

# Western Instruments Inc.

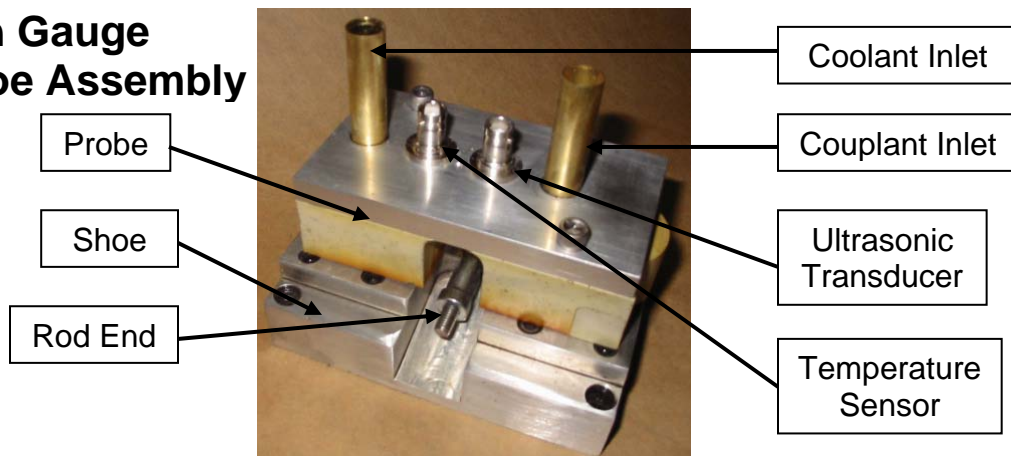
Established 1965

## Probe/Shoe Assembly

### Summary

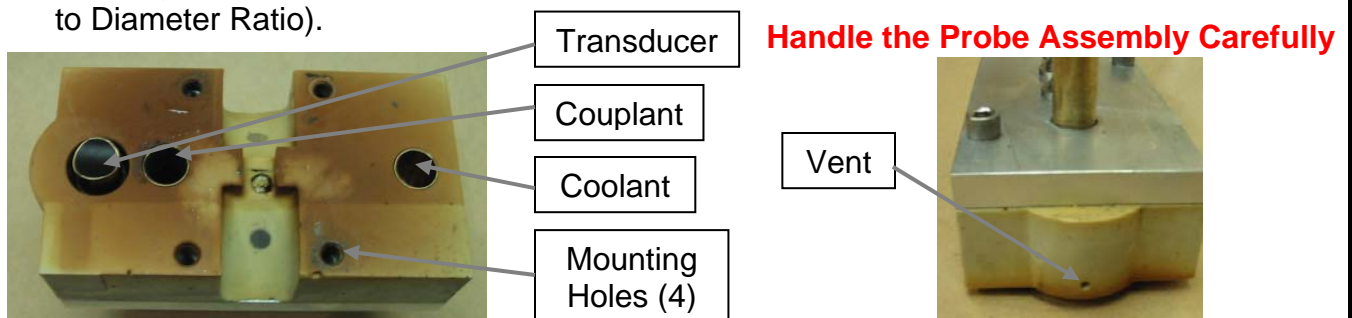
The Flash Gauge uses a unique Probe/Shoe Assembly, whereby the Ultrasonic Transducer is fixed within a cast plastic housing. A temperature sensor is also installed in the cast housing, and protects the assembly, if for some reason Couplant and Cooling fluids stop flowing. The Probe Assembly in turn is mounted to the Probe Shoe, which compensates for the OD Size of the Tube/Pipe being tested.

### Flash Gauge Probe/Shoe Assembly



### Probe

The Transducer in the Probe Assembly has been continually refined since its initial development in 1986. The transducer is 12.7mm (0.500") in diameter, very highly damped, with a specific focus. Prior to be cemented into the Probe Housing, its position is optimized to the customer's product mix (Wall Thickness to Diameter Ratio).



Probe Housings were originally machined from Aluminum, but over the years manufactures of High Frequency Welders and Seam Annealers have been allowing more and more electric potential to be induced into the product in the Mill. To protect the Flash Gauge Computer, Analog Electronics, and Controls, the Plastic Probe Housing was developed. The Plastic is heated to ensure toughness for its proximity to the hot weld, thus the discoloration.

Probes are equipped with connection tubes for Couplant and Coolant, and passages through to the Shoe. Steel Threads are Cast into the Probe Housings,

to ensure longevity. At the downstream end of the Probe assembly is a Vent, to allow Air Bubbles to escape from the Couplant Cavity. This Vent must be kept clear, or air bubbles could affect the Transducers signals.

