Commercial Marine & Industrial
Issue 2.0

MGDUFF

...trust the name

CATHODIC PROTECTION PRODUCT GUIDE

MGDUFF

MGDUFF is the UK's oldest and most experienced cathodic protection company offering more than 400 different types of anodes for every application in all water conditions. We set the standard for ship and small craft corrosion protection over fifty years ago and our continuous development keeps pace with modern corrosion prevention requirements.

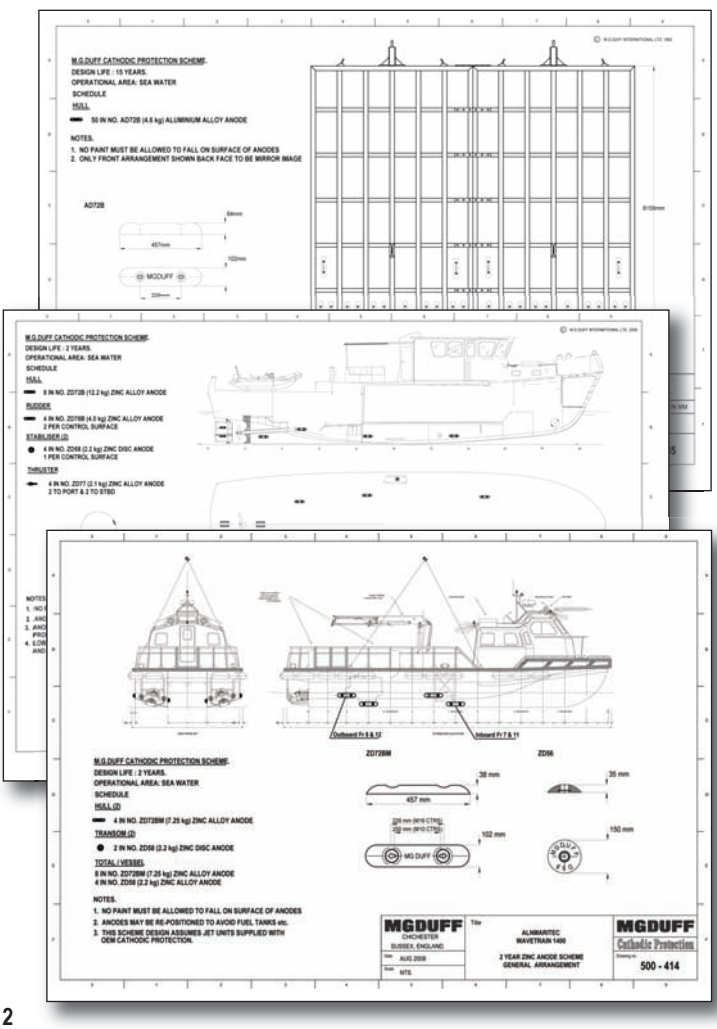
Commercial Marine

MGDUFF marine cathodic protection systems are specified and fitted by leading yacht and boat builders, commercial shipping companies and ship repair yards. Experienced and qualified personnel are able to offer our customers cathodic protection schemes with full technical back-up, producing designs for ships, tugs, ferries, and superyachts. Dry dock surveys, ballast tank inspections and production line quality audits are all undertaken.

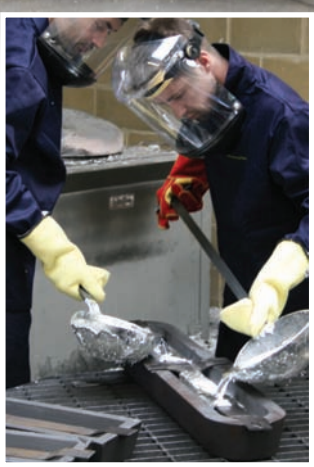
Industrial and Civil Engineering

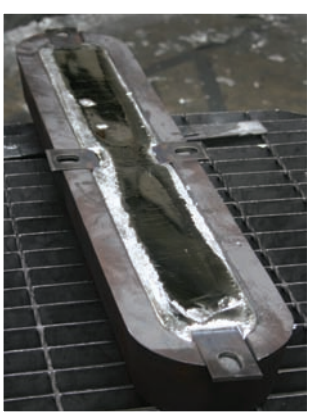
MGDUFF industrial cathodic protection systems are specified and fitted on lock gates, sheet and tubular piling, marinas, link-spans, jetties and piers. Developing technologies such as subsea renewable energy projects are protected by MGDuff anodes. We also design anode systems for a wide range of onshore applications including river generators, heat exchangers, filters and pumps.

