determining the proper joint size

UNIVERSAL APPLICATIONS

- Lawn Tractors
- Trash Compactors
- Dune Buggies
- Sound Film Apparatus
- Conveyors

Calculating the Joint Size Required

One way of determining the outside diameter (O.D.) size of the joint required is to measure the O.D. of the block and pin type joint you are replacing. You may also measure the shaft, which is generally equal to one-half the diameter. For powered applications, we recommend that the inside diameter (I.D.) of the joint not exceed 60% of the O.D.

If it is more appropriate to select the joint size taking into account its operating criteria, follow these steps:

1. Multiply RPM of the joint times the angle at which the joint will be operating. This yields the speed/angle factor.
2. With that result, select the corresponding operating use factor from the use factor table provided here. If the result exceeds 15,000, the speed/angle factor is too severe for a block and pin-type universal joint.
3. Calculate the input load on the joint:
   $$\text{Input Load (Inch Lbs.)} = \frac{63{,}000 \times \text{H.P.}}{\text{RPM}}$$
4. Multiply the operating use factor times the input load to obtain the required static torque carrying capacity of the U-joint for your application.
5. Compare the required static torque carrying capacity with the static torque ratings on the appropriate product selection guide in this catalog to select the correct joint size. Choose a joint with a static torque rating equal to or greater than your calculated requirements.

Please keep in mind that the above calculations are not intended to be absolute. These formulas should be used as a general guide for sizing universal joints that are exposed to non-harsh operating conditions. Special consideration must be taken when joints are exposed to severe conditions such as large operating angles, continuous operation, shock loading, reversing loads, high temperatures or harsh environments. Contact Curtis' Engineering Department for assistance in selecting the proper size universal joint for your application.

example

Operating Criteria:

Material = Alloy Steel — RPM of Joint = 85
Angle of Operation = 15° — Horsepower = 10

1. Determine the Speed/Angle Factor:
   RPM (85) x Angle of Operation (15) = 1275
2. Determine the Operating Use Factor:
   Use Factor Table indicates a use factor of 10 for an operating angle of 15° at a speed of 85 RPM.
3. Calculate the Input Load:
   $$\text{Input Load (Inch Lbs)} = \frac{63{,}000 \times 10 \text{ H.P.}}{85 \text{ RPM}} = 7{,}412$$
4. Multiply the Operating Use Factor times the input load to determine the required static torque carrying capacity of the U-joint:
   Use Factor (10) x Input Load (7,412) = 74,120 Inch Lbs.
5. Using Selection Guide for Alloy Steel Single Joints, select a joint with ratings equal to or greater than your calculated requirements.
   Select 4" O.D. CJ655 Steel Joint rated at 131,000 Inch Lbs., since next size smaller is rated at 55,000 Inch Lbs.

USE FACTOR TABLE

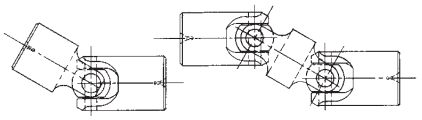
Speed / Angle Factor	Operating Use Factor
0 - 3,000	10
3,001 - 9,000	20
9,001 - 15,000*	40

** If the RPM x Angle of Operation is greater than 15,000, the application is not suited for a block and pin type universal joint.*

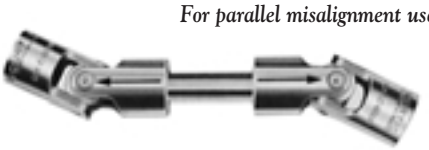
engineering / design tips

1. Dimensions of square holes in hubs and outside diameter (O.D.) of splines should not exceed one-half the outside diameter of the joint. Draw squares parallel to the fork ears.
2. Keyways cannot be in line on assembled joints; they must be at 90° except on double joints. Avoid cutting the keyway into the heat-treated ear of the fork.
3. Avoid blind bored holes and blind keyways in hubs. Bore, broach and cut clear through wherever possible.
4. Template drawings for all Curtis standard joints are available in a convenient folder which will be furnished free upon request.
5. In mounting two single universal joints in line, it is important that they be positioned correctly.

