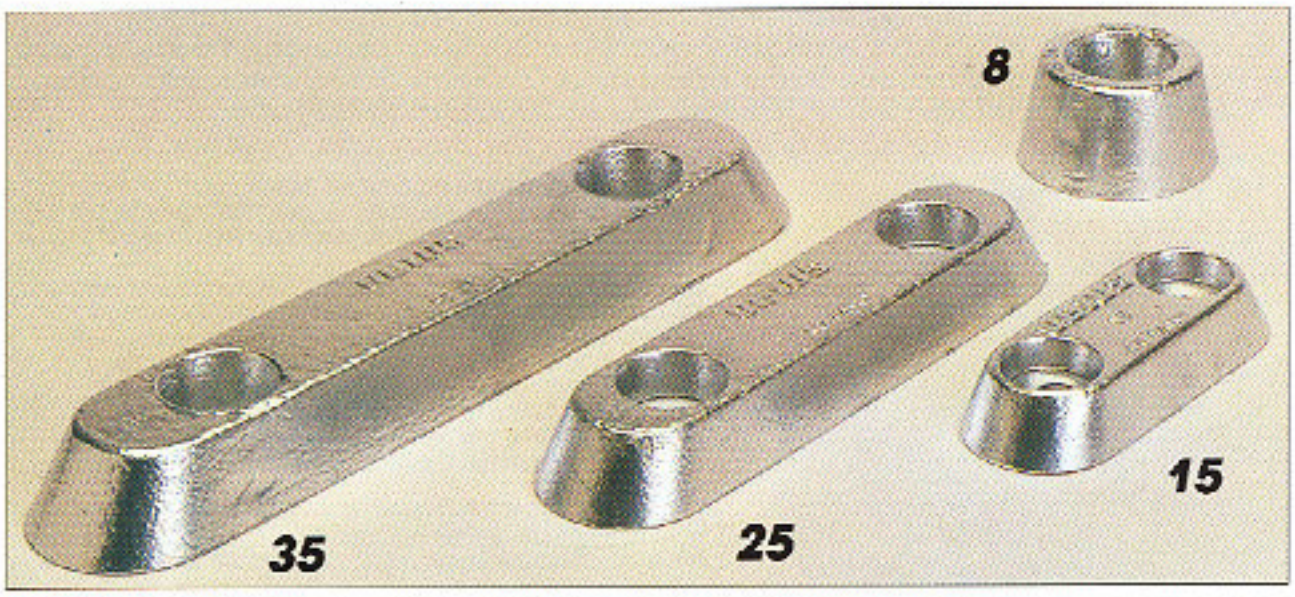
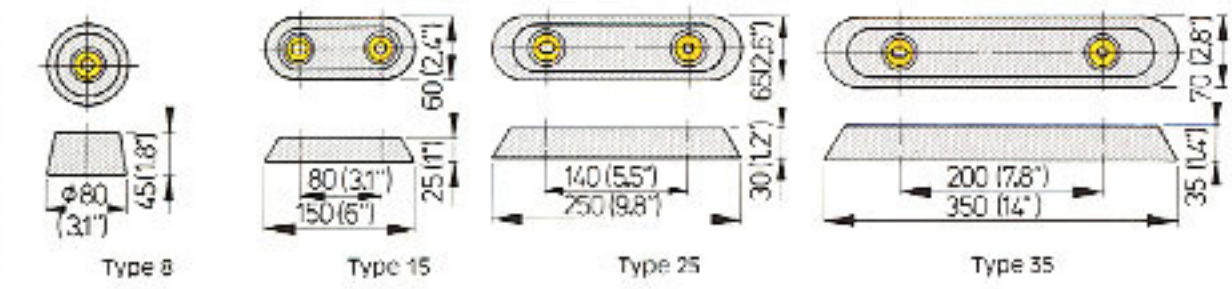
vetus® ALUMINIUM AND ZINC ANODES



WHEN TO APPLY ZINC ANODES AND WHEN THE ALUMINIUM MODELS?

For vessels, which mostly cruise on **inland (fresh)** waters, we recommend **aluminium** anodes, since aluminium has a greater difference of potential with other metals than zinc. This is very important, as fresh water provides a higher electrical resistance than salt water. For sailing on **salt waters** we recommend the use of **zinc** anodes. Although aluminium anodes would perform a perfect job at sea as well, they would be sacrificed much more quickly. We are absolutely against the use of **magnesium** anodes, as the difference of potential with other metals is too great, which could cause damage to the hull's paint coats, especially when sailing in brackish or salt waters.



Type 8 — Especially designed for transom mounting.