MGDUFF sacrificial anodes in zinc, aluminium and magnesium are manufactured strictly in accordance with internationally approved specifications using the highest purity ingredients.



FOUNDRY





MGDUFF's foundry located at the head office in Chichester provides the ability to meet short lead time requirements, whilst keeping stock levels up to maximum capacity to provide next day delivery across the U.K.

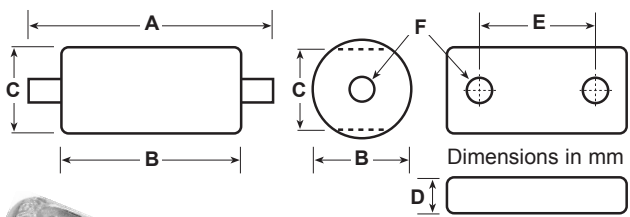
Our anodes are manufactured to strict quality standards through an ISO 9001 Quality Management System. In addition our zinc anodes meet US Mil-A-18001K specification code.

Each melt is tested using the in house spectrometer to check the correct chemical composition ensuring the necessary weight of alloying metals such as, Cadmium, lead and Indium (a rare earth metal) are used. Testing ensures only a top quality anode is produced.

ZINC ALLOY HULL ANODES

Please note that the following is a sample of our Zinc anode range, other sizes and weights are available. Please contact us for further information or visit www.mgduff.co.uk

Specification Code		US Mil Spec 18001K
Composition		
Iron	Fe	0.005 max.
Cadmium	Cd	0.025–0.07
Copper	Cu	0.005 max.
Aluminium	Al	0.10–0.50
Lead	Pb	0.006 max.
Others total		0.10 max.
Zinc	Zn	Remainder
Potential Ag/AgCl		-1.05 V
Capacity- Amp.hr/kg		780



ZD76 EURO
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	200	65	32	0-110	M10	1.3	1.4

ZD77
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	157	83	41	200	M10	1.9	2.1

ZD58
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	145	125	35	-	M10	2.1	2.2

ZD27
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	135	-	28	-	M10	2.6	2.6

ZD79
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	171	83	41	200	M10	2.8	3.0

ZD78B
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	305	76	32	200	M10	3.8	4.0

ZINC ALLOY HULL ANODES

ZD47
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	135		50	-	M10	4.3	4.4

40ZHD
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	200	100	40	110	M16	4.0	4.4

105ZHD
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	350	110	54	30	M12	5.5	6.0

ZD72BM
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	457	102	38	200-229	M10 or M16	6.0	7.25

ZD72B
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	457	102	64	229	M16	11.7	12.2

MTZ20SH
Zinc Hanging Anode
With insulated electrical cable

A	B	C	D	E	F	Net Kgs	Gross Kgs
1000	760	65	60	-	-	20	22

ZD75
Zinc Weld-on Anode

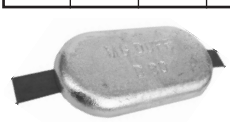
A	B	C	D	E	F	Net Kgs	Gross Kgs
152	100	45	28	-	-	0.5	0.6

ZD78
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	76	32	-	-	4.1	4.5

ZD60
Zinc Weld-on Anode

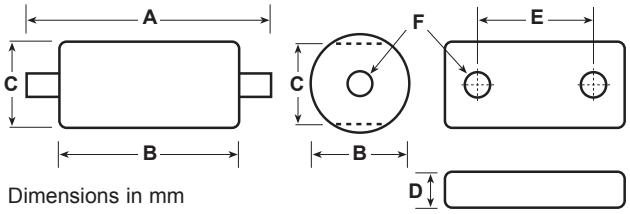
A	B	C	D	E	F	Net Kgs	Gross Kgs
380	320	125	25	-	-	5.7	6.0



