screw are within the range enclosed by bold lines in the column of "Body length ℓ_g". In the column of "Body length ℓ_g", thread of the screw with length shorter than that indicated under dotted lines should be continuous. For the continuous thread stud screw, the incomplete thread portion length under the neck of the screw should be approximately three times of the thread pitch.
 - The sides of the head of screw should be single or double knurled. The *d_k* values in the table are the maximum values without knurls.
 - Roundness or chamfers on the bearing surface should be provided between the diameter of the head (*d_k*) and the diameter of bearing surface (*d_w*), and the surface should be free from burrs.

Appendix Table 14 (2) Hexagon Socket Head Cap Screws (abstract from JIS B 1176: 1988)

M 27 – 52



Allowance of bolt length (ℓ)

Unit: mm

Bolt length (ℓ)		Allowance of length
Over	Incl.	
-	3	± 0.2
3	6	± 0.24
6	10	± 0.29
10	16	± 0.35
16	30	± 0.42
30	50	± 0.5
50	80	± 0.6
80	120	± 0.7
120	180	± 0.8
180	240	± 0.95
240	300	± 1.05

(2) Parts class A M 27–52

Unit: mm

Nominal size of screw d	Coarse screw thread pitch	(M 27)	M 30	(M 33)	M 36	(M 39)	M 42	(M 45)	M 48	(M 52)
Head dia. d_k		40	45	50	54	58	63	68	72	78
Head height k		27	30	33	36	39	42	45	48	52
Bearing surface dia. d_w (min.)		38.61	43.61	48.61	52.54	56.34	61.34	66.34	70.34	76.34
Nominal size of hexagon socket s		19	22	24	27	27	32	32	36	36
Thread length b (reference)		66	72	78	84	90	96	102	108	116

Nominal length ℓ	(M 27)	M 30	Body length ℓ_g (max.)							
45										
50										
55										
60										
65										
70										
80										
90										
100										
110										
120										
130										
140										
150										
160										
180										
200										
220										
240										
260										
280										
300										

- Remarks
- Priority is given to the nominal sizes of screws without parentheses.
 - Nominal lengths (ℓ) to be recommended for the nominal sizes of screw are within the range enclosed by bold lines in the column of "Body length ℓ_g ". In the column of "Body length ℓ_g ", thread of the screw with length shorter than that indicated under dotted lines should be continuous. For the continuous thread stud screw, the incomplete thread portion length under the neck of the screw should be approximately three times of the thread pitch.
 - The sides of the head of screw should be single or double knurled. The d_k values in the table are the maximum values without knurls.
 - Roundness or chamfers on the bearing surface should be provided between the diameter of the head (d_k) and the diameter of bearing surface (d_w), and the surface should be free from burrs.

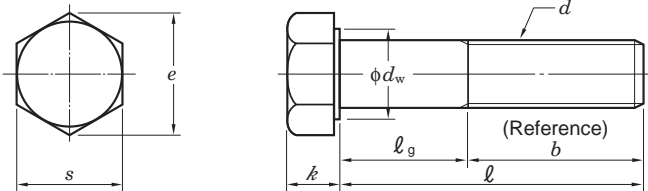
Appendix Table

Appendix Table 15 (1) Hexagon Head Bolts (abstract from JIS B 1180: 1994)

Parts class A M 1.6 – 24

Allowance of bolt length (ℓ)

Unit: mm



Bolt length (ℓ)		Allowance of length
Over	Incl.	
-	20	± 0.35
20	30	± 0.42
30	50	± 0.5
50	80	± 0.6
80	120	± 0.7
120	150	± 0.8

