

## 水腔技术和探靴技术的比较

### 水腔技术：

大部分超声波探头旋转的厂家提供的产品是水腔技术的旋转头。超声波探头布局在旋转水腔上，钢管要尽可能同心地通过水腔中心。

对于小管，紧公差导筒安装在水腔两侧以保证探伤过程中，钢管的中心线和水腔的中心线维持在一条线上。根据被检测管子的外径公差，在钢管表面和导筒之间可能会有较大的空隙，特别是管端这种情况下，很可能导致中心线不一致的情形，这样，就会导致超声波的入射



角变化，从而导致灵敏度的变化，机器的重复性变差。

水腔技术的优点主要体现在：1. 可以在更高的转速下运行，2. 在很小的长度空间可以布置更多的探头，这一点，在要求检测盲区很短时，并且在管端要获得最佳检测效果时很重要

典型的水腔式旋转头，对于表面没有氧化皮的小管径的精密管的探伤很好。如果这种技术用于热处理（黑）管，氧化皮尘土会在检测过程中堆积在水腔间，导致超声波信号的衰减，影响灵敏度。

虽然一些制造商声称可以将氧化皮冲洗掉，但这只能部分可行，通常情况下要获得好的检测效果，钢管需要被清洗除去氧化皮等。

## 探靴技术：

这种技术，探头安装在水柱块中，该水柱块通过探靴骑在钢管表面上。这种方法的主要优点是能够检测**热处理**后的钢管，钢管表面即使是粗糙的情况也行，钢管允许偏心± 10mm 也不会影响灵敏度。

采用这种技术的旋转头可以得到优异的重现性，减少误报率。典型的无缝钢管会有一些**弯曲**，特别是在**钢管端部**。探靴技术的跟踪能力，非常好地适用于这种产品的检测。探头块的总体长度必须尽可能短，以保证可以得到尽可能小的管端盲区。这种技术的唯一不足是，由于负荷增大，轴承的转速稍低。



Unicorn 可能是唯一提供两种技术旋转头产品的供应商。水腔技术产品可提供产品到最大管径 120mm。超过 120mm 的钢管，Unicorn 推荐采用探靴技术的产品，这种技术的产品，最小可适用管径在 40mm 左右。

原文: [http://www.unicorn-automation.co.uk/tech\\_comp.htm](http://www.unicorn-automation.co.uk/tech_comp.htm)

## Comparison between the water chamber and contact shoe technique

### Water Chamber Technique

Most manufacturers of ultrasonic rotating systems offer heads using the water chamber technique. The transducers are located within a rotating water chamber through which the tube is made to pass as centrally as possible. With small diameter tubes close tolerance guides can be used either side of the rotating chamber to ensure the tube is maintained as concentric as possible with the chamber during testing. Depending on the O.D. tolerance of the tubes to be inspected there may have to be larger gaps between the guides and the tube which nearly always leads to off centre conditions particularly at the tube ends; variation in the concentricity between the tube and rotating chamber gives rise to ultrasonic incident angle variation with resulting sensitivity variations and the repeatability statistics of the overall system deteriorates.



The main advantages of the water chamber is (i) higher rotational speeds can be achieved and (ii) the ability to get more transducers in a shorter space in terms of length; this point is important when trying to achieve minimum untested end lengths and also achieving optimised testing conditions at the tube ends.

Typically water chamber rotating heads are very good for small diameter precision tubes with surfaces free from scale. If these type of heads are used with hot finished (black) tubes then problems can occur with the scale dust collecting in the chamber during production testing which ultimately attenuates the ultrasound thereby affecting sensitivity.

Although manufacturers claim to be able to flush the scale away this is only partially successful and generally to achieve a good test the tubes need to be clean and free from scale.

### Contact Shoe Technique

In this technique the transducers are housed in a water column block which actually rides on the tube surface by means of a contact wear shoe. The main advantage of this method is the ability to test hot finished material even with rough surfaces and the ability of the probe assemblies to test with typical tube off-centre conditions of  $\pm 10\text{mm}$  without affecting the test sensitivity.



Excellent repeatability figures can be achieved with rotary heads using this technique and this inevitably leads to less spurious marking and prove up

requirements. Typical seamless tubes can suffer from some out of straightness particularly at the pipe ends and the contact shoe design with its tube following capacity is by far the better system for testing this type of product. The overall length of the contact shoes containing the transducers must be kept as short as possible to ensure testing can be carried out as close as possible to the tube ends. The only disadvantages of this technique are the slightly lower rotational speeds that can be used and the minimum tube O.D. size that can be tested. Unicorn are probably the only supplier which offer both types of rotating head; the water chamber technique can be used for tube diameters up to 120mm maximum O.D. and above this the contact shoe technique is recommended; the minimum diameter which can be tested by the contact shoe range of rotary heads is about 40mm O.D.

Author

C. James

C.Phys., M.Inst. P., M.Inst.NDT