ZD80
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	152	32	-	-	7.4	8.5

ZINC ALLOY HULL ANODES



Dimensions in mm

ZD73
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
459	356	152	32	-	-	9.2	10.0

ZD72
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
563	457	102	64	-	-	13.7	14.5

ZD82
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
913	813	102	38	-	-	18.7	20.0

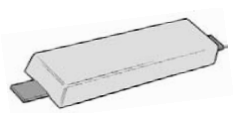
MONITOR

MHZB18
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	80	60	305	M18	18.0	19.0

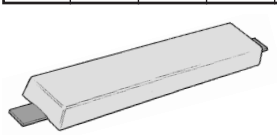
MHZ15
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
532	432	120	50	-	-	15.0	15.8



MHZ25
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
810	710	120	50	-	-	25.0	26.3

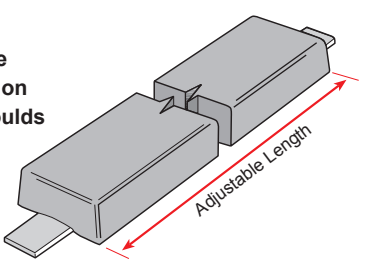


MHZ30
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
950	850	120	50	-	-	30.0	31.5

MHZ Custom Sizes

MGDuff are able to manufacture bespoke Zinc weld on and bolt on anodes from our adjustable moulds



ALUMINIUM ALLOY HULL ANODES

Please note that the following is a sample of our Aluminium anode range, other sizes and weights are available. Please contact us for further information or visit www.mgduff.co.uk

Specification Code		AL-CHEM
Composition		
Iron	Fe	0.12 max.
Silicon	Si	0.05–0.15
Copper	Cu	0.003 max.
Zinc	Zn	3.0–6.0
Indium	In	0.015–0.030 max.
Mercury	Hg	0.001 max.
Titanium	Ti	0.025 max.
Others each		0.02 max. (<0.1 total)
Aluminium	Al	Remainder
Capacity- Amp.hr/kg		Typically 2760

AD58
Aluminium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	150		35	-	M10	0.8	0.9

AD77
Aluminium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	157	83	41	200	M16	0.8	1.0

AD79
Aluminium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	171	83	41	200	M16	1.3	1.5

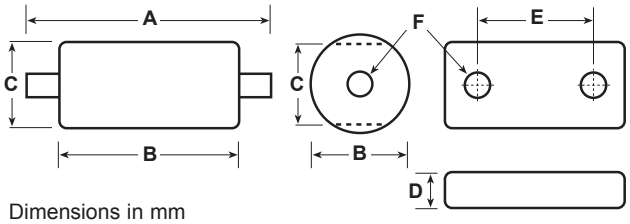
AD78B
Aluminium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	305	76	32	200	M16	1.5	1.7

AD72B
Aluminium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	457	102	64	229	M16	4.6	5.1

ALUMINIUM ALLOY HULL ANODES



Dimensions in mm

AD78
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	76	32	-	-	1.5	1.7

AD60
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
380	320	125	25	-	-	2.6	2.9

AD80
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	152	32	-	-	3.0	4.0

AD73
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
459	356	152	32	-	-	4.0	5.0

AD72
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
563	457	102	64	-	-	5.0	6.0

AD82
Aluminium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
913	813	102	38	-	-	7.5	9.0

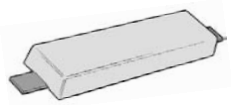
MONITOR

MHAB7
Zinc Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	600	80	60	305	M18	18.0	19.0

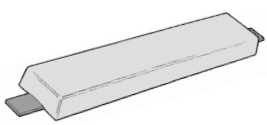
MHA7
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
625	525	120	50	-	-	7.0	8.0



MHA12
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
985	885	120	50	-	-	12.0	13.5



MHA16
Zinc Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
1275	1175	120	50	-	-	16.0	18.0

