Sacrificial

Z.B.A.

Anodes

ZYMARIS VASSILIOS



Application

Cathodic protection with Sacrificial Anodes is an economical and highly effective means of corrosion controlling for a wide range of applications.

The three industries which use sacrificial (galvanic) anodes are :

1.The marine industry- for protecting ships both internally and externally.

2.The offshore petrochemical industry.This includes offshore structures,drilling rigs,drill ships,fixed production platforms ,underwater pipelines.

Sacrificial anodes for submarine pipelines is the most interesting application engineering challenge.Pipeline anodes have very specific tolerance fit to the pipe and precise nett weight requirements in order to meet cathodic protection design.

The design of the bracelet is often varied to suit the mode of fitting or the type of pipe it is being fitted to.Bracelet anode can also be fully bolted,hinged and bolted,fully weld-on.

Sacrificial anodes for fixed production platforms are generally up to 30 cm in section and up to 300 cm in length of trapezoidal or circular cross section.Inserts are made from steels with a composition computible with welding direct to the structure or via doubler plate.Inserts are now invariably a tube with ends bent to facilitate attachement some 30 cm from the surface to be protected.

3.The on-shore petrochemical and pipeline industries.

Company Profile

ZBA-Cathodic Protection Services- specialises in the design and manufacture of sacrificial anodes (Zinc, Aluminium Magnesium) for shipping , offshore, and industrial applications.

The company has one of the largest sacrificial anode foundries in the Mediterranean area. Our facilities are equipped with 3 Gaz furnaces with a total capacity to produce 8 Tons of Zinc and 4 Tons of Aluminium per day.We are also have our own fully equipped tool room where all molds for the casting are made.ZBA has designed,manufactured & supplied in excess of 10.000 Tons of sacrificial Zinc & Aluminium Alloy anodes for various applications in Marine & Offshore Sectors.

Quality Assurance

To ensure the production of uniformly high quality products, ZBA is certified to the requirements of ISO 9001 by BV Quality Assurance.

The ZBA Management System covers every stage of the production process-from design,to manufacture,right through to delivery.The key objective of the ZBA management system is to continually improve.This is achived by reviewing and refining all processes critical to producing high quality products.

Laboratory Services

Our own in house quality program and laboratory facilities guarantees top quality products.
To ensure anode purity all raw materials undergo thorough inspection and every alloy batch is spectrografically tested prior to anode casting.Anodes can only be cast if the spectrographic analysis is within specification.On request ZBA can provide certificate of Chemical Analysis.

Customer may also arrange inspections by recognized quality assurance agencies such as BV,DNV,ABS.

Marine Corrosion & Cathodic Protection

Today much of our infrastructure built upon steel components is seriously threatened by a destructive and persistent enemy: Corrosion.

This undesirable process is initiated by the formation of corrosion cell which has three essential components : an anode and a cathode coupled in an electrically conductive solution (electrolyte). The corrosion of bare steel occurs by an electrolytic mechanism requiring the presence of water and oxygen. The overall reaction may be expressed as : 4 Fe + 302 + 2H20 ?2 Fe03 H20 (rust).

This is the result of two separate reactions , one taking place at anodic areas and producing electrons , another at cathodic areas and consuming electrons.

Anode 4Fe - 4 Fe++ + 8e
Cathode 202 + 4 H20 + 8e - 80H

The ferrous and hydroxyl ions produced by these reactions then react to form ferrous hydroxide , which in the presence of oxygen is oxidized to hydrated ferric oxide , or rust.

4 Fe ++ + 8 OH ? 4 Fe (OH) 2
4 Fe (OH2) + 02 ? 2Fe203 H20 + 2 H20

Accordingly in the rusting of iron there is a flow of electrons in the metal from the anodic to the cathodic areas and a corresponding corrosion current in the electrolyte carried by the movement of ions in solution. It has been demonstrated that the

Sacrificial Z.B.A. Anodes

amount of current that is flowing is equivalent to the amount of metal corroded, in accordance with Faraday's law. Corrosion always develops at the anode where current leaves the metal and enters the electrolyte , whilst a protective effect occurs at the cathode. Thus if the whole metal made sufficiently cathodic , corrosion will not occur.

This is the basic principle of cathodic protection - the practice of using electrochemical reactions to prevent the corrosion of steel structures.

The essential factor in cathodic protection is to ensure that the unwanted anodic reactions are suppressed by the application of an opposing current.
This opposing current can be achieved by either of two techniques:

1. Sacrificial Anodes - By corroding away a more reactive metal.
Anodes based on alloys of Zinc , Aluminum and occasionally Magnesium are attached to the structure and corrode in preference to the protected metal. Consequently these anodes require renewal at routine intervals.