Type 15

Type 25

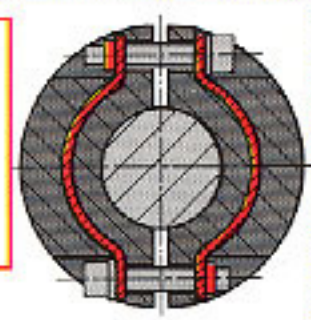
Type 35

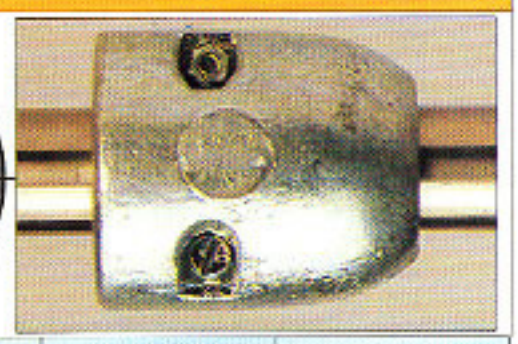
Weights of the aluminium and zinc anodes				
	Type 8	Type 15	Type 25	Type 35
zinc anode	1.0 kg (2.2 lbs)	1.0 kg (2.2 lbs)	2.3 kg (5.1 lbs)	4.5 kg (9.9 lbs)
Aluminium anode	0.45 kg (1 lb)	0.45 kg (1 lb)	1.1 kg (2.43 lbs)	2.0 kg (4.41 lbs)

Directives for the protection of **steel** hulls: **Exposed surface protected per anode, both aluminium and zinc.**			
Type	**Adequate paint system**	**Worn out paint**	**Unpainted bare**
8	12 m² 129 sq.ft.	6 m² 64 sq.ft.	3 m² 32 sq.ft.
15	14 m² 150 sq.ft.	7 m² 75 sq.ft.	3.5 m² 38 sq.ft.
25	24 m² 258 sq.ft.	12 m² 129 sq.ft.	6 m² 64 sq.ft.
35	40 m² 430 sq.ft.	20 m² 215 sq.ft.	10 m² 107 sq.ft.

Shaft anodes, for installation directly to the propeller shaft

These VETUS shaft anodes are provided with cast-in metal clamps, which ensure longer life of the anode, prevent early loss of material and give a firm grip onto the shaft.





Type	Shaft diameter	Anode diameter	Length	Weight
D 25	25 mm	55 mm 2.2"	65 mm 2.6"	0.77 kg 1.71 lbs
D 30	30 mm	55 mm 2.2"	65 mm 2.6"	0.68 kg 1.51 lbs
D 32	32 mm	70 mm 2.8"	80 mm 3.2"	1.3 kg 2.87 lbs
D 35	35 mm	70 mm 2.8"	80 mm 3.2"	1.2 kg 2.71 lbs
D 38	38 mm	70 mm 2.8"	80 mm 3.2"	1.1 kg 2.43 lbs
D 40	40 mm	70 mm 2.8"	80 mm 3.2"	1.1 kg 2.36 lbs
D 45	45 mm	85 mm 3.4"	100 mm 3.9"	2.6 kg 5.84 lbs
D 50	50 mm	85 mm 3.4"	100 mm 3.9"	2.4 kg 5.22 lbs
D 60	60 mm	85 mm 3.4"	100 mm 3.9"	1.8 kg 4.08 lbs

For fast-going vessels, we advise against the use of shaft anodes. They offer considerable resistance and, when partly sacrificed, will cause an undesirable unbalance of the propeller shaft.
In this case, please use the VETUS fairwater cap with integrated zinc anode.

Cathodic protection by means of anodes is a "must" for the protection of all metal parts under water. So, not only for steel, but also for wooden, fibreglass and concrete hulls, anodes are required. VETUS anodes are made to the highest possible standard, the U.S. mll.-A-18001 J. specifications.
VETUS aluminium anodes consist of an aluminium-indium-zinc alloy. Anodes which do not meet these specifications have hardly any effect or no effect at all.
All VETUS anodes are streamlined and mounted either with specially made studs, which can be welded to a steel hull, or special through-hull bolts for fibreglass, wooden and concrete boats. **We supply these studs and bolts separately.**
When ordering, please always specify the material of the hull. All metal parts must have a direct contact with the anode. Therefore the bolts supplied for e.g. fibreglass hulls already have a wire-connection, so that contact can be made with the metal parts. (See drawing B).
On fibreglass, concrete and wooden boats only the **metal** parts must be protected.
For anode type 8 you need **one** (1) connection kit and for types 15, 25 and 35 you need **two** (2) of these.
All VETUS anodes have a protective layer of paint at the mounting side to prevent damage to the paint work of your boat.

