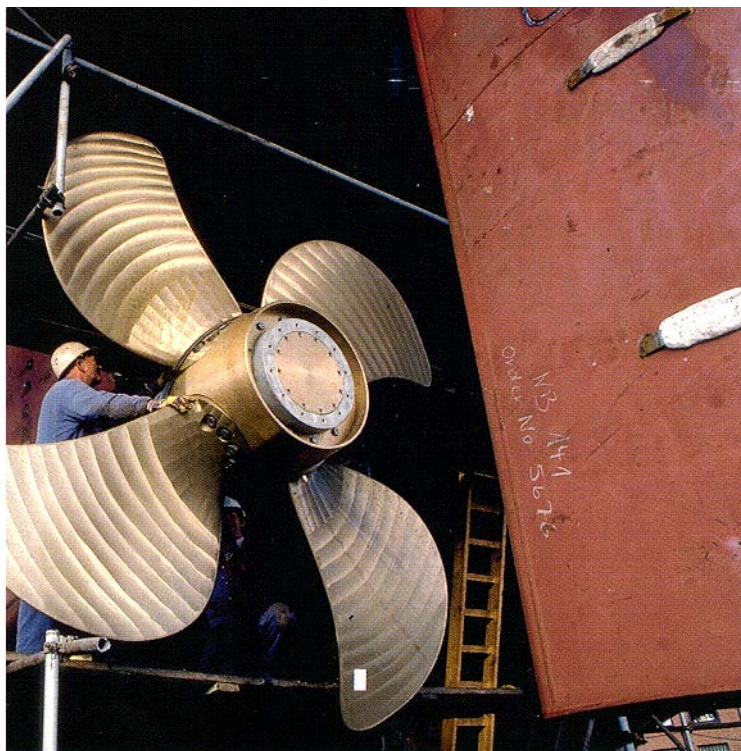


MANUAL FOR



BAC CORROSION CONTROL A/S

SHAFT GROUNDING ASSEMBLY FOR MAN ENGINE



BAC ORDER NO: 539800 *Copyright: BAC Corrosion Control A/S*

BAC CORROSION CONTROL A/S

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1 GENERAL DESCRIPTION

1.1 Control box with Amplifier for alarm 539172

This system is a precautionary measure installed, in order to reduce the electrical potential between the propeller shaft and hull to below 80 mV, and thus prevent spark erosion damage to the main bearings and journals of the main engine. (A reading between 5 and 50 mV is considered as normal).



With Amplifier for alarm

1. The system consists of the following main components:

- A.** A silver alloy slip ring is mounted on the intermediate shaft.
- B.** Brush holders with silver/graphite brushes.
- C.** Grounding wire and grounding plate.
- D.** Monitoring box with mV-meter and alarm output (optional).
- E.** Resistivity of the silver should be less than $0.1\mu \text{ Ohm} \times \text{m}$. The total resistance from the shaft to hull must not exceed 0.01Ohm
- F.** The total resistance of the cable from the brush holder to the hull, must not exceed 0.005 Ohm . Indication of less than 5mV can occur at low resistance.

The silver/graphite brushes are running on the slip ring. The two earthing brushes are connected to the hull through the grounding wire and the grounding plate welded to the hull. The monitoring brush is connected to the monitoring box.