2. Impressed Current - A protective current is impressed on the structure through semi-inert anodes.

ALUMINUM ANODES

The ZBA Aluminum Alloy Anodes are cast from the highest purity Aluminum ingot with small additions of Zn-In alloys.

Aluminum Anodes have been accepted as the most economical galvanic anode especially to large marine structures such as harbor facilities, offshore structure Power Stations & Plants , Ships & etc.. requiring long life corrosion protection.

COMPOSITIONS OF ALUMINUM ALLOYS	
Si 0.10 % Max	Si 0.10 % Max
Fe 0.10 % Max	Fe 0.13 % Max
Cu 0.005 % Max	Cu 0.005 % Max
Mn N / A	Mn N / A
Zn 2.0 – 6.0 %	Zn 4.0 – 6.0 %
Ti -	Ti -
In 0.01 – 0.03 %	In -
Sn -	Sn 0.05 – 0.15 % Max
Other El 0.10 % Max	Other El 0.10 % Max
Al Remainder	Al Remainder
Open circuit potential (VS Ag / AgCl ref. cell)	-1.05 volt
Nominal Electrochemical capacity seawater	Max 2680 Amp.hr / kg
Efficiency	95 %

ZINC ANODES

The ZBA zinc alloy anodes are cast to internationally recognized U.S.Military Specification MIL- 18001-K using only special high grade zinc ingot of minimum purity 99.995% with small additions of special alloy elements. This alloy is also covered by ASTM-418-95 Type I.

Our Sacrificial Zinc Anodes have stable electrochemical properties and are used in seawater or in water up to 1000 ohm-cm.
They should not be used where environmental temperature may exceed 120 degrees F. (50° C)

COMPOSITIONS OF ZINC ALLOYS	
ASTM B 418 TYPE I MIL – A – 18001-K	ASTM B 418 TYPE II
Fe 0.005 % Max	Fe 0.0014 % Max
Pb 0.006 % Max	Pb 0.003 % Max
Cu 0.005 % Max	Cu 0.002 % Max
Al 0.1 – 0.5 %	Al 0.005 % Max
Cd 0.025 – 0.07 %	Cd 0.003 % Max
Zn Remainder	Zn Remainder
Open circuit potential (VS Ag / AgCl ref. cell)	-1.03 volt
Electrochemical capacity in seawater	780 Amp.hr / kg
Efficiency	95 %

ZINC ALLOY CAST - BOLT ON / WELD ON

PRODUCT CODE	ANODE DIMENSIONS			STRAP DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L2	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
Z-05 B	110	35	20	205	16	4	30 x 7	155	0.50
Z-10 B	110	70	30	205	25	4	30 x 7	155	1.00
Z-20 B	190	65	25	290	25	6	40 x 13	220	2.00
Z-20 B A	150	80	40	270	30	4	20 x 10	200	2.00
Z-25 B	150	100	35	290	25	6	40 x 13	220	2.50
Z-30 B	150	100	40	290	25	6	40 x 13	220	3.00
Z-35 B	210	95	30	335	25	6	40 x 13	270	3.50
Z-50 B	290	90	40	455	35	6	60 x 12	365	5.00
Z-70 B	290	120	30	455	35	6	60 x 12	365	7.00
Z-80 B	290	120	30	460	50	6	60 x 12	365	8.00
Z-100 BA	270	150	40	460	50	6	60 x 12	365	10.0
Z-100 B	330	140	30	505	50	6	60 x 12	405	10.0
Z-110 B	380	145	40	570	50	6	60 x 12	470	11.0
Z-130 B	580	110	35	750	50	6	60 x 12	600	13.0
Z-160 B	580	110	40	750	50	6	60 x 12	600	16.0
Z-200	770	115	40	1000	50	6			20.0
Z-240	770	115	45	1000	50	6			24.0
Z-280	900	125	55	1100	50	6			28.0
Z-300	900	125	60	1100	50	6			30.0

Sacrificial Z.B.A. Anodes

-Anodes in this series contain a single, cast in steel mounting strap.
-Hull anodes can be welded or bolted by specially made holes on straps.

