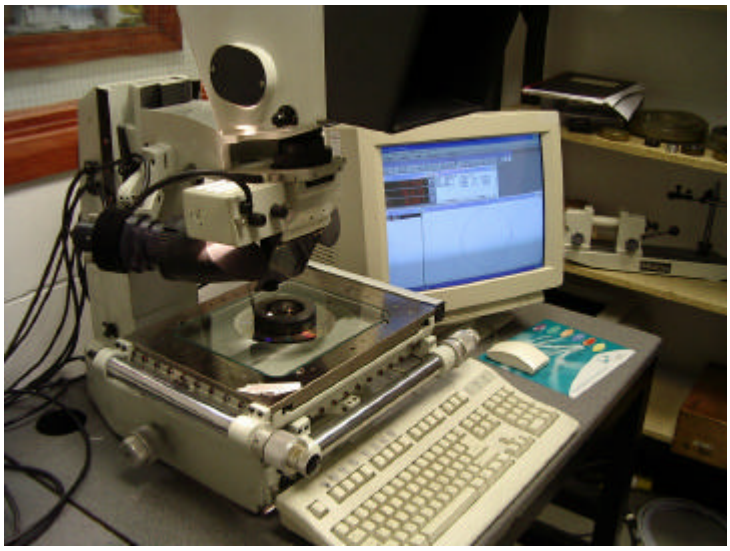
# OPTIMUM STAMPER MEASUREMENT

To measure stamper ID hole size, a non-contact method must be employed. Due to the softness and thinness of the nickel any sprung loaded bore micrometer will create denting in the punched ID and an oversize reading will be obtained.

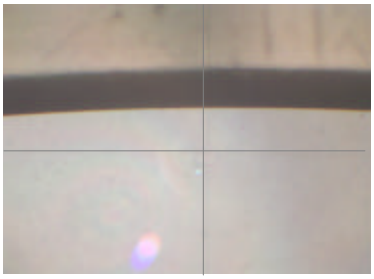


5D Macro Dynascope

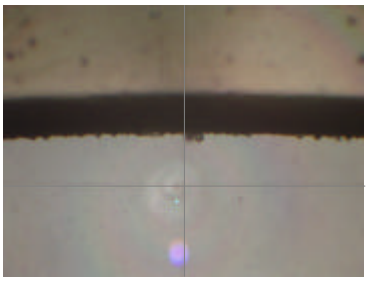
Sibert use a 5D Macro Dynascope for stamper ID size and ECC measurements. A glass stage with X-Y linear encoders with a resolution of 1µm is used along with a specially modified fine cross hair for repeatable results. The measuring accuracy is ± 1.5µm.

Before measuring, any protective coating present must be removed, and the punched ID must be cleaned to remove dust and debris.

A manual device with fine cross hairs is generally more accurate as certain erroneous defects such as dust, debris etc need to be filtered out by careful and selective placement of the cross hair. Automatic systems may not take this into account, creating an incorrect result.



Punched ID image showing fine cross hair



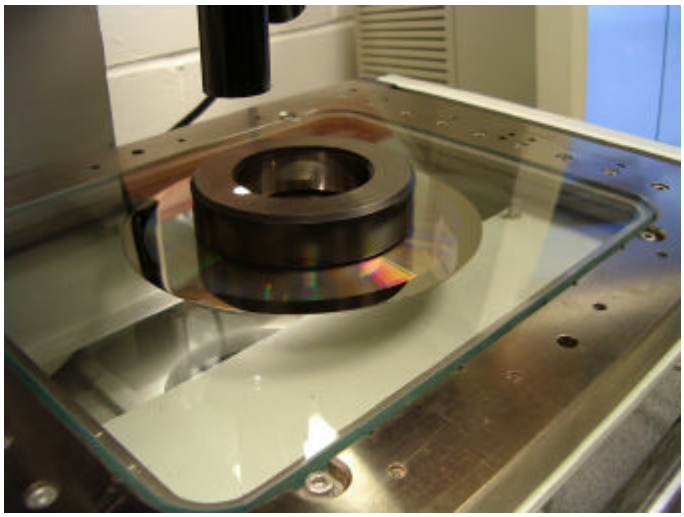
Punched ID image showing debris in ID hole

When viewing from the data side, it is important to ensure measurement is taken from the bore (minimum diameter), rather than the punch entry radius. Some automatic machines focus on the radius rather than the bore, creating an oversize reading.

A 50X magnification is optimum for good depth of field and clarity of image.

A four-point measurement is optimum for accurate hole size, with the unroundness reading also displayed. The cross hair should be placed carefully to avoid erroneous defects, which will affect the reading.

The stamper should be held flat onto a glass stage during measuring.