2. Functioning and checking of the earthing/measuring device.

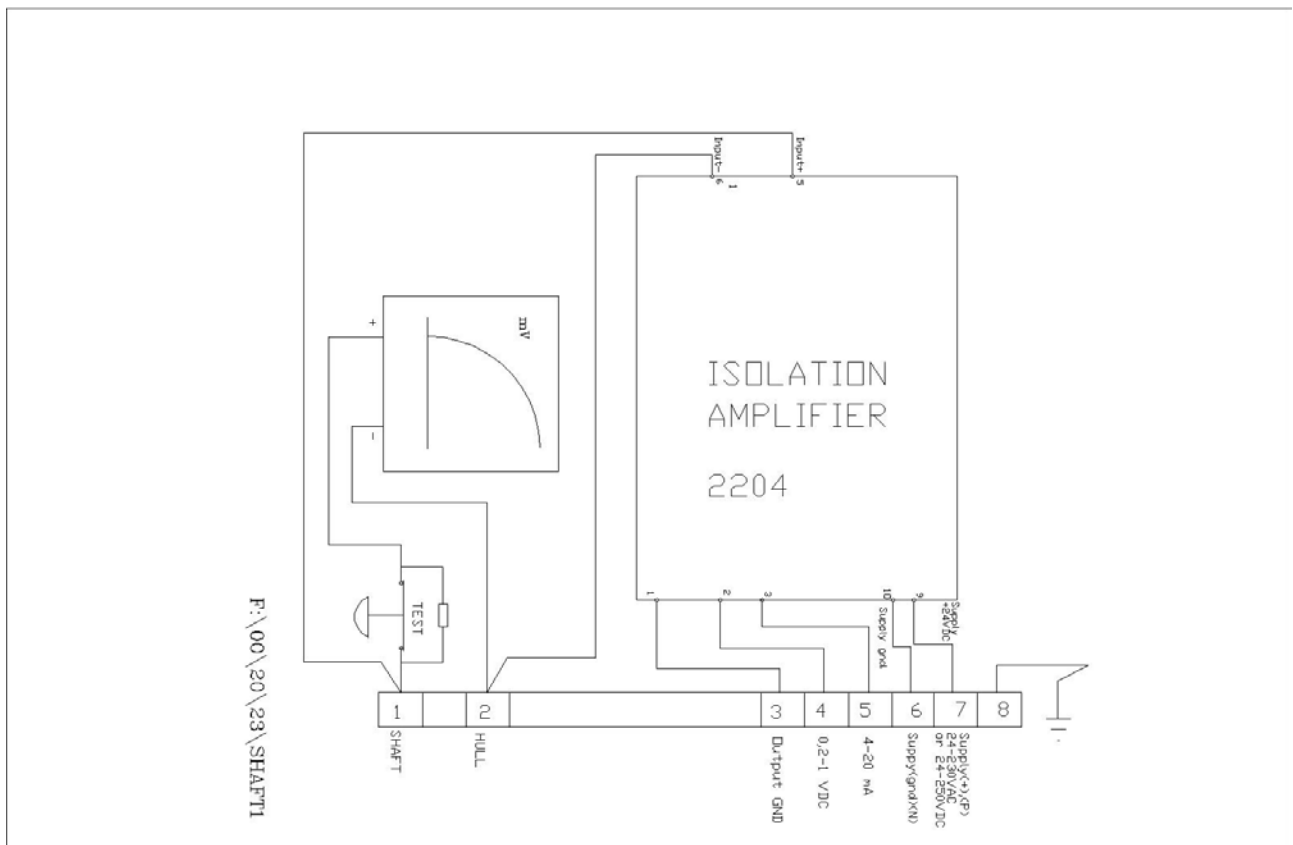
The meter normally reads 150 mV at full scale. If readings are above 150 mV , push the button on the front of the meter. The meter will now read 1500 mV at full scale.

The meter will read "0" when the shaft is at rest. When the shaft is turning at sea, a reading of between 5 and 80 mV indicates proper grounding,

although readings below 50 mV should be obtained with clean and properly contoured brushes.

With Amplifier for alarm

We will advise you to set a delay up to 5 min.
or the alarm to avoid errors during
manoeuvring of the engine.



Readings of "0" when the shaft is turning at sea, indicates a defective mV-meter or loose or broken cable connections.