(1) Parts class A M 1.6–24

Unit: mm

Nominal size of screw d	Coarse screw thread pitch	M 1.6	M 2	M 2.5	M 3	(M 3.5)	M 4	M 5	M 6	M 8	M 10	M 12	(M 14)	M 16	(M 18)	M 20	M 24	
		Fine thread	-	-	-	-	-	-	-	-	M 8 x 1	M 10 x 1	M 12 x 1.5	-	M 16 x 1.5	-	M 20 x 1.5	M 24 x 2
Bearing surface dia. d_w (min.)		2.27	3.07	4.07	4.57	5.07	5.88	6.88	8.88	11.63	14.63	16.63	19.64	22.49	25.34	28.19	31.71	33.61
Width across flats s (max.)		3.2	4	5	5.5	6	7	8	10	13	16	18	21	24	27	30	34	36
Width across corners e (min.)		3.41	4.32	5.45	6.01	6.58	7.66	8.79	11.05	14.38	17.77	20.03	23.36	26.75	30.14	33.53	37.72	39.98
Head height k (basic)		1.1	1.4	1.7	2	2.4	2.8	3.5	4	5.3	6.4	7.5	8.8	10	11.5	12.5	14	15
Thread length b (reference)	$\ell \leq 125$	9	10	11	12	13	14	16	18	22	26	30	34	38	42	46	50	54
	$125 < \ell \leq 150$	-	-	-	-	-	-	-	-	-	-	-	40	44	48	52	56	60

Nominal length ℓ	Body length ℓ_g (max.)																			
12	3	M 2	M 2.5																	
16	7	6	5	M 3	(M 3.5)															
20		10	9	8	7	M 4	M 5													
25			14	13	12	11	9	M 6												
30				18	17	16	14	12												
35					22	21	19	17	M 8											
40						26	24	22	18	M 10										
45							29	27	23	19	M 12									
50								34	32	28	24	20								
55									37	33	29	25	(M 14)							
60									42	38	34	30	26	M 16						
65									43	39	35	31	27	(M 18)						
70										48	44	40	36	32	28	M 20				
80											58	54	50	46	42	38	34	(M 22)	M 24	
90												64	60	56	52	48	44	40	36	
100													74	70	66	62	58	54	50	46
110														80	76	72	68	64	60	56
120															90	86	82	78	74	70
130																90	86	82	78	74
140																	96	92	88	84
150																		106	102	98

As for the bolts with nominal length within this area, standards of continuous thread stud hexagon head bolt (parts class A) should be observed.

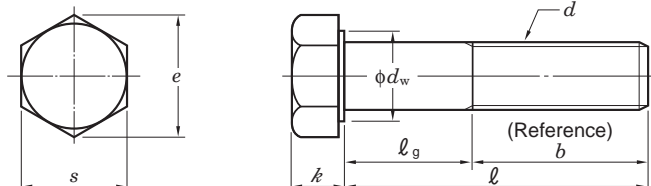
- Remarks 1. Priority is given to the nominal sizes of screws without parentheses.
- 2. Nominal lengths (ℓ) to be recommended for the nominal sizes of screw are within the range enclosed by bold lines.
- 3. Body length ℓ_g (maximum) should be found by the following formula : ℓ_g (maximum) = Nominal length (ℓ) – Thread length (b)

Appendix Table 15 (2) Hexagon Head Bolts (abstract from JIS B 1180: 1994)

Parts class B M 16 – 64

Allowance of bolt length (ℓ)

Unit: mm



Bolt length (ℓ)		Allowance of length
Over	Incl.	
-	80	± 1.5
80	90	± 1.7
90	120	± 1.75
120	180	± 2
180	240	± 2.3
240	300	± 2.6
300	400	± 2.85
400	500	± 3.15

