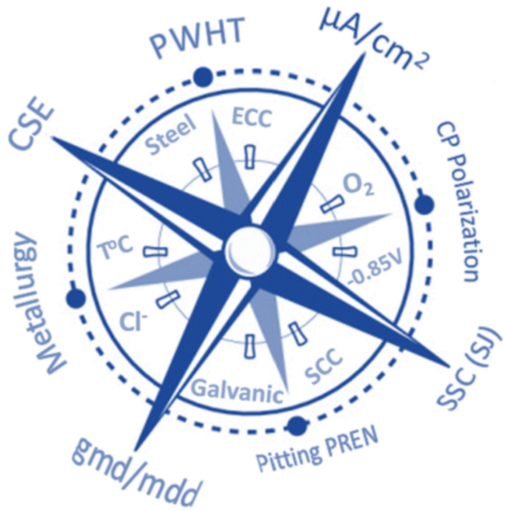

Corrosion Modeling Software and Corrosion Prediction Software

ACE®: Apps for Corrosion Engineers

The Ultimate Software Solutions to Costly Corrosion

Version 9.20

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

Anytime Anywhere Any Device Any OS

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Features and Functions of ACE - Apps for Corrosion Engineers

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries |PTable | GUC

ACE is a collection of 14 essential corrosion software applications for daily use by corrosion engineers, corrosion researchers, and corrosion technicians in laboratories and in fields. ACE can significantly increase the efficiency, productivity, consistency and accuracy of corrosion related calculations, conversions, CP survey data assessment, materials selection, and corrosion prediction. ACE helps you do more in less time with practically everything related to corrosion. If you cannot find the features you want in ACE, do let us know and we will add the features for you to ACE free-of-charge for licensed users.

Figure 1 below shows the screen shot of ACE. There are 14 modules under the respective Tabs in ACE.

- CRU: Corrosion Rate Unit Converter - Converting between all corrosion rate units for all metals and alloys.
- REF: Reference Electrode Potential Converter - Converting measured potentials at measurement temperatures to equivalent potentials at 25^{o}C vs. reference electrodes commonly used in labs and in fields.
- CP-Pol: Cathodic Polarization Assessment and Corrosion Rate Calculation - Assessing the effect of CP polarization on the corrosion rate when CP is ON. This software tool can be used to optimize cathodic protection design, to determine cathodic protection criteria, and to evaluate CP survey data.
- DO: Dissolved Oxygen Calculator - Calculation of dissolved oxygen in water at a specified temperature (oxygen solubility, oxygen saturated waters), calculation of diffusion limiting current density, prediction of the maximum oxygen corrosion rate.
- DewPoint: Calculation of Dew Point of flue gas.
- Metallurgy: Assessing the Effect of Metallurgy on Corrosion

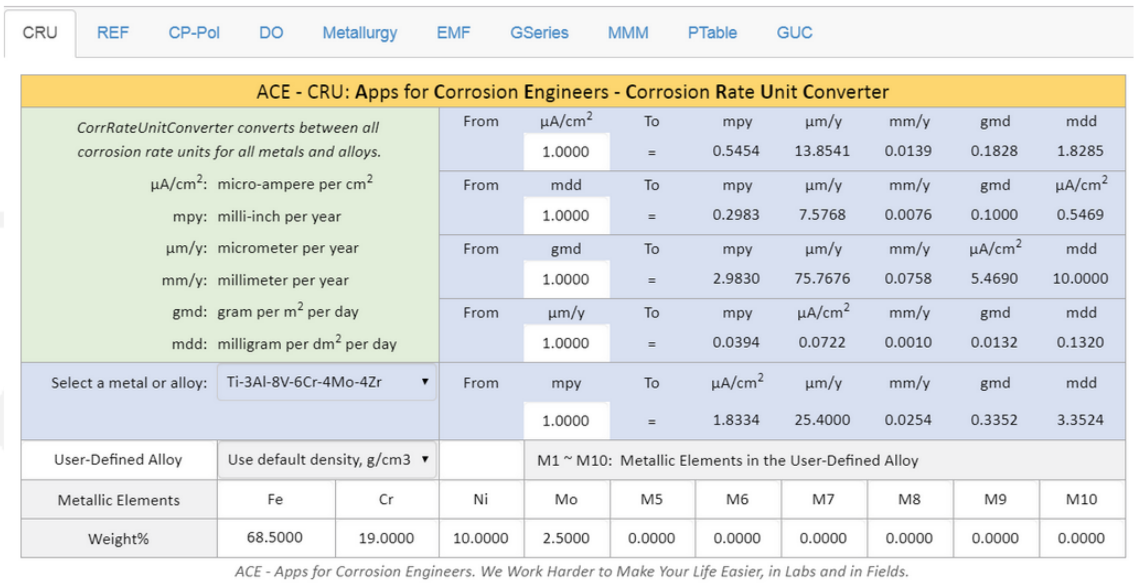
  There are 4 sub-modules under the metallurgy Tab:

  ACE-FER: Ferrite Content Predictor - Determining the ferrite content in cast stainless and alloys and the resistance to stress corrosion cracking.