MHA Custom Sizes

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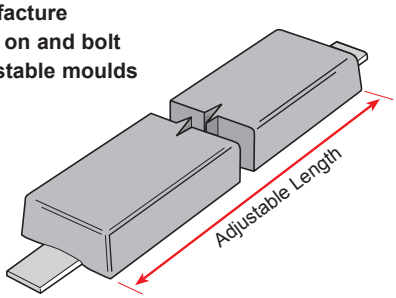
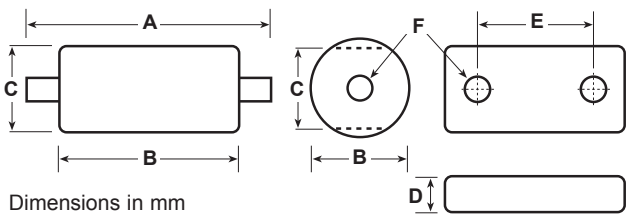


MAGNESIUM ALLOY HULL ANODES

Specification Code		Magnesium Alloy High Purity
Composition		
Copper	Cu	0.08
Aluminium	Al	5.3–6.7
Silicon	Si	0.03 max.
Iron	Fe	0.005 max.
Manganese	Mn	0.25 min.
Nickel	Ni	0.003 max.
Zinc	Zn	2.5–3.5
Lead	Pb	0.03
Magnesium	Mg	Remainder
Potential Ag/AgCl		-1.5 V
Capacity- Amp.hr/kg		1230



Dimensions in mm

MD77
Magnesium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	157	83	41	200	M16	0.5	0.7

MD78B
Magnesium Bolt-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	305	76	32	200	M16	1.0	1.3

MD20
Magnesium Hanging Anode
With insulated electrical cable

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	670	130	130	-	-	20	21

MAGNESIUM ALLOY HULL ANODES

MD79
Magnesium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
229	171	83	41	200	M16	0.8	1.0

MD78
Magnesium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	76	32	-	-	1.1	1.5

MD80
Magnesium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
356	305	152	342	-	-	1.9	3.0

MD73
Magnesium Weld-on Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
459	356	152	32	-	-	2.6	3.5

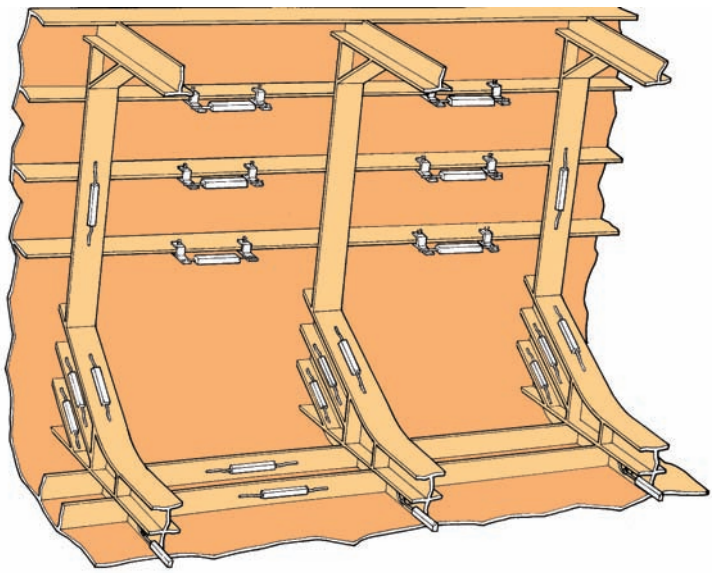
MD72
Magnesium Weld-on Anode

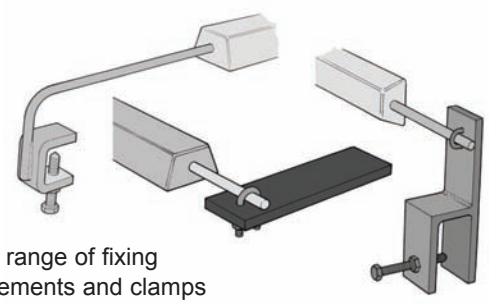
A	B	C	D	E	F	Net Kgs	Gross Kgs
563	457	102	64	-	-	3.5	4.5