(2) Parts class B M 16–64

Unit: mm

Nominal size of screw d	Coarse screw thread pitch																
	M 16	(M 18)	M 20	(M 22)	M 24	(M 27)	M 30	(M 33)	M 36	(M 39)	M 42	(M 45)	M 48	(M 52)	M 56	(M 60)	M 64
	2	2.5	2.5	2.5	3	3	3.5	3.5	4	4	4.5	4.5	5	5	5.5	5.5	6
	Fine thread																
	M 16 x 1.5	-	M 20 x 1.5	-	M 24 x 2	-	M 30 x 2	-	M 36 x 3	-	M 42 x 3	-	M 48 x 3	-	M 56 x 4	-	M 64 x 4
	-	(M 18 x 1.5)	(M 20 x 2)	(M 22 x 1.5)	-	(M 27 x 2)	-	(M 33 x 2)	-	(M 39 x 3)	-	(M 45 x 3)	-	(M 52 x 4)	-	(M 60 x 4)	-
Bearing surface dia. d_w (min.)	22	24.85	27.7	31.35	33.25	38	42.75	46.55	51.11	55.86	59.95	64.7	69.45	74.2	78.66	83.41	88.16
Width across flats s (max.)	24	27	30	34	36	41	46	50	55	60	65	70	75	80	85	90	95
Width across corners e (min.)	26.17	29.56	32.95	37.29	39.55	45.2	50.85	55.37	60.79	66.44	71.3	76.95	82.6	88.25	93.56	99.21	104.86
Head height k (basic)	10	11.5	12.5	14	15	17	18.7	21	22.5	25	26	28	30	33	35	38	40
Thread length b (reference)	$\ell \leq 125$	38	42	46	50	54	60	66	-	-	-	-	-	-	-	-	-
	$125 < \ell \leq 200$	44	48	52	56	60	66	72	78	84	90	96	102	108	116	-	-
	$200 < \ell \leq 500$	-	-	-	69	73	79	85	91	97	103	109	115	121	129	137	145

Nominal length ℓ	M 16 Body length ℓ_g (max.)																															
65	As for the bolts with nominal length within this area, standards of (1) parts class A should be observed.																															
70																																
80																																
90																																
100																																
110																																
120																																
130																																
140																																
150																																
160																	116	112	108	104	100	94	88	82	76	70	64	(M 45)	M 48			
180																	132	128	124	120	114	108	102	96	90	84	78	72	(M 52)	M 56		
200																	148		144	140	134	128	122	116	110	104	98	92	84	M 56		
220																	151			147	141	135	129	123	117	111	105	99	91	83	(M 60)	
240																	167				161	155	149	143	137	131	125	119	111	103	95	M 64
260																	181					175	169	163	157	151	145	139	131	123	115	107
280	195						189	183	177	171	165	159	151	143	135	127																
300	215							209	203	197	191	185	179	171	163	155	147															
320	229								223	217	211	205	199	191	183	175	167															
340	243									237	231	225	219	211	203	195	187															
360	263										257	251	245	239	231	223	215	207														
380	277											271	265	259	251	243	235	227														
400	291												285	279	271	263	255	247														
420	311													305	299	291	283	275	267													
440	325														319	311	303	295	287													
460	339															331	323	315	307													
480	359																351	343	335	327												
500	371																	363	355	347												

As for the bolts with nominal length within this area, standards of continuous thread stud hexagon head bolt (parts class A or B) should be observed.

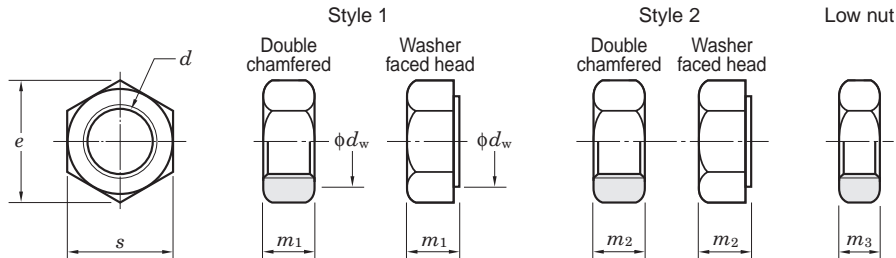
- Remarks 1. Priority is given to the nominal sizes of screws without parentheses.
 2. Nominal lengths (ℓ) to be recommended for the nominal sizes of screw are within the range enclosed by bold lines.
 3. Body length ℓ_g (maximum) should be found by the following formula : ℓ_g (maximum) = Nominal length (ℓ) - Thread length (b)

Appendix Table

Appendix Table 16 Hexagon Head Nuts (abstract from JIS B 1181: 1993)