  ACE-PWHT: Post-Weld Heat Treatment - Predict the equivalent carbon content and the requirement for pre-heating or post-weld heat treatment.

  ACE-FAC: Flow-Accelerated Corrosion - Predict the resistance to flow-accelerated corrosion.

  ACE-CRA: Corrosion Resistant Alloys - Predict the pitting resistance equivalent number (PREN) of corrosion resistant alloys, predict the application limits for temperature and chloride concentration.
- MMM: Mole and Molar Mass Calculator/Converter - Calculating/Converting mole and molar mass for all compounds.
- EMF: Electromotive Force Series - Table of Standard Potentials at 25^{o}C.
- GSeries: Galvanic Series - Table of Galvanic Series in Natural Sea Water.
- PTable: Periodic Table of Elements
- GUC: General Units Converter - Converting between metric and English units.



CRU | REF | CP-Pol | DO | Metallurgy | EMF | GSeries | MMM | PTable | GUC

ACE - CRU: Apps for Corrosion Engineers - Corrosion Rate Unit Converter

CorrRateUnitConverter converts between all corrosion rate units for all metals and alloys.		From	μA/cm^2	To	mpy	μm/y	mm/y	gmd	mdd
			1.0000	=	0.5454	13.8541	0.0139	0.1828	1.8285
μA/cm^2:	micro-ampere per cm^2	From	mdd	To	mpy	μm/y	mm/y	gmd	μA/cm^2
mpy:	milli-inch per year		1.0000	=	0.2983	7.5768	0.0076	0.1000	0.5469
μm/y:	micrometer per year	From	gmd	To	mpy	μm/y	mm/y	μA/cm^2	mdd
mm/y:	millimeter per year		1.0000	=	2.9830	75.7676	0.0758	5.4690	10.0000
gmd:	gram per m^2 per day	From	μm/y	To	mpy	μA/cm^2	mm/y	gmd	mdd
mdd:	milligram per dm^2 per day		1.0000	=	0.0394	0.0722	0.0010	0.0132	0.1320
Select a metal or alloy:	Ti-3Al-8V-6Cr-4Mo-4Zr	From	mpy	To	μA/cm^2	μm/y	mm/y	gmd	mdd
			1.0000	=	1.8334	25.4000	0.0254	0.3352	3.3524
User-Defined Alloy	Use default density, g/cm3		M1 ~ M10: Metallic Elements in the User-Defined Alloy						

Metallic Elements	Fe	Cr	Ni	Mo	M5	M6	M7	M8	M9	M10
Weight%	68.5000	19.0000	10.0000	2.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Figure 1 Overview of ACE - Apps for Corrosion Engineers

Detailed Feature Description of Apps for Corrosion Engineers

CRU: Corrosion Rate Unit Converter - Converting between All Corrosion Rate Units for All Metals and Alloys

Corrosion rate units commonly reported in the corrosion literature include:

- micro-ampere per cm^2: μA/cm^2,
- milli-inch per year: mpy,
- micrometer per year: μm/y,
- millimeter per year: mm/y,
- gram per m^2 per day: gmd,
- milligram per dm^2 per day: mdd

Converting the corrosion rate from one unit to another for comparison and for engineering applications is frequently required for numerous metals and alloys. For a given alloy, the conversion factors are different for each unit (μA/cm^2, mpy, μm/y, mm/y, mdd, gmd); for a given unit conversion (e.g. mdd => mpy), the conversion factors are different for different alloys which are influenced by the density, chemical compositions, atomic mass of elements, and the valence of metallic elements in the alloy. Manual conversion requires multiple steps of calculation using a set of equations. The procedure is time-consuming and prone to errors, particularly for many engineering alloys that contain multiple metallic elements in their chemical compositions. Try to manually convert a corrosion current density of 1 μA/cm^2 to mm/y for the titanium alloy Ti-3Al-8V-6Cr-4Mo-4Zr and see for yourself how long it takes you to get an accurate conversion.

