Certified Power Inc.
DRIVELINE DIVISION

Driveline Identification Guide

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390 Koopman Lane, Elkhorn, WI 53121-2020
Tel: 262 741-5600 Fax: 262 723-2785
Email: driveline@certifiedpower.com

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390 Koopman Lane, Elkhorn, WI 53121-2020
Tel: 262 741-5600 Fax: 262 723-2785
Email: driveline@certifiedpower.com

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Driveline Identification Guide

The purpose of this document is to guide field service technicians through the process of identifying off-highway vehicle driveshafts for the purpose of ordering a replacement or replacement parts. This document is not intended to facilitate designing a new driveline. If you have a need for design services or assistance please call Certified Power's engineering department at 262-723-2944.

The purpose of a driveshaft is to transmit torque and rotational motion at a fixed or varying angular relationship from one shaft to another, and when necessary, account for axial movement. A driveshaft is an assembly consisting of one or two universal joints connected by a solid or tubular shaft. We use the terms "driveline" and "driveshaft" interchangeably. However, the Society of Automotive Engineers (SAE) Universal Joint and Driveshaft Design Manual defines a driveline as,"…an assembly of one or more driveshafts." [1]

In order to identify a driveshaft it is necessary to identify each component and to characterize the assembly. This guideline addresses universal joint identification, driveshaft component identification and driveshaft assembly identification. Again, if you have questions or need assistance please contact CPI engineering.

Section I: Universal Joint Identification

There are literally thousands of different driveshafts and driveshaft component configurations. All driveshafts incorporate one or more universal joints. Universal joints are designed to be mated with a yoke. The various types of yokes are discussed in subsequent sections of this guideline. Universal joints, illustrated in Figure 1, are mechanical devices that can transmit torque and/or rotary motion from one shaft to another at fixed or varying angles of intersection of the shaft axis.[2]

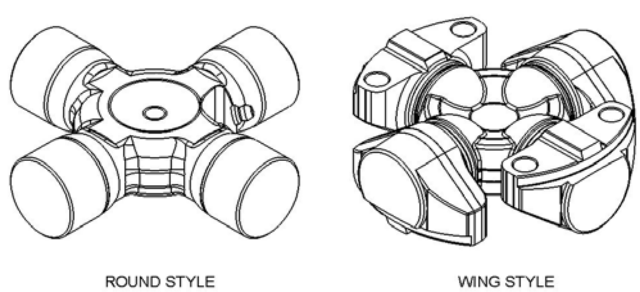

Figure 1
Universal Joints

[1] Universal Joint and Driveshaft Design Manual Advances in Engineering Series No. 7 The Society of Automotive Engineers Inc. Warrendale PA 15096 1979 Page 323
[2] Ditto Page Page 323

There are three main component types of a universal joint, the body or "cross", the bearing caps, and needle roller bearings, see Figure 2. The cross consists of a non-machined center portion and four ground trunnions.

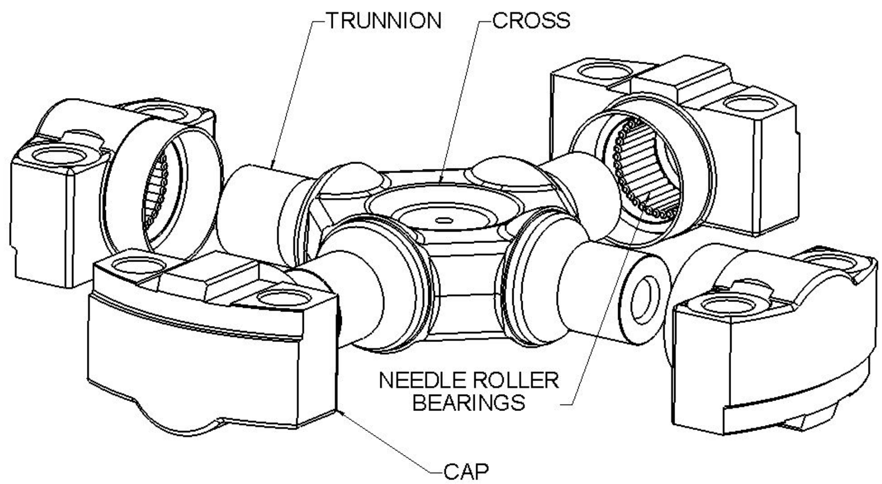

Figure 2
Universal Joint Components

Caps are classified as being either "wing" or "round" bearing style. There are three types of wing bearing caps: high wing (HW), low wing (LW), or delta wing (DW). Each has two holes for joining the caps to the adjacent driveline component. The holes in high wing caps are drilled, the holes in low wing caps are drilled or threaded, and the holes in delta wing caps are threaded.