ALUMINIUM ALLOY CAST - BOLT ON / WELD ON

PRODUCT CODE	ANODE DIMENSIONS			STRAP DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L2	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
AL-05 B	110	70	30	205	25	4	30 x 7	155	0.500
AL-10 B	190	65	25	290	25	6	40 x 13	220	1.00
AL-15 B	150	100	40	290	25	6	40 x 13	220	1.50
AL-20 B	210	95	30	335	25	6	40 x 13	270	2.00
AL-30 B	290	90	40	455	35	6	60 x 12	365	3.00
AL-40 B	290	120	30	460	50	6	60 x 12	365	4.00
AL-50 B A	270	150	40	460	50	6	60 x 12	365	5.00
AL-50 B	330	140	30	505	50	6	60 x 12	405	5.00
AL-60 B	380	145	40	570	50	6	60 x 12	470	6.0
AL-80 B	580	110	40	750	50	6	60 x 12	600	8.0
AL-100	500	130	50	720	50	6	-	-	10
AL-120	770	115	45	1000	50	6	-	-	12
AL-150	700	130	65	1000	50	6	-	-	15
AL-180	900	125	55	1100	50	6	-	-	18
AL-200	900	125	60	1100	50	6	-	-	20

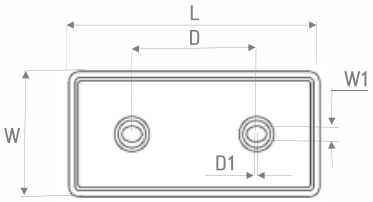
ZINC ALLOY CAST – MILITARY ANODES

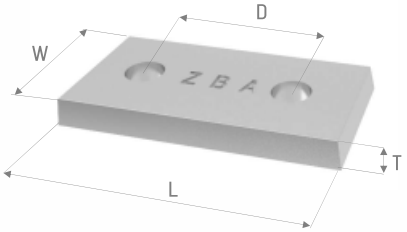
-These anodes contain two cast-in galvanized steel mounting straps or two cast-in cored holes on 150 mm

PRODUCT CODE	ANODE DIMENSIONS			STRAP DIMENSIONS			APPROX. WEIGHT
MF TYPE	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	KG
Z-100 M	300	150	30	290	25	6	10.0
Z-120 M	300	150	35	290	25	6	12.0

ALUMUNIUM ALLOY CAST – MILITARY ANODES

PRODUCT CODE	ANODE DIMENSIONS			STRAP DIMENSIONS			APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	KG
AL-35 M	300	150	30	290	25	6	3.5
AL-42 M	300	150	35	290	25	6	4.2



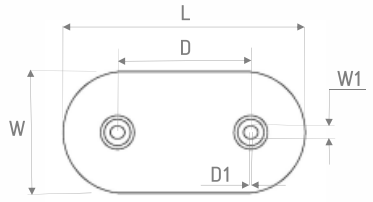


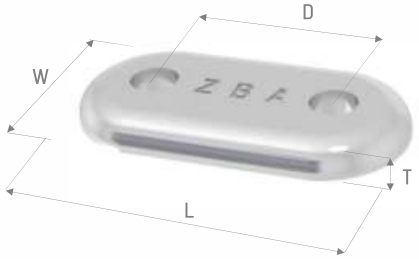
ZINC CAST PLATE - BOLT ON

PRODUCT CODE	ANODE DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
MF TYPE	LENGTH mm L	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
ZCP-75 B	150	75	20	21 x 17	75	1.2
ZCP-110 B 2	200	100	20	21 x 17	110	2.4
ZCP-110 B 3	200	100	30	21 x 17	110	3.4
ZCP-160 B 2	300	150	20	28 X 22	160	5.6
ZCP-160 B 3	300	150	30	28 X 22	160	8.5
ZCP-160 B 4	300	150	40	28 X 22	160	12.2
ZCP-160 B 5	300	150	50	28 X 22	160	16
ZCP-160 B 6	300	200	50	28 X 22	160	20.4

ALUMINIUM CAST PLATE - BOLT ON

PRODUCT CODE	ANODE DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
MF TYPE	LENGTH mm L	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
ACP-75 B	150	75	20	21 x 17	75	0.5
ACP-110 B 2	200	100	20	21 x 17	110	1.0
ACP-110 B 3	200	100	30	21 x 17	110	1.5
ACP-160 B 3	300	150	30	28 X 22	160	3.1
ACP-160 B 4	300	150	40	28 X 22	160	4.5
ACP-160 B 5	300	150	50	28 X 22	160	6.2
ACP-160 B 6	300	200	50	28 X 22	160	8.5
ACP-160 B 7	300	200	65	28 X 22	160	11
MF -93	400	150	60	28 X 22	180	9.3





ZINC CAST PLATE - BOLT ON

PRODUCT CODE	ANODE DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
RF TYPE	LENGTH mm L	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
ZCP-200 P	300	70	40	20 X 10	200	4
ZCP-230P	450	100	40	28 X 22	230	7
RB - 14	360	180	45	28 X 22	180	14
RB - 20	540	130	53	28 X 22	340	20
RB - 30	460	200	64	28 X 22	260	30
RB - 40	540	200	65	28 X 22	340	40