Proper mounting gives uniform rotation to the driven shaft, because the second joint compensates for the rotational error introduced by the first joint.



For angular misalignment use single joints. For parallel misalignment use double joints.



CORRECT ASSEMBLY

INCORRECT ASSEMBLY

Determine the Appropriate Part Number

Refer to the identification system below to determine how to find the appropriate part number for your joint based on the dimensions and/or static torque ratio you require. The part number's suffix will also indicate whether the joint will have a solid or bored hub, or will need any other modifications. Refer to the appropriate pages to find the Selection Guides for Alloy Steel, Stainless Steel, Naval Brass, Aluminum-Bronze, Nickel-Aluminum-Bronze and Monel joints. The Curtis Cross-Reference Chart provided here will assist you in cross-referencing universal joints from other manufacturers.

identification system

Assembled Universal Joint Identification Code

JOINT

CJ	650	BM

MATERIAL

- BZ - Naval Brass
- CJ - Steel
- ML - Monel
- NA - Nickel Aluminum Bronze
- SM - Special Material
- SS - Stainless Steel

SIZE

- 641 - 3/8
- 642 - 1/2
- 643 - 5/8
- 644 - 3/4
- 645 - 7/8
- 646 - 1"
- 647 - 1-1/8
- 648 - 1-1/4
- 650 - 1-1/2
- 651 - 1-3/4
- 652 - 2"
- 653 - 2-1/2
- 654 - 3
- 655 - 4

CONFIGURATION

- B - Standard Bore
- D - Double
- M - Modified
- S - Special Length Longer Than Standard

For complete product information, please refer to the Selection Guides for Alloy Steel, Stainless Steel, Naval Brass & Special Materials

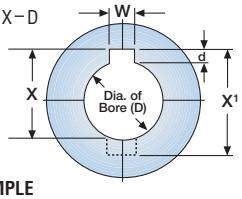
SELECTION GUIDE – BROACHES

KEYWAY BROACHES Frac. Size Width Keyway	Min. Bore	SQUARE HOLES Fractional Size		6-SPLINE HOLES Fractional Size	10-SPLINE HOLES Fractional Size
1/16"	3/8"	3/16"	3/4"	5/8"	1/2"
3/32"	3/8"	1/4"	13/16"	3/4"	5/8"
1/8"	1/2"	3/8"	7/8"	7/8"	3/4"
5/32"	19/32"	7/16"	57/64"	1"	7/8"
3/16"	19/32"	1/2"	1"	1-1/8"	1"
1/4"	21/32"	9/16"	1-1/4"	1-1/4"	1-1/4"
5/16"	27/32"	5/8"	1-1/2"	1-3/8"	
3/8"	57/64"	11/16"		1-1/2"	
1/2"	1-9/32"			1-5/8"	
5/8"	1-47/64"			1-3/4"	
				2"	

FORMULA FOR CALCULATIONS SINGLE & DOUBLE KEYWAY DEPTHS

$$X=\sqrt{\left(\frac{D}{2}\right)^2-\left(\frac{W}{2}\right)^2}+d+\frac{D}{2}$$

$$X^1=2X-D$$



EXAMPLE

Hole 1"; Keyway 1/4" wide (W) by 1/8" deep (d)

$$X=\sqrt{\left(\frac{1}{2}\right)^2-\left(\frac{1}{8}\right)^2}+\frac{1}{8}+\frac{1}{2}=1.109"$$

SELECTION GUIDE – BROACHES

Bore of Hub Diameter of Hole (D)			Keyseat W	D	Set Screw
5/16"	to	7/16"	3/32"	3/64"	10-32
1/2"	to	9/16"	1/8"	1/16"	1/4-20
5/8"	to	7/8"	3/16"	3/32"	5/16-18
15/16"	to	1-1/4"	1/4"	1/8"	3/8-16
1-5/16"	to	1-3/8"	5/16"	5/32"	7/16-14
1-7/16"	to	1-3/4"	3/8"	3/16"	1/2-13
1-13/16"	to	2-1/4"	1/2"	1/4"	1/2-13
2-5/16"	to	2-3/4"	5/8"	5/16"	5/8-11

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