Universal Joints: Wing Bearing Style

The three wing style bearing caps are illustrated in Figure 3.

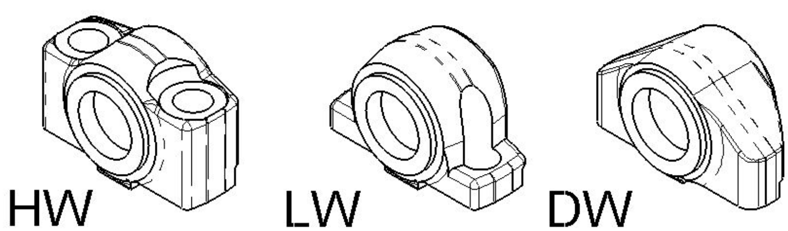

Figure 3
Wing Bearing Style Caps

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Based on this classification we use the following acronyms to describe wing bearing styles:

HWD:	High Wing Drilled
LWT:	Low Wing Threaded
LWD:	Low Wing Drilled
DWT:	Delta Wing Threaded

The "series" classifies the size of the universal joint. Wing bearing sizes are based on the "pilot diameter", keyway width, and the diameter and distance between the holes. The pilot diameter is illustrated in Figure 4. Identify the joint by measuring the pilot diameter and then determine the series from Table 1 on the following page.

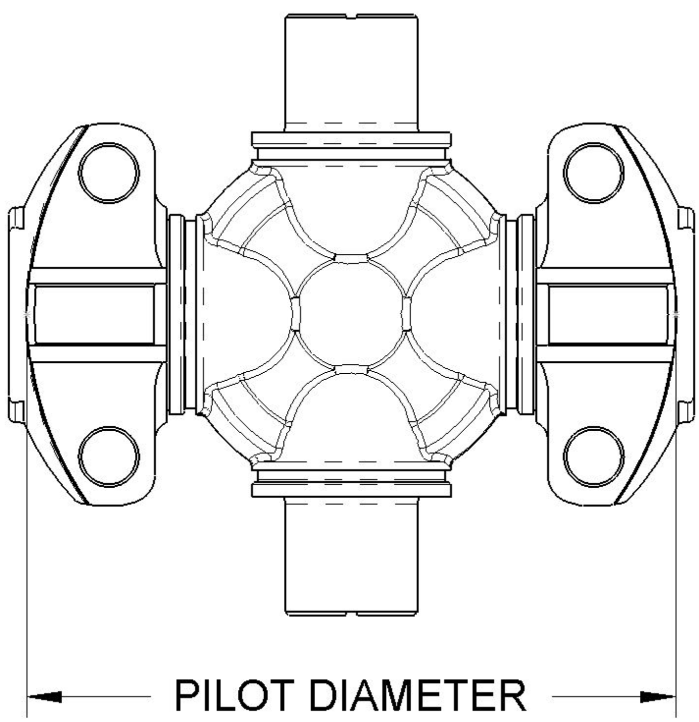

Figure 4
Pilot Diameter
(Prior to measurement fully compress the bearing caps.)

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Table 1
Wing Bearing Series

Series	Pilot Diameter
2C	3.125
3C	3.563
4C	4.250
5C	4.531
58WB	5.312
6C	5.531
7C	5.844
8C	8.125
8.5C	6.500
9C	8.250
10C	8.375
11C	8.750
15C	10.230

Universal Joints: Round Bearing Style

There are three major styles of round bearing caps: Inside snap ring (ISR), outside snap ring (OSR), and bearing plate (BP). The three round bearing style caps are illustrated in Figure 4.

Figure 5
Round Bearing Style Caps

As the name implies, ISR bearing caps are held in place with snap rings located inside of their contact with the yoke ears. Conversely, OSR bearing caps are held in place with snap rings located outside of their contact with the yoke ears. Alternatively, OSR bearing caps are also held in place with a projecting tab within the ear portion of the yoke.

Round bearing sizes are based on the inside or outside "lockup dimension" and the "bearing diameter". These dimensions are illustrated in Figure 6. To determine the series, measure the lockup dimension and bearing diameter and then compare the values to Table 2.

