Certified PowerTrain
Engineered Machined Solutions

390 Koopman Lane
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Phone: (262) 723-2944
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INSTALLATION & SUPPORT CONCEPTS

Any Driveshaft can vibrate if it is not properly installed or mounted to a secure and rigid foundation. If the following guidelines are followed during installation and all angles and dimensions are double-checked after installation (before operation), the chance of vibration will be greatly reduced.

FOUNDATIONS:

Driving and Driven units must be properly fastened to an adequate foundation to avoid vibration due to movement and misalignment.

STEADY BEARING SUPPORT:

If shafting is such that it requires two or more sections, the beam or bracket attaching the steady bearing must have enough rigidity to avoid vibrations. If there is no such beam in place we recommend these guidelines.

1. Keep spans as short as possible.
2. Make end connections rigid.
3. Use rigid beams and install so that the principle section modulus opposes the horizontal forces.
4. Beam selection should be sized so that the horizontal and vertical NATURAL FREQUENCY of the beam is four times the maximum system RPM.

CAUTION: THE OCCUPATIONAL SAFETY AND HEALTH ACT requires that all spinning drive shafts, which may be considered hazardous to life or limb, must be guarded.

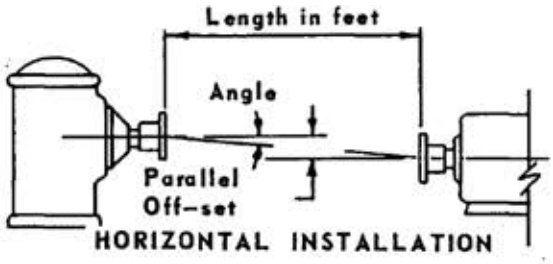
OFFSETS (also refer to examples):

Universal joints are capable of operating at various angles, depending on the type of yoke clearance. We have listed some guidelines below for our standard drivelines.

1. Maximum working angles should not exceed 3°.
2. Working angles of Driving and Driven unit should be parallel and equal to each other within 1°.
3. Offset should only be made in one plane.
4. Shafting can be plumb, but we recommend 1° offset.

	OFFSET IN INCHES							
LENGTH IN FEET	1°	2°	3°	4°	5°	6°	7°	8°
1	.209	.419	.625	.839	1.049	1.261	1.473	1.686
2	.418	.838	1.250	1.678	2.098	2.522	2.946	3.372
3	.627	1.257	1.875	2.517	3.147	3.783	4.419	5.058
4	.836	1.676	2.500	3.356	4.196	5.044	5.892	6.744
5	1.045	2.095	3.125	4.195	5.245	6.305	7.365	8.430
6	1.254	2.514	3.750	5.034	6.294	7.566	8.838	10.116
7	1.463	2.933	4.375	5.873	7.343	8.827	10.311	11.802
8	1.672	3.352	5.000	6.712	8.392	10.088	11.784	13.488
9	1.811	3.771	5.625	7.551	9.441	11.349	13.257	15.174
10	2.090	4.190	6.250	8.390	10.490	12.610	14,780	16.860

EXAMPLE: If the off-set dimension is 2.5000 inches for a 4 ft. shaft, the angular misalignment is 3°.



WE STRONGLY RECOMMEND THE USE OF SHAFT GUARDS WITH ALL DRIVE SHAFTS.

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SHAFT & FLANGE INSTALLATION:
HORIZONTAL APPLICATIONS:

All STOCK flanges are bored with a plus .001 - minus .000 tolerance and should be a slip fit over the output and input shafts. Align the key-ways in both the flange and shaft and gently tap flange on. Tighten set screws in the flange and install drive shaft.

In some installations, it is preferred that the flanges be SPECIAL ordered with the bore machined UNDERSIZE, creating an interference fit.

If the flanges are UNDERSIZE, we recommend the following procedure:

1. Heat the flange with a torch allowing the bore to expand.
2. Align the keyways in both the flange and shaft.
3. Slide the flange over the shaft and allow the flange to cool.

CAUTION: DO NOT attempt to hammer on an undersize flange without heat. This may permanently damage the thrust bearings in either the driver or driven equipment.

