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CP-Compass®: Cathodic Protection Design, Verification & Assessment

Version 9.18



☆ Performance ☆ Functionality ☆ Usability



Anytime

No USB dongles



Anywhere

No installation



Any Device

No Browser Plug-ins



Any OS

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CP-Compass has the following standalone modules:

- CP-Compass-Underground pipeline
- CP-Compass-Submarine pipeline
- CP-Compass-Platform
- CP-Compass-FPSO
- CP-Compass-Well casing
- CP-Compass-Jetty pile
- CP-Compass-Storage tanks
- CP-Compass-Concrete structure
- CP-Compass-Condensers & heat exchanger
- CP-Compass-Customized for special need

Design calculations in CP-Compass modules are in compliance with internationally accepted codes and standards: AS 2239; AS 2832; BS EN ISO 12696; BS EN 12473; BS ISO 15589; DNV-RP-B401; DNV-RP-F103; NACE SP0169; NACE SP0176.

Our NACE certified Corrosion Specialist will review and endorse all CP designs based on CP-Compass at no charge to licensed users.

Unparalleled Functionality: CP-Compass is not just for CP design and verification of CP design calculations by 3rd party contractors, it also gives you tools to predict the corrosion rate of the structure WHEN CP IS ON! Refer to the screen shot below for details.

Unmatched Usability: CP-Compass was designed with the user in mind. Experience the industry's first cross-platform and device-independent Cathodic Protection Design, Verification and Assessment application on your iPads, tablets, smart phones, notebooks and desktops, at any time and anywhere, in the office or in the field. No installation files to download, no browser plug-ins required, no USB dongles to carry around, and no license keys to transfer from one PC to another. **CP-Compass simply works on any device running any OS.** All you need is an internet browser.

A Brief Overview of CP-Compass-Underground pipeline

Galvanic Anode CP		ICCP	Corrosion Rate	Tools	About
Design Calculation for Galvanic Anode Cathodic Protection of Buried Pipelines					
Client:	ABC Company			PO#201706	
Project:	XYZ Pipeline Cathodic Protection			1/25/2010	
Design Life, yrs	20	Anode Material	Zn <input type="text"/>		
Steel Grade	API X65	Anode Potential	-1.10 V(CSE)		
Pipe OD, mm	273.10	Driving Voltage	0.250 V		
Pipe Length, m	30,000	Anode Length (packaged), mm	1,549		
Pipe Surface Area	25,739 m ²	Anode Diameter (packaged), mm	152		
Coating breakdown factor	5%	Anode Weight (Bare), kg	14.500		
Soil Resistivity, Ω.cm	1,500	Anode Consumption Rate, kg/A-y	10.76		
Design Current Density, mA/m ²	22.0	Current Efficiency	0.90		
Protection Potential, V(CSE)	-0.850	Utilization Factor	0.85		
CP Current and Anode Weight Requirements					
CP Current Required	28.313 A	Total Anode Weight Required	7,965 kg		
		Number of Anode by Weight	549.3		
Anode Current Output		Vertical Installation	<input type="text"/>		
Anode to Earth Resistance	5.242 Ω	Anode Current Output	47.696 mA		
Anode Burial Depth	200 cm	Number of Anode by Current	593.6		
Number of Anode Selected	594	Anode Life Calculation	22 yrs		
The number of anodes selected meets the design life requirement.					
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Galvanic Anode CP Design and Verification

With CP-Compass, designing a galvanic anode CP system or verifying a CP design by a 3rd party contractor is as easy as 1-2-3:

1. Enter the design parameters (items in the above screen shot).
2. Choose the anode from the dropdown list.
3. The number of anode required, the the anode life, and system design life are automatically determined and verified.

Impressed Current CP Design and Verification

Impressed Current CP design and verification are shown in the screen shot below:

Design Calculation for Impressed Current Cathodic Protection of Buried Pipelines

Client: ABC Oil and Gas Company

Project: XYZ Oil and Gas Pipeline Cathodic Protection

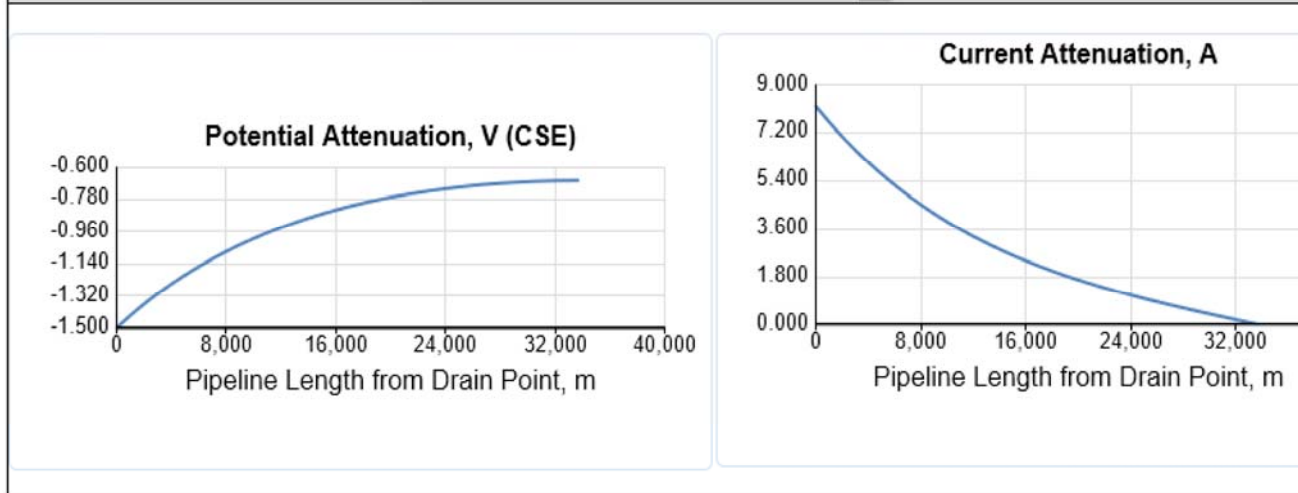
Design Life, yrs	20	Soil Resistivity, Ω.cm	1,500	Natural Corrosion Potential, V(CSE)	
Pipe Steel Grade	API X65	Coating Type	FBE	Minimum Protection Potential, V(CSE)	
Steel Resistivity, Ω.m	1.850e-007	Coating Resistance, Ω.m ²	4,000	Maximum Protection Potential, V(CSE)	
Pipeline Length, km	1,070.000	Coating Breakdown Factor	1.0%	Attenuation constant	7.2
Pipe OD, m	0.762	Design Current Density, mA/m ²	0.100	Current from E-LogI Test?	
Pipe Wall Thickness, mm	9.00	Total Surface Area	2,561,466 m ²	Enter current (A) if Yes	
Pipe Linear Resistance	8.689e-6 Ω/m	CP Current Required	256.147 A	This option can be used for what-if sen	
1. Total CP Current Based on the Specified Design Current Density			256 A	CP Current per Station	

2. Calculation of Protection Current Requirement Based on Attenuation

One Way of An Infinite Pipeline				One Way To A Mid-Point Between 2 Drain Points			
Protected Length One Side	m	23,724		Protected Length One Side	m		
Protection Current One Side	A	7.774		Protection Current One Side	A		
Resulting Current Density	mA/m ²	0.137		Resulting Current Density	mA/m ²		

3. Number of Stations and Spacing Between Stations

No of Stations Required	2	Located at	23,700 m	from pipe end	Current per Station
No of Stations Required	15	Spaced at	63,700 m	along the pipeline	Current per Station
Total No of Stations	17	One Way To Mid-Point Between 2 Drain Points			Total Current Required



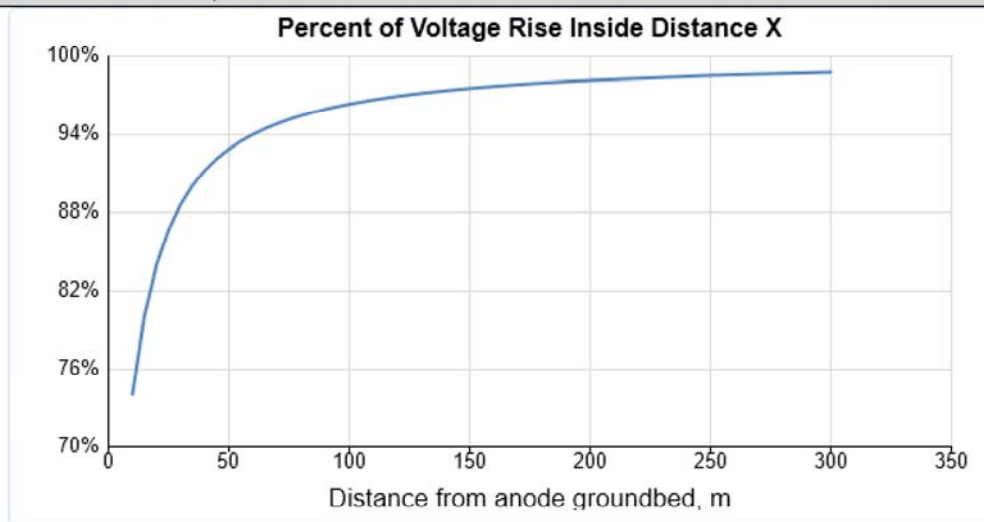
4. Selection of CP Current (per station) Based on: Attenuation 16 A Extra Capacity: %