HOW TO INSTALL

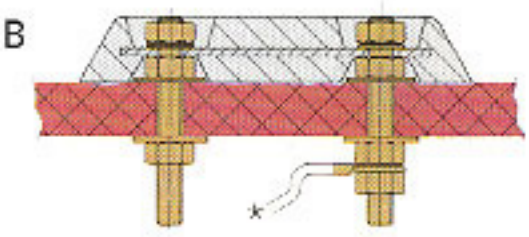
Weld-on studs for steel hulls.

A

Anodes that are installed by means of studs are much easier to replace than anodes that are welded directly to the ship's hull.

For fibreglass, wooden and concrete hulls.

B



* Copper wire to connect parts to be protected.

TECHNICAL INFORMATION

Sacrificial Anode Materials

There are three materials currently used for the sacrificial cathodic protection of ship's external and internal surfaces. These are zinc, aluminium and magnesium which are alloyed accordingly with other elements to ensure proper protection performances. Zinc and aluminium alloy materials are used for protection in sea-water, whereas magnesium alloy materials are used in fresh water conditions and other specialised applications such as electrolytic descaling of cargo tanks.

Ship External Hull

Zalco's Zinc and Aluminium anodes are used for the cathodic protection of ship's hull. Attention should be given to typical corrosion prone areas around the stern and in particular the inside of kort nozzles, bow thrusters and sea-water inlet boxes. Both type of anodes have a normal design life of one, two, three or four years to suit the owner's requirements.

Hull anodes can be welded directly or bolted. The environmental conditions will influence the design of the cathodic protection systems, electrochemically and mechanically. Conditions to be considered are temperature, salinity and flow rate.

The cathodic protection system requirement is based on the electrical current density required to bring the steel surface to a protected potential. The applied current density usually varies from 10mA/sq mtr to 20mA/sq mtr dependent on the paint system used. In certain instances, this can be increased to meet arduous operating conditions.

Anode Requirement Calculation:
The total current requirement is obtained by the formula:

$$\text{Current (A)} = \frac{\text{Area (sq mtr)} \times \text{current density (mA/sq mtr)}}{1000}$$

The total weight of anode material required is:

$$\text{Weight (kg)} = \frac{\text{Current (A)} \times \text{Design Life (Yrs)} \times 8760}{\text{Capacity of material (Ahrs/kg)}}$$

The number of anodes must satisfy both the total current and total weight requirements.

Ship Internal Tank

Classification Society ruling has it that up to ten percent reduction in scantlings, bulkhead platings, stiffeners and certain internal girders/webs can be permitted, provided an approved corrosion control system was adopted. A further ruling allowed a five percent reduction in thickness of the main longitudinal strength members.

The Classification Society ruling also did not permit impressed current systems in oil cargo tanks.

Magnesium anodes are not allowed in oil cargo tanks or tanks adjacent to oil cargo tanks.

Aluminium anodes are permitted in cargo tanks where the potential energy does not exceed 28kg m (200ft lb). The height of the anode is to be measured from the bottom of the tank to the centre of the anode and its weight is to be taken as the weight of the anode plus its fittings. Where aluminium anodes are located on the horizontal surfaces such as bulkhead girders and stringers not less than one metre wide and fitted with an upstanding flange or flat face projecting not less than 75mm above the horizontal surface, the height of the anode may be measured from this surface. Aluminium anodes containing magnesium are not to be used in cargo tanks. Zalco's aluminium tank anodes meet this requirement.

There is no restriction on the positioning of zinc anodes but it is recommended practice to ensure the potential energy does not exceed 540kg m.

The cathodic protection system should be not for less than four years. The top 1.5 metres of the tank must be coated in order to give optimum protection.

Current Densities

Fore and Aft Peak Tanks	130mA/sq mtr
Cargo/Ballast Tanks (Product Tankers)	110mA/sq mtr
Cargo/Ballast Tanks (Crude oil Tankers)	90mA/sq mtr
Ballast Only Tanks	110mA/sq mtr
Upper Wing Tanks	130mA/sq mtr
Lower Wing Tanks	90mA/sq mtr
Double Bottom Tanks	90mA/sq mtr
Coated Surfaces	5mA/sq mtr

For coated surfaces requiring longer anode life, the above minimum recommended current density of 5mA/sq mtr should be increased in anticipation of the coating breakdown.