ALUMINIUM CAST PLATE - BOLT ON

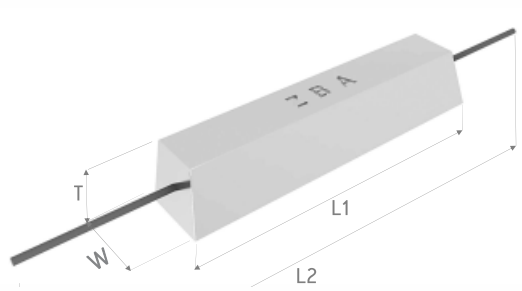
PRODUCT CODE	ANODE DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
RF TYPE	LENGTH mm L	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
ACP-200 P	300	70	40	20 X 10	200	2
ACP-230P	450	100	40	28 X 22	230	4
RF - 58	360	180	45	28 X 22	180	5.8
RF - 96	540	140	64	28 X 22	340	9.6
RF - 118	540	200	50	28 X 22	260	11.8
RF -155	540	200	65	28 X 22	340	15.4
ACP- 300 B	500	165	70	28 X 22	300	14.2

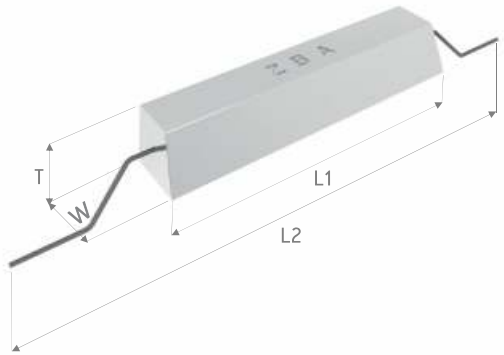
STRAIGHT CORE ARRANGEMENT

Anodes contain a straight steel core rod for clamping / bolting to a ballast tank structure with ¨U¨ bolts or clamps.

ZINC ALLOY

PRODUCT CODE	ANODE DIMENSIONS			CORE DIMENSIONS		APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L2	DIAMETER mm E	KG
ZT-67	250	60	50	700	12	6.70
ZT-100	500	60	45	1000	12	10.0
ZT-160	750	60	45	1250	12	16.0
ZT-200	1000	60	45	1500	12	20.0
ZT-230	1000	60	50	1500	12	23.0
ZT-260	1250	60	45	1750	12	26.0
ZT-310	1250	60	55	1750	12	31.0
ZT-400	1250	60	70	1750	12	40.0

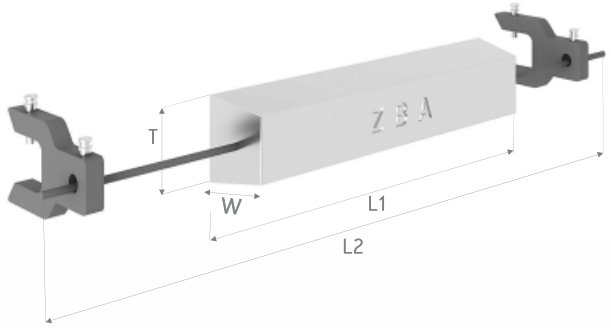




As an option steel core can be double cranked for direct welding to structure

ALUMINIUM ALLOY

PRODUCT CODE	ANODE DIMENSIONS			CORE DIMENSIONS		APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L2	DIAMETER mm E	KG
AT-50	500	60	45	1000	12	5.0
AT-80	750	60	55	1250	12	8.0
AT-100	1000	60	50	1500	12	10.0
AT-130	1000	60	70	1500	12	13.0
AT-160	1250	60	70	1750	12	16.0



PITGUARD ANODES

PRODUCT CODE	ANODE DIMENSIONS			APPROX. WEIGHT
	LENGTH mm L	WIDTH mm W	THICKNESS mm T	KG
ZTC-65 ZINC	250	60	50	6.5
ZTC-100 ZINC	500	60	45	10.0
ATC-30 ALUMINUM	250	60	50	3.0
ATC-50 ALUMINUM	500	60	45	5.0

*Weights excluding clamp

ANODE CENTRE CLAMP - M TYPE

PRODUCT CODE	ANODE DIMENSIONS			APPROX. WEIGHT
	LENGTH mm L	WIDTH mm W	THICKNESS mm T	KG
ZTC-65 ZINC	250	60	50	6.5
ZTC-100 ZINC	500	60	45	10.0
ATC-30 ALUMINUM	250	60	50	3.0
ATC-50 ALUMINUM	500	60	45	5.0

PRODUCT CODE	ANODE DIMENSIONS			STRAP DIMENSIONS			HOLE	HOLE CENTRE	APPROX. WEIGHT
	LENGTH mm L1	WIDTH mm W	THICKNESS mm T	LENGTH mm L2	WIDTH mm W	THICKNESS mm T	D1 x W1 mm	D mm	KG
ZINC	300	50	70	380	30	6	20 X 11	340	7
ZINC	500	50	95	700	30	6	20 X 11	615	17
ALUMINUM	400	80	90	530	30	6	20 X 11	460	9
ALUMINUM	600	80	80	740	30	6	20 X 11	700	11

