Corrosion Modeling Software and Corrosion Prediction Software

ACMF-Compass®: Modeling and Prediction of the Effects of AC and Magnetic Field on Metal Corrosion

Highly Effective Software Solutions to Costly Corrosion under the Influence of AC and/or Magnetic Field

Version 9.20

☆ **Performance** ☆ **Functionality** ☆ **Usability**

Anytime Anywhere Any Device Any OS

No USB dongles No installation No Browser Plug-ins

Contact Us for Licensing Details

Overview of ACMF-Compass: Modeling and Prediction of the Effects of AC and Magnetic Field on Metal Corrosion

AC corrosion has been a well known problem in the pipeline industry since the early 1900s. The body of literature indicates that AC corrosion exists in many industries from plumbing systems, power generation and process industries to electronics and semiconductor industry where capacitive coupling can lead to AC induced corrosion in mission critical power electronics cooling systems. In many engineering applications, metals are used within magnetic fields of various strengths and are exposed to a corrosive environment at the same time. Magnetic field may cause changes in the mass transfer of reactant or reaction product. Changes in mass transport arise as a result of solution flow induced by magnetohydrodynamics, the interaction of the electric current in the solution and the applied magnetic field. ACMF-Compass is the only device and OS independent predictive software on the market for the modeling and prediction of the effects of AC and magnetic field on metal corrosion. Designers, engineers, consultants, maintenance and inspection personnel can quickly assess and quantify the impact of AC and magnetic field on the corrosion rate and the remaining life for a range of materials including:

Aluminum Alloys:

AA1100 Bare

AA1100 Anodized

AA2219 Bare

AA2219 Anodized

AA2024 Bare

AA2024 Anodized

AA3003 Bare

AA3003 Anodized

AA5083 Bare

AA5083 Anodized

AA6061 Bare

AA6061 Anodized

AA7075 Bare

AA7075 Anodized

Copper

Brass

Cu70Ni30

Lead

Magnesium

Nickel

Electroless Nickel Plating

Carbon Steel

Galvanized Steel

Low Alloy Steel

Stainless Steel

Titanium

Zirconium

If you cannot find the material of your interest in the above list, do let us know through the Contact Us link and we will conduct the necessary tests to generate the required data for inclusion in the software, free of charge for licensed users of ACMF-Compass.

Under the conditions shown in Figure 1 below, at AC current density of 0.65 mA/cm^2, ACMF-Compass predicts that the AC corrosion efficiency (percent of AC current to equivalent amount of DC current) is 0.268%, the corrosion current density under the influence of AC is 6.745 uA/cm^2. The corrosion rate is 0.0742 mm/y. The remaining life is 40 years. ACMF-Compass predicts that under the current conditions, the design life of 30 years can be achieved. However, if the AC current density is increased to 3 mA/cm^2, as shown in Figure 2 below, ACMF-Compass

predicts that the AC corrosion efficiency is increased to 14.61%, the corrosion current density under the influence of AC is increased to 443.286 uA/cm^2. The corrosion rate is increased to 4.876 mm/y. The design life of 30 years can not be achieved due to the influence of AC current on the corrosion of aluminum alloy 2024.

