

Everything you need to know about cartridges: Stylus types

The stylus is an extremely important component in a Hi-Fi cartridge (se Fig. 1)

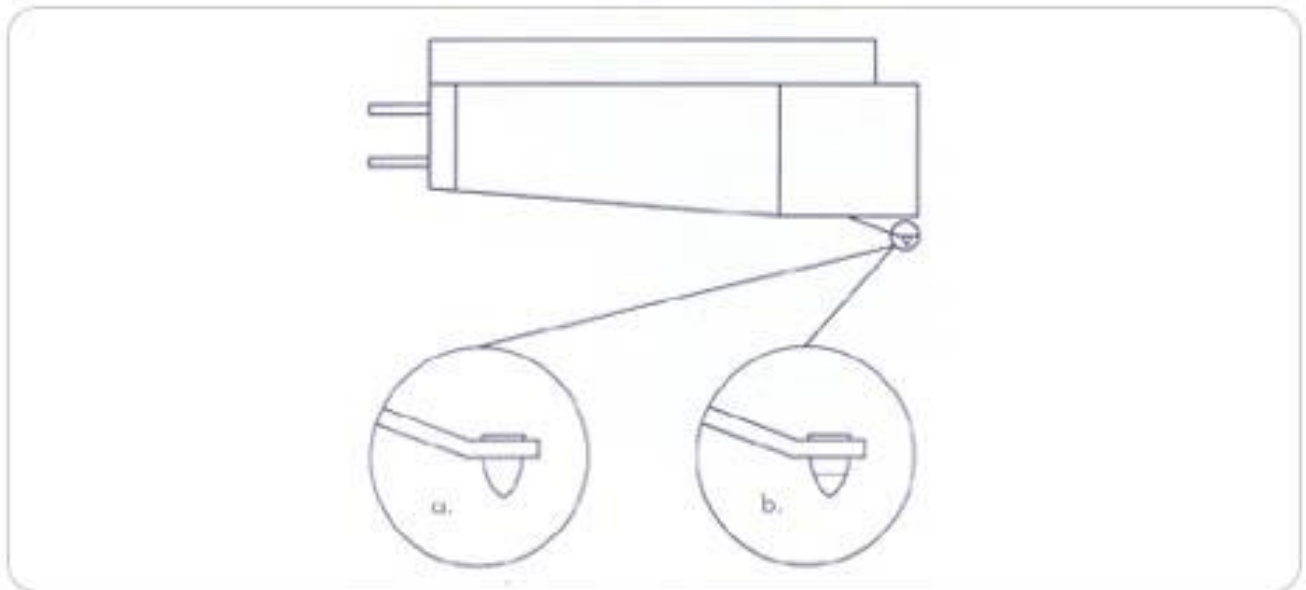


Fig. 1

a. Nude diamond. The stylus is a whole diamond, specially shaped and glued or fastened to the cantilever.

b. Tipped diamond. Here, a stylus tip of diamond is mounted on a metal shank.

It is usually made of diamond - the hardest material known - to give it maximum durability. However, the fact that it is of diamond is not sufficient in itself, for its construction and shape are also crucial factors in sound quality.

Many less inexpensive Hi-Fi cartridges use a so-called “tipped” diamond, where the diamond tip is mounted on a metal shank. However, such a shank may increase the stylus tip mass and thus impair the cartridge’s transient reproduction, in comparison with a cartridge that uses a nude, untipped diamond. There are several different diamond shapes to be found and the most important are described in the following paragraphs (see Fig. 2).

Fig. 2

- a. Cutting stylus used for the cutting of master discs.
- b. Spherical stylus.
- c. Elliptical stylus.
- d. Fine Line stylus.

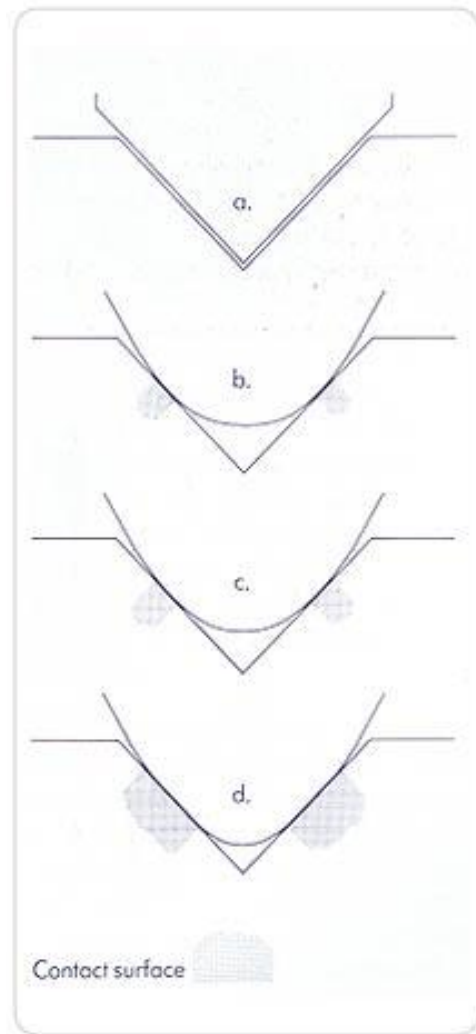
The spherical stylus

The spherical shaped stylus is the simplest and cheapest to produce and it is, therefore, the most common. Spherical styli can be recommended in all cases where robustness and economy are taken into consideration in the purchase of a cartridge.