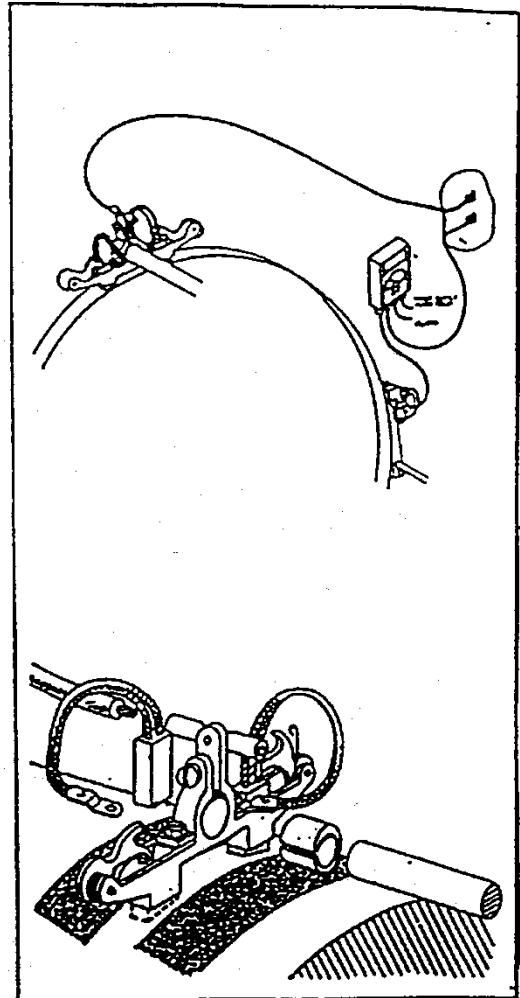
Checking the earthing device must be done when the shaft is rotating at sea and should be carried out once a month.

Release the earthing brushes from their contact with the slip ring; this should give high pulsating voltages of 100-400 mV reading on the meter. This indicates that the measuring circuit is in order. When the brushes are brought back to contact with the slip ring, the reading should fall below the 80mV limit. You can also read the result on the computer

It is important that the silver/graphite brushes are moving correctly in the brush holders with a spring load of 500-600 gr.

In some cases the copper lead on the brush will corrode, so it is recommendable to coat this lead with grease.

It is recommended that the readings of the mV-meter be recorded once a day in the engine logbook.



2 INSTALLATION INSTRUCTION

2.1

The slip ring usually located about 450 mm in front of the shaft coupling



2.2

Sand the area on the shaft between the two straps, until a bright steel surface appears.



2.3

Clean the grinded area
Use metal cleaner, spray or liquid, see datasheet. (BAC does not supply this)





2.4

Starting with the 45° end, warp the silver band around the shaft so that the excess overlaps the 45° angle. Mark the edges, scribe a line between them



