	2mm Scale Association 3D Printed Universal Joints Instruction Sheet	Shop Ref. 3-264

Introduction.

This instruction sheet has been produced with the purpose to detail the 2mm Scale Association's (2mmSA) 3D printed universal joints that are available through the associations shop '3'. It covers the design philosophy and the recommended use of the joints.

The universal joints were designed as a result of repeated requests for the 2mmSA to stock a simplified method of creating a flexible joint between a locomotive which was driven via a shaft from a motor located in the associated tender. These particular joints have been created after a period of development and testing where the design has been modified to improve the functionality, reduce the overall size as much as practical, whilst keeping within the limits of the current technology available. The following documents the resultant parts.

Design.

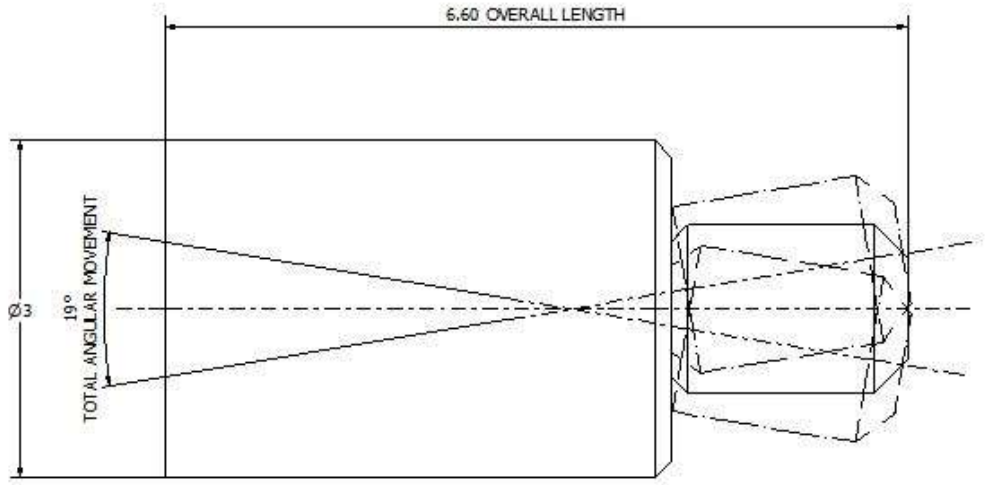


Fig 1 Joint Extents of Travel

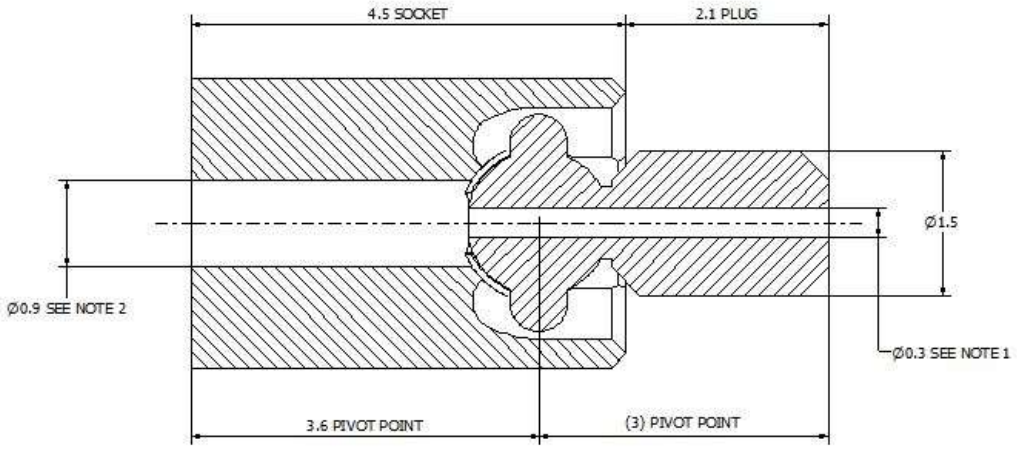


Fig 2 Basic Dimensions of Joint

The preceding two drawings detail the dimensional information regarding the joint. The larger (female) part shown on the left is intended to be fitted to a motor or worm drive whilst the smaller (male) part on the right is intended to be fitted to the intermediate shaft. The whole joint is supplied in two sets so to complete a typical drive-train from motor to worm drive.

Suggested Use

Below is a list of suggestions on the use of a joint. These have been tried and tested during the development stages. They are by no means an exact step-by-step guide and it is expected for the individual to have an understanding of the application the joints will be used for.

Female Joint

The intention for this part of the joint is to be used with a length of steel wire which acts as the driveshaft. As the printing process limitations didn't allow for a through hole to be added to the design, it is up to the end user to drill a through hole as shown in [*fig 2 Note 1*].