Anode Requirement Calculation:
The total current requirement is obtained by the formula:

$$\text{Current (A)} = \frac{\text{Area (sq mtr)} \times \text{current density (mA/sq mtr)}}{1000}$$

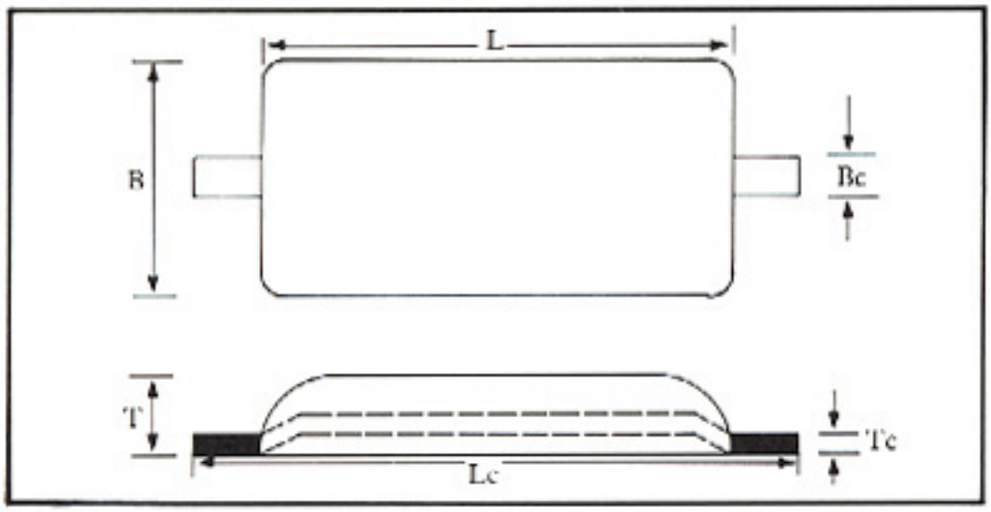
The total weight of anode material required is:

$$\text{Weight (kg)} = \frac{\text{Current (A)} \times \text{Design Life (Yrs)} \times 8760}{\text{Capacity of material (Ahrs/kg)}}$$

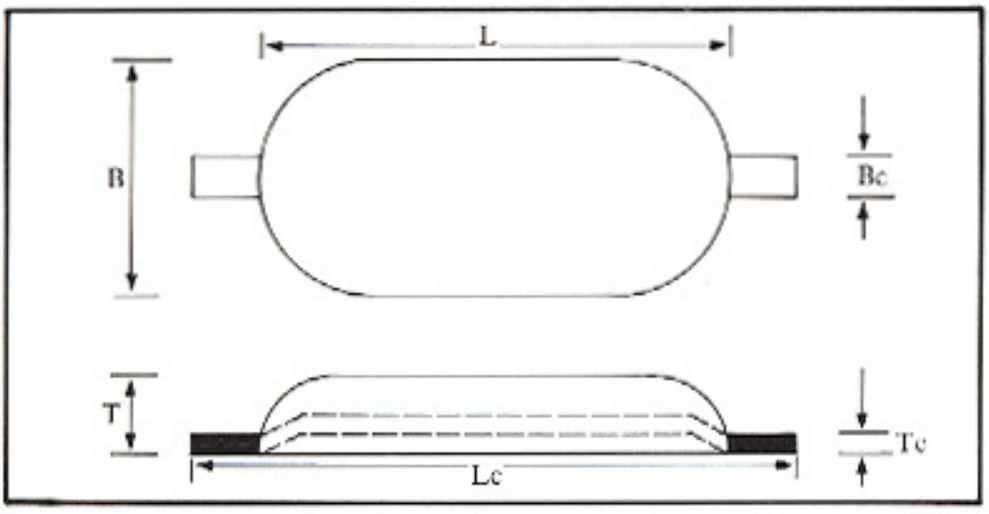
The number of anodes must satisfy both the total current and total weight requirements.

