Recognising that each company has their individual needs to train their staff, this manual has been drawn with a view to outline the products and related facts to assist in this task.

We trust that this will prove to be beneficial, however, please feel free to contact us for any further assistance required.

Written by the Interparts Team 2003
Interparts Europe Limited

As part of Interparts A.D.D. (Automotive Driveline Division), Interparts Industries Incorporated are a global manufacturer of driveline products.

Our clients include both original equipment manufacturers (O.E.M.) and the independent aftermarket.

Through our global operations we service markets with our regional partners. To further support this, Interparts has a competent and reliable distributors’ network, enhancing an excellent level of service.

With the technical knowledge of Interparts A.D.D., the quality of our products is always guaranteed and consistent by using the latest technology for production.

Product Range

- for passenger and light-commercial cars -

- Complete driveshafts.
- CV joint kit, complete with bands, boot, circlip/ snapring, grease, and hub nut.
- Boot kit, complete with bands and grease.
- Loose boots.
- Components for re-manufacturers.

General Information

Interparts CV Joints are supplied un-charged with grease, i.e. dry, to enable an accurate trial fit. CV Joints must be correctly charged with grease before attempting final fitting.

As a responsible manufacturer we brand all our products for two reasons:

1. to display the trust in our manufactured products and technical methodology.
2. some products are laser-marked while others bear a moulded impression of the Interparts US part number and production batch number for warranty and identification purposes, in case the items are out of their packaging.
Constant Velocity Joints

The CV joint allows the driving wheel to steer whilst maintaining constant velocity from the transmission box.

The driveshaft has an outboard CV joint (OJ), an inboard CV joint (IJ), and the two are connected by the bar- the joints are each protected by a neoprene bellowed boot.

Each CV joint needs to operate in a fairly luxurious bath of lubricant (grease) intended especially for the CV operation. The special lube is retained by the boot, which is secured to the housing of the joint with a large metal band, and to the bar with a small metal band.

On front wheel drive vehicles the outboard CV joint being connected to the steered wheel has to have a much wider operating angle in comparison to the inboard CV joint, which is connected to the gearbox.

It is simply because the outer joint may have to turn up to 50 degrees off centre when the front wheels are steered, whilst the inboard CV joint, by comparison, rarely sees an operating angle of more than about 20 degrees.

Just imagine your lower arm being the bar, your elbow as the inner CV joint, and your wrist as the outer CV joint: the operating angle of the elbow is rather restricted compared to the wrist.

Consequently, different types of CV joint designs may be used for the inner and outer CV joints.

The Outer Joint (OJ-####)

The most common type of outer CV joint is the “Rzeppa” style, also known as Cardan joint. A Dana engineer named Alfred H. Rzeppa invented this type of joint in 1920. Rzeppa designed a joint in which the input speed and output speed are delivered by a single universal joint in which all rotational velocities are the same, hence the term constant velocity.

The French introduced the use of the bear-claw housing, which has a fixed tripod with three longer arms. The bear-claw is friction welded / fused to the bar, which is a far stronger method than surface welding. With this design the drive bar and housing of the outer CV joint are integrated.

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Do not confuse it with the Universal Cross Joint used on prop shafts.
The CV Joint is designed to allow power to be transmitted through **six spherical balls (ball bearings)** located between the **race (inner race)** and the **housing (outer race)**. The cage, race and ball bearings are cased in the housing. The race has a set of **internal splines**, which fit the mating splines of the drive bar and is retained with a **snapring** or **circlip** – depending on the **groove location (clip location)**.

Both the race and the housing have a set of six **tracks** for the **ball bearings**. The balls are held in position by the small windows of the **cage**, which is a floating component located between the inner and outer race.

**Critical dimensions:**

- **A** = External Splines
- **B** = Seal Diameter
- **C** = Internal splines
- **D** = Number of ABS teeth
- **E** = Housing Diameter
- **G** = Overall Length
- **H** = Stub Length
- **I** = Clip location (Front/ Inside/ Back of race)

**Critical dimensions on ABS rings:**

- **D** = Number of ABS teeth
- **E** = outer diameter in mm (O.D.)
- **F** = inner diameter in mm (I.D.)
- **G** = height in mm

**Note:**

- **E** always refers to the Outer Diameter of the item in question
- **F** always refers to the Inner Diameter of the item in question
- **G** always refers to the overall height of the item in question
The Inner Joint

(IJ-6###)

The gearbox side of the driveshaft has the inner CV joint, which is either a six-ball or a roller-pin (Tripod) arrangement. Both joint designs allow the inner race, which is mounted on the end of the shaft, to slide in and out so that the shaft can change length, which is indispensable due to the shaft being usually longer than the control arms on the suspension. The difference in the length would create interference problems every time the suspension moved up and down and the plunging action of these joints compensate for the difference.