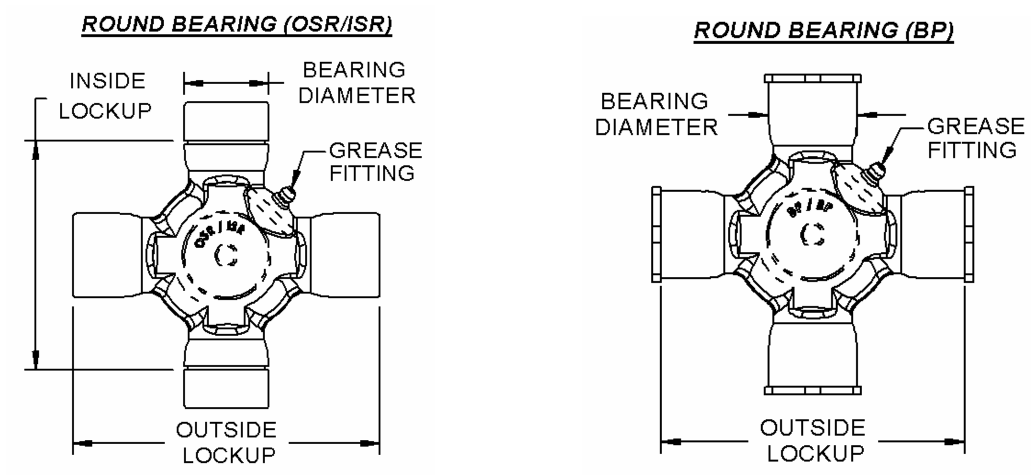

Figure 6
Lockup Dimensions and Bearing Diameters

Table 2
Round Bearing Series

Series	Lockup Method	Lockup Dimension	Bearing Diameter
1000	ISR	1.500	0.938
1310	OSR	3.219	1.062
1350	OSR	3.625	1.188
1410	OSR	4.188	1.188
1480	OSR	4.188	1.375
1550	OSR	4.964	1.475
1610	BP	5.312	1.875
1650	OSR	5.594	1.625
1710	BP	6.094	1.937
1710	OSR	6.187	1.937
1760	BP	7.000	1.937
1760	OSR	7.093	1.937
1810	BP	7.547	1.937
1810	OSR	7.640	1.937
1880	BP	8.094	2.188

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It should be noted that universal joints frequently utilize two different styles of bearing caps. For example, there may be wing bearing caps on one axis of the joint and round bearing caps on the other. It is necessary to identify the style of the bearing caps on either axis.

In most cases, the type of bearing cap will be evident from a brief look at the ends of the each universal joint. The end view of the various universal joint cap styles is illustrated in Figure 7.

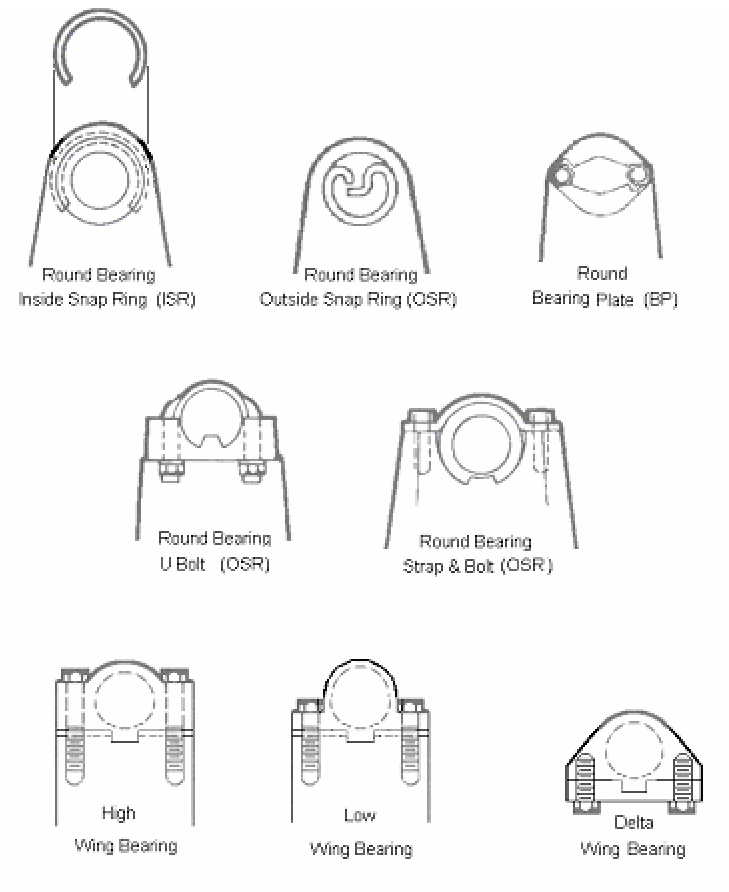

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Figure 7
Universal Joint Cap Styles

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Universal Joints: Lubrication

The final step in identifying a universal joint is determining if it can or cannot be re-lubricated. If a universal joint has a grease or "zerk" fitting it is "greasable", meaning old grease can be purged from the joint with new grease. On the other hand, if there are no grease fittings on the joint then it is "non-greasable" and is unintended for re-lubrication. Grease fittings are typically located on the body of the universal joint (see Figure 6) but may also be on one or more of the bearing caps. If the universal joint is greasable then it is necessary to describe the style of the grease zerk. Zerk variations are illustrated in Figure 8. If the fitting is extended measure and record the length.