ZINC HULL ANODES

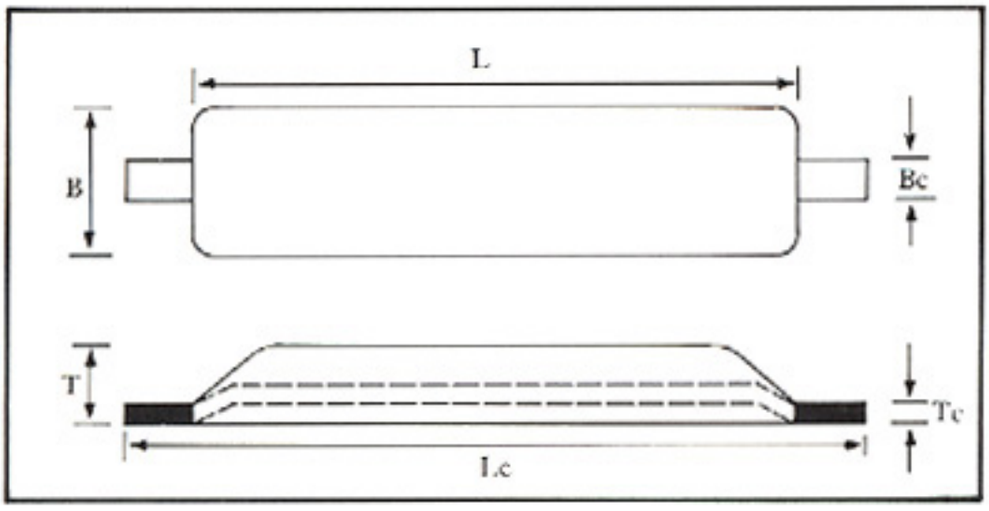
Z 4



Z 3
Z 8
Z 10



Z 5
Z 7
Z 9
Z 16
Z 20
Z 28



Anode Type	Anode Dimensions (mm)			Core Dimensions (mm)			Weight (kg)
	L	B	T	Lc	Bc	Tc	GROSS
Z 3	200	95	30	300	26	5	3.5
Z 4	200	100	30	300	26	5	4.0
Z 5	300	90	30	420	32	5	5.0
Z 7	300	90	40	420	32	5	6.5
Z 8	300	150	30	420	32	5	8.0
Z 9	356	152	32	458	50	6	9.6
Z 10	305	152	36	420	32	5	10.0
Z 16	520	120	40	625	38	6	15.5
Z 20	520	130	50	625	38	6	20.0
Z 28	800	120	40	994	38	7	26.0

ZINC HULL ANODES

'B' SERIES

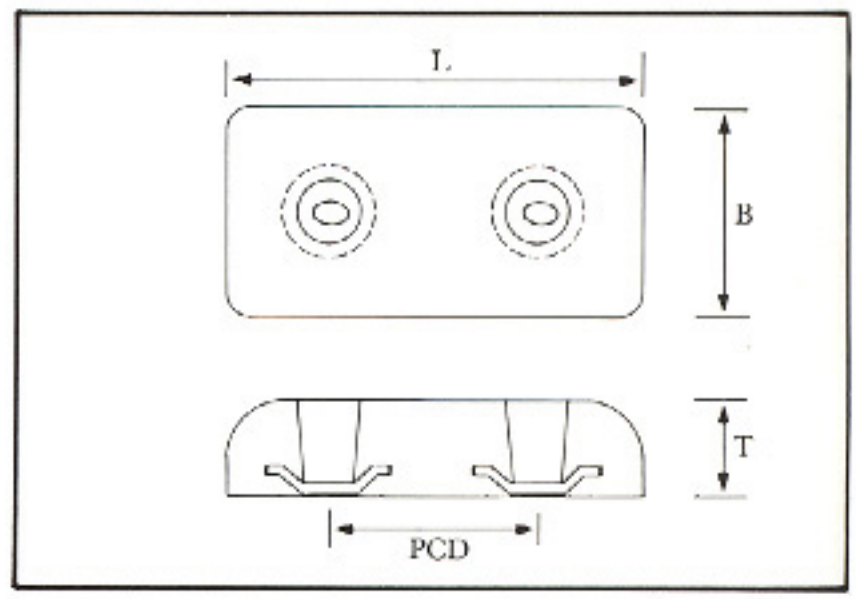
Anode Type	Anode Dimensions (mm)				Weight (kg)
	L	B	T	PCD	GROSS
B 1EE	120	40	25	60	0.7
B 1E	120	50	30	60	1.1
B 1	150	70	20	75	1.2
B 2	150	70	25	75	1.6
B 3	200	100	20	110	2.5
B 4	200	100	30	110	3.6
B 6	300	150	15	160	5.9
B 8	300	150	25	160	7.3
B 9	300	150	30	160	8.3
B 9E	300	150	40	160	12.0
B10	300	150	50	160	16.0
B10E	300	200	40	160	16.0
B11	300	150	75	160	24.0

'S' SERIES

Anode Type	Anode Dimensions (mm)			Core Dimensions (mm)			Weight (kg)
	L	B	T	Lc	Bc	Tc	Gross
S 1	150	70	20	270	30	4	1.5
S 3	200	100	20	300	38	3	3.0
S 4	200	100	30	300	38	3	4.2
S 8	300	150	25	270	30	5	8.0
S 9	300	150	30	270	30	5	9.5