Parts class A M 1.6 – 16

Parts class B M 18 – 64



(1) Parts class A M 1.6–16

Unit: mm

Nominal size of screw <i>d</i>	Coarse screw thread pitch	M 1.6	M 2	M 2.5	M 3	(M 3.5)	M 4	M 5	M 6	M 8	M 10	M 12	(M 14)	M 16
		Fine thread	–	–	–	–	–	–	–	–	M 8 x 1	M 10 x 1	M 12 x 1.5	–
		–	–	–	–	–	–	–	–	–	(M 10 x 1.25)	(M 12 x 1.25)	(M 14 x 1.5)	–
Bearing surface dia. <i>d_w</i> (min.)		2.27	3.07	4.07	4.57	5.07	5.88	6.88	8.88	11.63	14.63	16.63	19.64	22.49
Width across flats <i>s</i> (max.)		3.2	4	5	5.5	6	7	8	10	13	16	18	21	24
Width across corners <i>e</i> (min.)		3.41	4.32	5.45	6.01	6.58	7.66	8.79	11.05	14.38	17.77	20.03	23.36	26.75
Height	<i>m₁</i> (max.)	1.3	1.6	2	2.4	2.8	3.2	4.7	5.2	6.8	8.4	10.8	12.8	14.8
	<i>m₂</i> (max.)	–	–	–	–	–	–	5.1	5.7	7.5	9.3	12	14.1	16.4
	<i>m₃</i> (max.)	1	1.2	1.6	1.8	2	2.2	2.7	3.2	4	5	6	7	8

Remark Priority is given to the nominal sizes of screws without parentheses.

(2) Parts class B M 18–64

Unit: mm

Nominal size of screw <i>d</i>	Coarse screw thread pitch	(M 18)	M 20	(M 22)	M 24	(M 27)	M 30	(M 33)	M 36	(M 39)	M 42	(M 45)	M 48	(M 52)	M 56	(M 60)	M 64
		Fine thread	–	M 20 x 1.5	–	M 24 x 2	–	M 30 x 2	–	M 36 x 3	–	M 42 x 3	–	M 48 x 3	–	M 56 x 4	–
		(M 18 x 1.5)	(M 20 x 2)	(M 22 x 1.5)	–	(M 27 x 2)	–	(M 33 x 2)	–	(M 39 x 3)	–	(M 45 x 3)	–	(M 52 x 4)	–	(M 60 x 4)	–
Bearing surface dia. <i>d_w</i> (min.)		24.85	27.7	31.35	33.25	38	42.75	46.55	51.11	55.86	59.95	64.7	69.45	74.2	78.66	83.41	88.16
Width across flats <i>s</i> (max.)		27	30	34	36	41	46	50	55	60	65	70	75	80	85	90	95
Width across corners <i>e</i> (min.)		29.56	32.95	37.29	39.55	45.2	50.85	55.37	60.79	66.44	71.3	76.95	82.6	88.25	93.56	99.21	104.86
Height	<i>m₁</i> (max.)	15.8	18	19.4	21.5	23.8	25.6	28.7	31	33.4	34	36	38	42	45	48	51
	<i>m₂</i> (max.)	17.6	20.3	21.8	23.9	26.7	28.6	32.5	34.7	–	–	–	–	–	–	–	–
	<i>m₃</i> (max.)	9	10	11	12	13.5	15	16.5	18	19.5	21	22.5	24	26	28	30	32

Remark Priority is given to the nominal sizes of screws without parentheses.