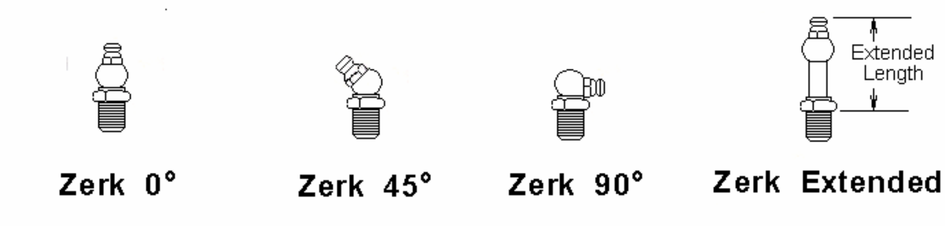

Figure 8
Grease Fitting (Zerk) Configurations

Summary: Universal Joint Identification

Use the following steps to identify a universal joint. If a driveshaft consists of more than one universal joint be sure to identify each one individually.

Step 1: Identify the bearing style.

> Remember: There may be two different sets of bearing caps on a single universal joint. Examples include: OSR/HWD, OSR/ISR, LWT/ISR, DWT/HWD, etc…

Step 2: Identify the series. Refer to Tables 1 and 2.

Step 3: Is the joint greasable? Yes /No

Step 4: If yes, note the type, quantity, and location of the zerk fitting(s).

Step 5: If the fitting(s) are extended note the length. See Figure 8.

Step 6: Complete the universal joint description, for example "6C HWD/HWD Greasable".

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Section II: Driveshaft Component Identification

The easiest way to identify driveshaft components is to review the principle driveshaft configurations and their individual parts. Section I reviewed universal joint identification, Section II will outline driveshaft component identification, and Section III contains various templates of the principal driveline configurations. Each template requires the necessary information to accurately identify a driveline. For further information on individual driveline components please refer to the Certified Power Parts Catalog and use Sections II and III of this guide to refine your search.

The driveshaft illustrated in Figure 9 has a fixed length and two round bearing universal joints. It cannot axially extend or contract. However, Figure 10 shows that the driveshaft can operate over a range of angles at either end.

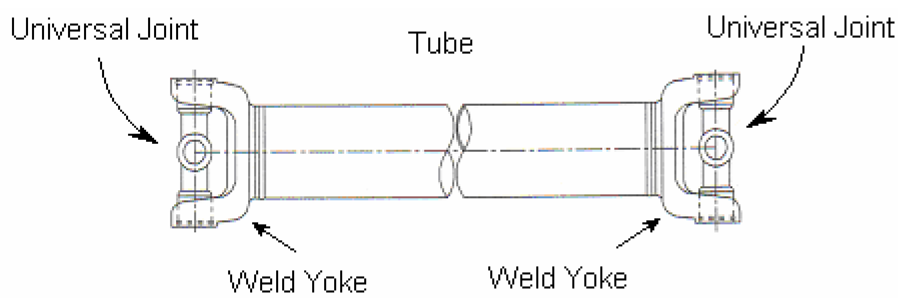

Figure 9
Fixed Length Driveshaft

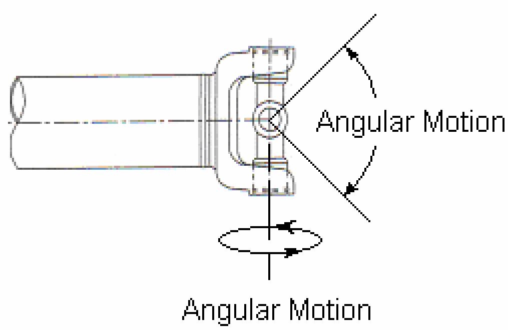

Figure 10
Detailed View of Figure 9

The universal joints on both ends are joined to yokes. The yoke style illustrated in Figure 9 and 10 are round bearing yokes. A yoke is a device that unites, couples, or connects. As it relates to driveshafts, a yoke is the basic torque input and output component. The yokes illustrated in Figures 9 and 10 are "tube or weld yokes". A tube or weld yoke is a yoke incorporating a locating diameter that aligns a tube or other driveshaft member. In the illustration both yokes are joined by a tube. Typically the tube is welded to the yoke, as it is in figures 9 and 10.