The elliptical stylus

The elliptical shaped stylus bears greater resemblance to the triangular shaped cutting stylus that is used when cutting master records.

The elliptical stylus is able to follow the groove oscillations more accurately than the spherical type, and its distortion and phase error will, therefore, be less.



In the outer turns of the record groove where the diameter is the greatest, it may be difficult to hear the difference between a spherical and an elliptical diamond, as there is relatively good space in the groove for the highest frequencies. However, in the innermost turns of record groove, the wider radius of the spherical diamond makes it difficult for this shape to track the finer groove undulations. This can muffle the treble, and lead to audible distortion in difficult passages. There was a time when the experts disagreed about the choice between spherical and elliptical cartridge styli. However, this debate can now be considered resolved and today, very few, if any, elite cartridges are supplied with spherical styli.

Other stylus types

The introduction in 1971 of quadraphonic music reproduction from records based on the CD-4 system started a completely new development in the Hi-Fi cartridge field. Cartridges for CD-4 records must be capable of reproducing frequencies as high as 45,000 Hz. This was more than the models in existence at the time could manage, as even the contact surface of the elliptical diamond is too wide for a 45,000 Hz oscillation to be tracked accurately. A solution to the problem might have been a

sharper grinding of the elliptical diamond to obtain a reduced horizontal contact surface. This would, however, increase wear on the record surface considerably. The Japanese scientist - Shibata - went in an entirely new direction and invented the special stylus shape that now bears his name.

The Shibata shape distinguishes itself by having the necessary small contact surface at the horizontal level for playback of the ultra-high frequencies found on CD-4 records. At the vertical level, the special shape of the stylus gives a wider contact surface than is the case with either spherical or elliptical styli. This means that a Shibata shaped stylus, in spite of its high frequency capabilities, gives less record wear than the traditional stylus shapes.

Various cartridge manufacturers have been inspired by the Shibata shape and now produce cartridges with stylus shapes that give the same advantages as the Shibata. These have names such as bi-elliptical, pramanic, quadrahedral, hyperbolic, pathemax, and Fine Line. Although CD-4 and other quadraphonic systems never really caught on with consumers, they have helped to speed up the development of stylus types that improve playback of stereo records in the form of a more precise treble reproduction, lower distortion, and less record wear.

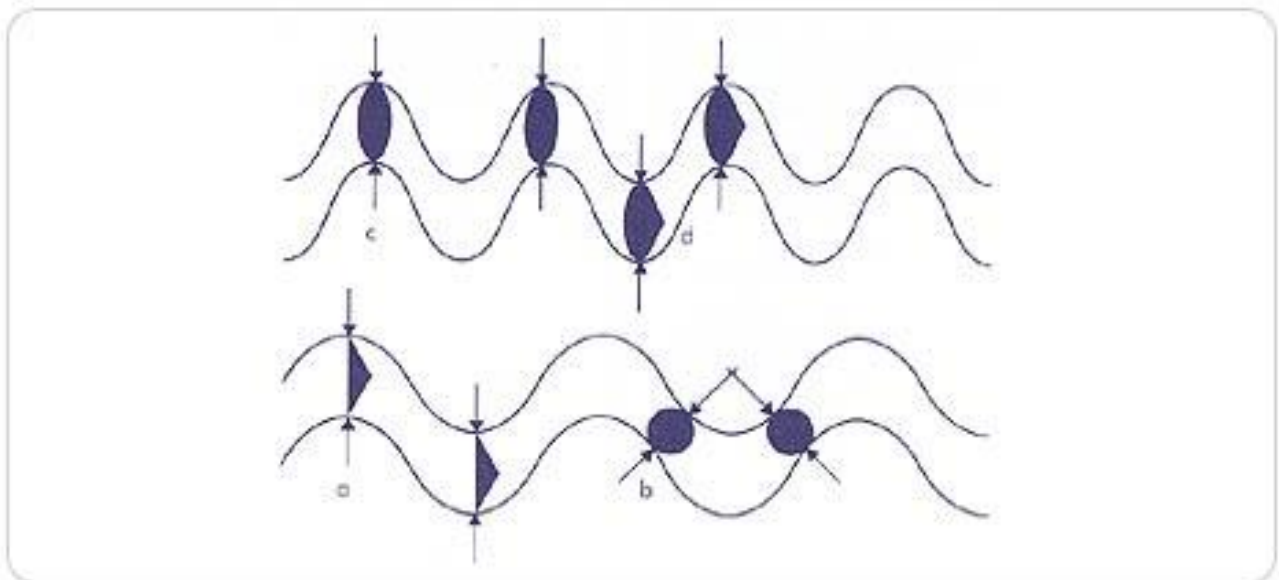


Fig. 3

A record groove showing the angles of different stylus types in relation to the groove when tracking the modulation:

- a. Cutting stylus
- b. Spherical stylus
- c. Elliptical stylus
- d. Fine Line stylus

The elliptical and Fine Line styli are able to follow the groove modulation more accurately than the spherical type. This gives lower phase distortion.