Appendix Table 17 Ball Bearing Units Interchange Guide

17.1 Pillow Block Units

	FYH · JTEKT	ASAHI	NTN
With pressed steel cover	UCP2·C UCP2·CD	UCP2·C UCP2·E	S-UCP2·D1 SM-UCP2·D1
With cast iron cover	UCP2·FC UCP2·FCD UCP3·C UCP3·CD	CUCP2·C CUCP2·CE CUCP3·C CUCP3·CE	C-UCP2·D1 CM-UCP2·D1 C-UCP3·D1 CM-UCP3·D1
Thick Pillow Block Units	UCIP2· UCIP3·	UCIP2· UCIP3·	UCIP2· UCIP3·
Tapped-Base Pillow Block Units	UCPA2·	UCPA2·	UCUP2·D1
High-Base Pillow Block Units	UCPH2·	UCPH2·	UCHP2·D1
Light Pillow Block Units	BLP2· ALP2·	BLLP·	ASPB2· AELPB2·
Compact Pillow Block Units	UP0·	UP0·	
Corrosion resistant series Pillow Block Units	UCSP2·H1S6 UCSPA2·H1S6 USP0·S6	MUCP2· MUCPA2	
Stamped Steel Pillow Block Units	SBPP2· SAPP2·	BPP·	ASPP2· AELPP2·

17.2 Flange Units

	FYH · JTEKT	ASAHI	NTN
With pressed steel cover	UCF2·C UCF2·D UCFC2·C UCFC2·D UCFL2·C UCFL2·D	UCF2·C UCF2·E UCFC2·C UCFC2·E UCFL2·C UCFL2·E	S-UCF2·D1 SM-UCF2·D1 S-UCFC2·D1 SM-UCFC2·D1 S-UCFL2·D1 SM-UCFL2·D1
With cast iron cover	UCF2·FC UCF2·FD UCF3·C UCF3·D UCFC2·FC UCFC2·FD UCFS3·C UCFS3·D UCFL2·FC UCFL2·FD UCFL3·C UCFL3·D	CUCF2·C CUCF2·CE CUCF3·C CUCF3·CE CUCFC2·C CUCFC2·CE CUCFS3·C CUCFS3·CE CUCFL2·C CUCFL2·CE CUCFL3·C CUCFL3·CE	C-UCF2·D1 CM-UCF2·D1 C-UCF3·D1 CM-UCF3·D1 C-UCFC2·D1 CM-UCFC2·D1 C-UCFS3·D1 CM-UCFS3·D1 C-UCFL2·D1 CM-UCFL2·D1 C-UCFL3·D1 CM-UCFL3·D1
Adjustable 2-Bolt Flange Units	UCFA2·	UCFA2·	UCFA2·D1
3-Bolt Flange Units	UCFB2·	UCFK2·	UCFH2·D1
Light 2-Bolt Flange Units	BLF2· ALF2·	BLFL·	ASFB2· AELFB2·
Compact 2-Bolt Flange Units	UFL0·	UFL0·	
Corrosion resistant series 4-Bolt Flange Units	UCSF2·H1S6	MUCF2	
Corrosion resistant series 2-Bolt Flange Units	UCSFL2·H1S6	MUCFL2·	
Stamped steel plate Flange	SBPF2· SAPF2· SBPFL2· SAPFL2·	BPF· BPFL·	ASPF2· AELPF2· ASPFL2· AELPFL2·



Appendix Table

17.3 Take-Up Units

	FYH · JTEKT	ASAHI	NTN
With pressed steel cover	UCT2·C UCT2·CD	UCT2·C UCT2·E	S-UCT2·D1 SM-UCT2·D1
With cast iron cover	UCT2·FC UCT2·FCD UCT3·C UCT3·CD	CUCT2·C CUCT2·CE CUCT3·C CUCT3·CE	C-UCT2·D1 CM-UCT2·D1 C-UCT3·D1 CM-UCT3·D1
Corrosion resistant series Take-Up Units	UCST2·H1S6	MUCT2	
Take-Up Units with frame	UCTH2·.... UCTL2·.... UCTU2·.... UCTU3·....	UCT2·..WB UCTL2·..+WL· UCTU2·..+WU· UCTU3·..+WU·	UCT2·..D1 UCL2·D1 UCM2·D1 UCM3·D1
Steel Plate Frame Take-Up Units	SBPTH2·.... SBNPTH2·....	BTAW201,X	ASPT2·....