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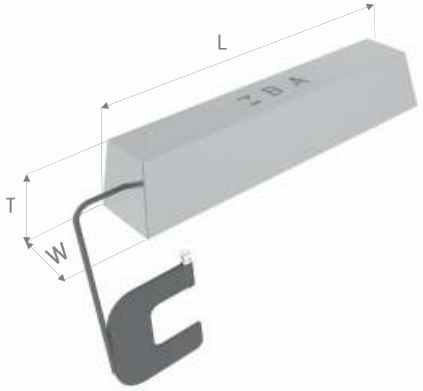
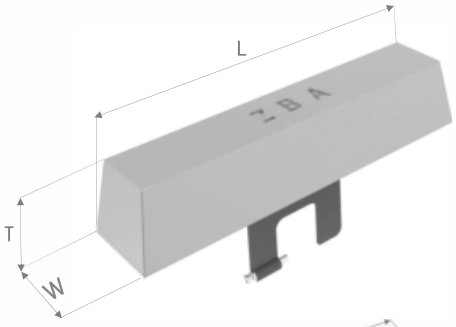
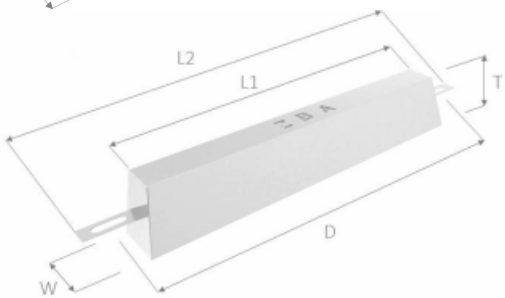
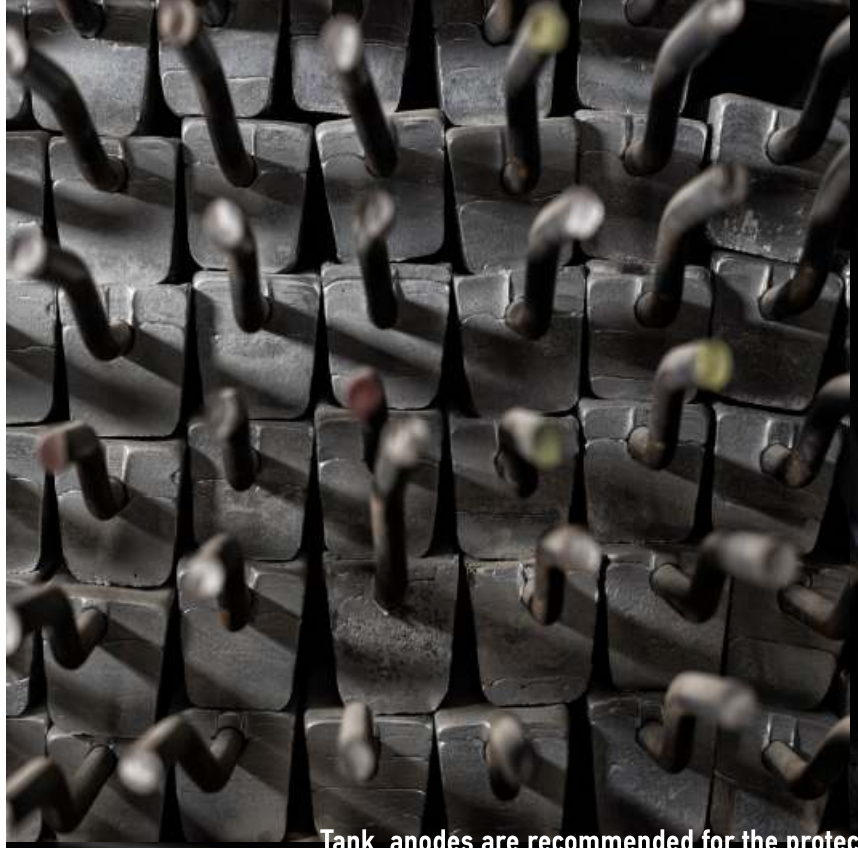
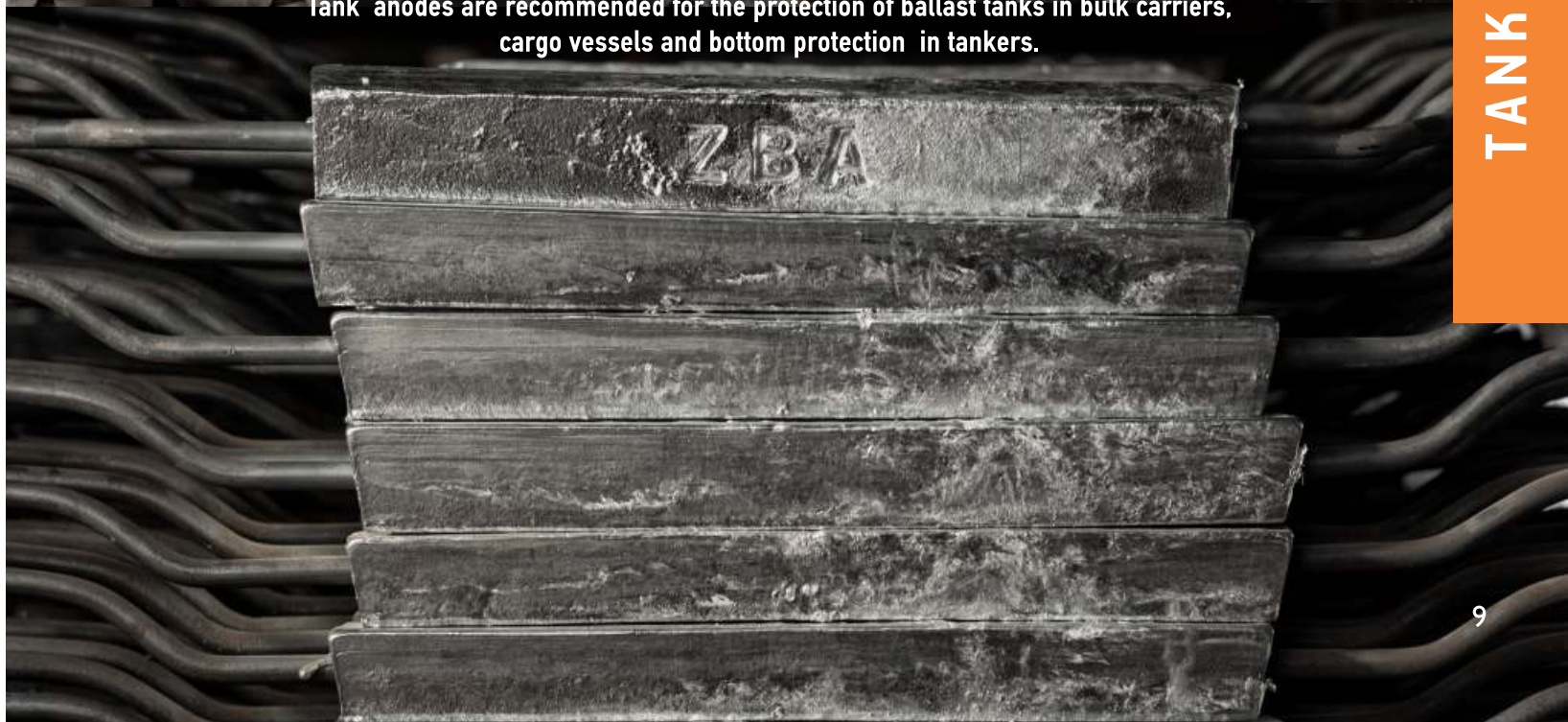








