Corporate Office: (903) 677-2871 Sales Office: (508) 455-3290

INTRODUCTION — BRONZE BEARINGS

Over 60 years of experience in the self-lubricating bearing field, combined with research and development to continuously upgrade our products, is your assurance of a quality product incorporating the latest developments and improvements.

We have complete manufacturing facilities, including our own foundry. Our foundry is highly specialized and its entire production is concentrated on Cosmec XL™ Bearings. Our machine shops are customized to manufacture our products. Our lubrication processes are unique with specially designed hydraulic presses to provide "hydra-therm" molding of the lubricant with the metal.

Rigid quality assurance procedures are supervised from the raw material, in ingot form, to the final product.

The selection of the proper bearing material is a matter of engineering mechanics. The success of a self-lubricating bearing system is in the lubrication. Research in this field has enabled Cosmec to produce specially compounded proprietary lubricant formulas that provide low friction and durability. Cosmec XL™ Lubricants are extruded through dies and thermally molded at pressures up to 20,000 psi (138 MPa) into engineered overlapping recesses in the bearing, providing complete coverage in the direction of motion.

Cosmec XL™ Lubricants, due to their laminar-lattice crystalline structure and low planar shear strength, provide low coefficient of friction by translation of movement along crystallographic planes within the lubricant itself. (The action is much like the results when an eccentric force is exerted on a deck of playing cards.) Pressure cannot destroy or damage the crystalline planes of lubricant.

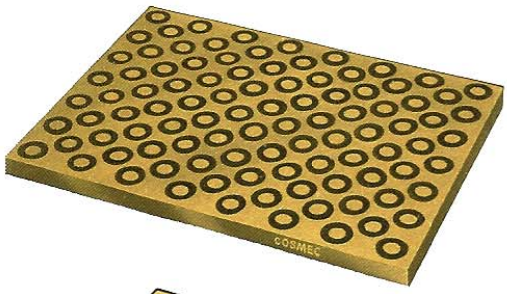
The reservoirs of lubricant, which are integrally molded with the bearing metal, project slightly above the bearing surface. With motion between mating surfaces, a heavy friction-reducing film is developed on intermediate areas of the bearing and on the mating surface. In operation the lubricant becomes embedded and bonded, through pressure, to the microscopic surface asperities of the mating surface.

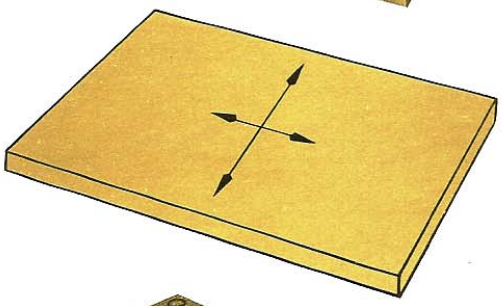
These features are reasons why Cosmec XL™ Bearings excel and others fail when subjected to heavy loads and slow surface velocities.

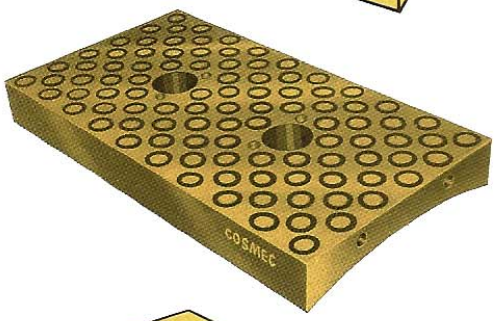
Cosmec XL™ Bearings can be used in the following applications:

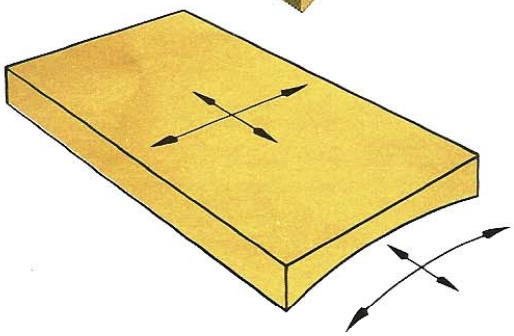
Bridges	Pipe Supports	Nuclear
Buildings/Structures	Drilling Rig Equipment	Environmental
Machinery	Missile Support Equipment	Seismic
Thermal	Hydro-Electric	Industrial
Cryogenic	Marine	Refinery

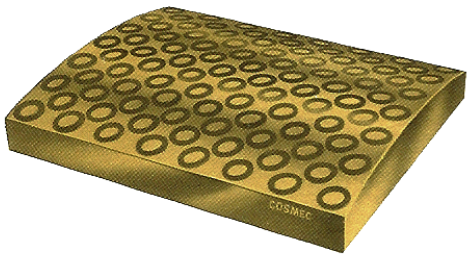
STANDARD BEARINGS — BRONZE BEARINGS

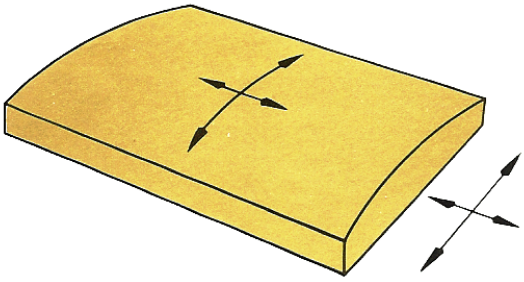






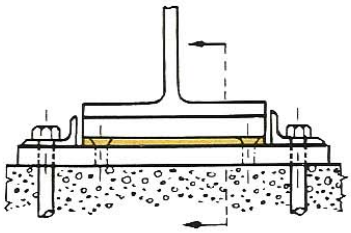


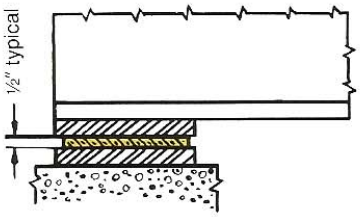


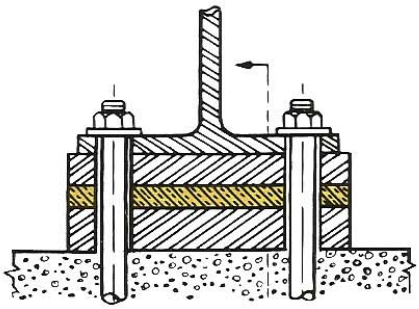


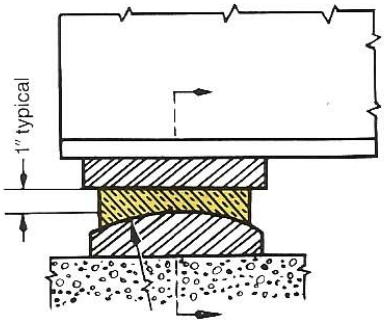
XL EXPANSION PLATES

A common application is uniplanar expansion and contraction. In this design only one face, usually the upper, of the COSMEC XL expansion plate is lubricated. It is commonly ''nested'' in or fastened to the base or masonry plate. A sole plate fastened to the beam or superstructure slides on the lubricated surface.