ACE-CRU - Corrosion Rate Unit Converter is the only device and OS independent software tool on the market for instantly converting between all corrosion rate units for all metals and alloys with precision. Users simply choose the metal or alloy from the list and the conversion between all corrosion rate units for the selected alloy is instantly displayed (Figure 1). If a metal or alloy is not available in the database, users can easily define their own alloys for the conversion (Figure 2).

ACE - CRU: Apps for Corrosion Engineers - Corrosion Rate Unit Converter										
CorrRateUnitConverter converts between all corrosion rate units for all metals and alloys.			From	μA/cm^2	To	mpy	μm/y	mm/y	gmd	mdd
				1.0000	=	0.4134	10.5002	0.0105	0.2267	2.2670
μA/cm^2:	micro-ampere per cm^2		From	mdd	To	mpy	μm/y	mm/y	gmd	μA/cm^2
mpy:	milli-inch per year			1.0000	=	0.1824	4.6317	0.0046	0.1000	0.4411
μm/y:	micrometer per year		From	gmd	To	mpy	μm/y	mm/y	μA/cm^2	mdd
mm/y:	millimeter per year			1.0000	=	1.8235	46.3172	0.0463	4.4111	10.0000
gmd:	gram per m^2 per day		From	μm/y	To	mpy	μA/cm^2	mm/y	gmd	mdd
mdd:	milligram per dm^2 per day			1.0000	=	0.0394	0.0952	0.0010	0.0216	0.2159
Select a metal or alloy:	User-Defined		From	mpy	To	μA/cm^2	μm/y	mm/y	gmd	mdd
Define your own metal or alloy below:				1.0000	=	2.4190	25.4000	0.0254	0.5484	5.4839
User-Defined Alloy	Use default density, g/cm3			M1 ~ M10: Metallic Elements in the User-Defined Alloy						
Metallic Elements	Fe	Cr	Ni	Mo	M5	M6	M7	M8	M9	M10
Weight%	71.5000	18.0000	8.0000	2.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Figure 2 User-Defined Alloy in Corrosion Rate Units Converter

ACE-CRU Corrosion Rate Units Converter provides error-free conversion conforming to relevant ISO, ASTM and NACE standards. Current database in ACE-CRU Corrosion Rate Units Converter contains the following metals and alloys:

Aluminum and Aluminium Alloys

Aluminum

AA1100 (A91100)

AA1199 (A91199)

AA2024 (A92024)

AA2060 (A92060)

AA2219 (A92219)

AA3003 (A93003)

AA3004 (A93004)

AA5005 (A95005)

AA5050 (A95050)

AA5052 (A95052)

AA5083 (A95083)

AA5086 (A95086)

AA5154 (A95154)

AA5357 (A95357)

AA5454 (A95454)

AA5456 (A95456)

AA6061 (A96061)

AA6062 (A96062)

AA6070 (A96070)

AA6101 (A96101)

AA7050 (A97050)

AA7072 (A97072)

AA7075 (A97075)

AA7079 (A97079)

AA7178 (A97178)

Copper and Copper Alloys

Copper

CDA110 (C11000)

CDA220 (C22000)

CDA230 (C23000)

CDA260 (C26000)

CDA280 (C28000)

CDA442 (C44200)

CDA443 (C44300)

CDA444 (C44400)

CDA510 (C51000)

CDA524 (C52400)

CDA608 (C60800)

CDA612 (C61200)

CDA655 (C65500)

CDA687 (C68700)

CDA706 (C70600)

CDA710 (C71000)

CDA715 (C71500)

CDA752 (C75200)

Stainless Steels and Alloys

201 (S20100)

202 (S20200)

302 (S30200)

304 (S30400)

304L (S30403)

304LN (S30453)

309 (S30900)

310 (S31000)

311 (S31100)

316 (S31600)

316L (S31603)

316LN (S31653)

317 (S31700)

317L (S31703)

317LMN (S31726)

321 (S32100)

329 (S32900)

330 (N08330)

347 (S34700)

410 (S41000)

430 (S43000)

446 (S44600)

502 (S50200)

254SMO (S31254)

654SMO (S32654)

Nicrofer 3228 NbCe (S33228)

Nicrofer 2509 Si7 (S70003)

Ferralium 255 (S32550)

Zeron 100 (S32760)

7Mo Plus (S32950)

2RE69 (S31050)

3RE60 (S31500)

44LN (S31200)

IN-744 (S31100)

Uranus 50 (S32404)

Uranus B66 (S31266)