The driveshaft illustrated in Figure 11 features a standard slip and wing bearing style universal joints.

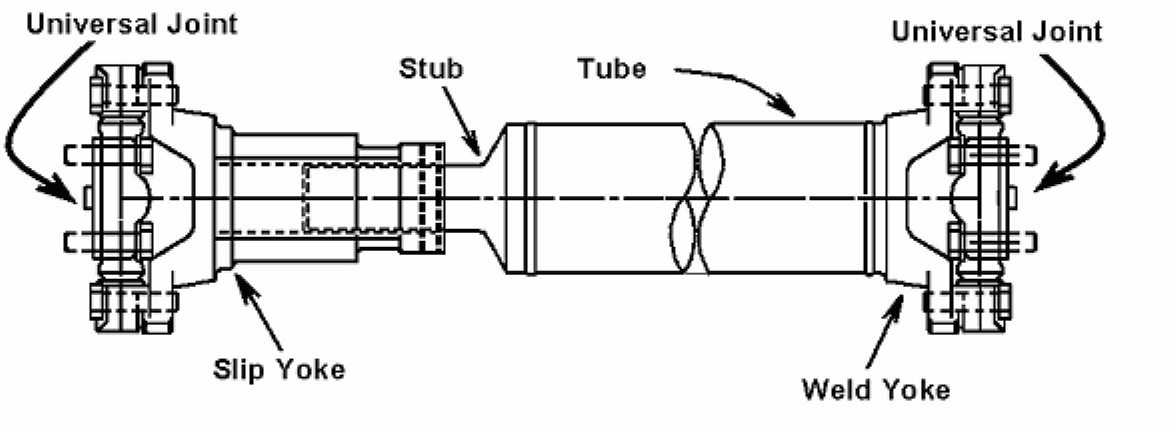

Figure 11
Standard Slip Driveshaft

This type of driveshaft can accommodate both axial and angular motion. The yoke on the left side of Figure 11 is a "Slip Yoke". This type of yoke facilitates axial movement as illustrated in Figure 12. The term "slip" also refers to the allowed length of axial travel. An exploded view of a Slip Yoke assembly is shown in figure 13.

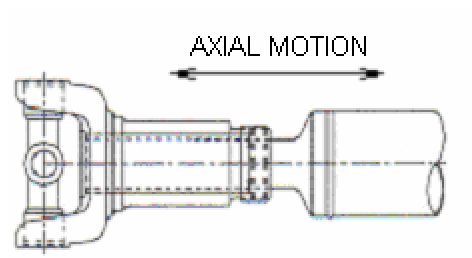

Figure 12
Driveshaft Slip Section

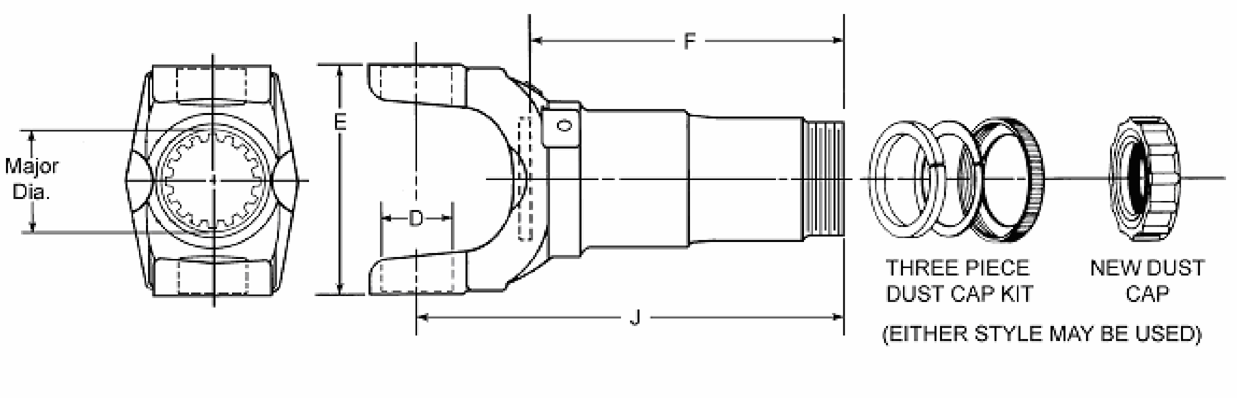

Figure 13
Exploded View of a Slip Yoke

The mating part is referred to as a "stub" and as illustrated in Figure 14. The hub diameter of the stub locates the mating part, which is typically a tube. The external spline of the stub mates to the internal spline of the slip yoke.