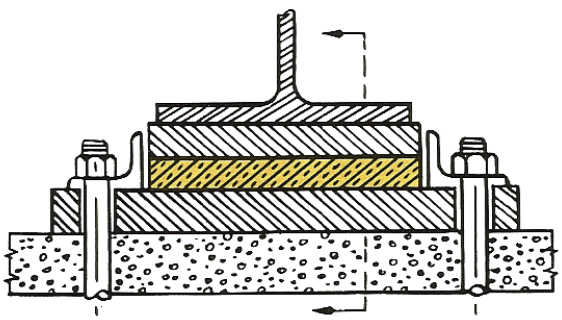


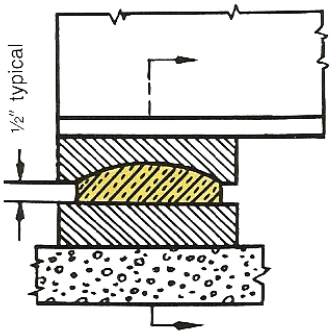


ROTEX™ EXPANSION PLATES

Where unidirectional deflection or rotation of a beam must be provided for, as well as expansion and contraction, either of the above or below designs will provide a solution.

The two self-lubricating bearing surfaces allow expansion and contraction on the flat face and deflection of the beam is permitted on the radial face—on fixed bearings, only the radial face is lubricated. These designs, which allow for the rotation of the beam, insure uniform distribution of loading on both bearing surfaces.





SELF-ALIGNING SELF-LUBRICATING BEARINGS

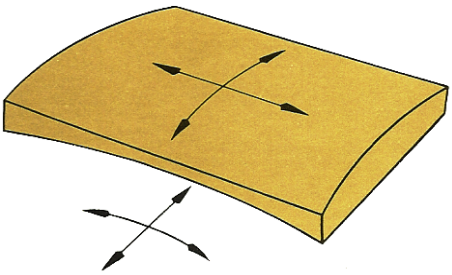
Today's bridge and structural designs are becoming increasingly complex with the necessary skews and wider spans. Also spans are being made longer with greater load carrying capacity. These requirements create unique design problems in the development of bearings to support these increased loads and transmit the loads uniformly through to the foundation with minimum overturning moment.

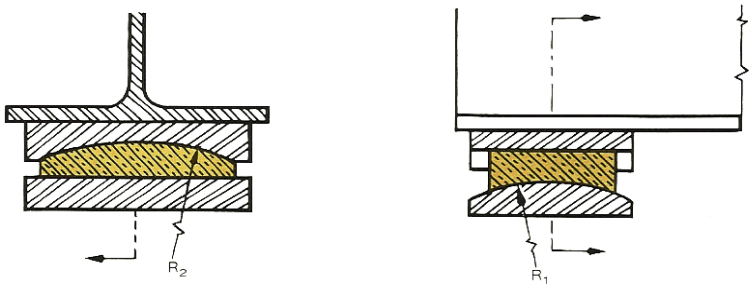
The designs shown on this page offer complete self-alignment as well as providing for expansion and contraction in all directions.

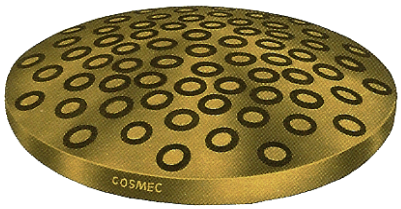
"BI-RADIAL™" EXPANSION PLATES

The "Bi-radial™" expansion plate is comprised of two self-lubricated circumferentially radial surfaces. They may be either concave or convex. However, the design shown with the upper radius convex and the lower radius concave is recommended. Both mate with their respective identical radii in the sole and base plates. The upper radius need not be the same as the lower radius.

Longitudinal expansion and transverse rotation are permitted on the upper convex radial surface. Longitudinal rotation and transverse expansion are permitted on the lower concave radial surface. The radii being at 90 degrees to each other allows rotation in any direction and complete self-alignment. Expansion and contraction take place along the radial axis of each surface.

