

Ceramic Liner For Superior Abrasive & Chemical Resistance

Advantages of ceramics

Ceramic liner tubes have many advantages over fluoropolymer (PFA/PTFE) or other liner materials like rubber. Yokogawa uses alumina ceramic (Al_2O_3) for its ceramic liner tubes, which demonstrates excellent characteristics for a broad range of applications.

Advantages of ceramic liner tube

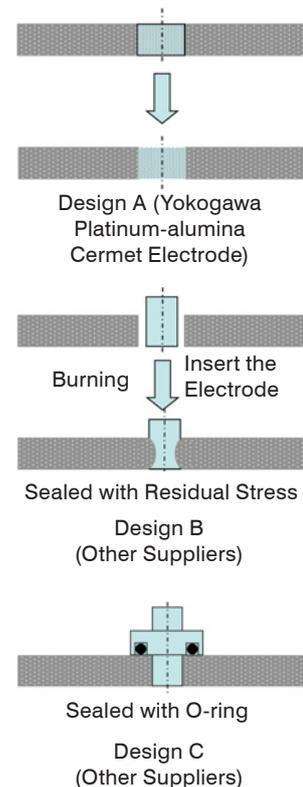
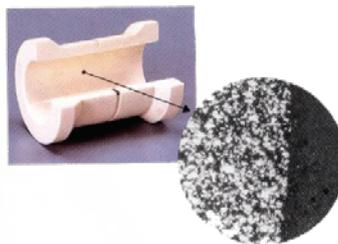
- Excellent insulating characteristics
- Excellent resistance to abrasion, ensuring accurate measurements even with highly abrasive slurries
- Excellent resistance to corrosive fluids
- Excellent durability under high temperature and high pressure conditions without additional metal tube

Engineered to withstand

Yokogawa produces its own ceramics in-house, starting with granular material (powder) and proceeding to processing, burning, and inspection. Alumina ceramic (Al_2O_3) with a purity of 99.9% contains almost no impurities. Ceramic liner tubes are cast in rubber molds and burned in ovens at strictly controlled temperatures.

Platinum-alumina cermet electrodes, made by burning a mixture of alumina and platinum powder, have a seamless structure, eliminating the necessity for a seal. Ceramic liner tubes from other magmeter suppliers generally use a solid platinum rod as an electrode, which is sealed by contractile force during burning or by using an O-ring.

With design B, large residual stress around the electrode may cause defective sealing or cracking to occur; with design C, performance depends on the quality of the seal achieved with the O-ring, and the ceramic liner tube easily cracks due to the residual stress around the electrode hole.



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Liquid pentran test

Tested for mechanical strength

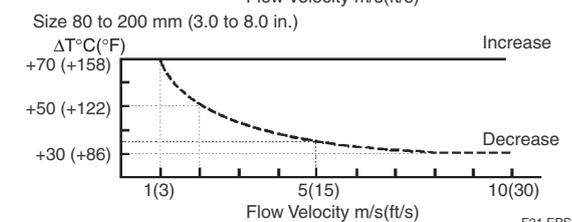
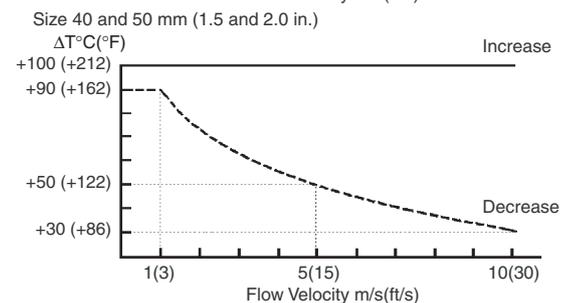
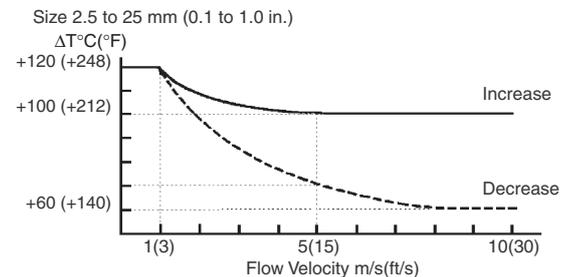
Ceramics are excellent materials in many ways, but if they are used improperly, they tend to crack easily. Yokogawa's ceramic liner tubes meet the same safety standards as metal

pipes. All ceramic liner tubes are strictly thermal shock tested and inspected for micro-cracks, and pressure tested at 1.5 times of the maximum pressure rating.

Mirror finished ceramic liner tube

Before measuring sticky fluids, it is important to take into consideration relevant design factors such as flow velocity and pipe diameter. At the same time, the adhesion-resistance of the magmeter must be considered. The smoother the surface of a magmeter's liner, the less likely it is that adhesion will occur.

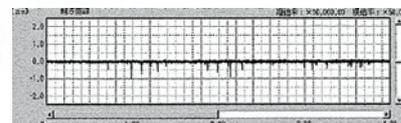
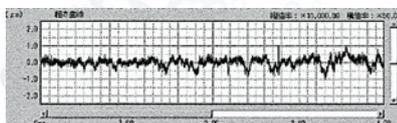
By means of a special magnetic polishing process, the inner surface of the ceramic liner tube is given a mirror finish. This polishing method is advantageous in eliminating problems such as abrasive irregularities and dull edges. The mirror finished ceramic liner tube has a surface roughness of $Ra < 0.1 \mu m$.



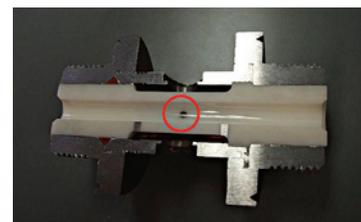
Surface of ceramic liner tube (standard)



Surface of ceramic liner tube (mirror finished)



High adhesion resistance of liner tube and electrodes in a magmeter, is very important for long term reliable measurement. It is supported by the integrated platinum-alumina cermet electrodes with no gaps that can cause adhesion. High adhesion resistance is thus achieved through the synergistic effect with the smooth surface of the ceramic liner tube.



Ceramic liner tube with platinum-alumina cermet electrode (Mirror finished)