DP-3W (S39274)

Monit (S44635)

2205 (S31803)

2304 (S32304)

2507 (S32750)

2707 HD (S32707)

Sea-Cure (S44660)

Nickel and Nickel Alloys

Nickel

200 (N02200)

400 (N04400)

600 (N06600)

Inconel 625 (N06625)

Incoloy 825 (N08825)

Hastelloy B (N10001)

Hastelloy B-2 (N10665)

Hastelloy C (N10002)

Hastelloy C-4 (N06455)

Hastelloy C-22 (N06022)

Hastelloy C-2000 (N02000)

Hastelloy C-276 (N10276)

Alloy 20 (UNS N08020)

Hastelloy G (N06007)

Hastelloy G-3 (N06985)

Hastelloy G-30 (N06030)

20Cb-3 (N08020)

20Mo-4 (N08024)

20Mo-6 (N08026)

Al-6X (N08366)

AL-6XN (N08367)

904L (N08904)

Allcorr (N06110)

Sanicro 28 (N08028)

Cronifer 1925 hMo (N08925)

Nicrofer 5923 hMo (N06059)

Inconel 686 (N06686)

Inconel 690 (N06690)

JS700 (N08700)

Carbon Steels, Cast Irons and Low Alloy Steels

Carbon Steels

Low Alloy Steels

Gray Cast Iron

Silicon Cast Iron

Titanium and Alloys

Titanium (unalloyed)

Ti-3Al-2.5V

Ti-5Al-2.5Sn

Ti-6Al-2Sn-4Zr-2Mo

Ti-6Al-6V-2Sn

Ti-6Al-4V

Ti-6Al-7Nb

Ti-5Al-2Zr-2Sn-4Mo-4Cr

Ti-6Al-2Sn-4Zr-6Mo

Ti-4.5Al-3V-2Mo-2Fe

Ti-4Al-4Mo-2Sn-0.5Si

Ti-10V-2Fe-3Al

Ti-3Al-8V-6Cr-4Mo-4Zr

Metals

Aluminium

Cadmium

Copper

Chromium

Iron

Lead

Molybdenum

Nickel

Silver

Gold

Palladium

Platinum

Tantalum

Tin

Titanium

Zinc

Zirconium

Magnesium and Magnesium Alloys

Magnesium

AZ63

AZ31

AZ33

AZ81

AZ91

AM60

AM50

AM20

AS41

AS21

ZK51

ZK61

ZE41

ZC63

EZ33

HK31

HZ32

QE22

QH21

WE54

WE43

M1

AZ31

AZ61

AZ80

ZM21

ZMC711

LA141

ZK31

ZK61

HK31

HM21

HZ11

User-Defined Alloy

Users can define their own alloy for the conversion by entering the chemical composition (wt%) of the metallic elements in the alloy. ACE-CRU Corrosion Rate Units Converter instantly displays the results of the conversion between all corrosion rate units, saving users' time and effort.

Application Example

Weight loss coupon test for magnesium alloy AZ61 reported a corrosion rate of 1.123 mdd.

What is the equivalent corrosion current density in uA/cm^2?

What is the corrosion rate expressed in um/y?

What is the corrosion rate expressed in mpy?

Answers to the above are instantly available (Figure 3) after selecting the alloy AZ61 from the dropdown list and entering the weight loss data "1.123" in the "mdd" field:

The equivalent corrosion current density is 1.0472 uA/cm^2.

The corrosion rate in um/y is 22.7844.

The corrosion rate in mpy is 0.897.

ACE - CRU: Apps for Corrosion Engineers - Corrosion Rate Unit Converter

CorrRateUnitConverter converts between all corrosion rate units for all metals and alloys.

μA/cm^2: micro-ampere per cm^2
mpy: milli-inch per year
μm/y: micrometer per year
mm/y: millimeter per year
gmd: gram per m^2 per day
mdd: milligram per dm^2 per day

Select a metal or alloy: AZ61

From	Unit	To					
From	μA/cm^2	To	mpy	μm/y	mm/y	gmd	mdd
	1.0000	=	0.8566	21.7575	0.0218	0.1072	1.0724
From	mdd	To	mpy	μm/y	mm/y	gmd	μA/cm^2
	1.1230	=	0.8970	22.7844	0.0228	0.1123	1.0472
From	gmd	To	mpy	μm/y	mm/y	μA/cm^2	mdd
	1.0000	=	7.9877	202.8888	0.2029	9.3250	10.0000
From	μm/y	To	mpy	μA/cm^2	mm/y	gmd	mdd
	1.0000	=	0.0394	0.0460	0.0010	0.0049	0.0493
From	mpy	To	μA/cm^2	μm/y	mm/y	gmd	mdd
	1.0000	=	1.1674	25.4000	0.0254	0.1252	1.2519