Inner joint types:
- Six-ball arrangement joints:
  1. With male splines
  2. With female splines
  3. Velocity Linear (VL) joint
- Roller-pin arrangement joint:
  4. Tripods

Male / female inner joints

The design of the inner CV joint is different to the outer CV Joint, as it can have a tripod or a six-ball arrangement, but the six-ball arrangement comprises of straight ball tracks. Furthermore, the inner CV Joints can have a male or female stub comprising of external or internal splines.

![IJ-6661 male joint](image)

![IJ-6904 female joint](image)

*Note:* these technical drawings show the tripod inside rather than the traditional six-ball arrangement. They are shown here to illustrate the difference between male and female stub of the CV joints.
Tripod Joint (spider assembly)

The tripod CV joint has a three-armed trunnion, which is secured to the bar with a *snapring*. Tripod CV joints do not have a six-ball configuration, instead they use *needle rollers (roller pins)* that run inside the shell *bearings*, which fit over the trunnions.

The three spherical roller bearings are mounted at 120 degrees to one another and slide back and forth in the three tracks of the outer housing. The design itself is well suited to the limited operating angles of the inner CV joint location.

The external shape of the tripod housing (cloverleaf) sometimes indicates the shape of the tripod itself but it can also be concealed completely by a spherical housing:

![Tripod Joint Diagram](image)

Tripod CV joints\(^2\) are mainly used for front wheel drive vehicles.

**Velocity Linear (VL) Joints (Cross Groove Joints / Pancake Joints)**

This flat six-ball CV joint has a very limited plunge motion but allows a certain amount of angle. It has no external splines as it is held with 6 high tensile bolts to the gearbox or drive flange. They are always retained on the drive bar by a circlip – never by a snapring.

A mere 20% of inner CV joints follow this design. However, they are occasionally used for the outboard CV joint too *(BJ-6037)* conditional to the vehicle being a four wheel or rear-wheel drive.

\(^2\) Aftermarket manufacturers are in the fortunate position to be able to modify original designs – it is a general practice either to rectify faulty designs or to come up with alternative designs to reduce manufacturing costs. For instance, Interparts redesigned all of its inner CV joints to have a tripod in the housing unless it is a VL Joint. The external design will match O.E., while the internal design will match our tooling specifications with the restriction that the inner splines of the tripod have to match the O.E. design of the race unless it is a custom production for a tailor-made drive bar.
CV Boot

The rubber part of the driveshaft assembly is known as the CV boot, which is secured with stainless steel crimp bands. The boot’s purpose is to protect the internal components of the CV joint\(^3\) by retaining the lubricant whilst also acting as a dust shield (dust guard).

CV boots come in different shapes and sizes. The bellows on the boot determine the amount of movement the boot tolerates. The type\(^4\) of boot to be used depends on the CV joint type; boots either have locking lips or they are plain on the retaining profile. On O.E. design tripodal inner CV joints tripodal boots are used.

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\(^3\) With some applications, like our OJ-0222 (Toyota Landcruiser), the boot is not provided in the kit as the CV Joint is intended to run in an oil bath, sealed from the elements.

\(^4\) Recently a universal (stretch) boot has been introduced. There are few available sizes, which are then cut to the required diameter by the mechanic. These are successful as a quick fit short term solution, as the disadvantage is that its material compound does not consist of any Neoprene and without this ingredient the life span of the CV Boot is compromised in various climates.
The quality of CV boots is greatly determined by the amount of Neoprene in them, as it makes them more tolerant in extreme climates. In spite of this, many O.E. manufacturers are now reverting to supplying Thermoplastic CV boots. Although these CV boots usually carry an O.E. lifetime warranty as they are so strong, the problem with this material and design is that the CV boot is very rigid and given time they usually slip off the CV joint causing the component to fail. Many mechanics prefer to replace the Thermoplastic boot with a Neoprene equivalent.