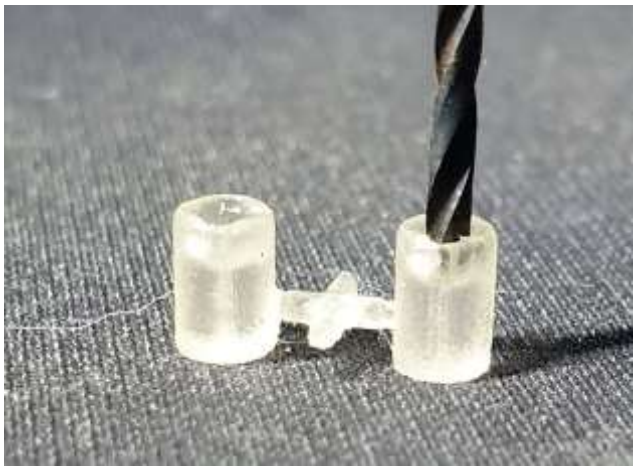
Fortunately it was possible to add a pilot hole to the shaft end of the joint so this can act as a suitable guide for drilling which will keep the drill true to the part. As there is an inherent weak point at the base of the sphere care must be taken not to force the drill through the remaining part as this could lead to the sphere breaking [*fig 2 note 1*]. At this point in the part the diameter is only 0.75mm so obviously the larger the shaft, the larger the hole, and therefore the weaker this area is going to become. On testing it was found that a 0.3mm diameter shaft was more than sufficient to act as a driveshaft, but there is a degree of allowance to increase this diameter to 0.4mm or even 0.5mm if required. This can be repeated for both female joints, I would recommend while still attached to the parent sprue.

Once both parts are drilled the shaft can be inserted for a trial fit. If all is ok then a thin coating of superglue can be added to the shaft which can then be inserted into the joint part. I found it was easier to allow a certain amount to ‘poke out’ from the part which can then be trimmed flush with the joint and cleaned up once the glue had hardened. By drilling and gluing the driveshaft through the part it then helps tremendously to strengthen this part. Do not leave any of the shaft protruding as this will affect the performance of the joint during operation.

This can then be repeated with the other end ensuring the driveshaft is set to the required length [*fig 3*].

Male Joint

The male joint has a nominal 0.9mm diameter hole through the component which can easily be opened to fit a 1mm diameter shaft by use of a taper reamer or drill. The body of the male part has been made to tolerate much larger shaft sizes and can fit upto a 2mm shaft comfortably [*fig 2 note 2*]. When increasing the shaft size much beyond 1.5mm though care must be taken not to drill too deep as this could remove the socket part of the male joint. I would recommend not drilling any deeper than 2.5mm if you are using shafts this size. It is important to not have the driveshaft protruding into the socket recess as this will affect the operation of the joint.



The male joint has been designed so the female part 'snaps' into and is held by the male part. If this is not the case (3D printing is not an exact manufacturing method) or if you require a loose fit it is possible to open out the socket end. As shown lightly drill the top outer edge of the socket, (I normally just hold the drill in my hand so I can feel it cutting). The 'snap' fit should be circa 1.5mm diameter. If this is still too tight then increase the drill size in small increments.

NEVER FORCE THE 2 HALVES OF THE JOINT TOGETHER. THE JOINT SHOULD BE A VERY LIGHT PRESS FIT.

Installation.

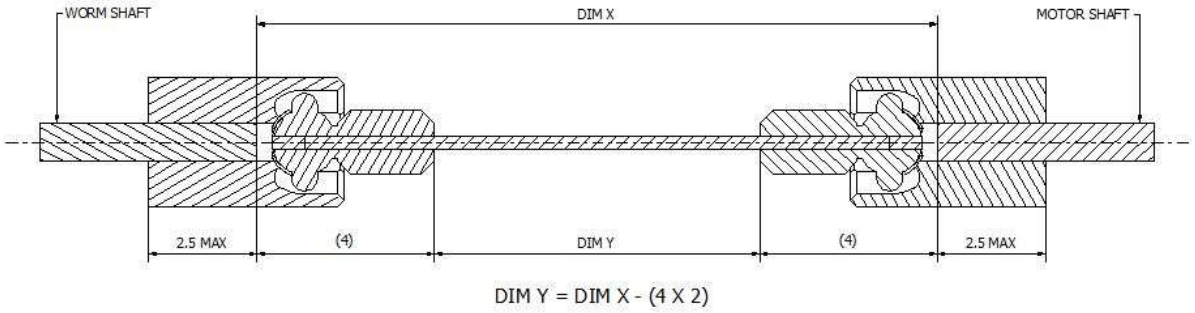


Fig 3 Installation Details

Below are some hints and tips I have found helpful when installing the universal joints.

- [*Fig 3*] details a typical installation. These are guidelines and provide information as to the required length of the driveshaft. I recommend during installation the fit between the universal joints and the motor /worm are adjusted until good running is achieved. A slow setting glue can be used to allow time to adjust.
- The 3D printed parts can be cleaned using IPA and a suitable scrubbing brush, I.E. a toothbrush. Parts can be painted using acrylic paint but avoid the socket and ball areas of the joint.
- Once you are happy with the fit and performance a light application of plastic friendly grease can be applied to each joint (in the socket) to reduce friction and wear.