VERTICAL APPLICATIONS:

In vertical applications most of the shafting weight is supported from the upper connecting flange. We RECOMMEND that when a drive shaft or multiple drive shaft installation weighs over 150 lbs., it should be supported in one of the following ways:

1. Ordering flanges with an extra set screw 90° from the keyway (Do not use with drive shafts weighing over 300 lbs.).
2. Ordering SPECIAL bored flanges with the bore machined UNDERSIZE (refer to above for proper installation of UNDERSIZE FLANGE).
3. Ordering flanges with a counter bore for a split ring adapter.
4. Ordering flanges with a taper bore and nut (consult with motor manufacturer).

In multiple installations, start with the upper most 'B' section of shafting:

1. Layering the 'B' section out on the floor, slide the steady bearing over the neck of the 'B' stub followed by the tapered 'B' FLANGE, NUT & COTTER PIN. Note steady bearings must be self-aligning type.
2. Attach universal end of shafting to upper connecting flange, using bolt, nut and lockwasher supplied.
3. Attach STEADY BEARINGS to support beams.
4. Repeat steps 1 thru 3 for each 'B' section.
5. The bottom or 'A' section is installed with the SLIP JOINT mounted to the connecting FLANGE on the pump.

NOTE: Make sure that the EARS on the YOKES are in line after assembly. Refer to drawing on page 3.

LUBRICATION:

There are only three major components that need to be lubricated:

1. Universal joint (NOTE: In some series, the universal joint is a lube for life bearing which never requires lubrication).
2. Sliding splines in the Slip Joint.
3. Steady bearings.

It is recommended that the UNIVERSAL JOINTS and STEADY BEARINGS be lubricated with Shell Alvania EP-2 or equivalent for speeds over 500 RPM and SAE 140 to 250 oil for speeds under 500 RPM.

The SLIDING SPLINES in the SLIP JOINT should be lubricated with any good grade of long fiber grease such as Texaco Mariac "0" E.P.

When adding lubricant, be certain that it appears at all four bearing seals to assure removal of dirt and contaminants. The bearing seals should relieve lubricant with a "pop" at about 80 PSI.

Bearings should be lubricated every 500 hours of normal service or every 200 hours of continuous service.

BOLT SPECIFICATIONS

Bolt Size	Series used on	Wrench Torque	Grade
3/8" 24NF x 1-1/4	1310•1610•1710	30 lbs. ft.	5
7/16" 20NF x 1-1/4	1350•1410•1810	48 lbs. ft.	5
1/2" 20NF x 1-1/2	1480•1550	76 lbs. ft.	5
5/8" 18NF x 2	1880•1910	155 lbs. ft.	8

CAUTION: U-joints contain only enough grease to provide protection during storage. It is necessary to completely lubricate them prior to installation to avoid premature failure.

TROUBLE SHOOTING GUIDE

Is necessary to completely lubricate them prior to installation to avoid premature failure.

PROBLEM	CAUSE	SOLUTION
VIBRATIONS	1. Operating in or near the critical or half-critical speed.	Reduce speed or rework using special tubing.
	2. Ears on yoke are not in line with each other.	Disassemble and align yokes.
	3. Drive shaft may be out of balance due to shafting being bent during shipment or not originally balanced.	Return for straightening and balancing.
	4. Bearings in the U-joint or steady bearing wore out.	Replace bearing.
	5. U-joints are stiff due to damaged bearing.	Replace bearing.
	6. Pilots not seated at con. flange or 'B' shaft connection	Reseat flanges.
	7. If operating in conjunction with a reciprocating engine, a torsional problem may exist.	A torsional analysis should be performed.
	8. Stead bearings are not self-aligning and are binding.	Replace.
	9. Thrust bearings binding up in either the driver or driven equipment.	Replace bearings.
	10. Exceeding recommended angular misalignments.	Shim if necessary.
	11. Input and output shafts are not parallel.	Reduce angle.
FLANGES SLIPPING OFF SHAFT	1. Exceeding weight limitations for stock bored flanges.	Add additional set screw.
	2. Set screw not tightened.	Tighten set screw.
PREMATURE FAILURE OF BEARING	1. Lack of proper maintenance.	See lubrication recommendations.
	2. Exceeding recommended angular misalignment or Max. RPM.	Reduce either or both.
	3. Excessive vibrations (See vibrations sec. above).	See above.
	4. Shafting under specified.	Reanalyze series.