2.5
Cut the silver band



2.6
Lightly smooth skive joint with fine file to eliminate any roughness



2.7
Apply preservation oil on the shaft
See datasheet. (BAC does not supply this)





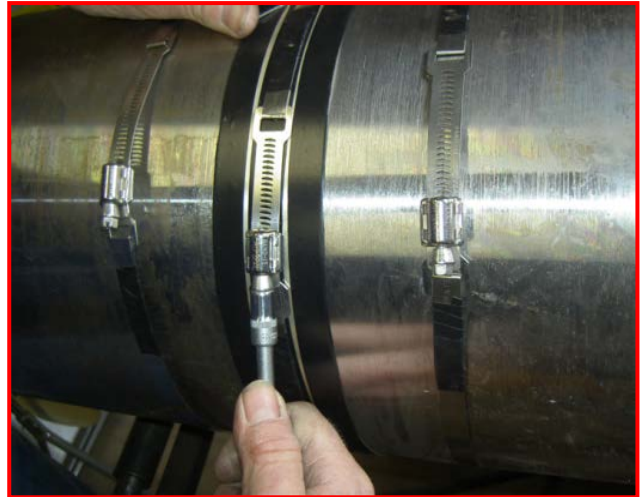
2.8

Apply el-tape in 3 strips on the silver band



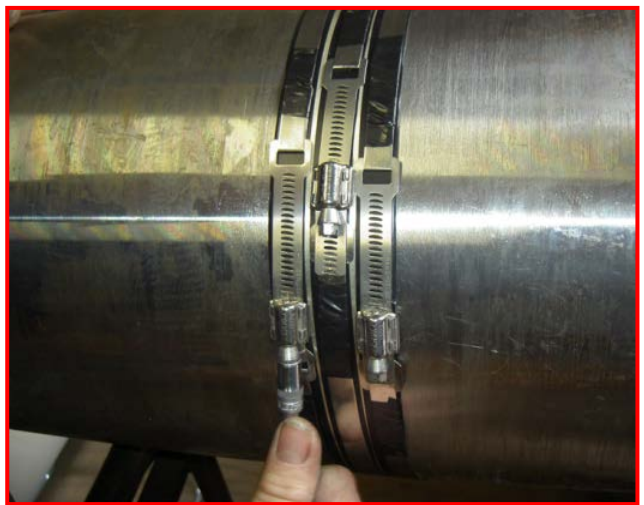
2.9

Assemble the 3 stainless steel band straps and apply the silver band with one band on the middle tape



2.10

Assemble the 2 other stainless steel band



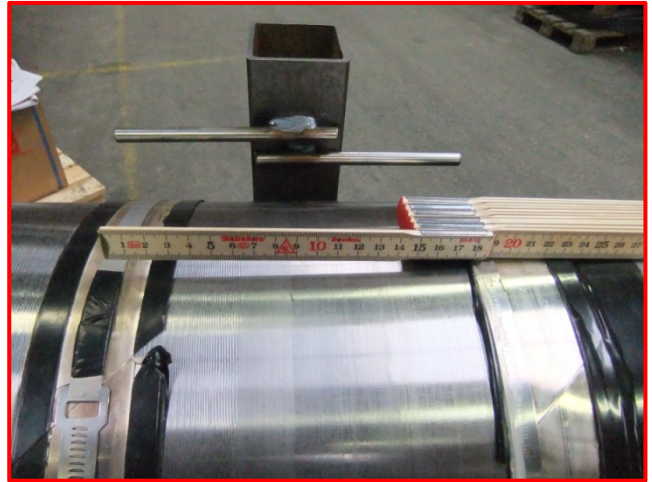
2.11

Remove the middle stainless steel band and remove el-tape



2.12

Now strap 2 can be mounted, as strap 1.
Space between the straps must be 100 – 200mm



2.13

Clean for oil and dirt before applying
Silicon and tape
(metal cleaner, see datasheet)



2.14

Apply silicone longitudinal on the edge of
the silver band in both sides



2.15

Seal the silicone with a wet finger all the way around in both sides



2.16

Wrap sensitive tape on one of the steel bands to make it absolutely tight



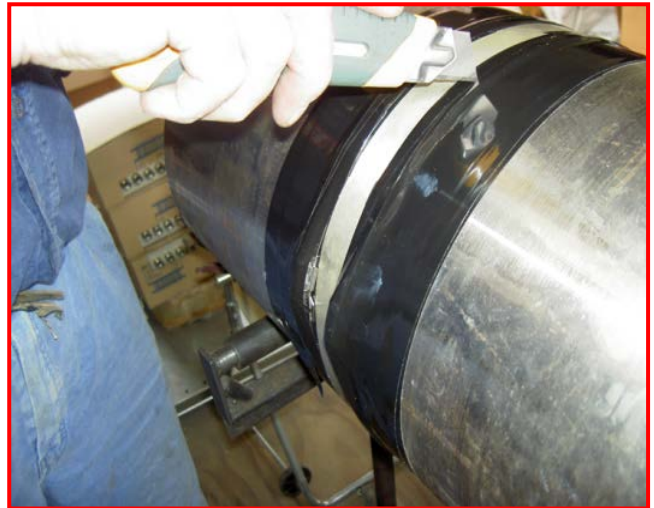
2.17

Wrap sensitive tape on other steel bands to make it absolutely tight



2.18

Cut the sensitive band so you can see the silverband between the two steel bands



2.19

The finish mounting of the shaft grounding before finishing the silver band



2.20

Cut app. 2 mm of the edge of the glass brush



2.21

Clean the silver band with glass brush



2.22

Grounding plate must be welded as close as possible, in order for the wires to be as short as possible