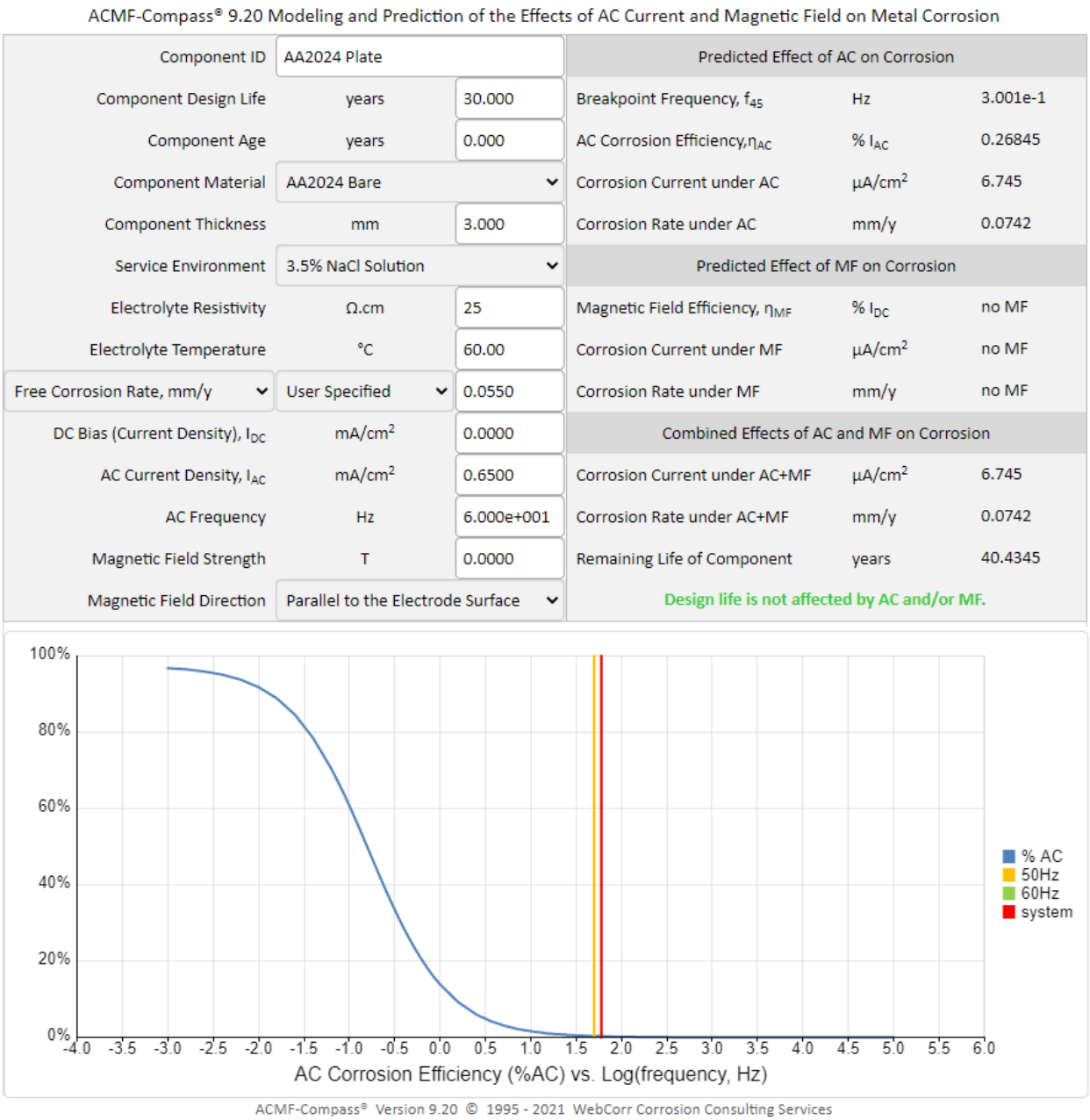

Figure 1 ACMF-Compass models the effect of AC on corrosion of metals.

Figure 2 ACMF-Compass models the effect of AC on corrosion of aluminum alloy 2024 at 3 mA/cm^2.

The prediction output includes a plot of the AC efficiency vs. the AC frequency for the metal in contact with the selected electrolyte. The available electrolytes in the software for selection include:

Low Vacuum (>10 Pa)

High Vacuum (<10 Pa)

Dielectric Fluid

Distilled Water

Deionized Water

Ethylene Glycol/Water (50%)

Propylene Glycol/Water (50%)

Tap Water

3.5% NaCl Solution

Natural Seawater

Natural Soil

If you cannot find the service environment (electrolyte) of your interest in the above list, do let us know through the Contact Us link and we will conduct the necessary tests to generate the required data for inclusion in the software, free of charge for licensed users of ACMF-Compass.

Figure 3 shows the modeling results for the effect of magnetic field on corrosion of carbon steel in 3.5% NaCl solution. The magnetic field efficiency (percent of the DC bias) is predicted to be 0.85%.