907MT
Hemispherical Magnesium
Hanging Anode

A	B	C	D	E	F	Net Kgs	Gross Kgs
-	610	-	305	-	-	89	90

BALLAST TANK ANODES





A wide range of fixing arrangements and clamps are available from stock

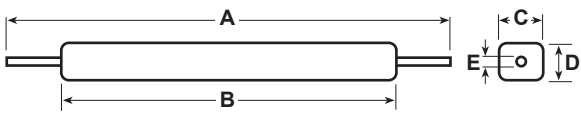
Straight Core arrangement

Double Cranked Core arrangement

- ✓ MGDuff Zinc and Aluminium Ballast Tank Anodes are manufactured to the highest standards with full batch traceability
- ✓ MGDuff will design sacrificial anode cathodic protection systems for all ballast tank applications
- ✓ MGDuff will carry out tank corrosion inspections and advise on cathodic protection requirements
- ✓ MGDuff carry extensive stocks of zinc and aluminium ballast tank anodes available for immediate despatch

MONITOR ZINC ALLOY BALLAST TANK ANODES

Specification Code		US Mil Spec 18001K
Composition		
Iron	Fe	0.005 max.
Cadmium	Cd	0.025–0.07
Copper	Cu	0.005 max.
Aluminium	Al	0.10–0.50
Lead	Pb	0.006 max.
Others total		0.10 max.
Zinc	Zn	Remainder
Potential Ag/AgCl		-1.05 V
Capacity- Amp.hr/kg		780



MTZ10
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
742	362	63	63	12	10.0	11.0

MTZ20
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1050	760	65	60	12	19.0	20.0

MTZ22
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1600	1220	60	62	12	21.2	22.7

MTZ27
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1600	1220	55	60	12	26.5	28.0

MTZ30
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1600	1220	60	62	12	30.4	31.9

MTZ42
Zinc Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
2000	1600	65	60	12	42.0	44.0

MHA Custom Sizes

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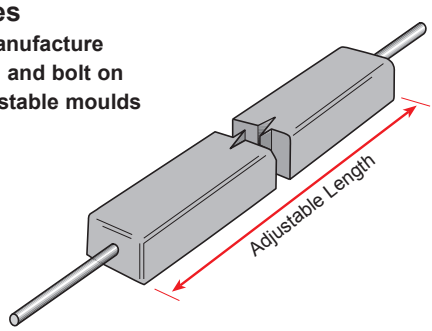

MONITOR ALUMINIUM ALLOY BALLAST TANK ANODES

Please note that the following is a sample of our Aluminium anode range, other sizes and weights are available. Please contact us for further information or visit www.mgduff.co.uk

Specification Code		AL-CHEM
Composition		
Iron	Fe	0.12 max.
Silicon	Si	0.05–0.15
Copper	Cu	0.003 max.
Zinc	Zn	3.0–6.0
Indium	In	0.015–0.030 max.
Mercury	Hg	0.001 max.
Titanium	Ti	0.025 max.
Others each		0.02 max. (<0.1 total)
Aluminium	Al	Remainder
Capacity- Amp.hr/kg		Typically 2760

MTA4
Aluminium Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
742	362	63	63	12	4.0	5.0

MTA8
Aluminium Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1050	760	65	60	12	8.0	9.0

MTA12
Aluminium Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1600	1220	60	60	12	11.6	13.2

MTA17
Aluminium Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
2000	1500	65	60	12	17.0	18.8

MTA20
Aluminium Weld/clamp-on Anode

A	B	C	D	E	Net Kgs	Gross Kgs
1700	1220	76	76	12	18.8	20.3

MHA Custom Sizes

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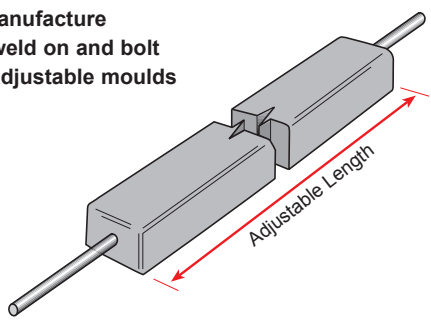
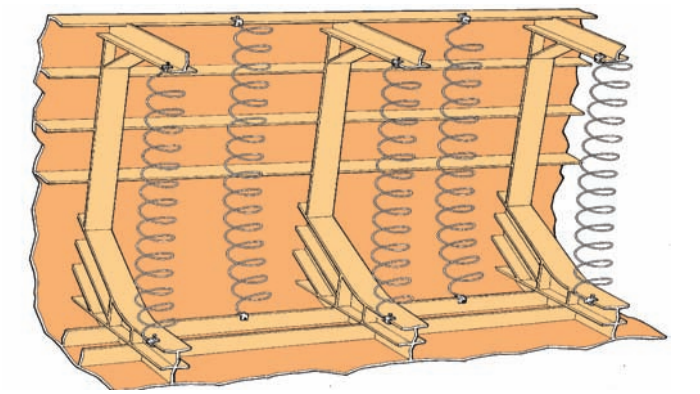