Experts can easily tell whether rubber parts contain Neoprene or not just by smelling them\(^5\).

The common mistake made during fitting a CV joint is that the grease is applied to the boot rather than to the CV joint itself.

### Anti-lock Braking System (ABS) Rings

Anti-lock braking systems (ABS) take a lot of the challenge out of bringing the vehicle to a standstill. In fact, on slippery surfaces, not even professional drivers can stop as quickly without ABS as an average driver can with ABS.

ABS rings\(^6\) are also known as ALB rings in some countries, and is a system that provides superior brake assistance whilst preventing wheels locking up and causing the vehicle to skid, thereby preserving steering control and reducing stopping distances on some road surfaces.

The two best-known anti-lock systems to date (developed by the Bosch and Alfred Teves companies in Germany) are electronically controlled. Basically, whenever the driver steps on the brake pedal an electronic control unit (ECU) “reads” the signals from the electronic sensors that are monitoring wheel rotation. If a wheel’s rotation rate suddenly decreases, the ECU orders a hydraulic control unit to reduce line pressure to that wheel’s brake.

With ABS rings these are the critical dimensions to look at:

\[
\begin{align*}
D &= \text{number of teeth} \\
E &= \text{External diameter (O.D.)} \\
F &= \text{Internal diameter (I.D.)} \\
G &= \text{Height mm}
\end{align*}
\]

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\(^5\) Another good quality test can be carried out by burning them: Neoprene boots will not burn, while ordinary rubber ones will.

\(^6\) Note that the ABS System is designed to enhance the braking performance but should it fail, it does not result in brake failure.
There are 3 different types of ABS rings, depending on the make and model:

- **Punch Window / Type W**
  They work on optical readers (no teeth) and optically pick out the windows. They are mainly used on German applications. They are very delicate and brittle, they do not allow any deflection or distortion.

- **Powder Metal / Type PM**
  They work on magnetic and are generated from a mould. The high aluminium content determines their delicacy. They do not allow any distortion either, otherwise they crack.

- **Steel / Type R**
  They are regular steel rings allowing minor distortion. They can be pressed on the joint, the tolerance of distortion is max. 1.5 mm. The larger the teeth are the more hardwearing they are. They work mechanically.

In most cases the ABS ring is fitted to the outer CV joint, however sometimes they can also be placed on the Inner CV Joint (i.e. Subaru) or, alternatively, there is a system incorporated within the drive flange (i.e. Ford, Opel, Vauxhall).
Cages, Races and Ball Bearings

In the race (centre of CV Joint) there are six ball tracks for ball bearings to run in once assembled.

The race has splines in its bore, while the mating splines are located on the shaft to fit inside the race bore. The race is retained on the shaft with a snapring or circlip. With regard to races, we often receive technical enquiries from customers regarding the valley-to-valley measurement or the spline profile.

The cage is used to retain the ball bearings in position between the ball tracks on the race and the housing, thus allowing them to be retained at any angle.

Ball bearings are used to provide smooth, low friction motion in rotary applications. The bearings can handle both radial and thrust loads. The ball bearings are a very price conscious commodity and are rather delicate. If they knock against each other they can distort but the distortion is not visible to the naked eye, as it is in microns.

In remanufacturing the windows of the cage and the 6 ball tracks of the race and CV joint housing are ground, thus requiring oversized ball bearings to make up for the amount removed in the grinding process.

\[ C = \text{Internal Splines} \]
\[ E = \text{Outer Diameter} \]
\[ G = \text{Height} \]

In spite having the same No’s of Splines the profile can vary (e.g. OJ-0220 vs. OJ-0220/30) by the pressure angle (P.A.), which can be pointed (P.A.45°) or flat (P.A. 30°).

This difference is also loosely referred to in the trade as Valley-to-Valley measurement. Note this is a measurement in mm across the widest point of the splined area and not the P.A. value that is in degrees.
Circlips and Snaprings

Circlips and snaprings secure the joint onto the bar, they can be located at the back, front or inside of the race. The bar itself has a groove, the position of which corresponds with the clip location.