User-Defined Alloy: Use default density, g/cm3 — M1 ~ M10: Metallic Elements in the User-Defined Alloy

Metallic Elements	Fe	Cr	Ni	Mo	M5	M6	M7	M8	M9	M10
Weight%	68.5000	19.0000	10.0000	2.5000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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Figure 3 Converting Corrosion Rate for Magnesium Alloy AZ61

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries | PTable | GUC

REF: Reference Electrode Potential Converter - Converting measured potentials at measurement temperatures to equivalent potentials at 25^{o}C vs. reference electrodes commonly used in labs and in fields.

CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | EMF | GSeries | MMM | PTable | GUC

ACE -REF: Apps for Corrosion Engineers - Reference Electrode Potential Converter									
SSC_SJ: Ag-AgCl solid junction (0.6M)			Standard Reference Electrode Potentials at 25°C (SHE), V						
SSC_LJ: Ag-AgCl liquid junction (sat.)			CSE	SCE	SSC_SJ	SSC_LJ	ZRE	SHE	User's Ref
ZRE: Zinc Reference Electrode			0.316	0.241	0.256	0.222	-0.800	0.000	0.288
Measurement Temperature, °C		45	Equivalent Potentials at 25°C vs. Respective Reference Electrode, V						
From	CSE (45°C)	To	CSE (25°C)	SCE	SSC_SJ	SSC_LJ	ZRE	SHE	User's Ref
	-0.850	=	-0.832	-0.757	-0.772	-0.738	0.284	-0.516	-0.804
From	SCE (45°C)	To	SCE (25°C)	SSC_SJ	SSC_LJ	ZRE	CSE	SHE	User's Ref
	-0.775	=	-0.789	-0.804	-0.770	0.252	-0.864	-0.548	-0.836
From	SSC_SJ (45°C)	To	SSC_SJ (25°C)	SSC_LJ	ZRE	CSE	SCE	SHE	User's Ref
	-0.790	=	-0.797	-0.763	0.259	-0.857	-0.782	-0.541	-0.829
From	SSC_LJ (45°C)	To	SSC_LJ (25°C)	ZRE	CSE	SCE	SSC_SJ	SHE	User's Ref
	-0.756	=	-0.770	0.252	-0.864	-0.789	-0.804	-0.548	-0.836
From	ZRE (45°C)	To	ZRE (25°C)	CSE	SCE	SSC_SJ	SSC_LJ	SHE	User's Ref
	0.266	=	0.266	-0.850	-0.775	-0.790	-0.756	-0.534	-0.822
From	SHE (45°C)	To	SHE (25oC)	CSE	SCE	SSC_SJ	SSC_LJ	ZRE	User's Ref
	-0.534	=	-0.534	-0.850	-0.775	-0.790	-0.756	0.266	-0.822
From	User's Ref (45°C)	To	User's Ref (25°C)	CSE	SCE	SSC_SJ	SSC_LJ	ZRE	SHE
	-0.822	=	-0.822	-0.850	-0.775	-0.790	-0.756	0.266	-0.534

If you cannot find the reference electrodes in the table above, you can define your own electrode for the conversion. Please enter the following information on your reference electrode:

Name of User-Defined Electrode:	User's Ref	
Standard Potential at 25°C (SHE), V	0.288	
Temperature Coefficient, mV/°C	-0.433	<== This is not required if the measured potential is at 25°C.

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Figure 4 ACE-REF Reference Electrode Potential Converter with Temperature Correction

Corrosion laboratories worldwide use a variety of reference electrodes for specific reasons. National and International cathodic protection standards use different reference electrodes for specifying cathodic protection criteria. Copper copper-sulphate electrode (CSE) is specified for cathodic protection of underground structures such as pipelines and storage tanks; silver-silver chloride electrode (SSC) is specified for cathodic protection of structures immersed in seawater; saturated calomel electrode (SCE) is most widely used in laboratories. Electrode potentials are sensitive to temperature. Potentials measured at temperatures other than 25^{o}C have to be converted to equivalent values for cross-referencing and comparison. For example, Cathodic protection potential survey data are collect in the fields at seasonal temperatures (not the standard 25^{o}C). It is essential that the CP system meets the protection criteria that is referenced to -0.85 V (CSE) at 25^{o}C for a buried pipeline. The ACE-REF module instantly converts the measured potential at the measurement temperature to the equivalent potential at 25^{o}C on commonly used reference electrode scale, or an user-defined reference electrode scale.