Tank anodes are recommended for the protection of ballast tanks in bulk carriers, cargo vessels and bottom protection in tankers.



TANK ANODES

Sacrificial Z.B.A. Anodes

Marine Growth Preventing System

Antifouling Anodes

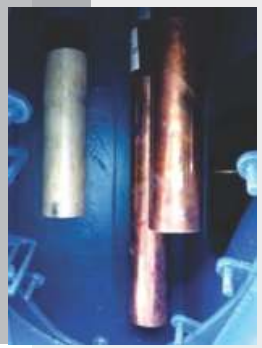
Bio-fouling commonly occurs in seawater circulation system when barnacles, mussels and other lower forms of marine life as larvae enter pipework, settle on interval surface of pipes where they rapidly grow and multiply if favorable environmental condition exists

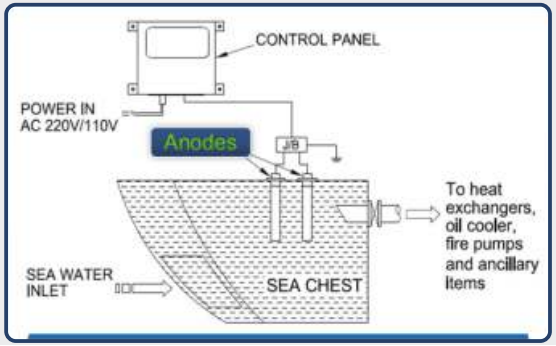
Blockages in seawater pipework caused by bio-fouling are expensive and time consuming to repair, which significantly jeopardize the operational capability and even safety of the vessels.