17.4 Other Units

	FYH · JTEKT	ASAHI	NTN
Hanger Units	UCHA2·	UCECH2·	UCHB2·D1

17.5 Ball Bearing Inserts

	FYH · JTEKT	ASAHI	NTN
Ball bearing inserts	UC2· UK2· NA2· SB2· SA2·	UC2· UK2· UG2·+ER B·	UC2·D1 UK2·D1 UEL2·D1 AS2· AEL2·
Cylindrical O. D.	RB2· ER2·	UR2· *1 SER2· *1	UCS2·LN *1

*1 Width of the outer ring for these items differs from that of others.

17.6 Special Specification Items

	FYH · JTEKT	ASAHI	NTN
Grease (heat temperature)	D1K2	HR5	HT2
(cold temperature)	D2K2	CR2A	CT1
(heat temperature)	D9K2	HR23	
Non-contact Seal	K3		U
Ductile cast iron	H4		N1
Lubricated type			D1
Non-lubricated type	E4	GOO	





Appendix Table 18 Spherical Roller Bearing Units Interchange Guide

Set Screw Collar Lock 2-Bolt Pillow Block

FYH		DODGE	REXNORD	LB	TIMKEN
UNIT NO.	SHAFT SIZE	PART NUMBERS			
XSE2P408-22	1 3/8	P2B-S2-106R & EP2B-S2-106R	-	-	-
XSE2P408-23	1 7/16	P2B-S2-107R & EP2B-S2-107R	ZA2107 & ZEP2107	PB22423H & PEB22423H	-
XSE2P408-24	1 1/2	P2B-S2-108R	ZA2108	PB22424H	-
XSE2P408	40MM	-	-	-	-
XSE2P409-27	1 11/16	P2B-S2-111R & EP2B-S2-111R	ZA2111 & ZEP2111	PB22427H & PEB22427H	-
XSE2P409-28	1 3/4	P2B-S2-112R	ZA2112	PB22428H	-
XSE2P409	45MM	-	-	-	-
XSE2P410-31	1 15/16	P2B-S2-115R & EP2B-S2-115R	ZA2115 & ZEP2115	PB22431H & PEB22431H	QAP10A115S & QAPL10A115S
XSE2P410-32	2	P2B-S2-200R & EP2B-S2-200R	ZA2200 & ZEP2200	PB22432H & PEB22432H	QAP10A200S & QAPL10A200S
XSE2P410	50MM	-	ZA2050MM	PB224M50H & PEB224M50H	QAP10A050S & QAPL10A050S
XSE2P411-35	2 3/16	P2B-S2-203R & EP2B-S2-203R	ZA2203 & ZEP2203	PB22435H & PEB22435H	QAP11A203S & QAPL11A203S
XSE2P411	55MM	-	ZA2055MM	PB224M55H & PEB224M55H	QAP11A055S & QAPL11A055S
XSE2P413-39	2 7/16	P2B-S2-207R & EP2B-S2-207R	ZA2207 & ZEP2207	PB22439H & PEB22439H	QAP13A207S & QAPL13A207S
XSE2P413-40	2 1/2	-	ZA2208 & ZEP2208	PB22440H & PEB22440H	QAP13A208S & QAPL13A208S
XSE2P413	65MM	-	ZA2065MMF & ZEP2065MM	-	QAP13A065S & QAPL13A065S
XSE2P415-43	2 11/16	-	ZEP2211	PEB22443H	QAP15A211S
XSE2P415-44	2 3/4	-	ZEP2212	PEB22444H	QAP15A212S
XSE2P415-47	2 15/16	-	ZEP2215	PEB22447H	QAP15A215S
XSE2P415-48	3	-	ZEP2300	PEB22448H	QAP15A300S
XSE2P415	75MM	-	-	PEB224M75H	QAP15A075S
XS2P415-43	2 11/16	P2B-S2-211R & EP2B-S2-211R	ZA2211	PB22443H	QAPL15A211S
XS2P415-44	2 3/4	-	ZA2212	PB22444H	QAPL15A212S
XS2P415-47	2 15/16	P2B-S2-215R & EP2B-S2-215R	ZA2215	PB22447H	QAPL15A215S
XS2P415-48	3	P2B-S2-300R & EP2B-S2-300R	ZA2300	PB22448H	QAPL15A300S
XS2P415	75MM	-	-	PB224M75H	QAPL15A075S
XSE2P418-55	3 7/16	P2B-S2-307R & EP2B-S2-307R	ZA2307 & ZEP2307	PB22455H & PEB22455H	QAP18A307S & QAPL18A307S
XSE2P418-56	3 1/2	-	ZA2308 & ZEP2308	PB22456H & PEB22456H	QAP18A308S & QAPL18A308S
XSE2P418	90MM	-	-	-	QAP18A090S & QAPL18A090S
XSE2P420-63	3 15/16	-	ZA2315	-	QAP20A315S
XSE2P420-64	4	-	ZA2400	-	QAP20A400S
XSE2P420	100MM	-	-	-	QAP20A100S
XS2P420-63	3 15/16	P2B-S2-315R	-	PB22463H	QAPL20A315S
XS2P420-64	4	-	-	PB22464H	QAPL20A400S
XS2P420	100MM	-	-	PB224M100H	QAPL20A100S