Stamper held flat onto glass stage

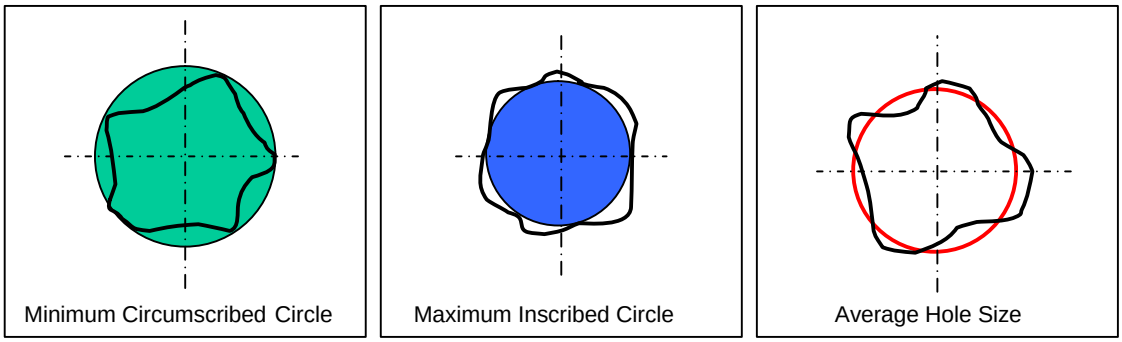
The roundness of the hole should be maximum 2µm. A result with a measurement higher than this should be rechecked.

The ID size can be calculated and displayed in three different ways.
1) Minimum Circumscribed Circle. Taking any unroundness into account this is the largest circle that can be inscribed over the maximum deviation points on the ID hole plot. This has no real use for a stamper and the ID measurement will always be larger.

2) Maximum Inscribed circle. This is the maximum size perfect circle or shaft that will fit within the ID hole profile. In theory this should represent the stamper holder but in practice will produce an undersize reading.

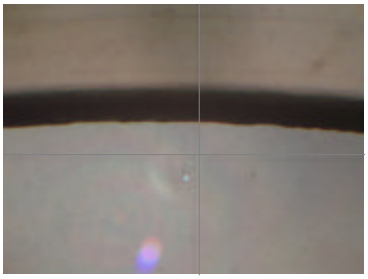
3) Average Hole size (Gauss). This is the average size between the two methods above and represents the optimum fit of the stamper onto the holder. Any small amount of irregularity in the bore will be adjusted as the stamper is fitted onto the holder, due to the softness of the nickel.

The measured result should be calculated as Average Hole size for optimum fit onto stamper holder.



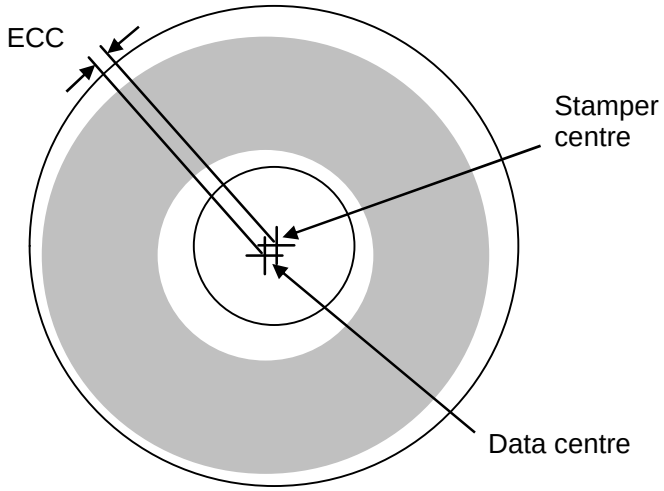

ID measurements should also be verified on the rear face of the stamper. The results should be within 2µm of each other.

To achieve a good quality clean punched hole, the stamper hardness rearside should be to within 200 ± 10%HV0.3. Stampers harder than this may have a ragged cut. Stampers softer than this may have an excessive punch entry radius.


Punched ID Image showing ragged cut

To measure ECC accurately, the stamper should be held stationary to avoid additional error from turntable/spindle bearings etc. The stamper ID hole should also be measured at the same time to prevent the ID size influencing the ECC result. It has been proven that any device that measures ECC from a parallel spindle will give erroneous results.

The ID is measured first, followed by a media band. The distance between the centre points of the two circles is calculated as ECC (TIR is twice ECC). The ID of data is generally used, as it is closer to the ID hole and therefore quicker.




It should be considered that, as the pit structure is laid down in a spiral, ECC results lower than the track pitch will only be an average reading. Results of 0-2µm ECC can therefore be achieved but cannot be obtained on a consistent basis. It is also much easier to arrive at an accurate ECC on HD formats as the data is produced on a much smaller track pitch, but it is still not possible to quote a repeatable ECC value of <3µm.

An additional consideration is that the track pitch is often not produced in a perfect spiral from the electroforming process, and data run-out of up to 10µm has been experienced. This feature also makes ECC results of <3µm on a repeatable basis impossible.

When measuring for optimum ECC, the geometry of the punched hole also plays a part in the end result. Unless the punched hole is perfectly round, the ECC result will increase.

Optimum ECC on the replica is controlled by the ECC of punched hole to data, punched hole size and roundness. All must therefore be measured to ensure optimum results.

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