2.23

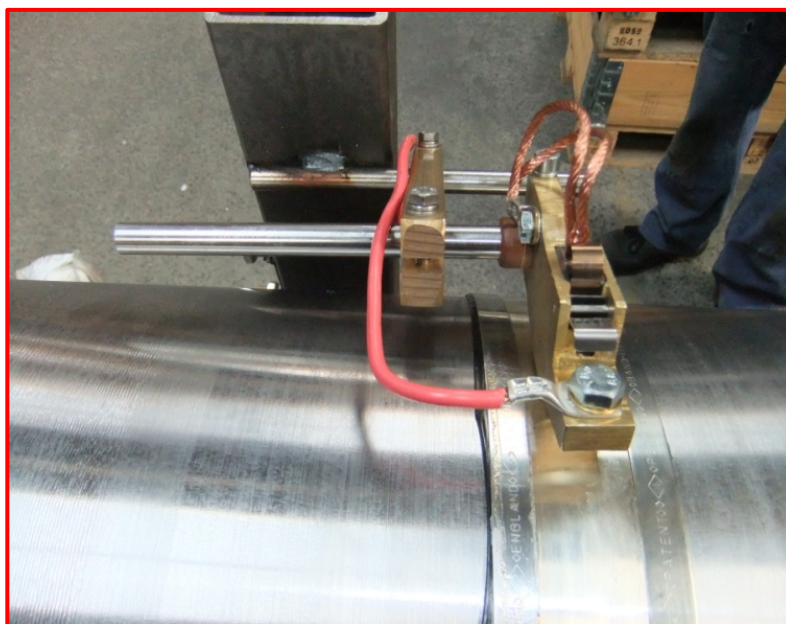
Ø12mm shaft are welded on the stand



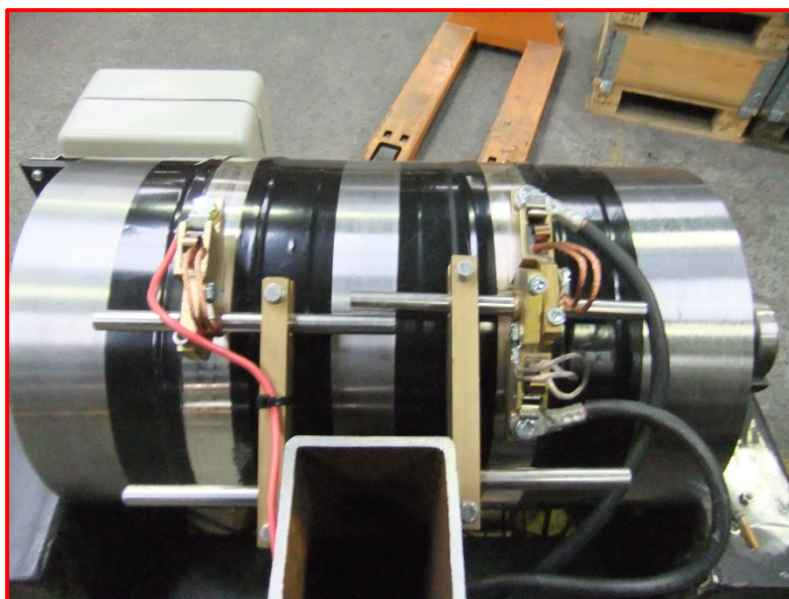
2.24
Mount the shaft holder



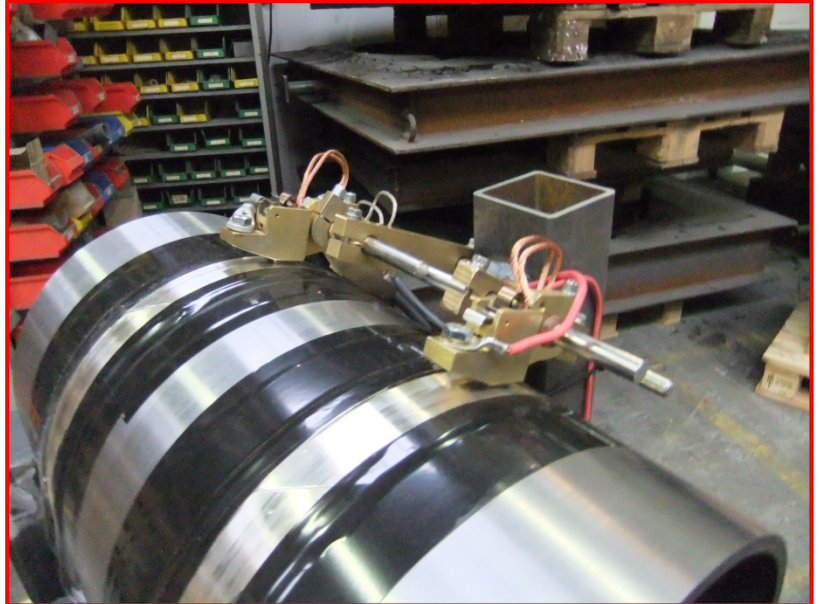
2.25
Mounting the silver graphite brush



2.26
Done



2.26
Done



3 GENERAL DATA

3.1 Components

539172