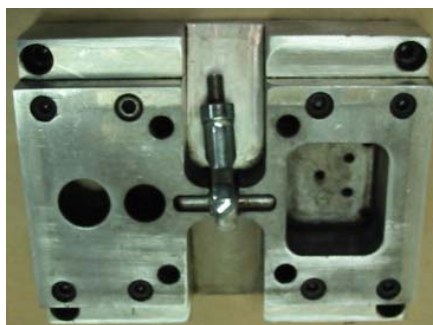
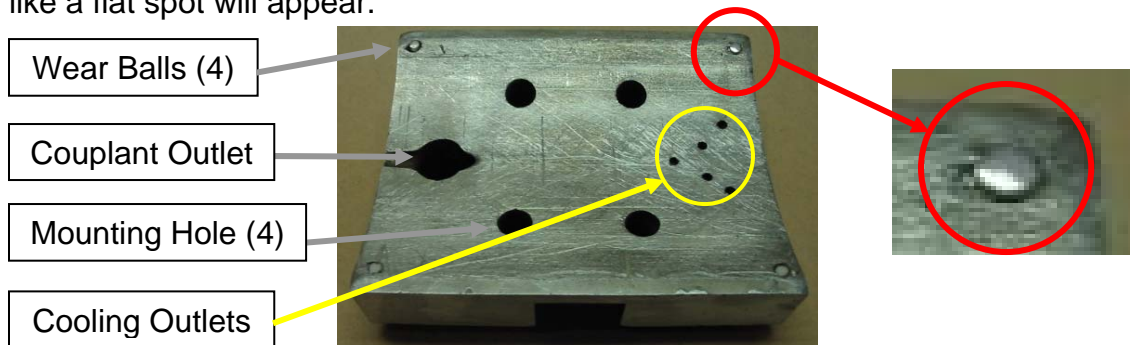
As mentioned previously, a temperature sensor is mounted to the Transducer Housing. The temperature sensor feeds back to the computer and when the internal temperature exceeds 80°C, the Flash Gauge is automatically lifted off the surface. Furthermore, the alarm indicator on the computer screen changes to red.

When the Probe is not mounted on the Shoe, the Transducer is exposed, so care must be taken to ensure it is not mechanically damaged. When installing a Probe to a Shoe, care must be taken in aligning the Mounting Holes, as they also align the two components. The Probe assembly should be cleaned with a mild soap solution every week. Depending on the cleanliness of the Mill Soluble, the Transducer should be cleaned every 4 hours of operation to ensure any build-up is removed.

### **Shoe**

The Probe Shoe is designed to follow the Tube surface, and is why Western Instruments specifies a Roundness. The diameter of the product, at the point of installation is not final and will be reduced in sizing, but the actual roundness (profile) is important.

The Shoe housing should not contact the surface, but the 4 Ceramic Wear Balls in each corner of the contact surface is where the contact happens. When new, the Wear Balls are round and quickly wear to the OD of the Tube in the Mill. Within short order, wear to the Wear Balls drastically decreases and what looks like a flat spot will appear.



The top surface of the Shoe, mates with the bottom surface of the Probe. The Shoe has cavities and passages for Couplant and Coolant. The Shoe is also equipped with a receptacle for the Rod End's Single Point Suspension Mounting Shaft, as well as major clearances for the Rod End itself. With the downward pressure applied to the Probe/Shoe Assembly by the Oscillator Assembly's Angular Liftoff Cylinder, the Shoe follows the contour of the OD

Surface of the Tube in the Mill. If the Tube is round, This "Single Point Suspension" is a very stable platform for the Ultrasonic Thickness Waves to be transmitted and

received. However, if the weld in 'Peaked or 'High Oval' (Pear Shaped), the Shoe will not be stable. Furthermore, OD irregularities such as a flat OD tool may also affect the stability of the Probe/Shoe assembly.

Under no circumstances should anyone attempt to adjust or remove the Ceramic Wear Balls. Each Wear Ball on each Shoe is hand fitted, to ensure a shoe does not rock on a reasonably round and straight Tube. Wear balls are very hard, and if a Flash Gauge is left running on a stationary Tube, the surface of the tube will be scratched, even though Wear Balls have a very low coefficient of friction, on water (coolant) lubricated Steel.



Note;  
This 273mm Shoe,  
used for illustrations  
was in service over  
a 10 year period.