ACMF-Compass® 9.20 Modeling and Prediction of the Effects of AC Current and Magnetic Field on Metal Corrosion

Component ID	CS Plate		Predicted Effect of AC on Corrosion		
Component Design Life	years	30.000	Breakpoint Frequency, f_{45}	Hz	no AC
Component Age	years	0.000	AC Corrosion Efficiency, η_{AC}	% I_{AC}	no AC
Component Material	Carbon Steel		Corrosion Current under AC	$\mu A/cm^2$	no AC
Component Thickness	mm	6.000	Corrosion Rate under AC	mm/y	no AC
Service Environment	3.5% NaCl Solution		Predicted Effect of MF on Corrosion		
Electrolyte Resistivity	Ω.cm	25	Magnetic Field Efficiency, η_{MF}	% I_{DC}	0.8504%
Electrolyte Temperature	°C	25.00	Corrosion Current under MF	$\mu A/cm^2$	10097.9665
Free Corrosion Rate, mm/y	User Specified	0.1500	Corrosion Rate under MF	mm/y	117.1364
DC Bias (Current Density), I_{DC}	mA/cm^2	10.0000	Combined Effects of AC and MF on Corrosion		
AC Current Density, I_{AC}	mA/cm^2	0.0000	Corrosion Current under AC+MF	$\mu A/cm^2$	10097.966
AC Frequency	Hz	6.000e+001	Corrosion Rate under AC+MF	mm/y	117.1364
Magnetic Field Strength	T	0.2500	Remaining Life of Component	years	0.0512
Magnetic Field Direction	Out of the Electrode Surface		Design life is affected by AC and/or MF.		

Figure 3 ACMF-Compass models the effect of magnetic field on metal corrosion

Using ACMF-Compass is as easy as 1-2-3:

(1) Select the component material from the dropdown list and enter the design data;

(2) Select the electrolyte and enter the AC and/or Magnetic Field data;

(3) Review the prediction results.

Users of ACMF-Compass have the option to specify the free corrosion rate (corrosion free from the influence of AC and MF) in either uA/cm^2 or mm/y (Figure 4). If the free corrosion rate for the selected metal in the selected electrolyte is not available, the default option (Figure 5) will trigger the predictive engine in ACMF-Compass to compute the free corrosion rate. The effect of magnetic field direction on the corrosion rate is also modeled in ACMF-Compass (Figure 6).