Appendix Table

Set Screw Collar Lock 2-Bolt Pillow Block

FYH		SEALMASTER	BROWNING	MOLINE
UNIT NO.	SHAFT SIZE	PART NUMBERS		
XSE2P408-22	1 3/8	USRB5000-106	SPB1000 1 3/8	-
XSE2P408-23	1 7/16	USRB5000-107	SPB1000 1 7/16	19121107 & 19221107
XSE2P408-24	1 1/2	USRB5000-108	SPB1000 1 1/2	19121108 & 19221108
XSE2P408	40MM	-	-	-
XSE2P409-27	1 11/16	USRB5000-111	SPB1000 1 11/16	19121111 & 19221111
XSE2P409-28	1 3/4	USRB5000-112	SPB1000 1 3/4	19121112 & 19221112
XSE2P409	45MM	-	-	-
XSE2P410-31	1 15/16	USRB5000-115 & USRBE5000-115	SPB1100 1 15/16	19121115 & 19221115
XSE2P410-32	2	USRB5000-200 & USRBE5000-200	SPB1100 2	19121200 & 19221200
XSE2P410	50MM	-	-	-
XSE2P411-35	2 3/16	USRB5000-203 & USRBE5000-203	SPB1100 2 3/16	19121203 & 19221203
XSE2P411	55MM	-	-	-
XSE2P413-39	2 7/16	USRB5000-207 & USRBE5000-207	SPB1100 2 7/16	19121207 & 19221207
XSE2P413-40	2 1/2	USRB5000-208 & USRBE5000-208	SPB1100 2 1/2	19121208 & 19221208
XSE2P413	65MM	-	-	-
XSE2P415-43	2 11/16	USRBE5000-211	-	-
XSE2P415-44	2 3/4	USRBE5000-212	-	-
XSE2P415-47	2 15/16	USRBE5000-215	-	-
XSE2P415-48	3	USRBE5000-300	-	-
XSE2P415	75MM	-	-	-
XS2P415-43	2 11/16	USRB5000-211	SPB1000 2 11/16	19121211 & 19221211
XS2P415-44	2 3/4	USRB5000-212	SPB1000 2 3/4	19121212 & 19221212
XS2P415-47	2 15/16	USRB5000-215	SPB1000 2 15/16	19121215 & 19221215
XS2P415-48	3	USRB5000-300	SPB1000 3	19121300 & 19221300
XS2P415	75MM	-	-	-
XSE2P418-55	3 7/16	USRB5000-307 & USRBE5000-307	SPB1100 3 7/16	19121307 & 19221307
XSE2P418-56	3 1/2	USRB5000-308 & USRBE5000-308	SPB1100 3 1/2	19121308 & 19221308
XSE2P418	90MM	-	-	-
XSE2P420-63	3 15/16	USRB5000-315 & USRBE5000-315	SPB1100 3 15/16	19121315 & 19221315
XSE2P420-64	4	USRB5000-400 & USRBE5000-400	SPB1100 4	19121400 & 19221400
XSE2P420	100MM	-	-	-
XS2P420-63	3 15/16	-	-	-
XS2P420-64	4	-	-	-
XS2P420	100MM	-	-	-