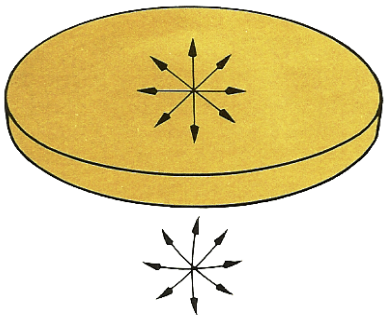


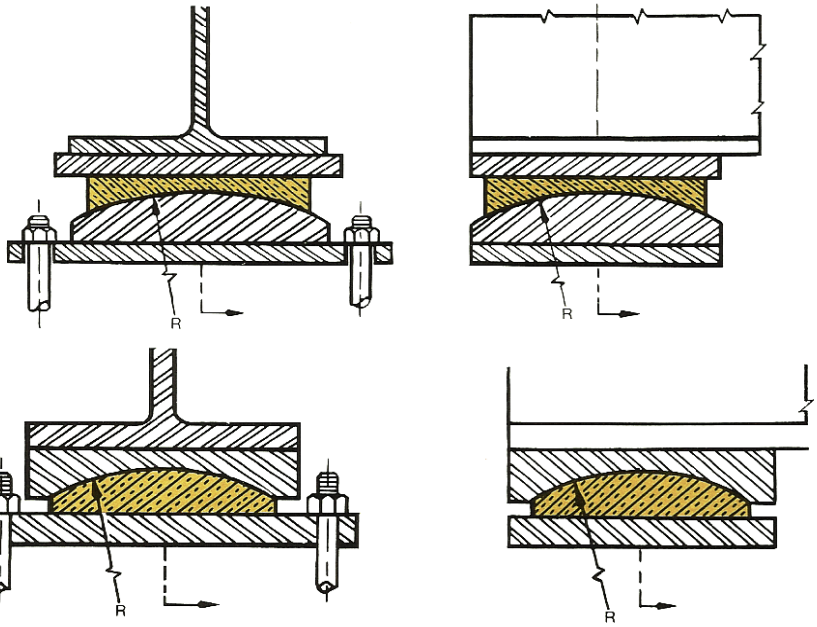


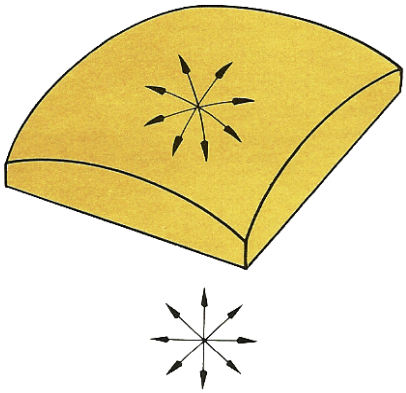


"UNISPHERE™" EXPANSION PLATES

The "Unisphere™" expansion plate also consists of two self-lubricated surfaces. One is flat, permitting expansion and contraction in all directions. The other is a spherical surface which permits deflection or rotation in all directions with this self-aligning feature. The spherical surface can be either concave or convex. The bearing may be either circular or rectangular.





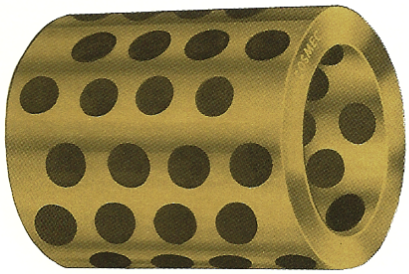


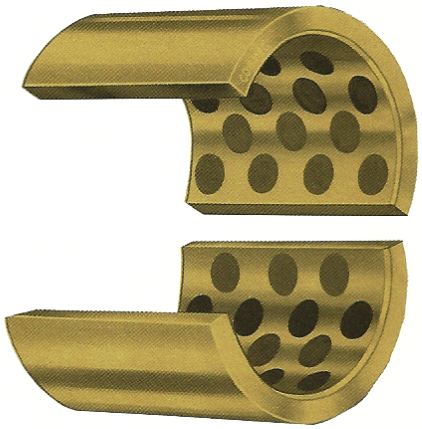
ONE-PIECE BUSHINGS

The most common and universally accepted design of bushing is the one-piece or sleeve-type bushing. This design lends itself to the majority of all bushing applications. Other designs are adaptions of the one-piece design to meet particular conditions which require variations.

One-piece bushings are designed to meet the needs of general purpose applications as well as heavy-duty applications by the selection of the proper supporting bearing material and/or by the selection of the internally lubricated design.

One-piece bushings are normally designed for rotary motion and will customarily be supplied for this type of service unless the conditions of the application warrant a different lubricating pattern.





TWO-PIECE BUSHINGS

Two-piece bushings are used where a two-piece housing or the requirement of installation ease necessitates quick assembly and disassembly of a unit.

Two-piece bushings are manufactured by temporarily bonding the two halves of the bushing as a one-piece unit before machining to the final dimensions. After machining, the halves are match-marked as a pair before separating. The match-marking facilitates the mating at assembly.

Two-piece bushings are not necessarily two perfect half bushings as the matchline may not be coaxial. Perfect half bushings are not economically practical and should only be specified where the center or split line is extremely critical to the application.

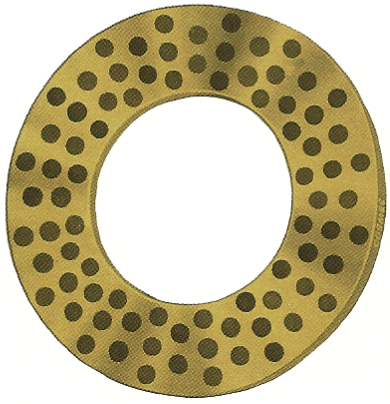
FLANGED BUSHINGS

Flanged bushings combine the features of a sleeve bushing and a washer into an integral unit. The flange may be located on one or both ends and is usually the same thickness as the wall of the bushing.

Extreme differences between the outside diameter of the bushing and the outside diameter of the flange may dictate the use of a separate bushing and washer for reasons of economy.

The flange may be lubricated to take end thrust or plain to act as a spacer or holding flange.

The flange may have through holes or countersunk holes for bolting to the housing.



THRUST WASHERS

Thrust washers are usually used alone or in conjunction with a sleeve bushing to take rotational end thrust that might otherwise be transmitted to the end of the bushing or the side of the housing.