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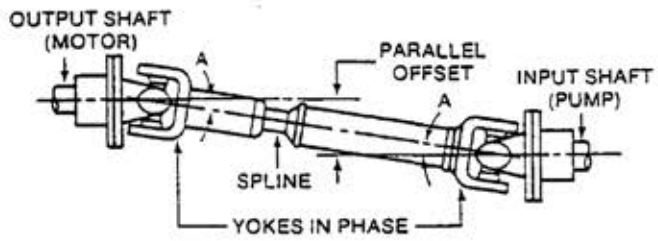
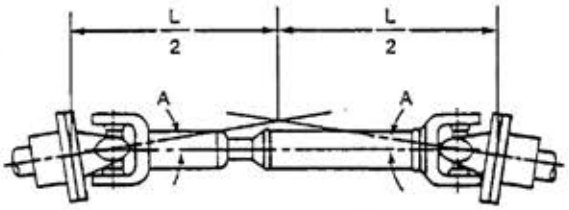
INSTALLATION INSTRUCTIONS (cont.)

SINGLE SHAFT



STANDARD INSTALLATION PARALLEL



ALTERNATE INSTALLATION

Joint angles 'A' must be equal to within one degree.

Angle A should be about 3° if driver is an engine.

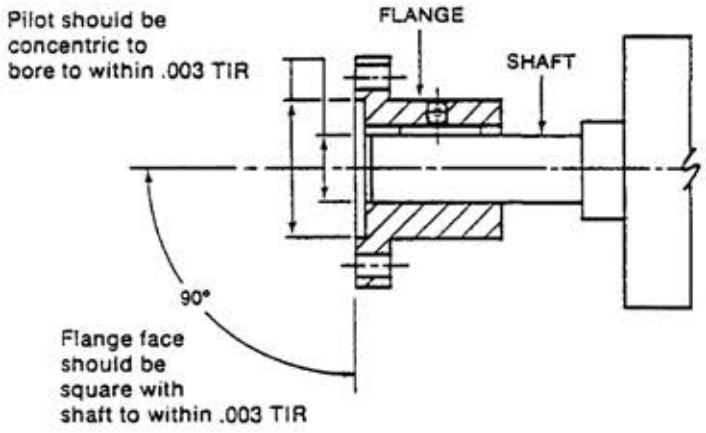
See Tables 1, 2, and 3.

Yokes must be in the same plane (in phase) to within 2°. Spline should be at mid slip.

In the standard installation, the output and input shafts must be parallel.

In the alternate installation, the centerlines of the output and input shafts must intersect at the center of the drive shaft.

B-NUT	
Torque Ratings	
Series	**Torque** (1 hr-ft)
1310 & 1350	100
1410 - 1480	230
550 - 1810	450
Apply light oil on threads.	



Flange and key must be seated properly on motor and pump shafts. On vertical installations top flange should have an additional set screw for shaft weights from 150 to 300 lbs. Over 300 lbs. we recommend n interference fit or a split ring retainer or a nut on the output shaft to support the weight of the drive shafts.