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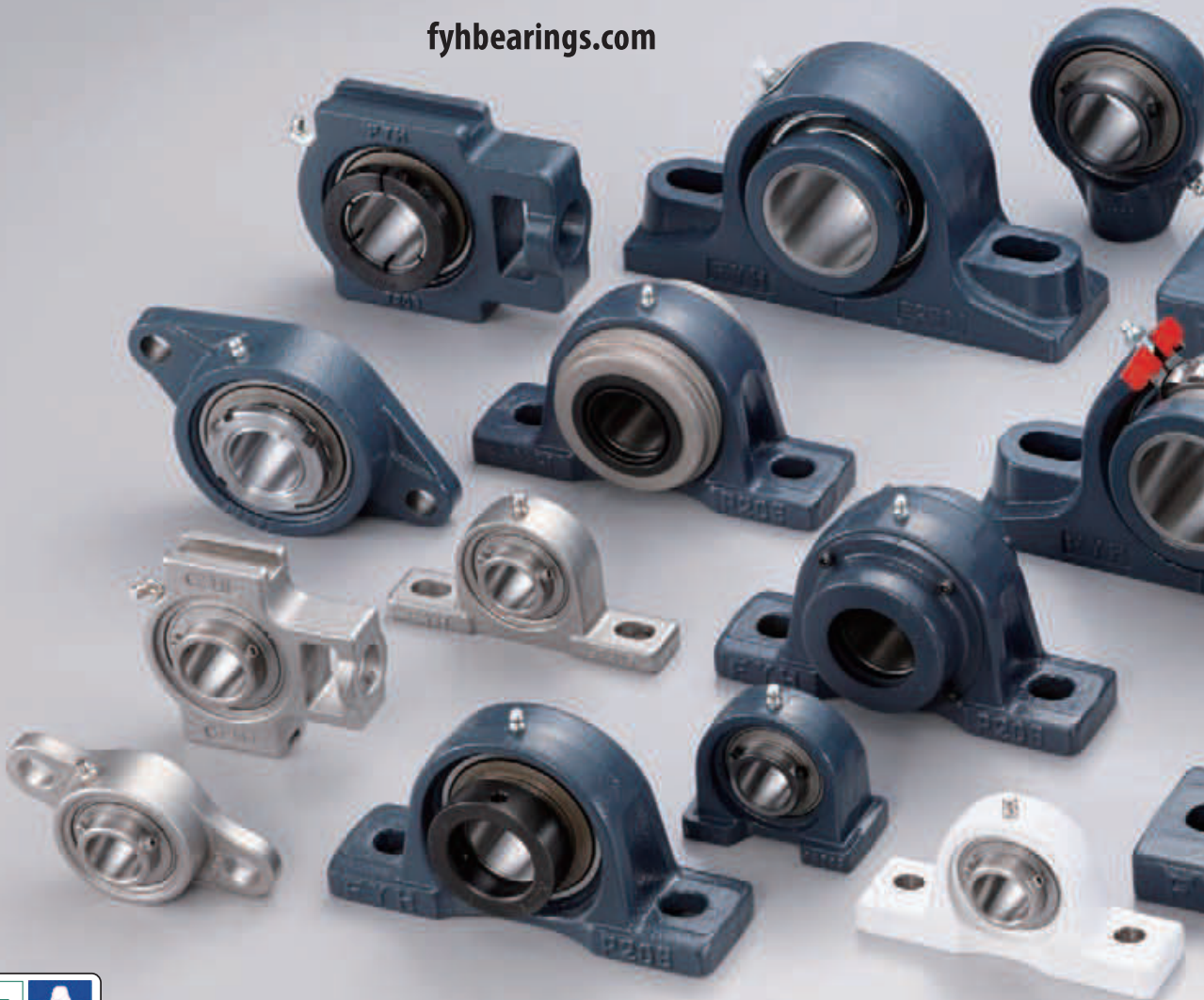
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