CATHODIC PROTECTION

Corrosion prevention and antifouling solutions for marine applications

AEGION®

Stronger. Safer. Infrastructure.®

corrpro®

Corrpro Companies Europe Ltd, formerly Wilson Walton International, has led the world in the field of corrosion protection and antifouling solutions for hull protection, ballast tanks and pipework for over 40 years.

Providing corrosion protection solutions utilising:

- Aloline® and Zincoline® galvanic (sacrificial) anodes
- Aquamatic® Impressed Current Cathodic Protection (ICCP) systems

Antifouling, marine growth protection systems:

- Anfomatic® antifouling and corrosion mitigation systems

Hull and Tank Protection

- Aloline® and Zincoline® hull and tank anodes are supplied worldwide
- Utilising the principle of sacrificial galvanic cathodic protection first pioneered in the 1800s by Sir Humphry Davy
- Aluminium and zinc anodes protect steel hulls, tanks and other submerged metallic structures and are cast at our foundry in Stockton on Tees

Aquamatic®

Aquamatic® is an Impressed Current Cathodic Protection (ICCP) system incorporating proven technology and comprised of anodes, reference electrodes and a power control unit for both automatic and manual operation.

The system is designed to suit the particular requirements of the vessel and its operating environment which allows for the fluctuations in protection current demand likely to be encountered during service.

Anfomatic®

Biofouling within pipework and heat exchangers is a major problem in ships, offshore platforms and refineries and causes a reduction in flow rates, effectiveness and efficiency.

To avoid the high cost of cleaning or using expensive chemicals or chlorination, Corrpro has developed an environmentally friendly, low cost system using cupric ion dissolution. The system can be retrofitted close to the seawater intakes or pumps that deliver water for cooling or fire protection.

Over 1000 ships, rigs and platforms have been fitted with this low maintenance, easily understood system.

Service Support

The reliability of Aquamatic® and Anfomatic® systems is well proven. However for optimum performance we recommend that all installations are serviced on a routine basis and during dry docking.

Our worldwide network of service technicians can offer advice on the operation of Corrpro/Wilson Walton equipment to ensure that they provide the maximum level of protection for your vessel.

AQUAMATIC®

The Aquamatic® System

The Aquamatic® system comprises several anodes, reference electrodes and a transformer/rectifier controller power unit. A drawing of a typical installation is shown in Figure 1. The types and sizes of these components and their positions on the hull are specified according to design parameters which allow for the size of the vessel and fluctuations in the protection current likely to be encountered during seagoing service.

Whilst these measures protect the hull, it is important to protect the propeller, exposed shafting and the rudder. The propeller and shafting are grounded to the hull structure with a shaft slip ring, making them electrically common with the hull. The rudder is also grounded with a flexible cable. In this way, electrical continuity is established, ensuring that these components are protected by the Aquamatic® system.