BALLAST TANK DESCALING



Magnesium Ribbon for Rapid Descaling

De-scaling ballast tanks with magnesium ribbon offers ship owners and managers a cost effective solution to what can otherwise be a very labour intensive process.

This type of system can be installed very simply by two or three people and does not require staging or shot blasting equipment. The ribbon is light and flexible and is fixed with screw down clamps.

The Process utilises magnesium ribbon, a continuous length of extruded high purity magnesium of rectangular section with a steel wire insert. As a rule of thumb about one metre of magnesium ribbon will be required for every three square metres of surface area within the tank.

The nature of the material combined with the long narrow profile makes it an extremely efficient sacrificial anode when fitted in the appropriate quantities and under full ballast condition. Within a matter of days the potential difference between the tank steelwork and the magnesium will literally lift most of the loose matter and corrosion products such as heavy and light scale, millscale and any loose paint or soft coatings not adhered to the steel work.

MGDuff have been involved in this type of application for over thirty years and offer a complete design and material package. Systems are tailored to suit the individual vessel and combine detailed installation plans with the complete scope of supply including the magnesium ribbon cut to length and ready to fit.

Magnesium Ribbon

- Potential against Ag/AgCl Reference Cell - 1.7 Volt
- Seawater Capacity - 1230 Amp/Hrs/Kg
- Cross Section - 20mm x 10mm
- Mild Steel Core - 3mm dia Flexible Core

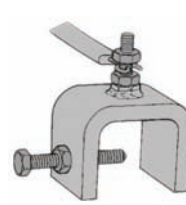
End Clamps

Ends of Magnesium Strips ‘cropped’ to reveal 50mm mild steel core for connection to the end clamp.

Magnesium ribbon clamps are made of mild steel and weigh approximately 0.75 kg each,

The clamp has a 50mm jaw and will fit most longitudinal bulb angles and stiffeners.

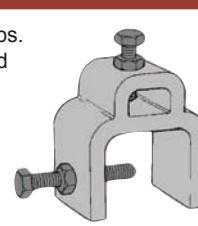
The ribbon wire insert is held in place with a locknut and stud arrangement on the top of the clamp. The stud has a 4mm hole to accommodate the ribbon insert. The clamp is held in place with a sharpened tip bolt with locknut arrangement.



Support Clamps

These are similar in construction to the end clamps. The ribbon is fed through the top slot and secured with locking nuts.

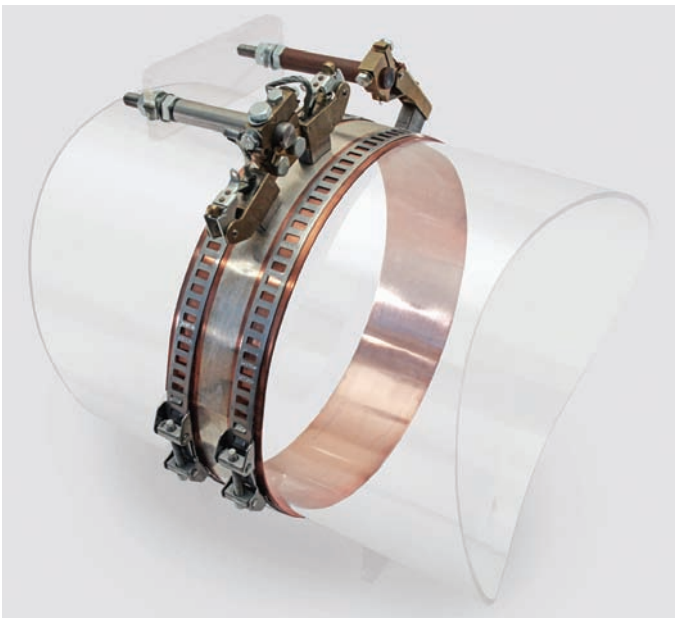
The ribbon is fed through the top slot and held in place with a sharpened tip bolt and locknut arrangement.