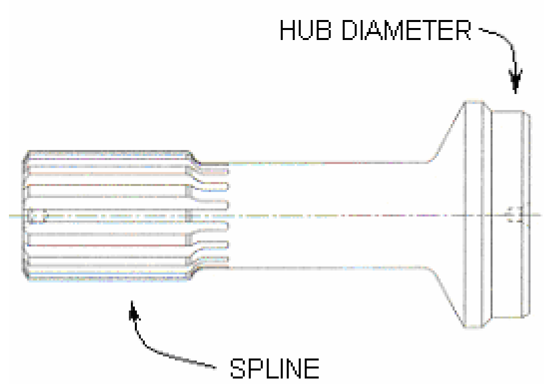

Figure 14
Stub

Spline Identification

A spline is a machine element consisting of integral keys (spline teeth) or keyway spaces equally spaced around a circle or portion thereof.[3] The function of a spline is to transmit the torque requirement from one driveshaft component to another. In many applications it must also allow length changes (axial motion) due to vehicle motions. There are two basic spline geometries, an involute spline and a parallel sided spline.

[3] Ditto Page 185

As the name implies an involute spline is a spline with a rolled or curled profile versus a parallel sided profile. Figure 15 illustrates an involute spline.

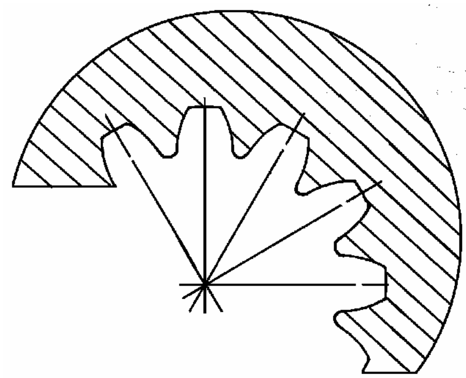

Figure 15
Involute Spline

Also as the name implies a parallel sided spline is characterized by teeth that have parallel sides. A parallel sided spline is illustrated in Figure 16.

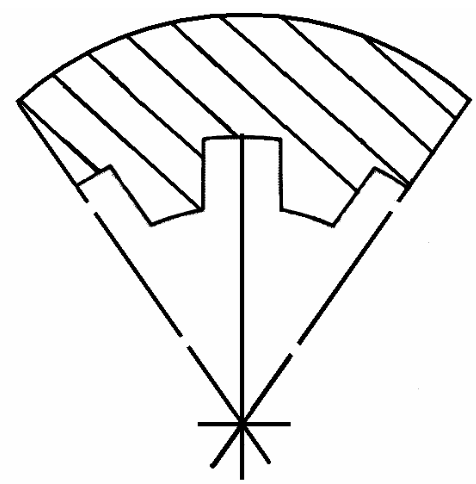

Figure 16
Parallel Sided Spline

Two pieces of information are needed to identify a spline, the major diameter and the number of teeth. The major diameter is illustrated in Figure 13.

The spline section of stubs may be coated with nylon or plastic like material. The purpose of this coating is to reduce the required axial slip force, provide protection from corrosion, and improve wear characteristics. When identifying a spline indicate whether or not the spline is coated.

Summary: Spline Identification

Step 1: Involute or parallel sided?

Step 2: Count the number of teeth

Step 3: Measure the major diameter

Step 4: Is the spline coated? Yes / No

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Other Driveshaft Components

It should be noted that most driveline yokes are manufactured in both round bearing and wing bearing styles. In this section the major driveline component types are illustrated.

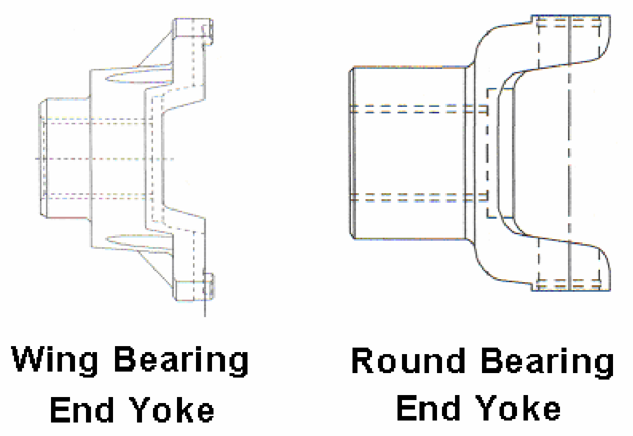

Figure 17
End Yokes

An end yoke connects a universal joint to another driveline component.