5. Anode Selection and Groundbed Design

Design Life	yrs	20	Anode Material Selected	H:
Total Capacity Required	A-y	320.000	Net Weight of Single Anode	kg
Single Anode Output	A	5.000	Anodes Consumption Rate	kg/A-y
Single Anode Capacity	A-y	47.247	Anode Utilization Factor	

If not known, enter data on the right to calculate =>			Single Anode Capacity	A-y	4:
Number of Anode Required	6.77	The number of anodes selected meets the design life req			
Number of Anodes Selected:	7	Current Output:	16.536 A	System Life:	21 yrs
Shallow Anode Groundbed Design			Vertical	Deep Well Anode Groundbed Design	
Anode Length (incl. backfill)	cm	243.84	Groundbed Diameter	cm	2
Anode Diameter (incl. backfill)	cm	30.48	Coke Consumption Rate	kg/A-y	0.
Anode Spacing	cm	500.00	Coke Utilization Factor		(
Anode Burial Depth	cm	200.00	Coke Length by Consumption	m	2
Single Anode Resistance	Ω	3.093	Coke Length by Current Limit	m	1
Groundbed Resistance	Ω	0.650	Coke Column Length Selected	m	
Pipe Resistance to Earth	Ω	0.061	Anode Spacing	cm	
Cable Resistance per km	Ω/km	0.833	Groundbed Drilling Depth	m	
Cable Length	m	150	Pipe Resistance to Earth	Ω	0
Cable Resistance	Ω	0.125	Groundbed Resistance	Ω	0
Total Circuit Resistance	Ω	0.836	Total Circuit Resistance	Ω	0
Rectifier Output Rating			Rectifier Output Rating		
Back Voltage	V	2.000	Back Voltage	V	2
TR Voltage Output Rating	V	16	TR Voltage Output Rating	V	
TR Current Output Rating	A	17	TR Current Output Rating	A	

6. Separation Distance of Anode Groundbed from Pipeline



Distance from the Anode Groundbed	X	m	50	This is the minimum separation distance for the groundbed to be electrically "remote".
Voltage Drop at Distance X from anode	V _x	V	0.238	
Voltage drop over 1 m at X _{min} from anode	V _d	mV	5.000	
Min Distance of Anode to Pipeline	X _{min}	m	87.404	
Recommended Separation Distance of Anode Groundbed from Pipeline				90 m

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Current and potential attenuation are calculated automatically to give you the most realistic estimation of the number of anode groundbeds required (see plots under Section 3 above).

The separation distance between the anode groundbed and the structure is automatically optimized based on the user specified acceptable voltage drop (see plot under Section 6).

The corrosion rate of the structure when CP is on can be calculated based on the polarization measurements, as shown in the screen shot below:

Effect of Cathodic Protection on Corrosion Rate		
Environment:	Soil	
Temperature:	oC	5
Corrosion Rate (No CP):	mm/y	0.1500
Polarization:	mV	100
Tafel slope:	V	0.0552
CorrRate Reduction factor:		65
Corrosion Rate (CP on):	mm/y	0.002311

This unique function not found in any other CP design softwares allows users of CP-Compass to assess the degree of CP protection on an existing structure based on the CP survey results (the polarization data). It also allows the designer to set the CP criteria (e.g., 100 mV or 150 mV) to meet the corrosion rate target when CP is on.

The "Tools" menu in CP-Compass allows users to perform design calculations for any CP system for any structure.

Galvanic Anode CP	ICCP	CorrosionRate	Tools	About
Relative Values of Typical Reference Electrodes to Copper-Copper Sulfate Reference Electrode				
Electrode (Half - Cell)	Name	Potential (Volts)		
Copper - Copper Sulfate (Cu-Cu SO4)	CSE	0		
Silver - Silver Chloride (Saturated)	Ag-AgCl	-0.05		
Saturated Calomel	SCE	-0.07		
Zinc (Pure Zinc)	Zn	-1.1		
Sacrificial Anode Efficiency and Utilization Factor				
Magnesium :				
$L_M = \frac{C_a * W * E * U_F}{I}$				
Ca = Electrochemical Capacity (A-y/kg)		Ca =	0.250	
W = Weight of Anode (kg)		W =	109.000	
E = Current Efficiency		E =	0.5	
UF = Utilization Factor		UF =	0.85	
I = Total Protection Current (amps)		I =	2.000	
LM = Life of Magnesium Anode (yrs)		LM =	5.791 yrs	

CP-Compass, giving you the right directions in the design and operation of cathodic protection.

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