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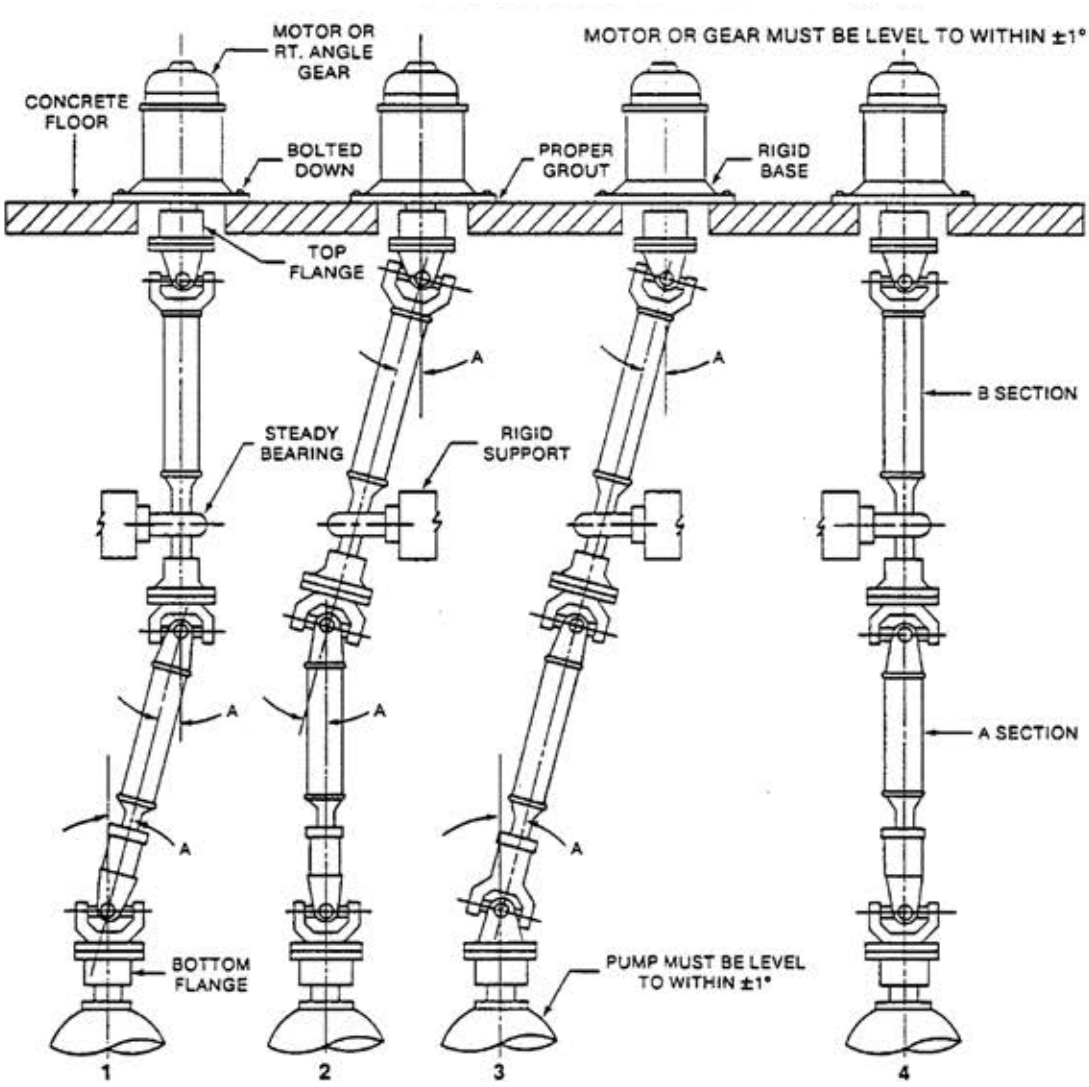
INSTALLATION INSTRUCTIONS (cont.)

TWO SHAFTS Instructions on following page.



All examples 1, 2, 3, and 4 are acceptable. Turn page 90° for horizontal applications. Driver (motor) and driven member (pump) must be parallel

Joint angles 'A' must be equal to within one degree and yokes are in phase.

Example 2 is preferable if shafts are engine driven. Make angle 'A' about 3°. Joint without an angle is furthest from engine.

See Tables 1, 2, and 3.

Flange and key must be seated properly on motor and pump shafts. Top flange should have an additional set screw for shaft weights from 150 to 300 lbs. Over 300 lbs. we recommend an interference fit or a split ring retainer or a nut on the output shaft to support the weight of the drive shafts.

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INSTALLATION INSTRUCTIONS (cont.)

TWO SHAFTS

EXAMPLE 1

1. Connect B-section to motor.
2. Modify support or shim out to steady bearing so B-section can hang vertical.
3. Connect B-section to support.
4. Connect A-section to B-section and pump.

EXAMPLE 2

1. Connect B-section to motor.
2. Connect A-section to B-section and to pump.
3. Set A-section vertical and modify support or shim out bearing so A-section will remain vertical after B-section is connected to support.
4. Connect B-section to support.

EXAMPLE 3

1. Unscrew dust cap and remove splined sleeve yoke from A-section. Rotate yoke 90° and reinstall it. Screw on dust cap.
2. Use fish line and draw taut line from motor shaft to pump shaft.
3. Measure from taut line to support. This distance should equal distance from center of base of steady bearing. Modify support or shim out so drive shafts will be on a common center line.

EXAMPLE 4

1. Drop plumb bob from center of motor shaft. If plumb bob is not at center of pump shaft, go to Example 1 and continue.
2. Measure from plumb bob string to support. This distance should equal distance from center to base of steady bearing. Modify support of shim so shafts will hang vertical.
3. Connect B-section to motor and to support.
4. Connect A-section to B-section and to pump.