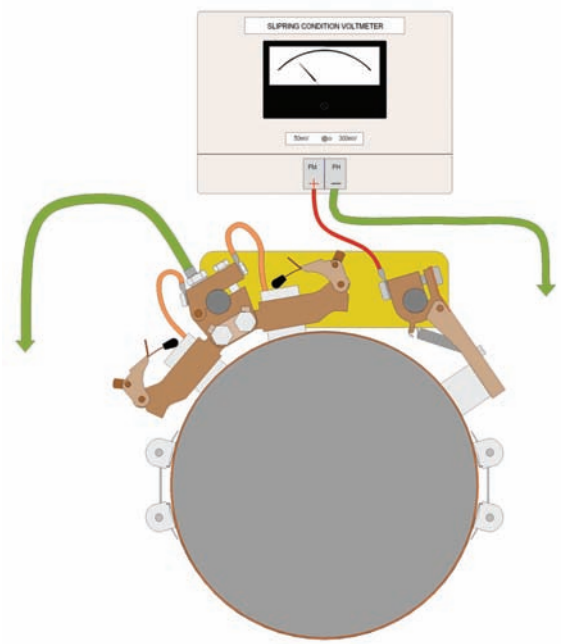


BONDING SYSTEMS

MG Duff Shaft Earthing Systems meet the requirements of BS Code of Practice CP.1021 as well as major engine manufacturer's recommendations. The shaft earthing systems provides a direct connection from a steel ship's hull to the propeller, extending the ships cathodic protection to this large unprotected area. It can also be used on GRP vessels to provide continuity from the hull mounted anodes to the prop and shaft. The highly efficient silver tracked slip rings and silver graphite brushes also reduce the effect of arcing by reducing the potential across the shaft/hull to less than 50 mV. Spark erosion can lead to pitting and striping of white metal bearing surfaces. Slip rings are available for shafts of 100mm diameter and upwards.

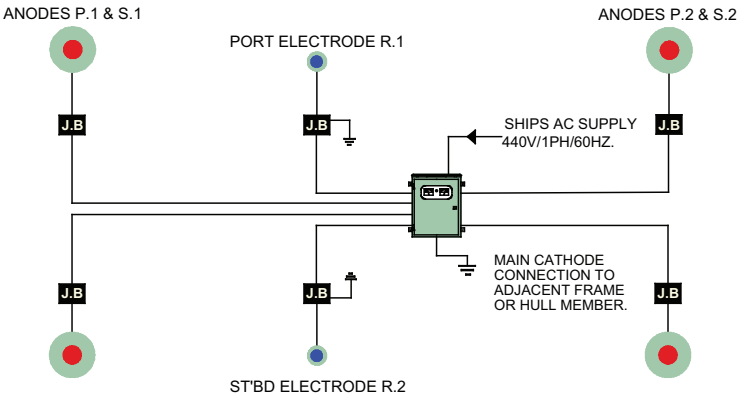
The effectiveness of the shaft bonding may be monitored by an optional Shaft Condition Monitor. The condition monitoring system provides a permanent and readily available indication on the condition and therefore, effectiveness of the shaft bonding system. Measurement of the shaft is achieved by using the installation of a single Monitoring Brush which runs on the main bonding slip ring, but has its own brush gear mounted on a separate INSULATED spindle.