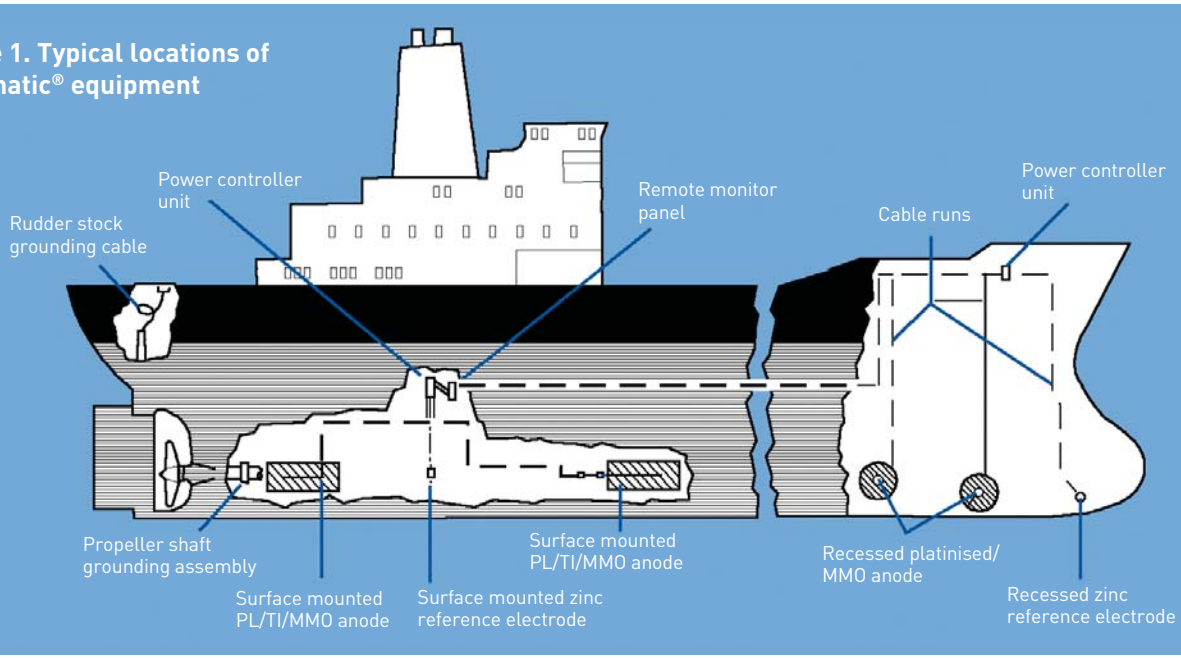
Anodes

The anodes used in an Aquamatic® system may be linear or elliptical types, both of which are inert. All types of anodes are provided with a cofferdam, incorporating a double gland assembly, approved by the Classification Societies, to ensure a watertight hull penetration for the anode cable.

Reference Electrodes

At least two and sometimes four reference electrodes are used in the Aquamatic® system. They can be surface mounted or recessed. Both types incorporate a block of high purity zinc, which because of its robust construction and stable electrochemical characteristics, is an ideal material for reference purposes.

Figure 1. Typical locations of Aquamatic® equipment



Power Controller Unit

The power controller unit is self contained in a cabinet situated in the engine room or another convenient space. It includes solid state circuitry with PCBs for easy maintenance. Power supply is from the ship's AC mains, which is transformed and rectified to produce the DC current required for cathodic protection.

Full electrical protection is provided on input whilst output fuses are fitted in each anode circuit. All components are readily accessible within the drip-proof steel enclosure.

Remote Monitoring System

The remote monitoring system has a liquid crystal display. One panel is directly connected to the forward and aft controller boards. The signal from both power units can be displayed and monitored on the remote unit from any location on the vessel.

Rudder Stock

Since rudder stock bearings do not give adequate electrical continuity between the rudder and the hull, to provide a bond which will ensure cathodic protection for the rudder, a flexible cable is secured between the rudder stock and the deck head.

ELECTRICAL BONDS

Propeller Shaft Grounding And Monitoring Assembly

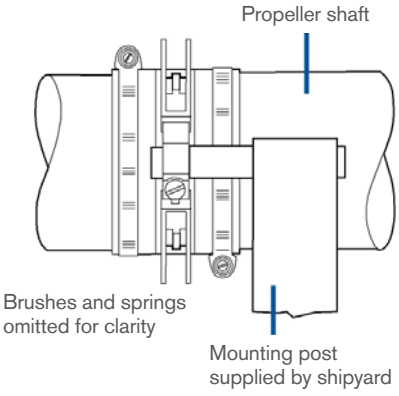
This assembly ensures good electrical contact between the propeller, propeller shaft and the ship's hull. This, in turn, inhibits dezincification of bronze propellers and provides a level of protection to propellers made of other materials. It also protects the shaft bearings from corrosion.

The assembly comprises a silver inlaid copper band, clamped to the shaft, and a brush assembly (see Figure 2). High silver content brushes running on the silver strip provide electrical continuity with the hull. Monitoring panels can be supplied for single and twin shafts which can be used as stand alone monitoring systems, if required.

Installation, Commissioning and Service

Typical Aquamatic® installations are shown in Figure 1. The 'aft' system is applicable for both small and large vessels, whereas the forward system applies only to large vessels whose length necessitates the use of a supplementary system near the bow section. For forward systems, it is necessary to recess anodes to protect them from mechanical damage and to reduce drag.

Figure 2. Propeller shaft slip ring assembly



Once commissioned, an Aquamatic® system operates automatically, requiring no adjustment. However, to confirm that the system is functioning correctly, log sheets are provided on which daily recordings of operational readings from the control unit are made. The log sheets provide a continuous record of the level of protection and data from which any malfunction of the system and the state of the underwater coating can be assessed.

Automatic logging of the power controller settings is available as an option. The parameters are recorded onto an SD memory card which can be downloaded to a computer.

Although the reliability of the Aquamatic® system is well proven, we recommend that installations are serviced on a routine basis during dry docking by our trained personnel.