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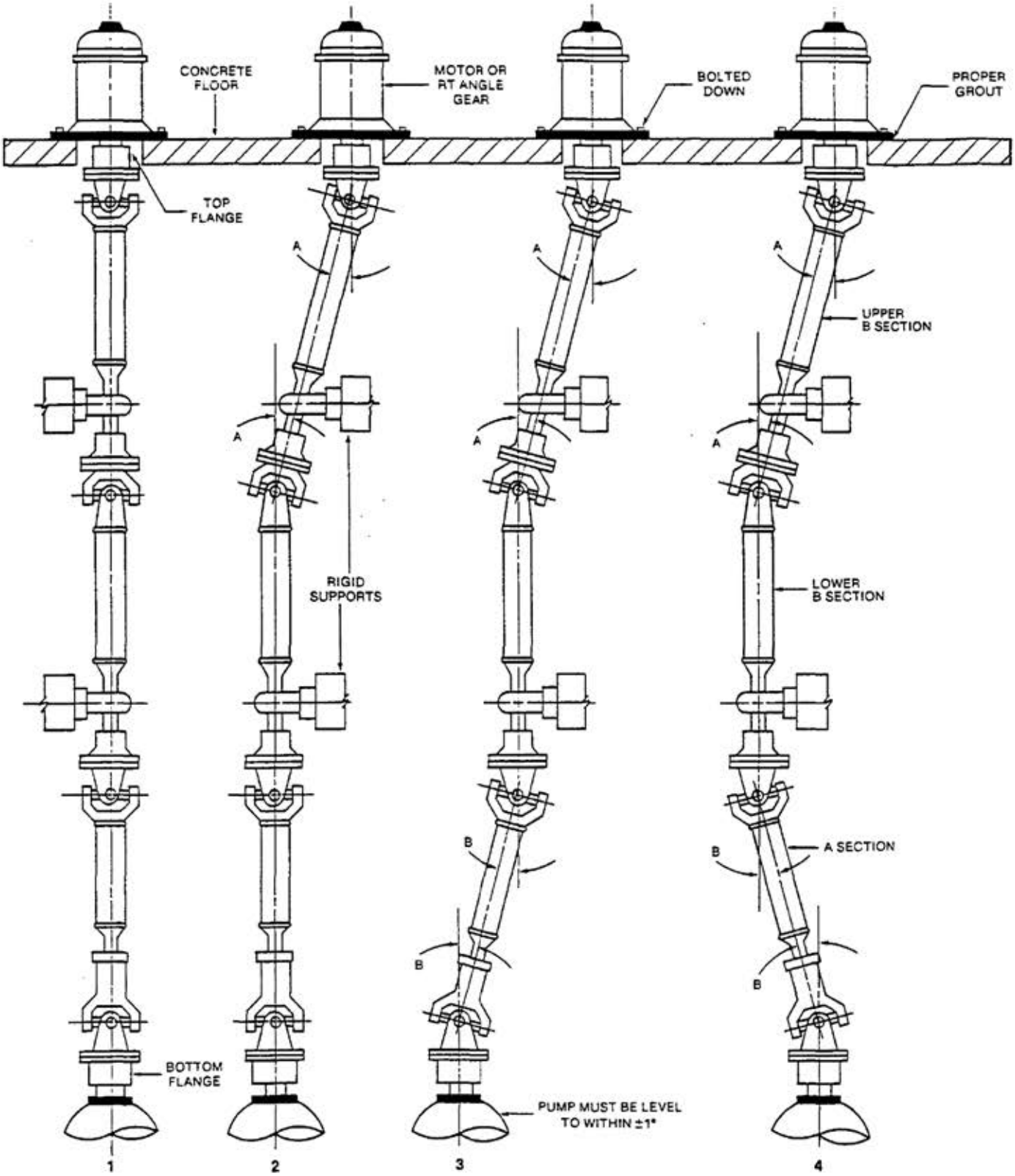

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INSTALLATION INSTRUCTIONS (cont.)

THREE SHAFTS

All examples are acceptable.

Driver (motor) and driven member (pump) must be parallel.

Middle shafts in Examples 3 and 4 are parallel to pump and motor.

