PRODUCT
BULLETIN

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ANOTEC

ISO 9001 REGISTERED

Design Parameters

Consumption Rate

The consumption rate of high silicon cast iron anodes has been found to be between 0.2 and 1.2 pounds per ampere-year. For anodes of the same chemistry and microstructure, variance in consumption is primarily due to the chemical and physical characteristics of the anode environment. The consumption rate does not appear to be significantly affected by current density (amperes per unit area of anode surface). The use of coke breeze around the anode in soil ground beds will tend to lower the consumption rate. A generally accepted design guideline for anodes buried in coke breeze is **0.75 pounds per ampere-year**.

Utilization

The utilization of an anode represents the percentage of the anode weight that can be consumed before the cable connection area becomes compromised. It is not possible to utilize 100% of the anode weight. Since current preferentially discharges from the ends of anodes, the utilization is different for solid stick anodes (where the cable connection is made at one end) and a tubular anode (where the cable connection is made in the middle).

As a guideline, one can use a utilization of **65% for solid stick anodes and 85% for tubular anodes**.

Current Density

The maximum stable current density discharge may be limited by the environment regardless of the anode type. In free flowing water or in very wet soil ground beds, there is very little restriction on current density. However, anodes buried in clay soils tend to suffer "electro-osmotic drying", a phenomenon of magnitude directly proportional to current density. For any particular soil with electro-osmotic characteristics, there will tend to be a critical maximum current density at the anode-to-soil (or coke breeze-to-soil) interface, above which progressive drying occurs, with corresponding increases in anode-soil resistance. Drying is usually reversible by increasing soil moisture and / or lowering current density.

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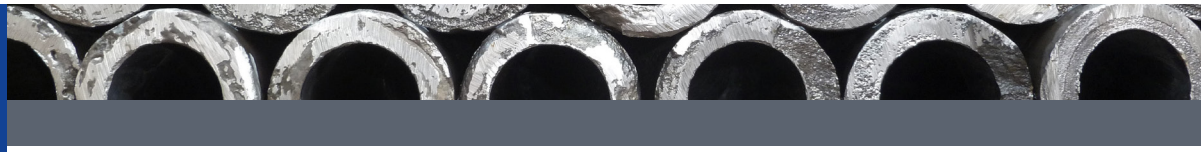

The following table represents guideline values to minimize electro-osmotic drying of groundbeds installed in clay soils.

Average Soil Resistivity Along Ground Bed (ohm-cm)	Maximum Amps Per Anode in a Coke Breeze Column 12" OD by 60" Long	Equivalent Current Density on Surface of Coke Breeze Column (mA / sq. ft.)
Less than 1,000	2.00	127
1,000 - 1,500	1.75	111
1,500 - 2,000	1.50	96
2,000 - 3,000	1.25	80
Over 3,000	1.00	64
Note: For greater success, limit current density to less than 100 mA/sq. ft. for soils of less than 1,500 ohm-cm resistivity.		

Example Design Calcualtion

Variables

CR = Consumption Rate
UF = Utilization Factor
DL = Design Life
A = Current Requirements
AW = Anode Weight

$$AW = \frac{A \times DL \times CR}{UF}$$

Estimate the Required Tubular Anode Weight

CR = 0.75 lb / Ampere-Year
UF = 0.85 (Tubular Anode)
DL = 15 Years
A = 15 Amps
AW = ?

$$AW = \frac{15\ Amps \times 15\ Years \times 0.75\ lb/(Amp - Year)}{0.85}$$

AW = 200 lb (approximate)

From this, one would choose a tubular anode package that resulted in a total weight of 200 lb.

4 x 2660Z (50 lb each)
4 x 2284Z (50 lb each)
3 x 2684Z (70 lb each)

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