

Metal-to-Metal Bearing Area - Design of the Novatech™ Uni-body Inertia-welded Valve

Why is metal-to-metal bearing area so important?

As today's drilling pressures continue to rise, mud pump valves generate tremendous impact energy against the valve seat. The valve insert only absorbs a very small portion of this energy; the primary function of the insert is to seal rather than absorb energy. Today, most drilling valves and seats are manufactured from similar steel with similar heat treatment for wear resistance. Flow area is necessary to ensure smooth operation of the pump, however, additional flow area does not improve valve and seat life. The proper insert material is necessary to withstand the stress of rapid cyclic loading, high temperatures and other problems. However, the size or type of the insert does not increase valve life. Improvements in valve and seat life can then only be achieved by increasing the metal-to-metal bearing area between the valve and seat. The greater this area, the greater the area to absorb the high impact energy from valve closing. In the drawings on this page, Metal-to-Metal Bearing Area is shown in orange, the impact forces are shown as green arrows.

Generally, the web seat / stem guided valve design maximizes bearing area because the valve flange is designed to bear on top of the webs in addition to the seating bevel on the inside of the seat, as illustrated in the image below left.

The performance of this design is due to the maximization of the seat bearing area and the heavy-duty design of the 4-web

seat. The success of this design has resulted in the design becoming the de facto standard in the industry, now copied by most all manufacturers. Previous full open valve and seat designs have suffered from a lack of bearing area. Primarily because the valves of these designs used guide legs that were forged into the main valve body as shown on the valve shown middle left. Because of forging limitations, these types of guide legs are large and thus restrict flow area. To recover the necessary flow area, the throat in the seat is increased, which reduces bearing area and thus limits the performance of this style of valve and seat.

To solve the above problem, Novatech™ pioneered the design of a new style of valve body; one in which the guide legs are inertia welded to the machined valve body forging as illustrated in red in the drawing to the middle right. The unique inertia welded one-piece valve body combines advantages of a forging for strength with advantages of a casting for smooth streamlined flow. This new one-piece valve body, with its hemispherical dome and Channel-Beam groove design, is incredibly strong and capable of withstanding today's highest drilling pressures.

Most important, the streamlined guide legs of the new design do not limit flow area; valuable metal-to-metal bearing area is regained. When the Novatech™ Uni-Body Inertia Welded Valve is combined with Novatech™ Cast-N-Place™ inserts, as shown in the drawing below right, a valve of superior performance is achieved for today's stringent drilling requirements.