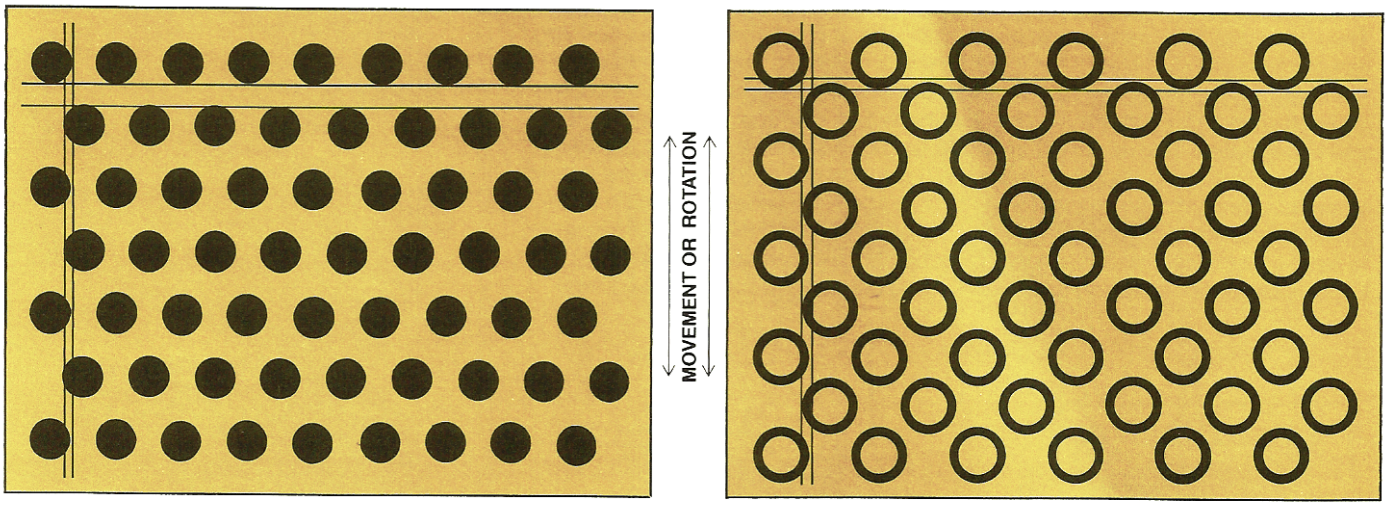
Thrust washers may be lubricated on one or both faces as the conditions require. Depending on size and configuration, it is often more economical to use a thrust washer in conjunction with a sleeve bushing rather than a flanged bushing.

DESIGN — BRONZE BEARINGS

Cosmec XL™ Structural Bearings provide a positive means to permit expansion and contraction of a superstructure relative to its substructure when subjected to temperature changes or seismic movement. The low coefficient of friction of Cosmec XL™ Bearings minimize the effects of thermal and vibrational stresses that might build up in a structure.

Cosmec XL™ Structural Bearings lend to simplicity and economy of design, manufacture and installation. A typical assembly consists basically of only three components: the sole plate, the base plate and the Cosmec XL™ Self-Lubricating Plate which separates them and permits relative motion between the two. Designed to outlast the structure they support, the overall low-cost and permanence of metal are factors that provide you with advantages of bearings that have stood the test of time.

Cosmec XL™ Structural Bearings are normally provided with the advantageous “trepanned” style of lubricating pattern. Compared with the ordinary recesses and based on the same percentage of lubrication on a surface, the trepanned pattern permits the lubricant reservoirs to be closer together as well as providing overlapping lubrication coverage both transversely and longitudinally (See Details Below).



Developed layout of typical lubrication pattern with standard recesses.

Developed layout of typical lubrication pattern with trepanned recesses.

With proper design and selection of accessory materials, Cosmec XL™ Bearings will outlast the life of the structure they support. Rust and corrosion of mating materials have often limited the life of a bearing assembly to the life of the steel components, not the Self-Lubricating Bearing. A stainless steel mating surface on the sole and/or the masonry plates in contact with the self-lubricating surfaces is recommended in order to provide an entire corrosion-resistant bearing assembly.

Expansion assemblies should be designed so that the loading is uniformly distributed over the entire surface of the bearing. If eccentric forces might tend to develop an edge concentration of loading condition, some self-aligning features should be introduced for best results.

The mating plates with the Cosmec XL™ Self-Lubricating Surface should be wider or longer than the Cosmec XL™ Bearing Plate by at least the expected amount of motion. This protects the lubricated surface from exposure to possible contaminants when movement takes place. Cosmec XL™ Bearing Plate thickness should be consistent with overall plate size. However, on flat plates, a minimum thickness of ½ inch (13mm) is desirable to provide suitable thickness for machining and lubrication.

For Rotex™, Bi-Radial™ and Unisphere™ Expansion Plates, where both the flat and the radius faces are lubricated, a minimum thickness of 1 inch (25mm) is desirable. Also a differential between maximum and minimum thickness of at least ½ inch (13mm) is strongly recommended. This differential provides the minimum necessary positioning power of the radial face in its mating member and translates the horizontal forces to the flat face for expansion and contraction movements.

The selection of radii is developed empirically. However, the selection is governed by the requirement of “minimum differential”. That is, as previously mentioned, a ½ inch (13mm) minimum should be generated. On Rotex™ and Bi-Radial™ Expansion Plates, for maximum economy, the radius should be between 12” (305mm) and 36” (915mm) for the convex style and between 12” (305mm) and 24” (610mm) for the concave style. The 12” (305mm) and 18” (457mm) radii will cover the majority of requirements.

Cosmec XL™ Bearing Expansion Plates are supplied completely finished, ready for installation. Therefore, if regular or countersunk bolt holes are required, this information must be provided. This will permit the proper layout of the lubricating pattern around the bolt holes for maximum efficiency. Bolt holes and the area consumed by countersunk recesses should be kept to the minimum practical for positioning and minimum loss of lubricating area.

Other methods of affixing the expansion plate, when necessary, are with the use of milled channels in the mating plate, building a “nest” by means of welding bars to the mating plate or by drilling and/or tapping partially-through holes into the “plain” or back face of the Cosmec XL™ Bearing Expansion Plate.

SELF-LUBRICATING BUSHINGS:

Cosmec XL™ Self-Lubricating Bushings were developed to fill the void in the field of bearings for service at slow speeds and heavy loads with permanent self-lubrication. The ability to withstand extremes in static loads, environmentally adverse conditions, high temperatures and negligence are added “pluses” built into Cosmec XL™ Bushings.

Design techniques for Cosmec XL™ Bushings follow the basic principles for configuration that have been long established, with certain modifications. Consideration must be given to unit loading, surface speed, ambient temperature and environmental media. The design process consists of determining the bushing size, the bushing alloy, appropriate clearances and fits, the support system and the proper selection of the lubricant. Load-carrying capacity is inversely proportional to the surface velocity (speed) and the operating temperature.

Please contact Cosmec’s Engineering Staff for any further help in the design of Cosmec XL™ Bushings.

DESIGN COEFFICIENT OF FRICTION:

Friction is defined as the resistance to relative motion between materials in contact, and is directly proportional to the shear strength of the softer material. The major causes of this resistance to movement are the interlocking action of the surface asperities and the high shear strength of the mating materials.