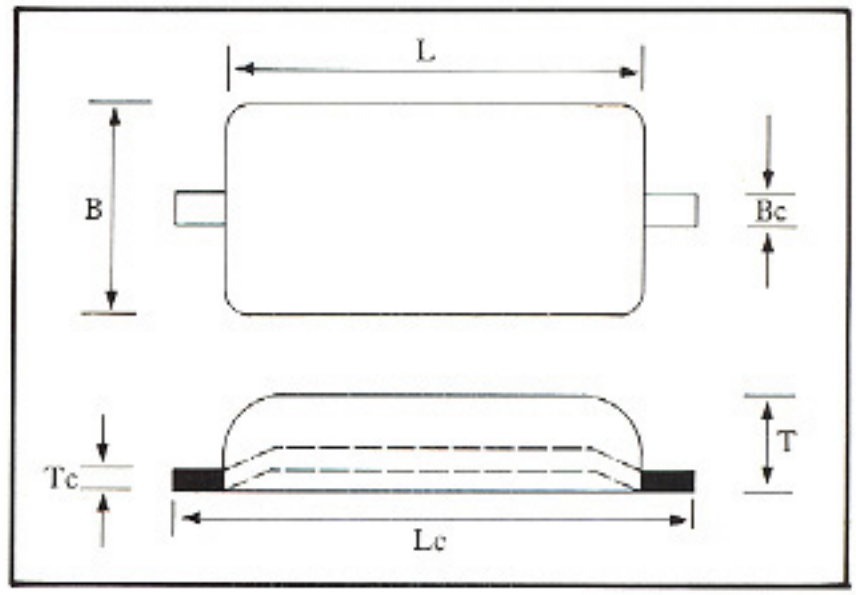
Only S & B series with rubber backing.

