

# Impressed Current Anode (ICCP)



## Betelguard MMO/Platinized Titanium Probe Anode



**Betelguard Probe Anode** using MMO or Platinum coated solid titanium rod is with exceptional resilience. They also permit the anodes to operate in temperatures up to 160°C, and to perform well in chloride environments which require high CP current output.

To prevent leaks, these nipples are filled with special sealant, and prior to shipping, each electrode is pressure tested to 1.5 MPa.

### Typical Applications

- Heat exchangers
- Pressure vessels
- Condenser water boxes
- Water pumps
- Large diameter piping
- Other aqueous processing tanks

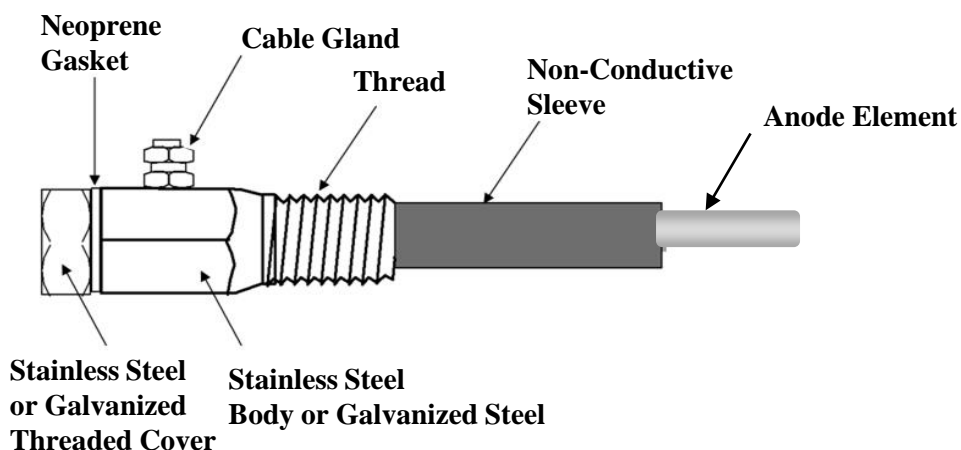
### Anode Performance

Expected Life :	Min. 20 years
Anode Coating:	Iridium Oxide Based MMO or Platinum
Coating Thickness:	Determined by current output, environment and design life

### Substrate Titanium

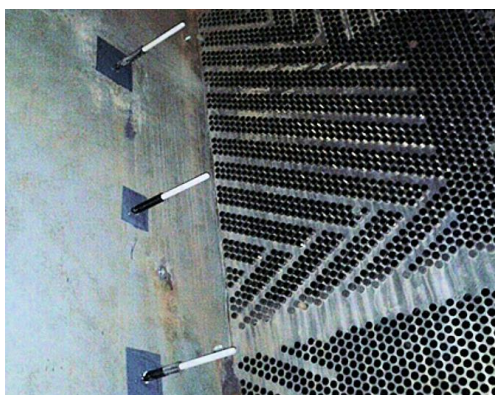
Breaking Voltage:	8 to 9 volts in chloride water
Coefficient of Thermal expansion:	$8.7 \times 10^{-5}/^{\circ}\text{K}$
Thermal conductivity at 20°C :	15.6 W/m·°K
Electrical Resistivity:	0.000056 ohm-cm
Modulus of Elasticity:	105 GPa minimum
Tensile Strength:	245 MPa minimum
Yield Strength:	175 MPa minimum

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Note:

All probe anodes are custom made to the customer's specifications. To order the required anode for your structure, indicate the substrate metal (Niobium or Titanium) and anode coating type (MMO or Platinum), the anode diameter, length and current requirement, along with the non-conductive sleeve length, and the fitting diameter (thread) and length.



Condenser Water Box



Heat Exchanger

### Technical Notes

- When the design maximum voltage exceeds 8 volts, titanium substrate is not recommended due to the risk of titanium breakdown.
- The rate of platinum consumption accelerates in the presence of AC current ripple. Most wastage was observed to occur with AC frequencies of less than 50 Hz. The repeated oxidation/reduction processes result in the formation of a brownish layer of platinum oxide. To avoid the occurrence of this phenomenon, a single or a three phase full-wave rectification is recommended. The consumption rate of platinized anodes is also adversely affected by the presence of organic impurities such as sugar and diesel fuel.