Metals, regardless of the degree of surface finish, contain surface irregularities or asperities that can be measured in micro-inches. In an un-lubricated system of dissimilar materials, the softer material must necessarily wear or abrade if motion is to take place.

The purpose of a lubricant is to eliminate or minimize the actual contact between opposing materials and, at the same time, introduce a low shear strength lubricating material into the system.

Cosmec XL™ Lubricants allow us to offer frictional coefficients of under 10%. However, for design purposes, a design coefficient of friction of 10% is recommended. This value has proven satisfactory for the majority of applications. Actual full-scale tests in the laboratory and in the field have determined the Cosmec XL™ Bearings have a coefficient of friction of between 4% and 8% for medium and heavy load applications.

For high temperature service and for lightly loaded applications a design coefficient of 15% is recommended.

In critical applications where a low value for design coefficient of friction is essential, Cosmec XL™ Lubricants are available to meet this need. Please submit application details for recommendations.

The proper surface finish of the contiguous moving members is an important factor in the design of a bearing assembly. Cosmec XL™ Bearings do not require expensive or highly polished finishes on the bearing surface or on the mating surface. An ordinary finish of 63 – 125 micro-inches RMS will provide satisfactory results with all Cosmec XL™ Bearings.

Irregularities of surface textures are a divergence from the geometric ideal and can be described as peaks and valleys. With thin film lubricants these peaks and valleys (asperities), must of necessity be small, and hence the finish must be high in order to not break-through the film causing metal to metal contact and high frictional forces.

Thick film Cosmec XL™ Lubricants fill the asperities of the mating surfaces with high load-carrying capacity but low shear strength lubrication forming a mirror-like friction reducing film.

MATERIALS — STRUCTURAL BRONZE BEARINGS

Cosmec XL™ Bronze Structural Bearing materials are highly corrosion resistant and are especially adapted for adverse environments. The design unit loadings suggested are considered conservative (See Table 1). However, in view of the extended life expectancy and the size of the structures supported, the loadings are tempered by the principles of good engineering practice. The permitted loadings on these materials as shown in the latest AASHTO, AREMA and any State DOT Specifications should be consulted before a final alloy choice is made.

A representative group of alloys that are most popular and are accepted as standard with many Federal and State Agencies as well as leading Design Engineers, are shown in Table 1.

TABLE 1: Cosmec XL™ Structural Bearing Bronze Alloys

Cosmec Alloy No.	Class of Service	Design Unit Loading KSI (MPa)	Physical Properties-KSI (MPa)			Applicable Specification
			Comp. Str. .001 set	Tensile Strength	Yield Strength	
315	Light Duty	.5-1.5 (34-10.3)	13 (90)	30 (207)	14 (97)	ASTM B 584 Alloy C93200
210	General Purpose	.75-2.0 (5.2-13.8)	17 (117)	40 (276)	12 (83)	ASTM B 22 Alloy C90500
196	Medium Duty	1.5-2.5 (10.3-17.2)	18 (125)	—	—	ASTM B22 Alloy C91100
417	Medium Heavy Duty	2.0-3.0 (13.8-20.7)	18 (125)	75 (517)	30 (207)	ASTM B 148 Alloy C95400
424	Heavy Duty	2.5-3.5 (17.2-24.1)	55 (380)	110 (760)	60 (415)	ASTM B 22 Alloy C86300

The alloys in Table 1 are listed in ascending order of load carrying capacity and are also listed in ascending order of cost. This is due to the factors of the chemical element requirements in the alloy, and/or special foundry techniques necessary in producing castings and/or a lower machinability rating.

Alloys 210 (ASTM B22 Alloy C90500) and 196 (ASTM B22 Alloy C91100) are the most frequently specified and meet the requirements of over 80% of the designs. The values for design unit loading were empirically established based on the physical properties of the alloy, laboratory tests and long experience in the field. Ordinarily, a value intermediate in each range is used in design.

Table 2 shows other, less-used bronze alloys also available in Cosmec XL™ Bearings.

TABLE 2: Other Cosmec XL™ Structural Bearing Bronze Alloys

Cosmec Alloy No.	Commercial Designation	Compressive Strength	Tensile Strength	Yield Point	ASTM Specification
305	Leaded-tin Bronze	10,000 (70)	30,000 (207)	12,000 (83)	B 584 Alloy C93700
418	Aluminum Bronze	30,000 (210)	90,000 (620)	40,000 (276)	B 148 Alloy C95500
237	Low Tin Bronze	17,000 (117)	40,000 (276)	12,000 (124)	B 584 Alloy C90500 Modified*
194	Tin Bronze	24,000 (165)	—	—	B 22 Alloy C91300
423	Manganese-Aluminum Bronze	50,000 (350)	90,000 (621)	45,000 (310)	B 584 Alloy C86200

*Cosmec Alloy 237 is a modified ASTM B22 Alloy C90500 with up to 2.5% Pb providing the increased physical properties shown, as well as improving the natural bearing qualities of inherent lubricity, conformability, embed ability, shock resistance and durability.

Structural bearing designs should be proportional to the size of the structure they support. Bearing size should not be reduced just to bring it up to the maximum allowable loading. Within practical limits of available space, good design practice dictates that well distributed conservative unit loads will offer optimum performance.

SELF-LUBRICATING BUSHINGS:

In the design of Cosmec XL™ Bushings, the variables of load, operating temperature and environmental conditions are the major factors to be considered by the Engineer. In general, as one variable increases other variables must decrease in inverse proportion. Remember, Cosmec XL™ Bushings are NOT designed to be used as high-speed bushings.

The loading (P) where P = total load/projected bearings area and the velocity (V) where V = surface speed/minute are combined to determine the PV rating of a particular design. The allowable PV for a particular alloy has been developed empirically. Experimental testing, experience and past performance results have been relied upon heavily to arrive at the allowable PV factor (See Table 3).