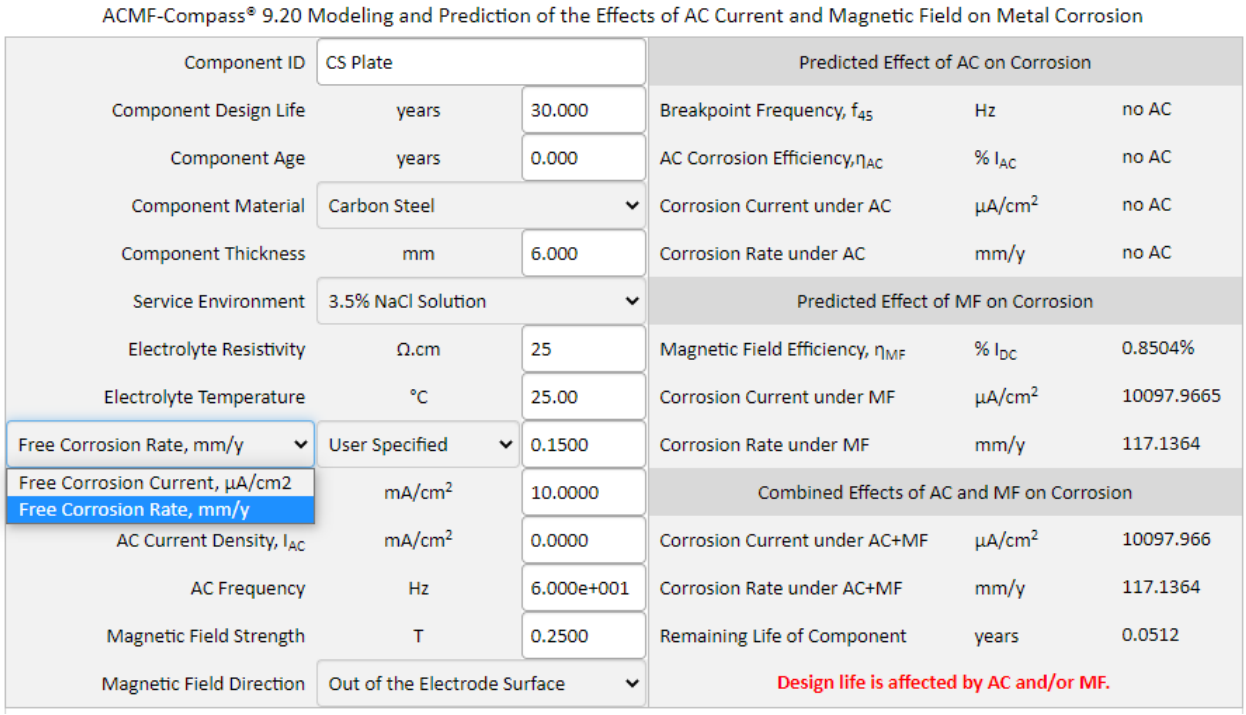

Figure 4 ACMF-Compass allows users to select free corrosion rate in uA/cm^2 or mm/y.

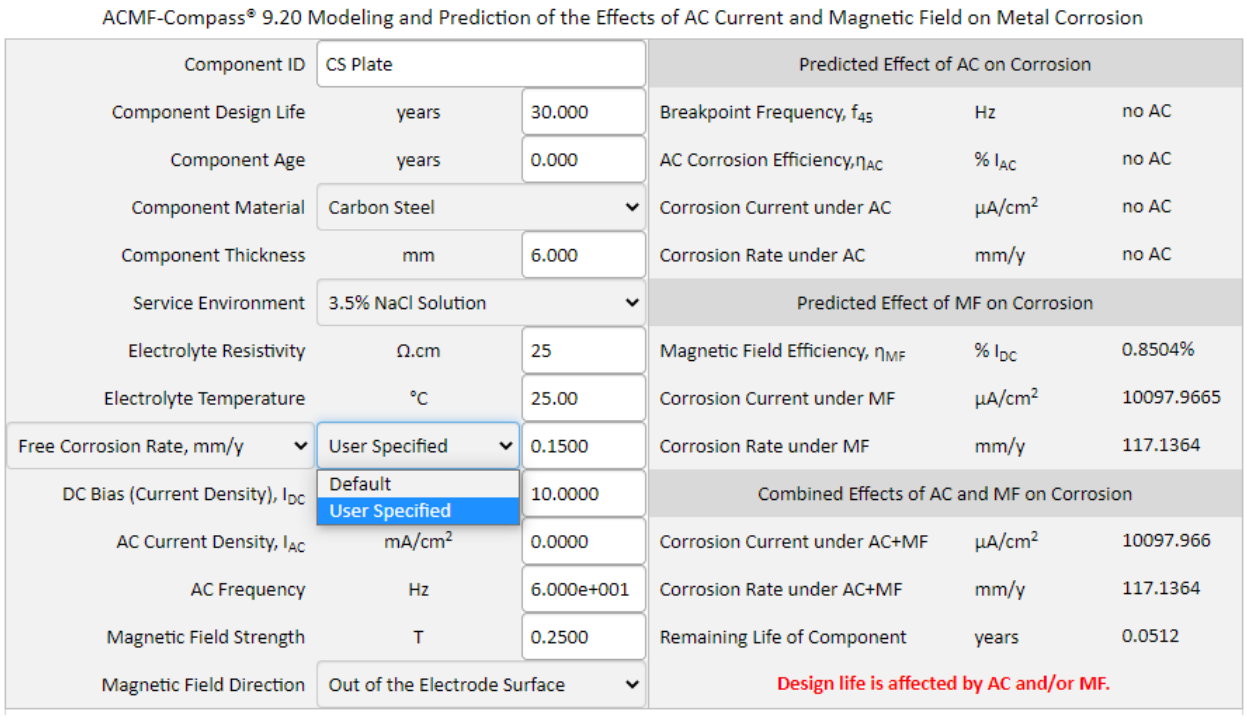

Figure 5 ACMF-Compass can determine the free corrosion rate if user data is not available.