Joint angles 'A' must be equal to within one degree and joint angles 'B' must be equal to within one degree but joint angle 'A' does not have to equal joint angle 'B'.

Yokes are in phase to within two degrees.

Examples 3 and 4 are preferred if shafts are engine driven. Make angles about three degrees.

A "C-section" (Jack shaft) could be used as the middle shaft in Examples 3 and 4, but top shaft would have to be an "A-section" instead of a "B-section." This would make installation easier because both steady bearings would be on the same vertical line.

EXAMPLE 1

1. Drop plumb bob from center of motor shaft.
2. Measure from plumb bob string to support. This distance should equal distance from center to base of steady bearing. If distance is longer, shim out to correct distance. If it is too short, modify support.
3. Connect upper B-section to motor and support.
4. Connect lower B-section to upper B-section and support.
5. Connect A-section to lower B-section and to pump.

EXAMPLE 2

1. Drop plumb bob out from lower support and position it over center of pump shaft.
2. Measure distance from support to plumb bob string. Shim out or modify support so center of bearing is over center of pump shaft.
3. Connect upper B-section to motor.
4. Connect lower B-section to top B-section.
5. Connect lower B-section to support.
6. Connect A-section to pump and B-section.
7. Move lower B-section until it is vertical.
8. Shim out to bearing or modify support for upper B-section so lower B-section and A-section can remain vertical.
9. Connect upper B-section to support.

EXAMPLE 3 AND 4

1. Connect upper B-section to motor and support.
2. Connect tower a-section to upper B-section.
3. Modify lower support or shim out to bearing so lower a-section can remain vertical.
4. Connect lower B-section to support.
5. Connect A-section to B-section and to pump.

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STEEL FLANGE SPECIFICATIONS

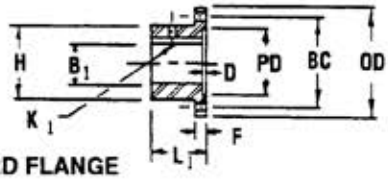
FLANGES are ordered separately to fit the driver and driven shafts.

STOCK FLANGES, which are listed on the price sheet, are bored to a plus .001 - minus .000 tolerance allowing for a slip fit over the input and output shafts of the driver and driven equipment.

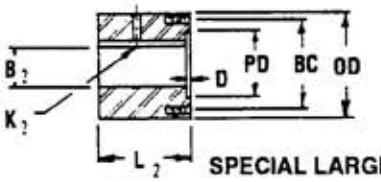
MACHINE TO ORDER FLANGES are recommended for vertical installations where the total weight of the shafting exceeds 150 lbs. One of the following methods should be used for attaching the upper connecting flange to the driver output shaft:

1. An additional set screw 90° from the keyway. (NOT recommended for shafts exceeding 300 lbs.)
2. Flanges bored undersize creating an interference fit.
3. Flanges with a counter bore to mate up with a split ring adapter (consult with driver equipment manufacturer).
4. Flanges with taper bore (consult with the driver equipment manufacturer).

ROUGH BORE FLANGES are specified only when the customer plans to finish boring and keying themselves. Rough bored diameters are listed below