MULTIFUNCTION CP CONTROLLER
(Fitted to Aquamatic® power controller unit)

Functions

- Metering
- Monitoring
- Data logging
- Data output
- Controlling
- Input keypad
- Alarm
- Remote control

Features

Multifunction OLED graphic display for:

- Total current and applied voltage
- Individual anode current - maximum 6 number
- Reference electrode potential - maximum 4 values
- Voltage monitoring - maximum 6 values
- Temperature - maximum 2 values from external thermocouples
- Alarm conditions - setup parameters - diagnostic routines

User-selectable displays and setup parameters via solid state switching; all controlled by 4 tactile waterproof, IP65 keys

Automatic, closed loop, constant current or constant voltage modes

Current limiting based on total output as well as individual anode circuit fuseless protection

Output signals, 4 number 0 to 10Vdc proportional to setpoint/error value, current output, voltage output and least protected reference electrode value

Single or three phase, half or full wave thyristor variable phase angle-displaced firing pulses

Data logging to internal industry-standard SD card with time-stamped data from onboard real time clock (RTC)

Data output on industry-standard data bus, both RS232 and CAN

Alarm output on normally open or normally closed volt free contacts as well as fan start via normally open volt free contacts

Remote control, master/slaving for instantaneous off synchornising funtions via data bus

Built in self-test and user diagnostic test facilities obviates internal engineer intervention

Six-pulse power unit

Advantages

- No auxiliary or synchonising transformers required
- Low quiescent power consumption < 1W, maximum power consumption < 15W
- Operates over a temperature range -5ºC to 65ºC with up to 80% relative humidity
- Wide voltage input tolerance with onboard isolated switch mode supply
- Single or three phase operation - automatically sensed forward or reversed phase rotation
- 4 keypad tactile waterproof - IP65 - human/machine interface HMI
- Single chip DSPIC microprocessor controlled PCB using surface mount technology
- Minimised component count and interconnection wiring for enhanced reliability
- Designed and built to international standards for rugged industrial applications
- Connections via plugs and sockets to simplify installation

ANFOMATIC®

Principle of Operation

Marine fouling and biofouling commonly occur in seawater circulation systems. This involves the establishment of marine organisims and bacterial growths. The fouling organisms enter the system in micropscopic and macroscopic form (eg. larvae) and spats settle and develop into adult forms wherever environmental conditions exist.

Hard fouling by mussels, barnacles, etc., most commonly occurs in seawater circuits and can result in interference in flow conditions, blockage and increased corrosion. Traditional chemical methods of water treatment to prevent fouling are now less favoured, particularly chlorination. Chlorine accelerates corrosion rates, usually by causing pitting attack on steel, is environmentally unacceptable and treatment requires continuous monitoring and control.

The Anfomatic® System

The Anfomatic® system applies direct current to copper anode(s) releasing a controlled quantity of copper ions into the system to create an environment in which primary forms of marine life do not grow. Current applied to the aluminum anode releases a 'floc', a precipitate of aluminum hydroxide.

The aluminum oxidation products reduce corrosion rates on ferrous components in the seawater system by modifying the ferrous oxides formed and by film deposition. Similarly, iron anodes are utilised for cupro-nickel pipework.

The Anfomatic® system is automatic, requires minimal maintenance and is environmentally friendly. Mussels are not killed by the systems: the environment it creates prevents them settling or developing. A further benefit on the Anfomatic® system is that potable water distallation of plants can be operated without interruption.

Anfomatic® Anodes

Each microprocessor controlled module supplies two anodes. The current flowing to each anode is indicated by digital display. This allows visual monitoring of all the separate anode currents. The unit also incorporates the following features as standard:

- IP rating: 56
- Manual or automatic switching between normal operation and standby modes
- Reduced output option when running on DC back up supply to reduce battery drain
- Green "Power ON" indicator LED
- Red LED and onscreen warning indication for anode failure
- Option to include remote control by PC interface
- Signal outputs compatible with IAMCS operation
- Power failure relay for connection to an independent alarm system
- Standard colour: RAL 7035

Antifouling Anode

The antifouling anode is a rod of our Cuproline alloy, used in conjunction with an anti-corrosion anode.

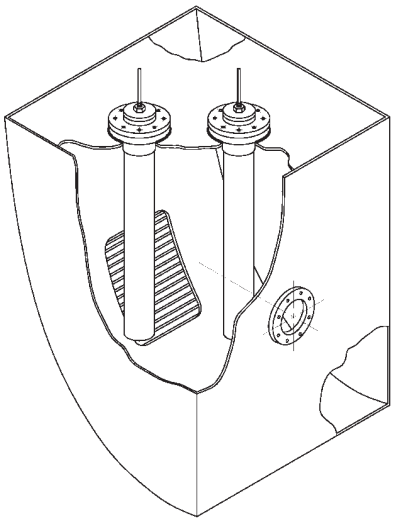
Anti-corrosion Anode

Depending on the location of the anit-corrosion anode in a seawater circulation system and the metal it is protecting, the material will be one of two alloys: Aloline® or Ferroline®.