Try to manually convert the potential of -0.850 V (CSE) measured at 45^{o}C to the potential at 25^{o}C on the SSC (SJ) scale and see how long it takes to get an accurate conversion. In ACE-REF, it take less than a second and the conversion is done for all common reference electrodes used in labs and in fields. In this example, the reading of -0.85 V (CSE) at 45^{o}C does not meet the CP protection criteria as the equivalent potential at 25^{o}C is -0.832 V (CSE), as shown in Figure 4 above. In contrast, a potential reading of -0.837 V CSE) at 10^{o}C meets the cathodic protection criteria as the equivalent potential at 25^{o}C is -0.850 V (CSE), as shown in Figure 5.

CRU | REF | CP-Pol | DO | Metallurgy | EMF | GSeries | MMM | PTable | GUC

ACE -REF: **Apps** for **C**orrosion **E**ngineers - **Ref**erence Electrode Potential Converter									
SSC_SJ: Ag-AgCl solid junction (0.6M)			Standard Reference Electrode Potentials at 25°C (SHE), V						
SSC_LJ: Ag-AgCl liquid junction (sat.)			CSE	SCE	SSC_SJ	SSC_LJ	ZRE	SHE	User's Ref
ZRE: Zinc Reference Electrode			0.316	0.241	0.256	0.222	-0.800	0.000	0.288
Measurement Temperature, °C		10	Equivalent Potentials at 25°C vs. Respective Reference Electrode, V						
From	CSE (10°C)	To	CSE (25°C)	SCE	SSC_SJ	SSC_LJ	ZRE	SHE	User's Ref
	-0.837	=	-0.850	-0.775	-0.791	-0.757	0.266	-0.535	-0.822
From	SCE (10°C)	To	SCE (25°C)	SSC_SJ	SSC_LJ	ZRE	CSE	SHE	User's Ref
	-0.775	=	-0.765	-0.780	-0.746	0.276	-0.840	-0.524	-0.812
From	SSC_SJ (10°C)	To	SSC_SJ (25°C)	SSC_LJ	ZRE	CSE	SCE	SHE	User's Ref
	-0.790	=	-0.785	-0.751	0.271	-0.845	-0.770	-0.529	-0.817
From	SSC_LJ (10°C)	To	SSC_LJ (25°C)	ZRE	CSE	SCE	SSC_SJ	SHE	User's Ref
	-0.756	=	-0.746	0.276	-0.840	-0.765	-0.780	-0.524	-0.812
From	ZRE (10°C)	To	ZRE (25°C)	CSE	SCE	SSC_SJ	SSC_LJ	SHE	User's Ref
	0.266	=	0.266	-0.850	-0.775	-0.790	-0.756	-0.534	-0.822
From	SHE (10°C)	To	SHE (25oC)	CSE	SCE	SSC_SJ	SSC_LJ	ZRE	User's Ref
	-0.534	=	-0.534	-0.850	-0.775	-0.790	-0.756	0.266	-0.822
From	User's Ref (10°C)	To	User's Ref (25°C)	CSE	SCE	SSC_SJ	SSC_LJ	ZRE	SHE
	-0.822	=	-0.822	-0.850	-0.775	-0.790	-0.756	0.266	-0.534

If you cannot find the reference electrodes in the table above, you can define your own electrode for the conversion. Please enter the following information on your reference electrode:

Name of User-Defined Electrode:	User's Ref	
Standard Potential at 25°C (SHE), V	0.288	
Temperature Coefficient, mV/°C	-0.433	<== This is not required if the measured potential is at 25°C.

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Figure 5 ACE-REF Reference Electrode Potential Converter for Cathodic Protection Applications

ACE-REF can literally be a life-saver for cathodic protection contractors, cathodic protection technicians, cathodic protection technologists who are involved in meeting both the technical and the contractual requirements of cathodic protection criteria. Facility owners can use ACE-REF to instantly verify if the CP survey data meet the protection criteria at a specific location and in a specific season.

Users of ACE-REF can easily define their own Reference Electrode scale for conversion. In Figures 4 and 5 above, the user-defined reference electrode named "User's Ref" has a standard potential of 0.288 V (SHE) at 25^{o}C with a temperature coefficient of -0.433 mV/^{o}C.