The Marine Growth Prevention System (MGPS) accomplishes dual tasks – pipework anti-fouling and corrosion suppression , by taking advantages of active metal actions (or hypochlorite) generated based on electrolytic principle and distributing the electrolyte into pipework using flowing seawater as media. The system can dramatically enhance operational efficiency and equipment performance of seawater systems , water pumps, heat exchangers, condensers ,etc.

MGPS consist of Copper anode coupled with an Aluminium or Iron anode. Copper ions released into the system to create an environment in which primary forms of marine life cannot exist .Aluminum or Iron oxidation products reduce corrosion rates in the sea water-system of ferrous or non ferrous components.

Typical Arrangement for Sea chest Mount





Engine anodes serves to protect heat exchangers, piping ,tanks, pumps , and other hydraulic equipment from corrosion.

-Cast rod anodes available from 12 mm to 200 mm diameter
-Cast rod anodes has maximum length 500 / 600 mm
-Also available 300 mm

- Anodes of different styles.
-Square ,Circular
-Solid / Drilled.

Different dimensions (length x width x thickness) are also available upon request.

HEAT EXCHANGER - STYLE CIRCULAR

PRODUCT CODE	ANODE DIMENSIONS		HOLE	HOLE THREAD
	DIAMETER mm E	THICKNESS mm T	D1 x W1 mm	D mm
ZD-30	30	20	UPON REQUEST	
ZD-40	40	20	UPON REQUEST	
ZD-50	50	20	UPON REQUEST	
ZD-60	60	20	UPON REQUEST	
ZD-70	70	20	UPON REQUEST	
ZD-80	80	20	UPON REQUEST	
ZD-90	90	20	UPON REQUEST	
ZD-100	100	20	UPON REQUEST	
ZD-110	110	25	UPON REQUEST	
ZD-120	120	25	UPON REQUEST	
ZD-130	130	25	UPON REQUEST	
ZD-140	140	25	UPON REQUEST	

PRODUCT CODE	ANODE DIMENSIONS		HOLE	HOLE THREAD
	DIAMETER mm E	THICKNESS mm T	D1 x W1 mm	D mm
ZD-150	150	25	UPON REQUEST	
ZD-160	160	30	UPON REQUEST	
ZD-170	170	30	UPON REQUEST	
ZD-180	180	30	UPON REQUEST	
ZD-190	190	30	UPON REQUEST	
ZD-200	200	30	UPON REQUEST	
ZD-210	210	30	UPON REQUEST	
ZD-220	220	30	UPON REQUEST	
ZD-230	230	30	UPON REQUEST	
ZD-240	240	30	UPON REQUEST	
ZD-250	250	30	UPON REQUEST	
ZD-300	300	30	UPON REQUEST	

PRODUCT CODE	ANODE DIMENSIONS		APPROX. WEIGHT
	LENGTH mm L	DIAMETER mm E	KG
ZR12-500	12	500	0,40
ZR16-500	16	500	0,72
ZR19-500	19	500	1.00
ZR22-500	22	500	1.50
ZR25-500	25	500	1.70
ZR30-600	30	600	3.00
ZR35-600	35	600	4.10
ZR40-600	40	600	5.40
ZR45-600	45	600	6.60
ZR50-600	50	600	8.50
ZR60-600	60	600	12.2
ZR65-600	65	600	14.7
ZR70-600	70	600	16.6
ZR75-550	75	550	17.0
ZR80-600	80	600	22.0
ZR90-600	90	600	27.5
ZR100-500	100	500	28.5

SACRIFICIAL CORROSION FLANGE

PIPE NUMBER	ANODE DIMENSIONS			HOLE CENTRE	NUMBER	DIAMETER	HOLE
	OUTSIDE DIAMETER mm	INSIDE DIAMETER mm	THICKNESS mm				
32	115	38	20	90	4	15	M12
40	120	44	20	95	4	15	M12
50	130	56	20	105	4	15	M12
65	155	70	20	130	4	15	M12
80	180	80	20	145	4	19	M16
100	200	106	20	165	8	19	M16
125	235	130	20	200	8	19	M16
150	265	160	20	280	8	19	M16
200	320	204	20	280	8	23	M20
250	385	253	25	345	12	23	M20
300	430	305	25	390	12	23	M20
350	480	340	25	435	12	25	M22
400	540	402	25	495	16	25	M22
450	605	443	25	555	16	25	M22
500	655	495	25	605	20	25	M22
550	720	545	30	665	20	27	M24
600	770	595	30	715	20	27	M24