The Shoe's cavities for Couplant Fluid, joins near the bottom surface of the Shoe (near the surface of the Tube), as shown in the pictures to the left. Couplant flows into the cavity around the Transducer and allows any entrained bubbles to escape from the Probe Vent. The majority of the Couplant, smoothly changes direction. within the Couplant Cavity, and contact the Hot Weld as a Laminar Flow. This flow slightly delays the boiling of the Couplant, so the

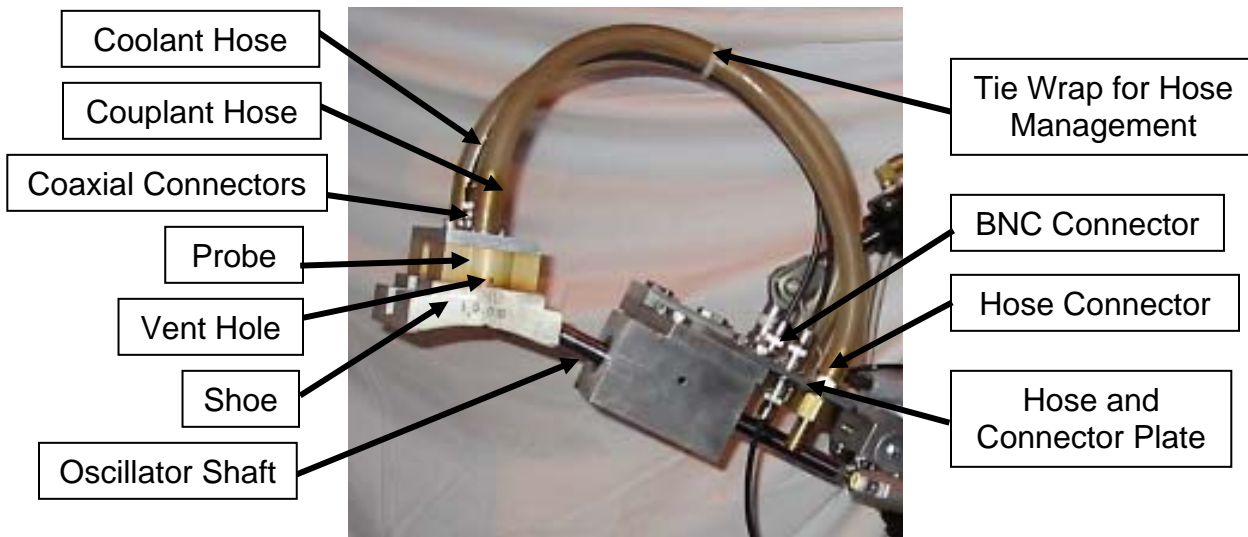
Ultrasound can be transmitted and received by the Transducer.

### Assembly

When assembling a Probe Shoe assembly, it is recommended that you first fit the Shoe to the Rod End's Single Point Suspension Mounting Shaft. There are two ways to manage these components;

1. Keep the Rod End on the Oscillator Shaft, and ensure the Single Point Suspension Mounting Shafts are a little undersize so they fit easily into the Shoe.
2. Gather together enough Rod Ends and Single Point Suspension Mounting Shafts, so they can be fitted to all the Shoes you have, excluding spare Parts.

If the second method is selected, the operator can assemble the Probe Shoe Assembly in a comfortable environment. Then when he arrives at the Flash Gauge, he is just attaching the Rod End to the Oscillator Shaft .



*Probe / Shoe Assembly*

If the first method is utilized, the operator needs to arrive with the Shoe, Fasteners, and Allan Key (the Probe is left attached to the Coaxial Cables and Couplant/Coolant Hoses). The operator then must fit the Shoe to the Rod End and the Single Point Suspension Mounting Shaft. Then carefully, align the Probe to the Shoe, and fasten the components together. Either method outlined above will work well, and neither is more advantageous than the other.

### **Maintenance**

Flash Gauge Shoes take a beating, as they are in intimate proximity to the Weld Area. Sometimes, their contoured surface is scarred by contact with un-trimmed OD Flash contact. They are simply subject to damage due to the operational environment.

Flash Gauge Shoes should be examined after every production run, to ensure they are serviceable. They need to be cleaned with a mild soap solution, and then examined for signs of physical damage that could hinder their use. Any scratches or gouges should be filed or polished out with Steel Wool (Fine or Medium). The Top of the Shoe, which mates to the Probe, should be smooth and clean, to ensure Couplant or Coolant do not spray out when in operation. When a Shoe is put away, it should be clean and ready for immediate use.

Note: Flash Gauge Shoes can be reworked due to excessive wear. Wear reveals itself as excessive blank spots on the computer profile. As the Shoe wears, it affects the dynamics of the Coolant flow between the Shoe to Tube interface. Operators will notice a need for more and more couplant flow for consistent operation.

Shoes are simply returned to Western Instruments, they are examined and measured for wear. If practical, the wear balls are removed, the mating surface (to the tube) is re-machined and the wear balls are reset. It is most practical to send more than one shoe in at a time, as this re-work is performed on an hourly basis.