Voltmeter for shaft-hull potential difference with amplifier for alarm



539170

Slip ring. Silver alloy band,
63,5 mm wide and approx.
100 mm longer than the
circumference of the shaft.

**539184 & 539185**

EL tape + pressure sensitive
tape

**539180 & 539182**

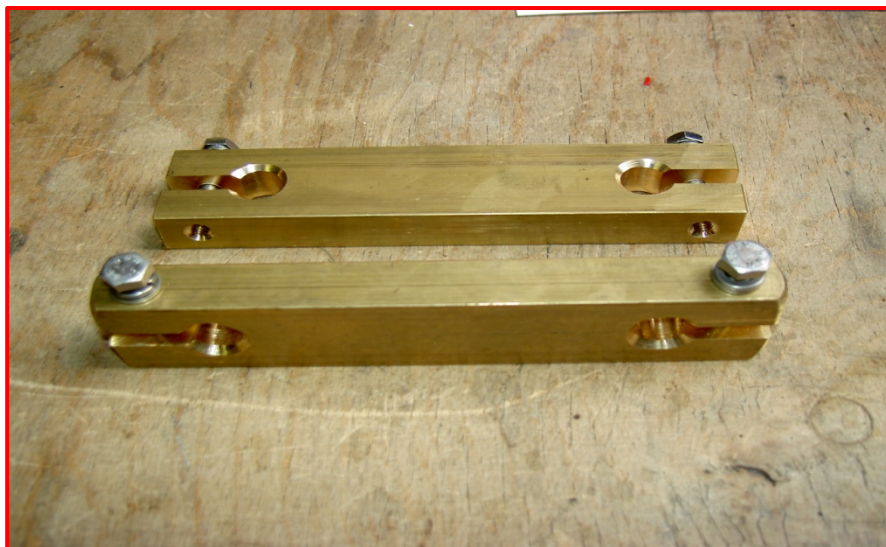
Holding straps. The
permanent
holding straps are made of
Stainless
Steel.