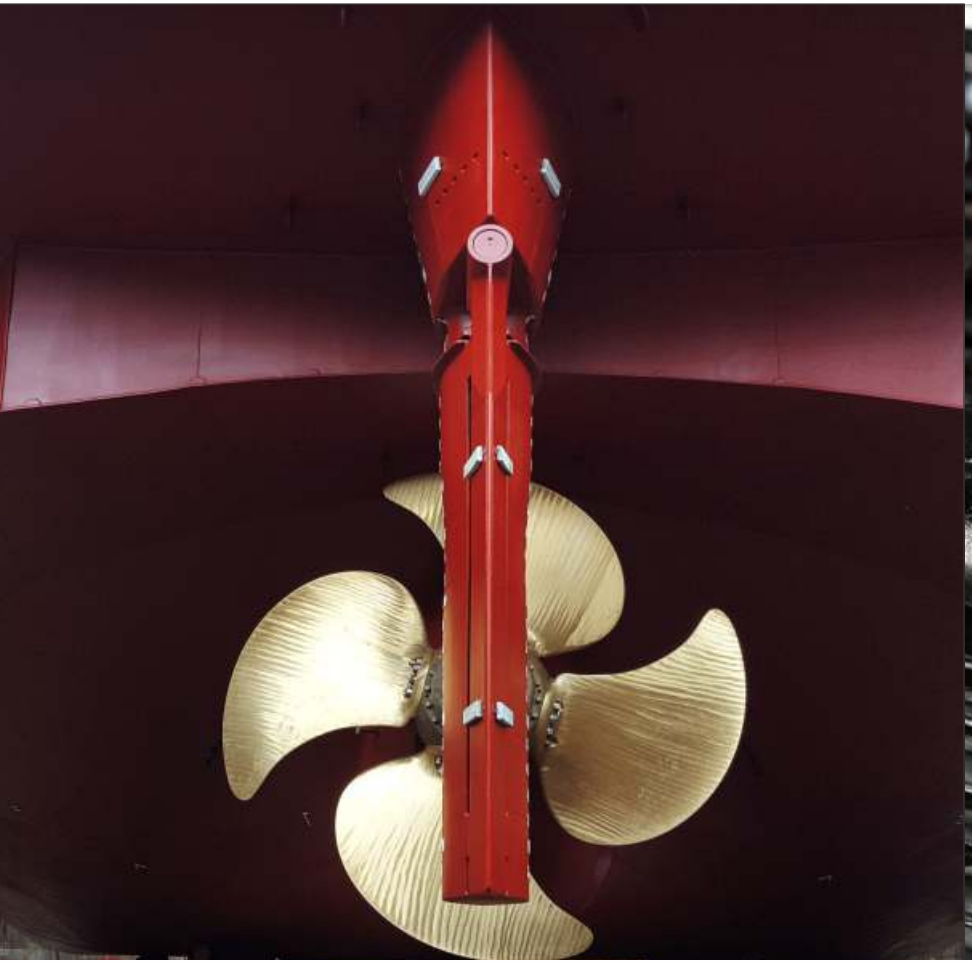
HEAT EXCHANGER - STYLE SQUARE

PRODUCT CODE	ANODE DIMENSIONS			APPROX. WEIGHT
	LENGTH mm L	WIDTH mm W	THICKNESS mm T	KG
ZP-1005020	100	50	20	0,750
ZP-10010020	100	100	20	1.440
ZP-1507025	150	70	25	1.900
ZP-15015020	150	150	20	3.240
ZP-20010020	200	100	20	2.900
ZP-20020025	200	200	25	7.200
ZP-25025020	250	250	20	9.000
ZP-2507040	250	70	40	5.100
ZP-30015020	300	150	20	6.400
ZP-30015025	300	150	25	8.100
ZP-10005020	1000	50	20	6.800
ZP-10006025	1000	60	25	10.200
ZP-10007025	1000	70	25	11.900
ZP-8004025	800	40	25	5.440

PRODUCT CODE	ANODE DIMENSIONS		APPROX. WEIGHT
	LENGTH mm L	DIAMETER mm E	KG
ZR30- 300	30	300	1.52
ZR35- 300	35	300	1.96
ZR40- 300	40	300	2.70
ZR45- 300	45	300	3.30
ZR50- 300	50	300	4.25
ZR60- 300	60	300	6.12
ZR65- 300	65	300	7.30
ZR70- 300	70	300	8.30
ZR75- 300	75	300	9.70
ZR80- 300	80	300	10.9
ZR90- 300	90	300	13.8
ZR100-300	100	300	17.0
ZR110- 300	110	300	20.5
ZR120- 300	120	300	24.5
ZR150- 300	150	300	38.2
ZR160- 300	160	300	43.5
ZR170- 300	170	300	49.0
ZR185- 300	185	300	57.5
ZR200- 300	200	300	68.0

Sacrificial Z.B.A. Anodes

ZYMARIS VASSILIOS



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ISO 9001 BUREAU VERITAS Certification