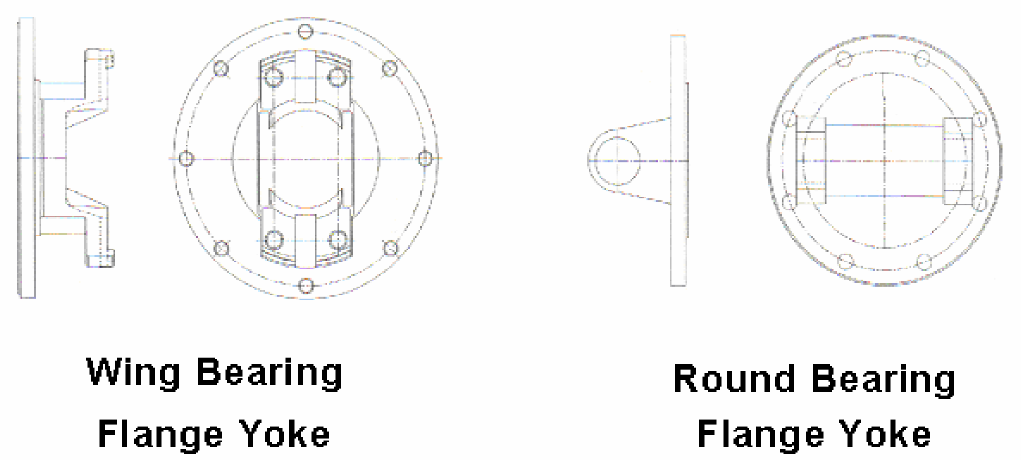

Figure 18
Flange Yokes

A flange yoke connects a universal joint to a companion flange.

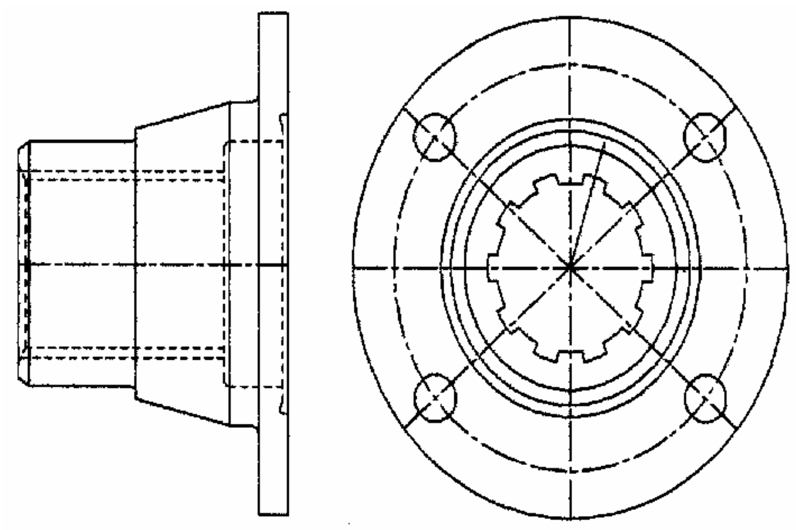

Figure 19
Companion Flange

A companion flange is a component that connects a flange yoke to another driveline component.

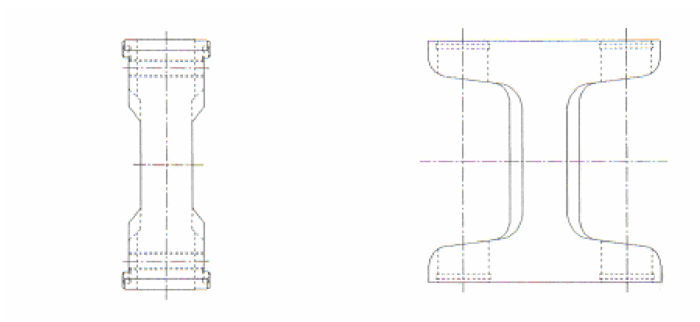

Figure 20
Center Yokes

A center yoke is a component that connects two universal joints.