Snaprings (in the US they are called circlips) are used for back or inside location of the race. They will snap into position, hence the name snapring. These are placed on the drive bar for assembly. CV Joints with an internal clip location have a groove in the bore of the race. CV Joints with a back clip location have no groove in the bore of the race, the snapring will actually be pushed through the bore of the race and expand to retain the CV joint once it has reached the back of the race.

Circlips (in the US they are called snaprings) are located in the front of the race - there is a captive groove on the race for the circlip to be embedded. To put them into position one has to use circlip pliers. Circlips are easy to differentiate from snaprings as circlips have two ears and are placed in position after assembly.

The Complete Driveshaft

The complete driveshaft is made up of an outer and an inner joint, and the drive bar connects the two.

The driveshafts on the two sides of the vehicle can be of the same or of different lengths. This symmetrical nature of the driveshaft depends on the engine and gearbox location. If the engine located with the drive / fan belts facing the front, then there is a possibility of the driveshafts being equal in length, whereas if these belts are located to one side of the vehicle, then the lengths will vary from left to right.

Quite often it can be confusing to establish which driveshaft is required. Mechanics would normally refer to the shorter or the longer driveshaft, if that is the case. However the simplest solution is to sit in the vehicle and verify if it is the left or right that needs to be replaced regardless of the car being a left or a right hand drive, as it is actually irrelevant.

With CV joints it is much easier, as apart from having the term inner and outer CV joint, they can also be referred to as the wheel side or the gearbox side.
On very rare occasions the outer CV Joints can differ from left and right.

### The Life-span of a CV Joint

Outer CV joints need to be replaced more often than inner CV joints:

1) Outboard CV joints have to operate on a wider variant as they need to be steered with constant velocity.
2) The outer CV Joints run closer to the road surface, hence there is more exposure to the elements.

The outer CV joint needs to be changed if there is a clicking sound heard when turning corners or on full lock. The inner CV joint needs to be changed if there is a constant clicking noise when the vehicle is being driven in a straight line.

But this is a simple rule given that all other related components have already been checked.

The life-span of a CV joint is determined by many interrelated causes:

- design of the ball tracks in the inner and outer race;
- how light or bulky the CV joint is: the heavier it is the more hardwearing it is;
- the higher the torque output is the more the demand is, having said that in this case the design would be heavier too.

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8 With the Gothic arch design we have an oil-vein between the ball bearings and the ball tracks, also allowing minimum contact between the ball bearings and ball tracks, resulting in reduced friction. The lower the friction the higher the output is, however since the contact area has been reduced the load pressure is much higher. Honda favors this design; they also make their CV joints lighter. On the other hand the spherical (standard) arch design has maximum contact between the ball bearing and the ball track, which spreads the torque between the components. This design is quite popular with European manufacturers, who also make their CV joints bulkier.

9 The weight of a CV joint can vary from 1 Kg to 3 Kg on passenger and light commercial cars.
Submitting Samples

To offer a better level of support to our clients, we consistently broaden our range to meet the individual market demands. Due to the difficulties in obtaining these samples from the O.E. dealership, we rely upon our distributors assisting us in this area, as on occasions an enquiry is placed for a CV Joint, that later concludes to be a dealer part only and is not available in any replacement brand. In this instance, we encourage our distributors to make an offer to the enquirer to purchase the old unit and submit to us with the exact details of the vehicle for reverse engineering (Make, Model, Year, Eng. #, Chassis #, Transmission Type).

Part Number Identification

The European carpark reflects a rather diverse picture – we tried to come up with a logical and consistent system of part number identification, which is as follows:

<table>
<thead>
<tr>
<th>Outer CV Joint</th>
<th>Inner/ Outer (Both) CV Joint</th>
<th>Inner CV Joint</th>
<th>Manufacturer / Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>OJ-01##</td>
<td>BJ-61##</td>
<td>IJ-61##</td>
<td>Nissan</td>
</tr>
<tr>
<td>OJ-02##</td>
<td>BJ-62##</td>
<td>IJ-62##</td>
<td>Toyota</td>
</tr>
<tr>
<td>OJ-03##</td>
<td>BJ-63##</td>
<td>IJ-63##</td>
<td>Isuzu</td>
</tr>
<tr>
<td>OJ-04##</td>
<td>BJ-64##</td>
<td>IJ-64##</td>
<td>Mazda</td>
</tr>
<tr>
<td>OJ-05##</td>
<td>BJ-65##</td>
<td>IJ-65##</td>
<td>Daihatsu</td>
</tr>
<tr>
<td>OJ-06##</td>
<td>BJ-66##</td>
<td>IJ-66##</td>
<td>Mitsubishi</td>
</tr>
<tr>
<td>OJ-07##</td>
<td>BJ-67##</td>
<td>IJ-67##</td>
<td>Suzuki</td>
</tr>
<tr>
<td>OJ-08##</td>
<td>BJ-68##</td>
<td>IJ-68##</td>
<td>Honda</td>
</tr>
<tr>
<td>OJ-09##</td>
<td>BJ-69##</td>
<td>IJ-69##</td>
<td>Subaru</td>
</tr>
<tr>
<td>OJ-1###</td>
<td>BJ-60##</td>
<td>IJ-60##</td>
<td>Non-Japanese</td>
</tr>
</tbody>
</table>

Within the Interparts Group we have two sets of part numbers, these have been established to overcome application confusion between the two continents. The Interparts Europe sequencing is as above, while the U.S. part numbers have two letters to indicate the make followed by digits and an A if it is an ABS version. All our CV joints are laser-marked with the U.S. part reference.

10 Price offered for old unit needs to be agreed with Interparts, Unit must be O.E. and must not be broken, damaged or tampered with.

Tel: +44 (0)20 8655 2765    Fax: (0)20 8655 2865
E-Mail: sales@interparts.eu.com  Website: www.interparts.eu.com
If the CV joint happens to be out of its original box and needs to be identified, we need to cross-refer the first two letters and the last 3 digits (Laser marked on the housing) using the interchange function in the CD catalogue as follows:-

- Search
- Interchange
- Select Interparts (In manufacturers list)

Other Search facilities included are:

- **Locate Part**: enter either the joint number or the boot number and it will give you all the applications that it fits with the option of printing a report or viewing the technical drawing.

- **Outer Joint Spec**: enter the outer spline number, the seal diameter and the inner spline count and it will give you a list of possible applications with the option of printing a report or viewing the technical drawing.

- **Inner Joint Spec**: same steps as above but you can exclude the outer spline count in case it is a VL joint with the option of printing a report or viewing the technical drawing.

- **Interchange**: this also includes our competitors’ part numbers with the option of printing a report or viewing the technical drawing.
**Important questions to ask with technical queries**

- Make and Model
- Engine No. (mainly for Japanese applications)
- Chassis No. (mainly for Japanese applications)
- Manual / Auto
- CC Engine
- Year
- With or Without ABS

**Quality**

Interparts products are manufactured to O.E. specifications conforming to ISO9001:2000 / ISO9002.

All products are subjected to rigorous simulation tests throughout development and production to ensure high and consistent quality.
Warranty

As a responsible manufacturer, we are always concerned with warranty claims, as we would like to establish any errors or imperfections in our manufacturing processes and procedures as fast as possible so that we can effect the corrective measures if required.

Interparts products are guaranteed for 20,000 km / 24 months, whichever occurs first from fitment date. With reference to inconvenience or fitting charges, it is clearly stated in our catalogue and the reverse of our dispatch notes / Invoices that

our warranty is a limited liability warranty that covers product only.

CV joints returned with the following faults are not covered under warranty:

- CV Joints returned with damaged threads.
- Products damaged through fitment to an unsuitable application.
- Products returned incomplete as originally supplied, as these are imperative to assessing products for failure.
- Products returned without a warranty claim form.
- Warranty is only valid when all original Interparts products are used, including Boots, Grease, Circlips / Snaprings.

Whilst every care has been taken in compiling our catalogue, Interparts Europe & Interparts Industries cannot accept any liability for any inaccuracies. In simple terms this means that although we have taken every precaution to validate this information we cannot vouch for all of it, like any catalogue, there are always unintentional errors that become evident after publication.

Finally, for this reason our CV Joints are supplied un-charged with grease, so that the mechanic is able to dry fit the assembly to verify accuracy prior to final fit. If the replacement CV Joint supplied does not match the old unit removed the mechanic should not proceed with assembly.

However, if the mechanic fails to notice the difference and continues to fit the product, he has automatically void any warranty that the manufacturer offers as he has applied the product to an application that it is not intended to fit.