TABLE 3: Cosmec XL™ Bushing Bronze Alloys

Max Load PSI (MPa) P	Max Speed S. F. M. (m/min) V	P.V.	Cosmec Alloy No.	Comp. Str. .001 set (.025 set) PSI (MPa)	Tensile Str. PSI (MPa)	Yield Point PSI (MPa)	Elongation % in 2" (50mm)	Specifications
1,000 (7)	500 (150)	10,000 (20)	315	13,000 (90)	30,000 (207)	14,000 (97)	12 (12)	ASTM B 584 Alloy C93200
2,000 (14)	100 (30)	20,000 (40)						
2,000 (14)	300 (90)	30,000 (60)	237	17,000 (117)	40,000 (276)	18,000 (124)	25 (25)	ASTM B 22 Alloy C90500 Modified* ASTM B 584 Alloy C90500 Modified*
2,000 (14)	50 (15)	40,000 (80)						
3,000 (21)	25 (8)	50,000 (100)	424	55,000 (380)	110,000 (760)	60,000 (414)	12 (12)	ASTM B 22 Alloy C86300 ASTM B 584 Alloy C86300
2,000 (14)	100 (30)	70,000 (140)						
7,000 (49)	35 (11)	70,000 (140)						
20,000 (140)	10 (3)	100,000 (200)	Consult our Engineering Staff for recommendations					

*Cosmec Alloy 237 is a modified ASTM B22 Alloy C90500 with up to 2.5% Pb providing the increased physical properties shown, as well as improving the natural bearing qualities of inherent lubricity, conformability, embed ability, shock resistance and durability.

Ultimate performance with Cosmec XL™ Self-Lubricating Bushings can be attained by careful consideration of load and speed characteristics. Load carrying capacity is controlled by the physical properties of the bearing alloy. The following three Cosmec XL™ Alloys (315, 237, 434) shown in Table 3, provide excellent results in the vast majority of applications and offer the greatest economy in their operating range.

A list of other bronze alloys (with some of their physical properties) that are also available from Cosmec are shown in Table 4 below.

TABLE 4: OTHER Cosmec XL™ Bushing Bronze Alloys

Cosmec Alloy No.	UNS No.	Previous Designation	Commercial Designation	Compressive Strength	Tensile Strength	Yield Point	Elongation %
225	C90300	B143-1B	Modified "G" Bronze	13,000 (90)	40,000 (276)	18,000 (125)	20
305	C93700	B144-3A	High-Leaded Tin Bronze	15,000 (103)	30,000 (207)	12,000 (83)	15
415	C95400	B148-9C	Aluminum Bronze	22,000 (150)	75,000 (515)	30,000 (207)	12
418	C95500	B148-9D	Aluminum Bronze	30,000 (207)	90,000 (620)	40,000 (275)	6
423	C86200	B147-8B	Manganese Aluminum Bronze	50,000 (340)	90,000 (620)	45,000 (310)	18

All materials for all US bearings will be certified domestic material manufactured and fabricated in the USA in accordance with the “buy American” requirements for all Federally funded work.

Cosmec XL™ LUBRICANTS:

Cosmec XL™ Lubricants are a unique proprietary combination of active lubricating ingredients which stress their dominant desirable properties and subordinate the lesser qualities of each, much like the alloying of steels to produce particular characteristics.

Cosmec XL™ Lubricants are not to be confused with so many “look-alikes” which are composed almost entirely of graphite. Cosmec XL™ Lubricants are not primarily graphite based. A percentage of graphite may be used in some of the formulas because of its excellent anti-galling and anti-seizing qualities. However, graphite alone or in high concentration, has a coefficient of friction of over 25%.

Just as no one bearing alloy will meet all service requirements, no single lubricant formula can met the operational needs of extremes in operating media.

Cosmec XL™ Lubricants are specially formulated and compounded to produce optimum performance for particular environmental and service conditions. The elements and percentages in the proprietary compounded formulas were developed through research, testing and in-the-field performance results. All the ingredients in Cosmec XL™ Lubricants have lubricating properties, including the binder material.

A list of the various lubricants and their specific classes of service is intentionally not included to avoid the improper selection for a particular operating condition. It is preferable that the operating data be supplied to Cosmec’s Engineering Staff for recommendations.

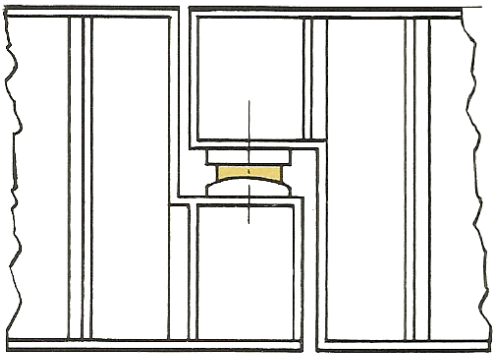
Cosmec Custom XL™ Lubricant is the most economical general purpose lubricant. Custom XL™ is normally supplied in all Cosmec XL™ Bearings unless the service requirements indicate that another Cosmec Lubricant would provide more satisfactory results.

For unusual or severe service conditions such as in temperatures over 200^{O}F (93^{O}C), in steam, subject to radioactivity, exposure to chemicals, oils and solvents, specific lubricants have been developed to provide solutions where few, if any, other types of bearings or lubricants can perform at all.

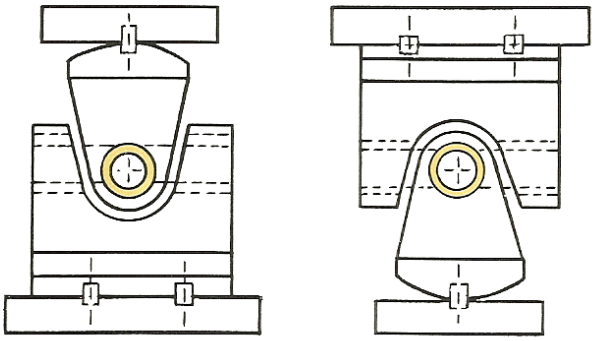
Where bearings are exposed to temperature extremes, submerged in salt or highly mineralized water or in a corrosive atmosphere, care should be exercised in the selection of the bearing alloy as well as the lubricant.

Cosmec’s Engineering Staff will offer recommendations on bearing applications if detailed data is submitted.