'B' SERIES

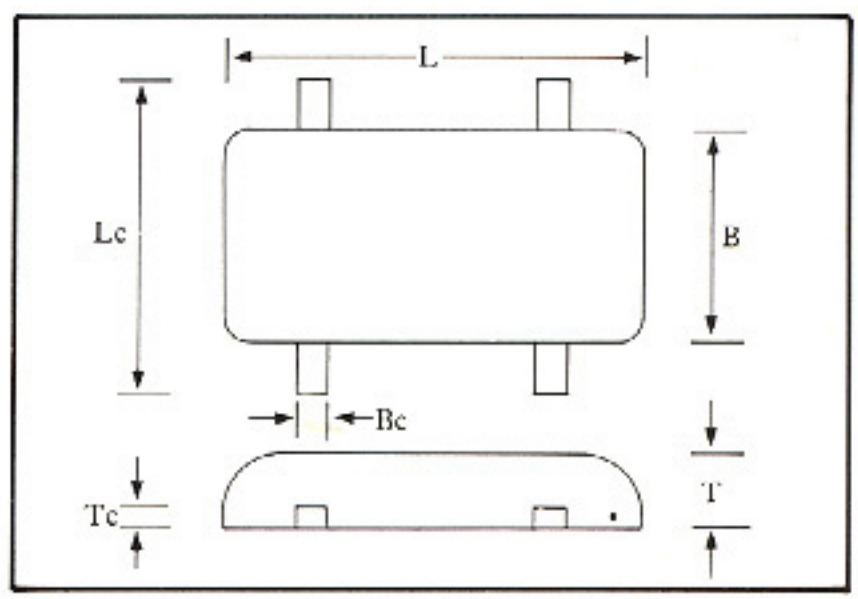


'S' SERIES

S 1
S 3
S 4

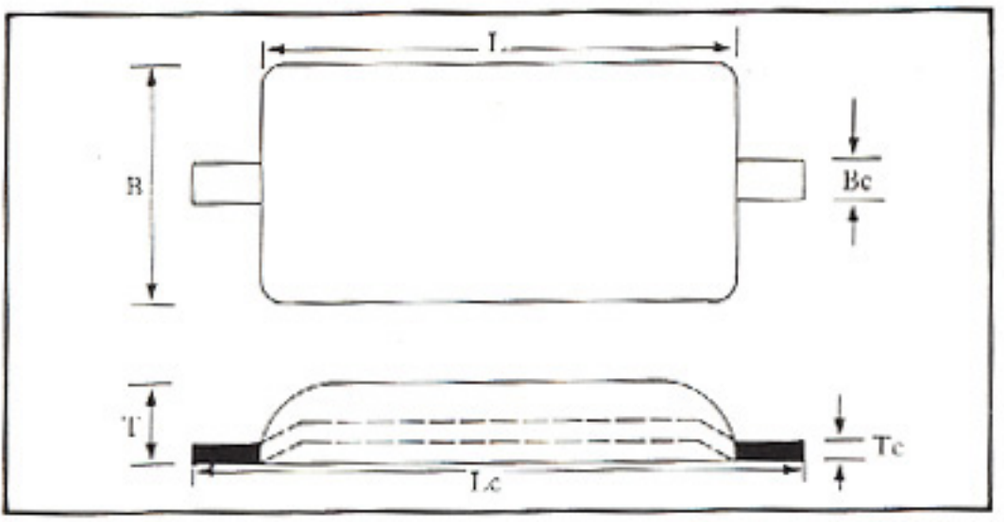


S 8
S 9

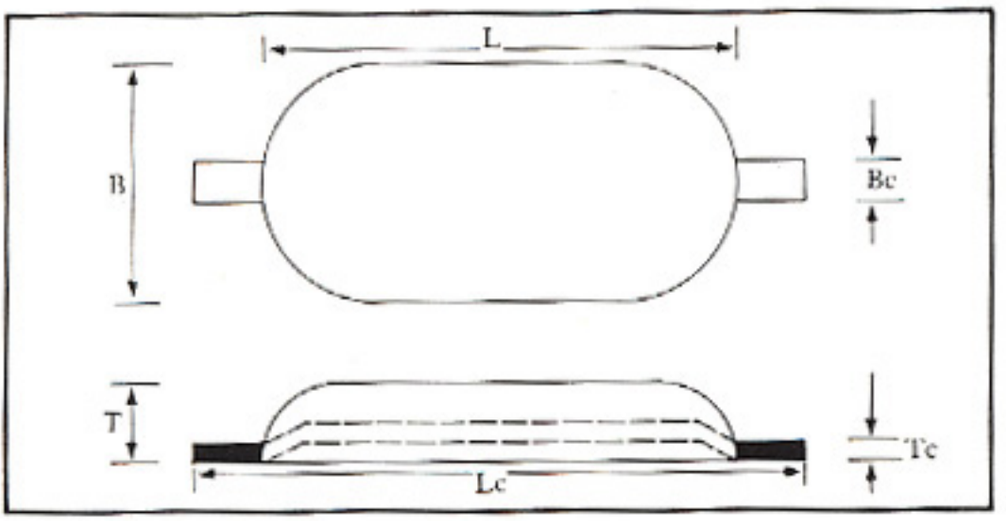


ALUMINIUM HULL ANODES

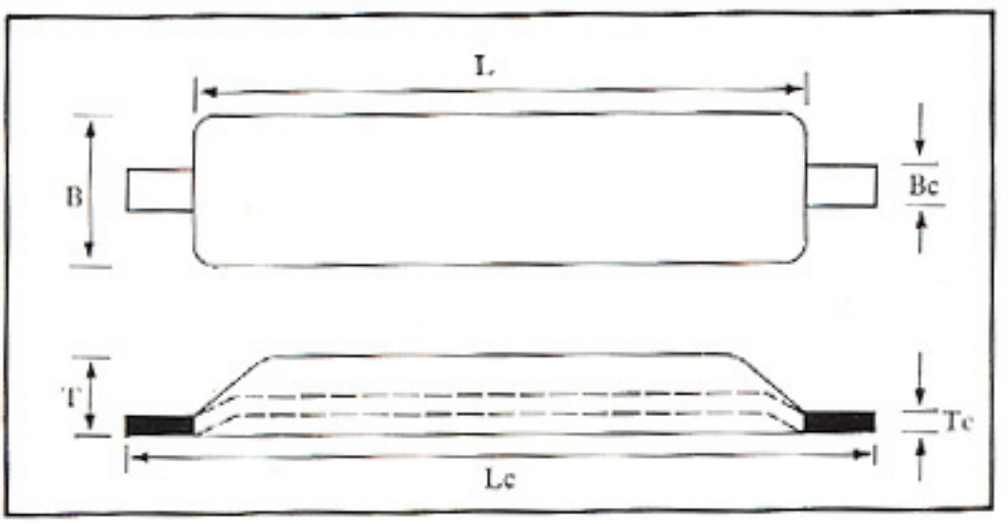
A 4



A 3
A 8
A 10



A 5
A 7
A 9
A 16
A 20
A 28



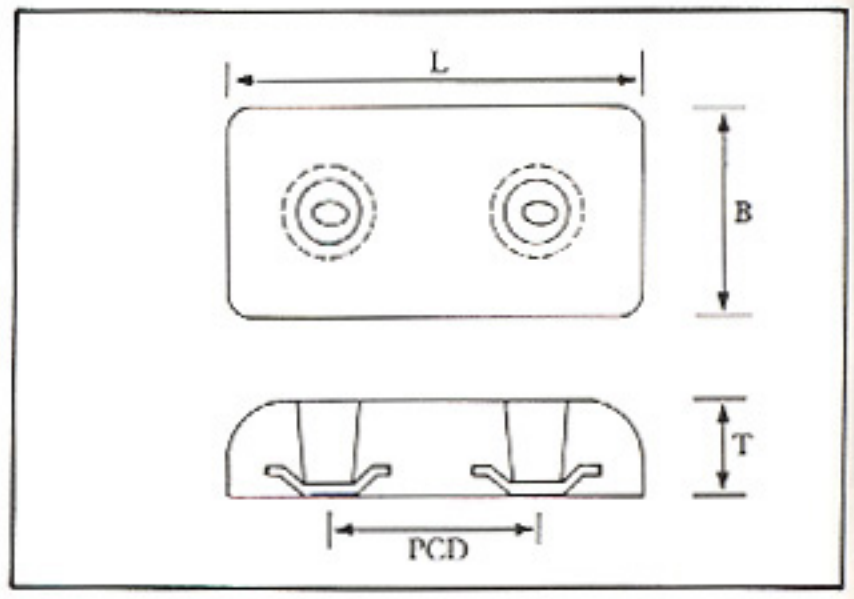
Anode Type	Anode Dimensions (mm)			Core Dimensions (mm)			Weight (kg)
	L	B	T	Lc	Bc	Tc	GROSS
A 3	200	95	30	300	26	5	1.6
A 4	200	100	30	300	26	5	1.8
A 5	300	90	30	420	32	5	2.3
A 7	300	90	40	420	32	5	2.9
A 8	300	150	30	420	32	5	3.5
A 9	356	152	32	458	50	6	4.5
A 10	305	152	36	420	32	5	4.3
A 16	520	120	40	625	38	6	6.2
A 20	520	130	50	625	38	6	8.2
A 28	800	120	40	994	38	7	10.5

ALUMINIUM HULL ANODES

'B' SERIES