Availability

The worldwide nature of Corrpro's operation means that Anfomatic® antifouling systems can be designed and fitted to vessels wherever in the world dry docking is available. Whilst installation is a straight-forward procedure, Corrpro staff are always on hand to provide specialized advice and to assist with commissioning. In addition, Corrpro can supply replacement anodes and spares for most types of antifouling systems and box coolers.

Anfomatic® anti-fouling system



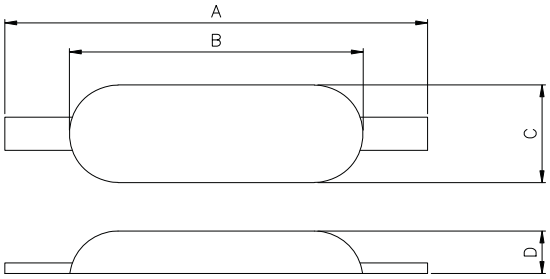
Sea chest anode arrangement

GALVANIC ANODES

Aloline® and Zincoline® Hull and Tank Anodes

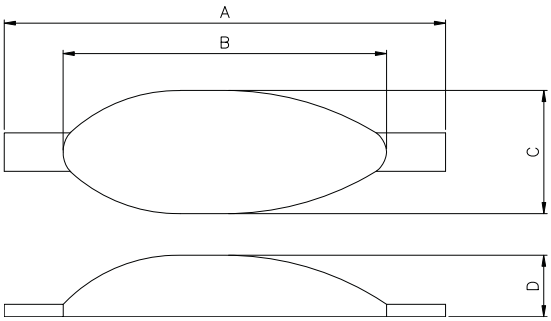
The standard alloy composition shown opposite. This has proven to be suitable for use in a wide range of environments. Other formulations or modifications to the standard alloys in respect of limits on residual elements (such as iron) can be manufactured to customer specification.

Standard Composition	Aloline®	Zincoline®
Zinc	3.0 - 5.5%	99.314% min
Aluminium	Remainder	0.010 - 0.50%
Copper	0.005% max	0.005% max
Silicon	0.10% max	-
Iron	0.13% max	0.005% max
Titanium	0.02% max	-
Indium	0.01 - 0.02%	-
Lead	-	0.006% max
Cadmium	-	0.025 - 0.07%
Other	0.02% max	0.01 total max
Nominal Electromechanical Capacity (AH/kg)	2500	780
Nominal Solution Potential (mV) (Ag/AgC1)	-1080	-1050
Density (kg/m3)	2710	7000



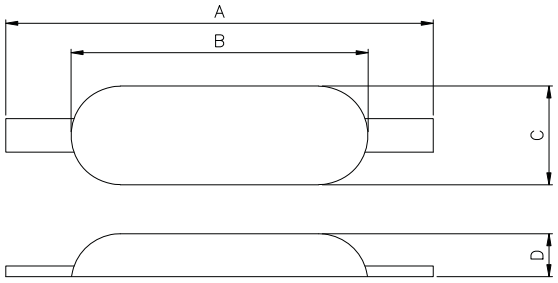
Aloline® Anodes

Type	A	B	C	D	Insert Dims.	Nett Wt.	Gross Wt.
W131	300	200	95	32	20 X 3	1.2	1.3
W130	350	270	150	32	40 X 6	2.6	3.2
W111	500	400	150	32	40 X 6	4.0	5.0
W114	650	550	130	50	40 X 6	8.0	9.2
W117	650	550	130	65	50 X 6	10.1	11.6
W119	650	550	130	75	50 X 6	12.6	14.1
W118	650	550	130	95	50 X 6	16.5	18.0
W124	1015	920	130	50	50 X 6	13.0	15.4
W126	1015	920	130	75	50 X 6	21.0	23.4
W128	1015	920	130	105	50 X 6	30.0	32.4