STRUCTURAL DESIGN IDEAS—BRONZE BEARINGS

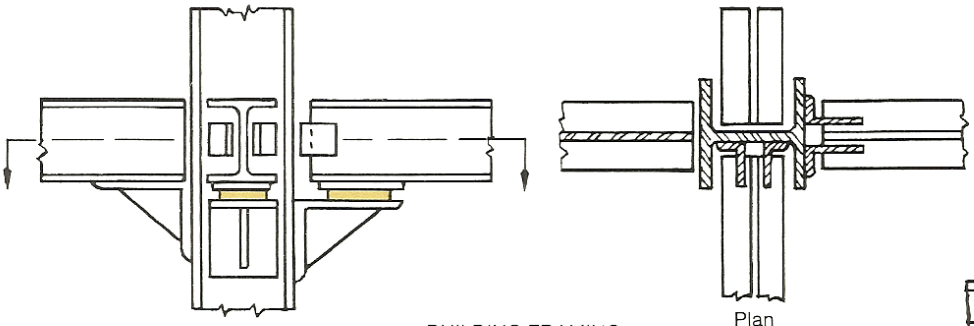


CANTILEVER SUPPORT



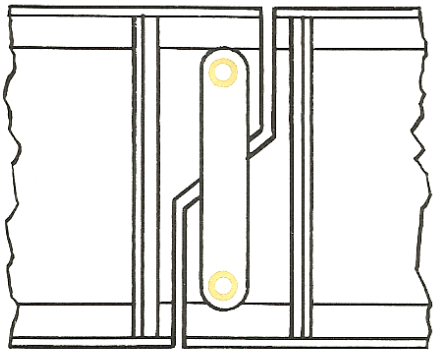
Front Side

UNIVERSAL ROCKER

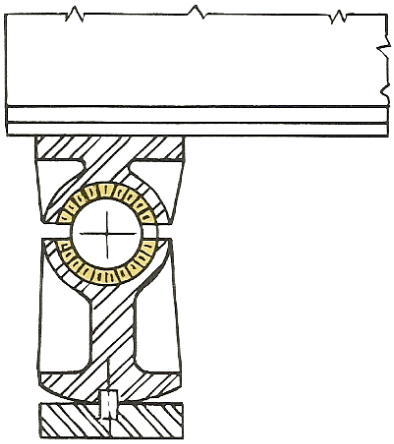


Elevation Plan

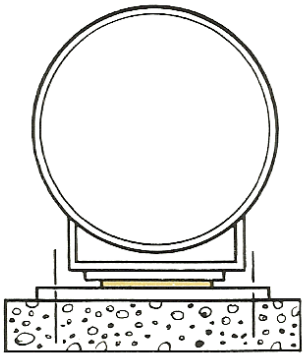
BUILDING FRAMING



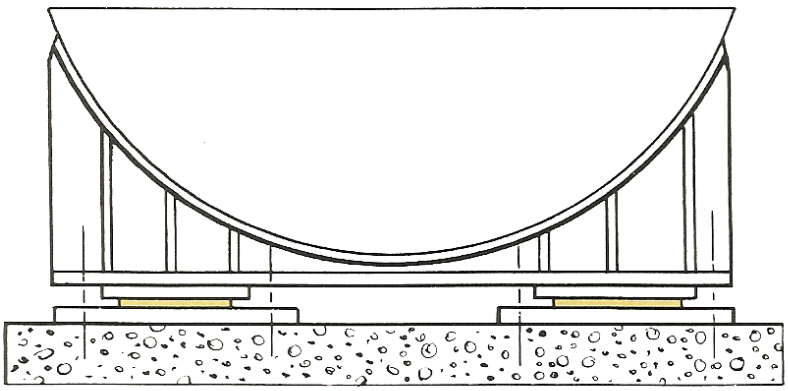
SUSPENDED SPAN HANGER



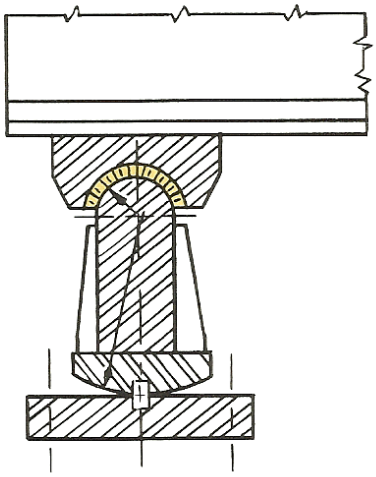
SPLIT-BUSHING ROCKER



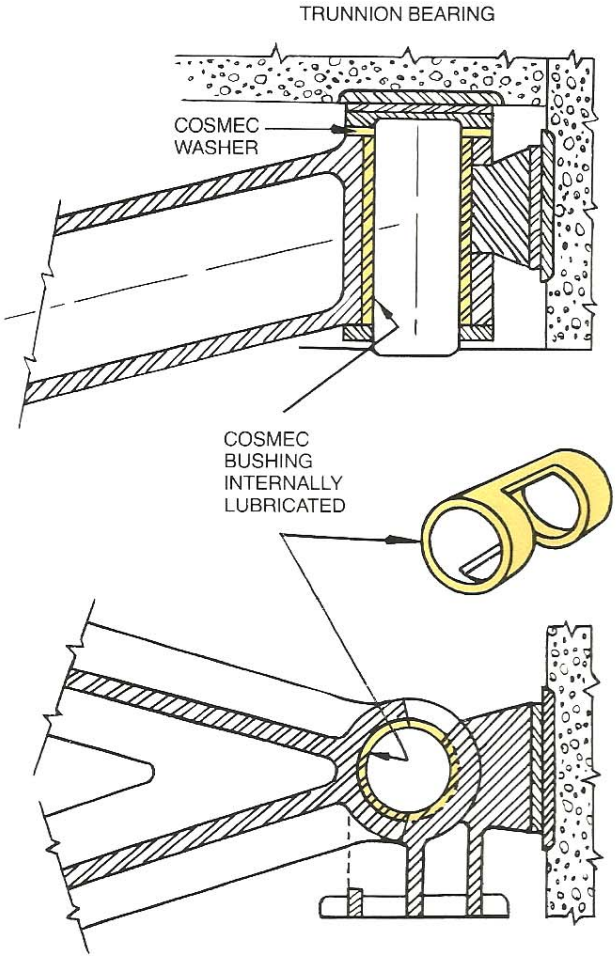
PIPELINE SUPPORT
BEARING ASSEMBLY

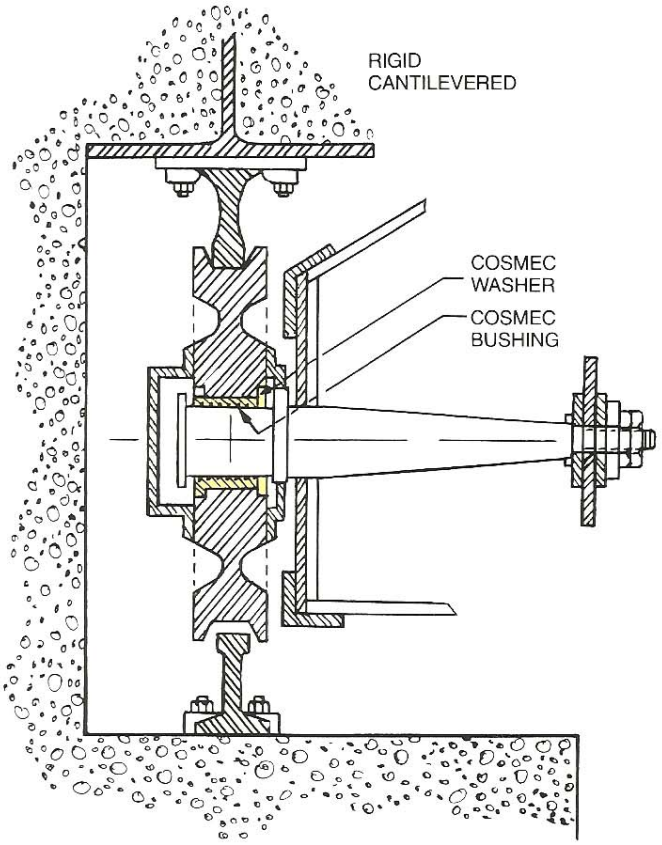


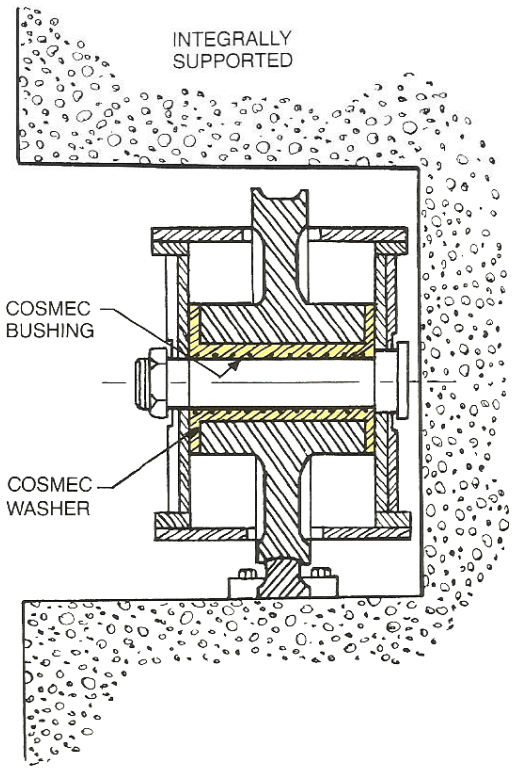
VESSEL SUPPORT BEARING ASSEMBLY

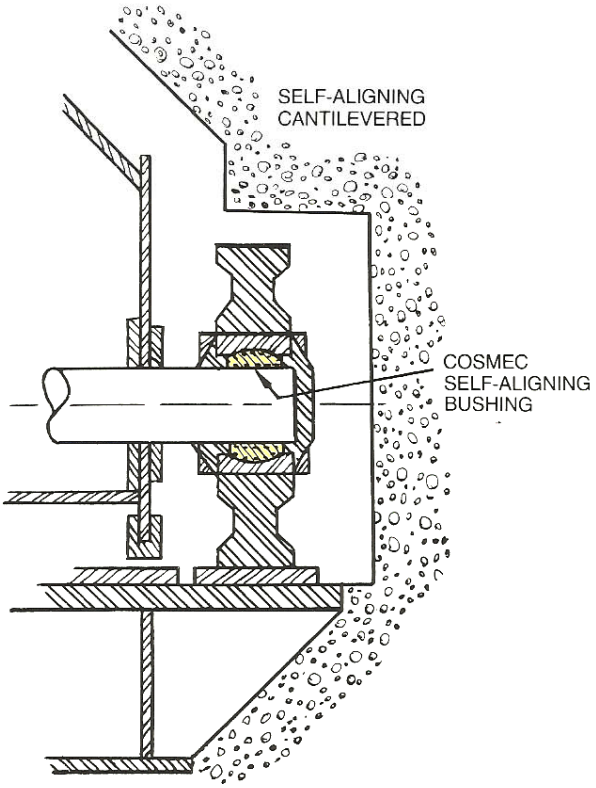


HALF-BUSHING ROCKER


TRUNNION BEARING
COSMEC
WASHER
COSMEC
BUSHING
INTERNALLY
LUBRICATED


RIGID
CANTILEVERED
COSMEC
WASHER
COSMEC
BUSHING


INTEGRALLY
SUPPORTED
COSMEC
BUSHING
COSMEC
WASHER


SELF-ALIGNING
CANTILEVERED
COSMEC
SELF-ALIGNING
BUSHING

INSTALLATION—BRONZE BEARINGS

Cosmec XL™ Bearings are manufactured to close tolerances in a controlled environment. Care must be taken in the handling and installation to ensure they start their service life in a clean undamaged condition. They should be stored under cover and off the ground. Retainer clips or strapping are used to hold bearing parts together for shipping and installation; they must be removed to allow the bearing to function, but not before final positioning and only at the Engineer's direction.

Bearings should not be disassembled on site without direct supervision by qualified personnel. We will not be responsible for the subsequent non-performance of a bearing if disassembly occurs without our supervision and/or written approval. In case of inadvertent disassembly, call us immediately.

Lift bearings by their bases only. Do not rely on transportation straps or brackets to carry the bearing's weight.

Do not specify paint or coatings on the Cosmec XL™ Bronze Plate or mating sliding surfaces. A rust inhibitor will be put on the steel surface(s) in contact with the bronze plate in our shop and will be sufficient until the bearings experiences movement under load.

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