THE **OSMOS** GROUP

the anode solution that saves money

OSMOS **ENDGARD**™

COSTLY PROBLEMS

You've spent years dealing with the same problems in your corrosion protection systems. Over time, every system loses effectiveness, every anode must be replaced and almost every cable connection fails. Inevitably, you'll have to replace material and absorb the cost of lost resources.

What would you say if we presented a simple new technology that would save you money by decreasing your material waste, while prolonging the life of your cathodic protection system by over 30%?

Such a technology is here – Osmos Endgard.

LEADERS IN CORROSION PROTECTION

The Osmos Group has a world-wide reputation for innovative and cost-saving solutions in the fields of electrophysics, electrochemistry, power engineering and corrosion protection.

And once again, this unique group of scientists and engineers, has applied years of experience and training to create better CP systems. Osmos Endgard represent an inventive technology that prolongs the life and increases the effectiveness of your cathodic protection installations.

WHY TRADITIONAL METHODS FAIL

THE END EFFECT

According to Faraday's Law, local mass (material) consumption is directly proportional to current density. That is why in traditional anode designs the ends, where current density is higher, dissolve faster than at the center, where the currents are less dense. This phenomenon, known as the 'End Effect' results in many problems. Loss of cable connection due to the 'End Effect' is the most important of them. Others include increase in resistance, requiring additional power to maintain proper current levels, increased generation of chlorine and heat around the ends of the anode.

Avoiding the cable connection failure with complicated center connection requires sophisticated assembly and significant added expenses. And the use of expanded ends for the same purpose is just a temporary measure.

THE NECK EFFECT

Placing non-conductive caps at ends of the anode is another approach to the same problem. This method may alleviate material loss at the extreme ends, but it presents another problem known as, the 'neck effect.'

Here, the area of increased current density is at the rim of the cap.

With the neck effect, the anode still deteriorates along this edge, resulting in decreased effectiveness, mechanical damage and cable connection failure.

HOW ENDGARD IS DIFFERENT

Osmos Group's patented Endgard are non-conductive plates mounted at the ends of the anode. The Endgard significantly improves current distribution along the body of the anode and provides uniform material consumption. Endgard by Osmos Group will extend the life of your anodes at a minimal cost increase, while producing greater efficiency.

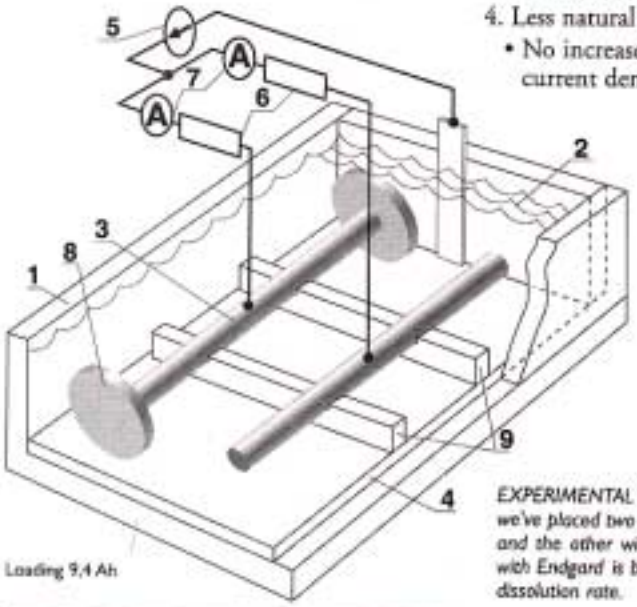
BENEFITS OF OSMOS ENDGARD

Whether your using Sacrificial Anodes (SA) or Impressed Current Cathodic Protection (ICCP), Osmos Endgard will significantly improve your CP systems. And Endgard not only enhances the anodes themselves, but it also provides a benefit to the surrounding media and the protected surface.

LOSSES FROM END EFFECT. Over time all anodes are consumed. Higher current density results in more rapid deterioration at the ends, known as the 'End Effect'.

HOW ENDGARD IMPROVES YOUR ANODES:

1. No 'end effect'
   - No cable failures (ICCP, SA)
   - No need for complicated and expensive center connection (ICCP)
2. No 'neck effect' thereby limiting mechanical damages (ICCP, SA)
   - Reduced material waste
3. Increased efficiency
   - Improved anode size/lifetime ratio (ICCP, SA)
   - More uniform power unit loading (ICCP)
   - Even current output (SA)
4. Less natural corrosion close to the ends
   - No increased consumption at high current density (ICCP, SA)

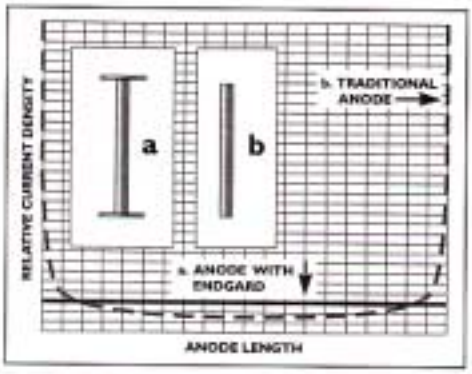


1. Test Cell
2. Electrolyte 30% NaCl
3. Test Electrode(s)
4. Counter Electrode
5. Current Source
6. Balancing Resistor(s)
7. Ammeter(s)
8. Endgard(s)
9. Support(s)

Loading 9,4 Ah

EXPERIMENTAL PROOF. In this simple experiment, we've placed two identical anodes, one with Endgard and the other without, in an electrolyte. The anode with Endgard is better preserved thanks to the even dissolution rate.

Losses	Usual Electrode	Electrode with Endgard
Mass (g)	13	7,5
Length (mm)	5	0



CURRENT DISTRIBUTION CURVE. With and without Endgard. Peaks of current density at the ends of the anode are clearly visible. Note the uniformity of the same parameter in anode with Endgad.

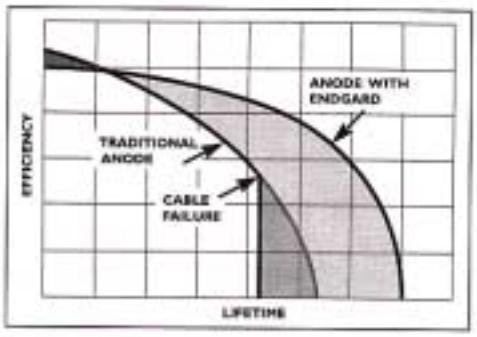
BENEFITS FOR:

THE SURROUNDING MEDIA

1. Less local chlorine generation close to the ends
   - Less acid (ICCP)
   - No cable damage (ICCP)
   - Ecological compliance (ICCP)
2. Less local soil (coke) heating
   - Less coke ash (ICCP)
   - No stress cracking (Magnetite ICCP anode)
3. Less clay-soil overdrying (electro-osmotic)
   - No loss of active anode surface due to glazing effect (ICCP)
   - Lower resistance through anode life (ICCP)
4. Lower coke consumption
   - No need for backfill overdesigning (ICCP)
5. Lower electric field strength in sea media
   - Surpasses ecological requirements (ICCP)
   - Protects sea life (ICCP)

THE PROTECTED SURFACE

Minimize over-protection
- No coating failures (ICCP)
- No hydrogen steel embrittlement (ICCP)



30 TO 40% ENHANCEMENT IS GENERALLY ACHIEVED. This simple chart shows how anodes with Endgard outperform traditional anodes in terms of both efficiency and longevity.