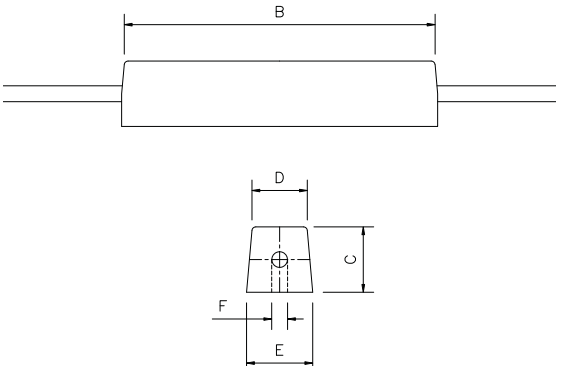
Zincoline® Anodes

Type	A	B	C	D	Insert Dims.	Nett Wt.	Gross Wt.
WP0	200	120	40	25	10 X 3	0.5	0.55
WP1	260	180	60	32	20 X 3	1.0	1.1
WP2	300	220	75	38	20 X 3	2.15	2.3
WP5	380	290	100	50	30 X 5	4.55	5.0
W10Z	400	280	150	75	40 X 6	10.0	10.7
W16z	520	420	160	70	40 X 6	15.0	16.0



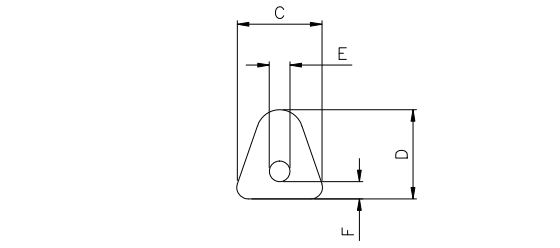
Zincoline® Anodes

Type	A	B	C	D	Insert Dims.	Nett Wt.	Gross Wt.
WP3	300	200	95	30	40 X 3	3.1	3.2
W6Z	350	270	150	32	40 X 6	6.5	7.1
W11Z	500	400	150	32	40 X 6	10.8	11.8
W14Z	650	550	130	50	40 X 6	21.3	22.5
W17Z	650	550	130	65	50 X 6	25.0	26.5
W18Z	650	550	130	95	50 X 6	42.6	44.1
W19Z	650	550	130	75	50 X 6	33.0	34.5
W24Z	1015	920	130	50	50 X 6	35.0	37.4



Aloline® Tank Aluminium Anodes

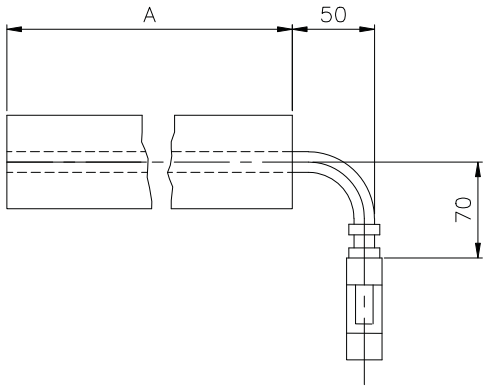
Type	A	B	C	D	E	F (Dia.)	Nett Wt.	Gross Wt.
W110	1225	765	50	40	50	12	4.2	5.3
W115	1985	1525	50	40	50	12	8.4	10.2
W156	765	305	70	50	76	12	3.3	3.8
W155	1070	610	70	50	76	12	7.1	8.1
W154	1222	762	70	50	76	12	8.7	10.0
W153	1476	1016	70	50	76	12	11.6	13.1
W152	1730	1270	70	50	76	12	14.5	16.3
W151	1984	1524	70	50	76	12	17.3	19.3
W196	765	305	95	75	85	12	5.8	6.5
W195	1060	600	95	75	85	12	12.2	13.1
W194	1210	750	95	75	85	12	15.0	16.1
W193	1465	1005	95	75	85	12	20.2	21.5
W192	1720	1260	95	75	85	12	25.4	26.9
W191	1984	1524	95	75	85	12	30.9	32.7



Zincoline® Tank Anodes

Type	A	B*	C	D	E	F (Dia.)	Nett Wt.	Gross Wt.
WT50Z	1676	1219	63	57	12	19	21.0	22.5
WT70Z	1676	1219	76	68	12	23	30.0	32.0
WT90Z	1676	1219	82	78	12	25	40.0	42.0
WT110Z	1676	1219	94	91	20	32	50.0	54.0

* Anode lengths given in this table are standard but other lengths can be supplied to order.



Pit Guard Anodes

Type	Material	A	B*	C	Nett Wt. (kg)
Aloline® Anodes					
AT2235	Aloline®	193	70	76	2.25
AT2235/1	Aloline®	386	70	76	4.5
AT2235/2	Aloline®	344	70	76	4.0
Zincoline® Anodes					
ZT2247	Zincoline®	332	70	76	10.0

All weights in Kilograms. All dimensions in millimetres. All weights and dimensions are nominal.

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