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries | PTable | GUC

CP-Pol: Cathodic Polarization Assessment and Corrosion Rate Calculation - Assessing the effect of CP polarization on the corrosion rate when CP is ON.

This software tool can be used to optimize cathodic protection design, to determine cathodic protection criteria, and to evaluate CP survey data.

CRU	REF	CP-Pol	DO	Metallurgy	EMF	GSeries	MMM	PTable	GUC

ACE - CP-Pol: CP Polarization and Corrosion Rate		
Effect of Cathodic Protection on Corrosion Rate		
Temperature:	°C	10.00
Corrosion Rate (No CP):	mm/y	0.2500
Cathodic Polarization:	mV	100
Tafel slope:	V	Default
User-defined:	V	0.120
CorrRate Reduction factor:		60
Corrosion Rate (CP on):	mm/y	0.004146

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Figure 6 CP-Pol: Assessing the effect of CP polarization on the corrosion rate when CP is ON.

An user simply enters the temperature and cathodic polarization, CP-Pol calculates the corrosion rate reduction factor. If the native corrosion rate (no CP) is known (typically less than 0.25 mm/y in soil or seawater), the corrosion rate when CP is on is calculated. CP-Pol allows users to enter the Tafel slope value for use in the computation.

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries | PTable | GUC

DO: Dissolved Oxygen Calculator

This software tool helps you with the following tasks:

- calculation of dissolved oxygen in waters and other aqueous process fluids at a specified temperature,
- prediction of oxygen diffusion limiting current density,
- prediction of the maximum oxygen corrosion rate for carbon steels.

CRU	REF	CP-Pol	DO	Metallurgy	EMF	GSeries	MMM	PTable	GUC

ACE - DO: Dissolved Oxygen and Diffusion Limiting Current Density			
Enter Salinity	Temperature	Dissolved Oxygen	Diffusion Limiting Current Density
‰	°C	ppm	μA/cm^2
33.00	25.00	6.85	25.39
The maximum corrosion rate of steels **under O2 diffusion control**, mm/y			0.295
Corrosion rate is proportional to the area ratio of cathode to anode. The maximum corrosion rate should be multiplied by the cathode to anode area ratio.			

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Figure 7 Calculation of Dissolved Oxygen in Waters at a Specified Temperature.

Users have complete flexibility in defining the fluid by entering either the salinity, or conductivity, or TDS, or just select one of the waters without the need to have the water analysis results.

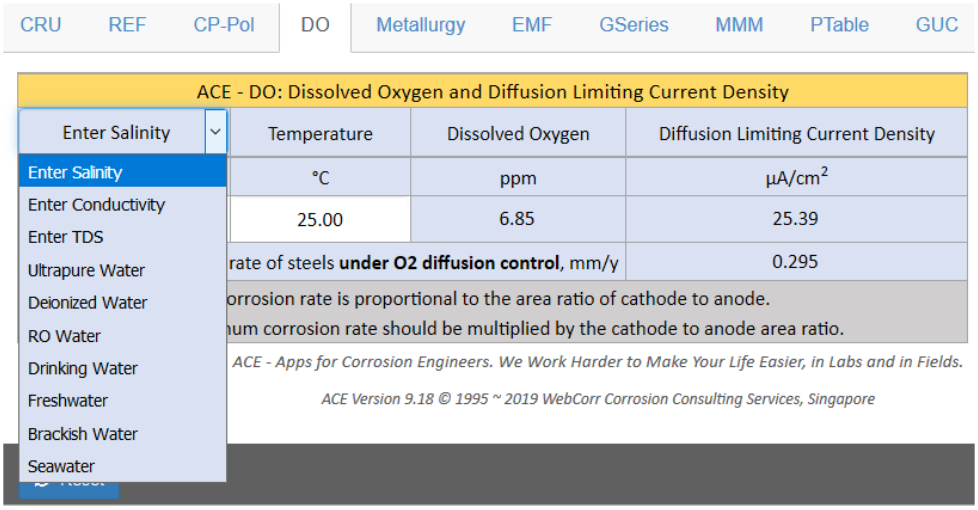

Figure 8 Calculation of Dissolved Oxygen and O2 Diffusion Limiting Current Density in Waters at a Specified Temperature.

The solubility of oxygen in water is dependent on both temperature and salinity (salt concentration). The oxygen diffusion limiting current density and the corresponding corrosion rate in mm/y for carbon steels are predicted in this module. An user can use the CRU module to convert the diffusion limiting current density to the preferred corrosion rate unit for any metal or alloy.