Anode Type	Anode Dimensions (mm)				Weight (kg)
	L.	B	T	PCD	GROSS
AB 1EE	120	40	25	60	0.3
AB 1E	120	50	30	60	0.44
AB 1	150	70	20	75	0.5
AB 2	150	70	25	75	0.6
AB 3	200	100	20	110	1.0
AB 4	200	100	30	110	1.4
AB 6	300	150	15	160	2.4
AB 8	300	150	25	160	2.9
AB 9	300	150	30	160	3.3
AB 9E	300	150	40	160	4.8
AB10E	300	150	50	160	6.4
AB10	300	200	40	160	6.4
AB11	300	150	75	160	9.6

'B' SERIES



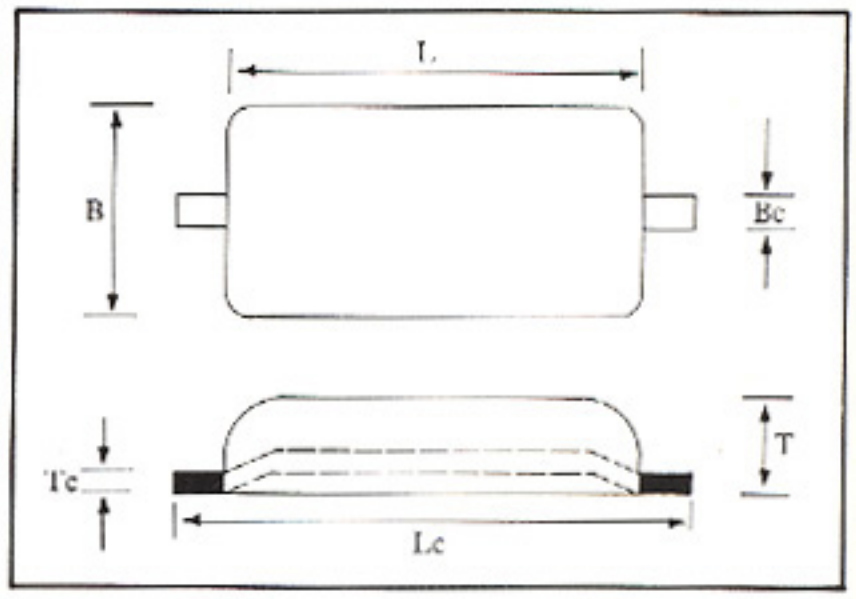
'S' SERIES

Anode Type	Anode Dimensions (mm)			Core Dimensions (mm)			Weight (kg)
	L	B	T	Lc	Bc	Tc	GROSS
AS 1	150	70	20	270	30	4	0.6
AS 3	200	100	20	300	38	3	1.2
AS 4	200	100	30	300	38	3	1.7
AS 8	300	150	25	270	30	5	3.2
AS 9	300	150	30	270	30	5	3.8

Only S & B series with rubber backing.

'S' SERIES

AS 1
AS 3
AS 4



AS 8
AS 9