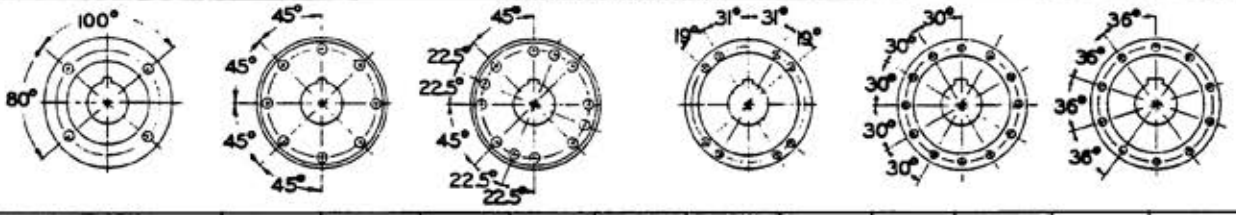
STANDARD FLANGE



SPECIAL LARGE FLANGE

FLANGE SERIES	1310	1350-1410	1480-1550	1610	1710	1810	1880-1910	1900	1950	2050	2150
OD - Outside dia.	3 7/8"	4 1/2"	5 7/8"	6 7/8"	8"	8"	9 5/8"	10 7/8"	11 3/16"	13 5/8"	17 1/2"
BC - Bolt circle	3 1/8"	3 3/4"	4 3/4"	6 1/8"	7 1/4"	7 1/4"	8 1/4"	9 3/4"	9 13/16"	12"	15 11/16"
PD - Pilot dia.	2 3/8"	2 3/4"	3 3/4"	6 5/8"	7 3/4"	7 3/4"	7"	8 3/4"	8 1/4"	10 3/8"	13 11/16"
D - Pilot depth	5/64"	5/64"	3/32"	1/16"	1/16"	1/16"	9/64"	9/64"	1/8"	3/16"	13/64"
STANDARD FLANGE											
B_1 - Max. Bore	1 11/16"	1 7/8"	2 7/16"	3 1/8"	4"	4"	4 5/8"	5 1/2"	5 1/2"	7 1/2"	7 1/2"
- Rough Bore dia.	3/4"	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"	1 1/2"	2 1/4"	2 1/4"	4"	5"
K_1 - Max Keyway	3/8"x3/16"	1/2"x1/4"	5/8"x5/16"	3/4"x3/8"	1"x1/2"	1"x1/2"	1 1/8"x9/16"	1 1/4"x5/8"	1 1/4x5/8"	1 1/2"x3/4"	1 1/2"x3/4"
F - Flange Width	3/8"	3/8"	3/8"	3/8"	3/8"	3/8"	5/8"	5/8"	3/4"	1"	1 1/4"
L_1 - Length	2"	2"	2 1/2"	3 1/2"	4"	4"	5"	5"	5 7/8"	7 1/2"	7 1/2"
H - Hub	2 7/16"	2 7/8"	3 3/4"	5 1/4"	6 3/8"	6 3/8"	6 7/8"	8 1/2"	8"	10"	13 1/4"
Approx. Weight	3#	5.2#	10#	20.5#	29#	29#	51#	87#	92#	166#	337#
SPECIAL LARGE FLANGE											
B_2 - Max. Bore	2 3/8"	2 3/4"	3 3/4"	4 1/2"	5 1/2"	5 1/2"	6 3/8"	7 1/4"	7 1/4"	-	-
- Rough bore dia.	1 3/8"	1 3/4"	2 3/8"	3 1/8"	3 1/2"	3 1/2"	4 1/4"	5"	5"	-	-
K_2 - Max. keyway	5/8"x5/16"	3/4"x3/8"	1"x1/2"	1 1/8"x9/16"	1 1/4"x5/8"	1 1/4"x5/8"	1 1/4"x5/8"	1 1/2"x3/4"	1 1/2"x3/4"	-	-
L_2 - Length	2 1/2"	3"	3"	5"	6"	6"	6"	8"	8"	-	-
Approx. weight	7.5#	12.5#	28#	41#	68#	68#	100#	150#	155#	-	-

BOLT HOLE SPACING



FLANGE SERIES	1310	1350-1410	1480-1550	1610	1710	1810	1880-1910	1900	1950	2050	2150
Number of Bolts	4	4	4	8	8	12	8	8	12	10	12
[1] Bolt size	3/3-24x1 1/4"	7/16-20x1 1/4"	1/2-20x1 1/2"	3/8-24x1 1/4"	3/8-24x1 1/4"	7/16-20x1 1/2"	5/8-18x2"	5/8-18x2"	3/4-16x2 1/2"	7/8-14x3 1/2"	1-12x4"
Number of threads	3/8-24	7/16-20	1/2-20	3/8-24	3/8-24	7/16-20	5/8-18	5/8-18	3/4-16	7/8-14	1-12

[1] Bolt sizes 3/8" thru 1/2" are grade 5, sizes 5/8" thru 1" are grade 8.

SPLINED FLANGES, which are used with many pieces of farm equipment, are available in either 1 3/8 - 6 spline or 1 3/8 - 21 spline.

EXTRA SPECIAL LARGE FLANGES can be supplied in 1310 through 1550 series. These are furnished with bore and keyway dimensions greater than the maximums listed above.

KWIK DIS-CONNECT FLANGES are available in 1310 through 2150 series. Consult with our engineering department for details.

ALL FLANGES are supplied with a set screw over the keyway except for taper bore and splined flanges. Two set screws are standard on vertical applications.

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