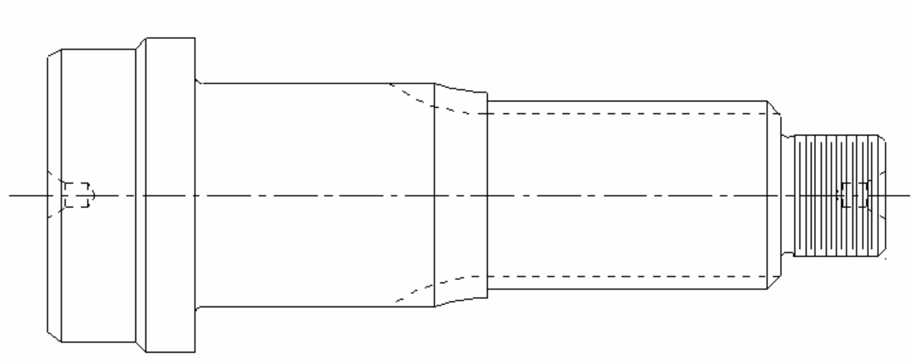

Figure 21
Bearing Stub

A bearing stub is a component that connects a tube to an end yoke and is used in conjunction with a rigidly mounted bearing to help support the driveshaft.

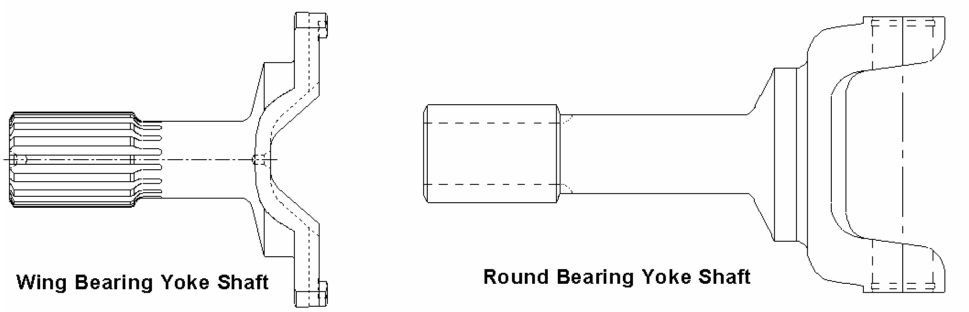

Figure 22
Yoke Shaft

A yoke shaft is a component that connects a slip yoke to a universal joint.

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Section III: Driveline Identification

In general, the process of identifying a driveline consists of classifying the universal joint(s), categorizing the individual components, defining the assembly configuration, and collecting the necessary dimensional information. To facilitate this process Certified Power has created a universal joint template and nine driveline templates. These templates include the most common driveshaft configurations.

Driveline Identification Process:

Step 1:

Lay the driveline on a flat surface where you have easy access to the components. As you face the driveline consider it's configuration from left to right.

Step 2:

Does the driveline match one of the templates? If yes, use Sections I through III of this guideline to complete the appropriate template.

Step 3:

If the driveline does not match one of the templates, does one of the driveline templates match a portion of the driveline you wish to identify? If yes, use Sections I through III of this guideline to complete the appropriate template. Then use Sections I through III of this Guideline and the CPI Inc. Parts Catalog to identify the extra components. Characterize the extra components on an additional sheet.

For Example," The driveline is a 1410 series driveline and matches Template Number 3 'Fixed Length (Round Bearing Joints)' plus the right side universal joint illustrated in template 3 is connected to a 1410 Round Bearing Center Plate (3.03 inch, drilled), connected to a OSR/OSR 1410 Universal joint, connected to a 1410 Round Bearing Flange Yoke (5.875 inch OD, 3.750 inch Pilot diameter and the "D" dimension is equal to 2.00 inches.)."

Step 4:

If the driveline is not similar to any of the templates, use Sections I through III of this guideline and the CPI Inc. Parts Catalog to describe each of the driveline component, from left to right. If possible, photograph the driveline and send us the photo along with the component descriptions.

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Appendix I: Driveline Templates

1. Universal Joint Identification
2. Fixed Length (Wing Bearing Joints) Driveline Identification
3. Fixed Length (Round Bearing Joints) Driveline Identification
4. Standard Slip (Wing Bearing Joints) Driveline Identification
5. Standard Slip (Round Bearing Joints) Driveline Identification
6. Short Couple Slip (Wing Bearing Joints) Driveline Identification
7. Short Couple Slip (Round Bearing Joints) Driveline Identification
8. Carrier Shaft (Wing Bearing Joints) Driveline Identification
9. Carrier Shaft (Round Bearing Joints) Driveline Identification
10. Inverted Slip (Wing Bearing Joints) Driveline Identification

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