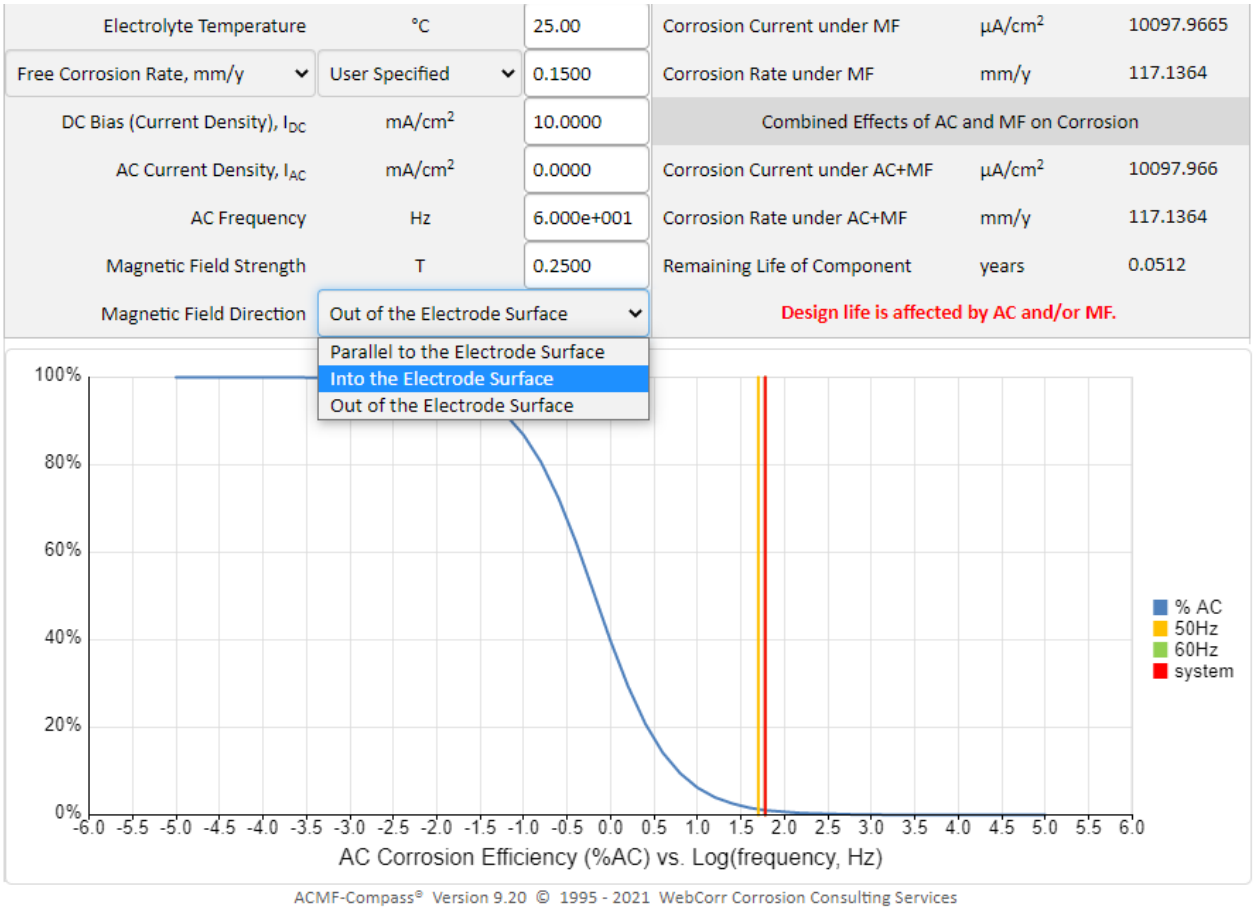

Figure 6 ACMF-Compass models the effect of magnetic field direction on the corrosion rate of metals.

The powerful applications of ACMF-Compass are truly unlimited in engineering design, materials selection, process operation, inspection and maintenance, modeling and prediction of metal corrosion under the influence of AC and/or magnetic field. Click here to contact us for licensing details.

WebCorr can customize ACMF-Compass for your specific systems.

ACMF-Compass, giving you the right directions in managing corrosion under the influence of AC and magnetic field.