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries | PTable | GUC

DewPoint: Dew Point of flues gas calculator - Predicting the dew points of flue gas: HBr, HCl, HF, NO2, SO2, SO3, and H2O

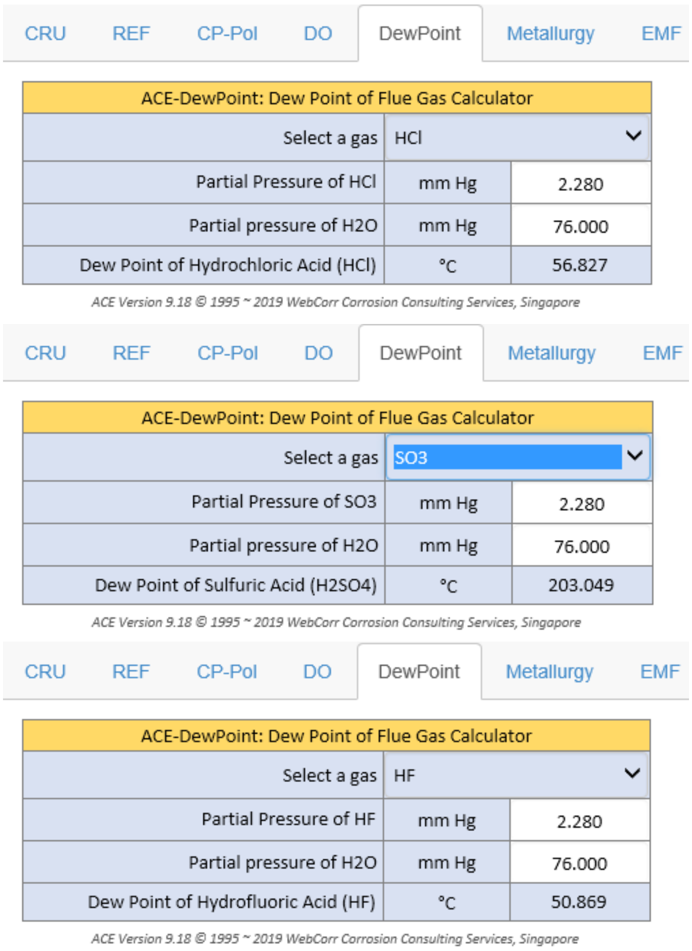

Figure 9 Predicting Dew Point of Flue Gas

Metallurgy: Predicting the Effects of Metallurgy on Corrosion

There are 4 sub-modules under the metallurgy Tab:

ACE-FER: Ferrite Content Predictor - Determining the ferrite content in cast stainless and alloys and the resistance to stress corrosion cracking.

An user can define customized alloy. ACE-FER predicts the ferrite content (%volume) in the cast microstructure and the resistance to stress corrosion cracking (SCC).

Figure 10 Assessing the Effect of Metallurgy on Corrosion

ACE-PWHT: Post-Weld Heat Treatment - Predict the equivalent carbon content (ECC) and the requirement for pre-heating or post-weld heat treatment.

ACE-FAC: Flow-Accelerated Corrosion - Predict the chromium equivalent and the resistance to flow-accelerated corrosion.

ACE-CRA: Corrosion Resistant Alloys - Predict the pitting resistance equivalent number (PREN) of corrosion resistant alloys, predict the application limits for temperature and chloride concentration.

MMM: Mole and Molar Mass Calculator/Converter - Calculating/Converting mole and molar mass for all compounds.

CRU | REF | CP-Pol | DO | Metallurgy | EMF | GSeries | MMM | PTable | GUC

ACE - MMM: **M**ole and **M**olecular **M**ass Converter									
Name of Compound:	Polythionic acid				Formula:	H2S5O6			
Enter the symbol of element and the number of atoms in the formula:									
H	S	O	E4	E5	E6	E7	E8	E9	E10
2	5	6							
From	Mole	To	Mass, g		From	Mass, g	To	Mole	
	1.000	=	258.35			258.35	=	1.000	

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Figure 11 Mole and Molar Mass Calculator and Converter

The MMM module works for all elements in the periodic table and all compounds with known formulae.

EMF: Electromotive Force Series - Table of Standard Potentials at 25^{o}C.

GSeries: Galvanic Series - Table of Galvanic Series in Natural Sea Water.

PTable: Periodic Table of Elements

GUC: General Units Converter - Converting between metric and English units.

ACE Overview | CRU | REF | CP-Pol | DO | DewPoint | Metallurgy | FER | PWHT | FAC | CRA | MMM | EMF | GSeries |PTable | GUC

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