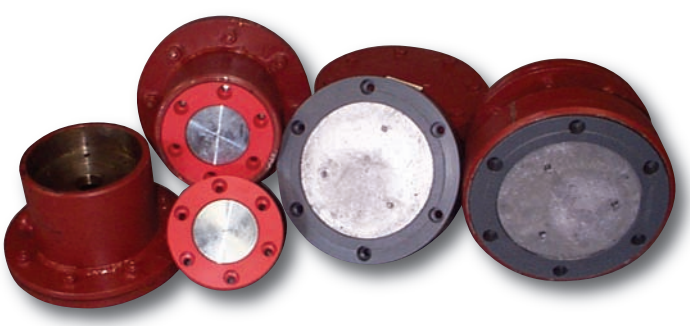
Shaft Earthing System with optional monitor box

IMPRESSED CURRENT CATHODIC PROTECTION SYSTEMS



The MG Duff system converts the ship's a.c. supply into a controlled low voltage d.c. output, which is then delivered onto the metal surface by long life anodes attached to, but insulated from the hull structure. Various factors affect the amount of current required, therefore to ensure the correct level of protection is accurately controlled it is necessary to measure the potential of the steel against a known and reliable reference cell.

This potential is monitored by reference electrodes mounted on the underwater hull surface. The number of electrodes and their locations is carefully selected in conjunction with the anode configuration and hull geometry. Solid state circuitry within an automatic control unit compares the reference potential against a desired an pre-set optimum. Any difference between these will induce a resultant error signal, which is electronically conditioned to provide suitable regulation of the d.c. power supply to the anodes.



Underwater Components

The whole range of MG Duff anodes and electrodes is manufactured to high performance and low maintenance specifications. Innovative design combines proved cathodic protection materials with advanced plastics technology. High strength uPVC encapsulations resist chemical attack and take advantage of superior insulation characteristics to replace out-moded GRP based systems.

Watertight integrity at anode and electrode penetrations is maintained by heavy grade steel housings and cofferdams. Lighter grade assemblies are available for light hull vessels.

ZINGA

Zinga is a film galvanising system comprising precisely milled zinc particles suspended in a unique aromatic liquid base. Zinga will bond to any prepared steel substrate to form a finished surface layer of 96% zinc. Zinga offers all the advantages of hot-dip galvanising and thermal zinc spray but without the application and overcoating problems. Zinga has been approved to NORSOK Standard M- 501 Revision 5 to meet the exacting demands of the Oil and Gas Industry. Zinga' Properties:

- ✓ **Is easy to use**
  – Apply by brush, roller, spray or dipping
- ✓ **Protects longer than hot-dip galvanising at the same dft** – 28 years of field evidence
- ✓ **Cost effective alternative to hot-dip galvanising**
  – And no distortions, fettling or drilling to de-gas
- ✓ **Can be applied on site**
  – regardless of structure, size and shape
- ✓ **Re-coats existing galvanising**
  – No dismantling required
- ✓ **Can be re-charged**
  – fusing with the first coat to form single layer
- ✓ **Excellent primer in Duplex systems**
  – Can more than double the lifespan
- ✓ **High resistance to mechanical abrasion**
  – Used to coat piling, rail track and chain
- ✓ **Excellent adhesion**
  – Extremely high pull-off results achieved
- ✓ **Extremely flexible**
  – Will not crack or delaminate, unlike HDG
- ✓ **Can be applied to damp surfaces**
  – Up to 90% Relative Humidity
- ✓ **Can be applied in extreme temperatures**
  – Minus 15°C to Plus 40°C
- ✓ **Weldable to X-ray quality**
  – Weld steel through 60µm of Zinga
- ✓ **Certified for use with potable water**
  – BS6920(2000)
- ✓ **Certified as non-flammable**
  – BS476 Part 6 & 7 Fire Propagation
- ✓ **Suitable for large and small areas**
  – From the largest bridges to small nuts and bolts

ZINGA

The Zinga product range is widely used in:

- ✓ Energy, Oil and Gas
- ✓ Marine and Offshore
- ✓ Construction
- ✓ Light and Heavy Engineering
- ✓ Manufacturing
- ✓ Transport, Rail and Automotive
- ✓ Water and Sewerage
- ✓ Agriculture, Food and Fisheries
- ✓ Architectural and Restoration

ZINGA®

NORSOK BBA BRITISH BOARD OF AGREMENT

www.zinga-uk.com

Full Product Specification sheets are available to down load from www.zinga-uk.com or contact us on 01243 533336

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