**539264**

St. steel shaft 12.0 x 180mm



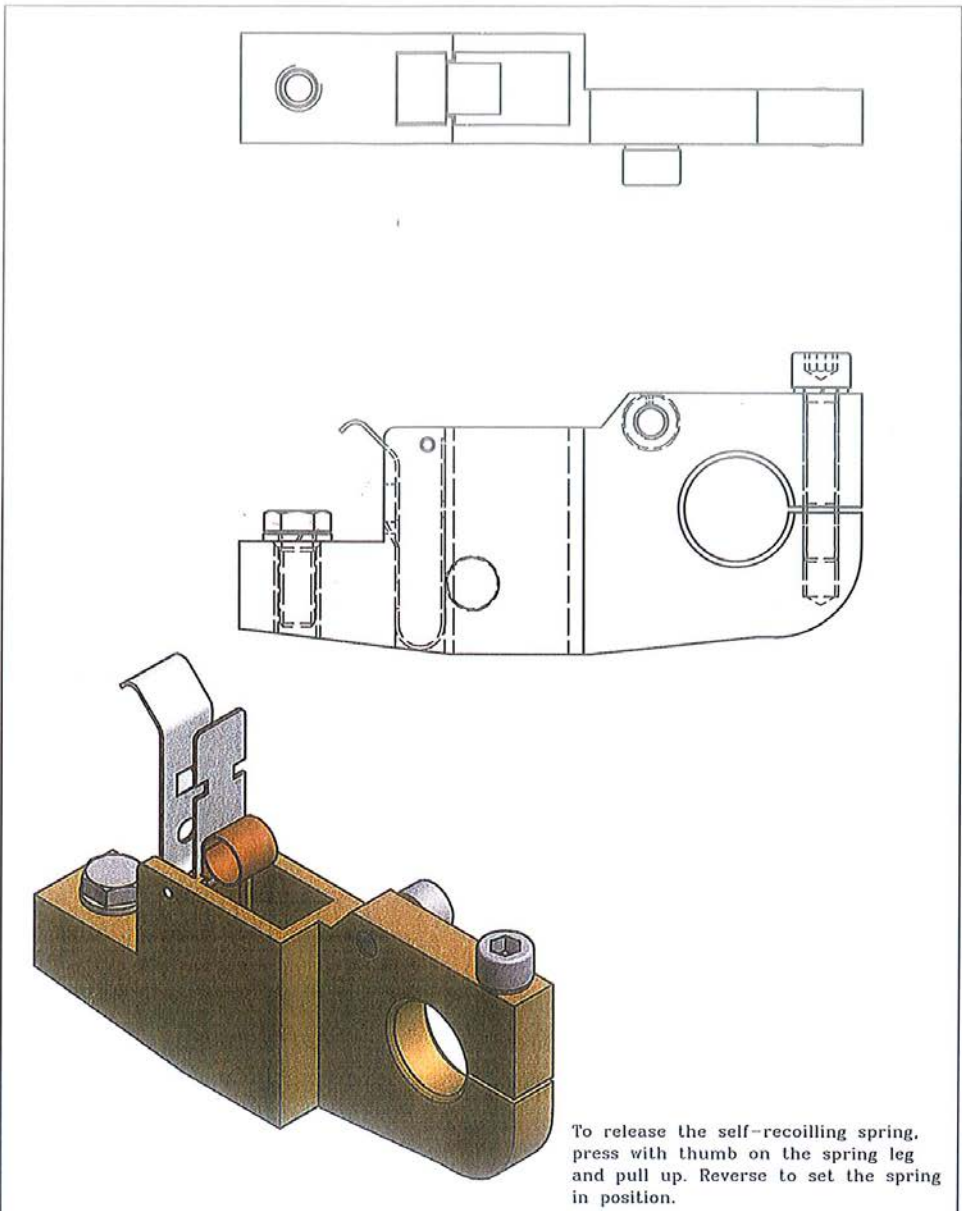
539265
Brass shaft holder



539263 & 539262
ISO and Brass bushing
for shaft



539465 Brush box



BAC CORROSION CONTROL A/S BAC

Brush Box

Drawing No.:

Rev. No.:

Rev. Date:	Date: 16.09.10	Draw. by:	File No.:
CAD No.:	BAC No.: 539465	App. by: EE	Scale:
Copyright: BAC Corrosion A/S	Witness. by:	Replacing File No.:	

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539105
Silver graphite brush



539230
Grounding plate
Place as close to the brush
as possible



526354 & 526352
35²mm cable socket with
10 and 8 mm hole



520600 & 526060
6²mm cable socket with
8 mm hole



539125
Glass brush



94116
Silicone



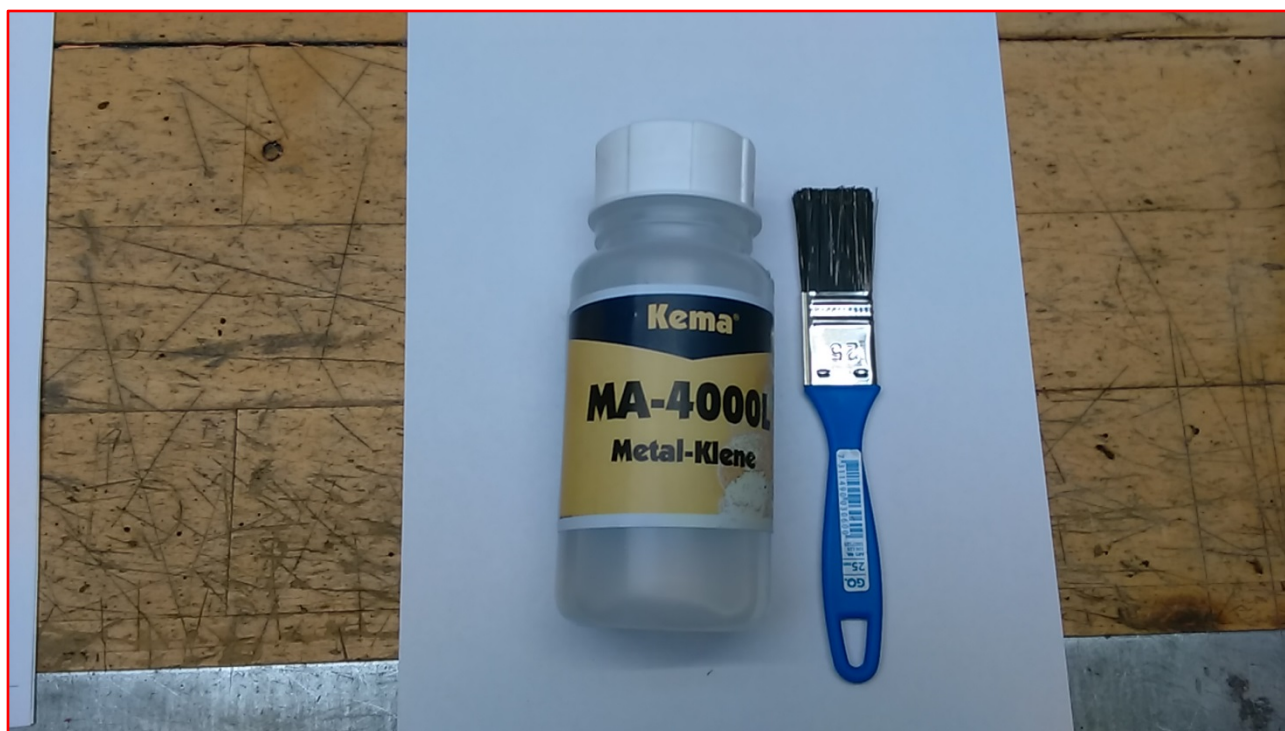
94118

Preservation Oil, see datasheet
BAC does not supply this,
please buy locally



94119

Metal Cleaner, see datasheet
BAC does not supply this,
Please buy locally



3.2 List of components

POS.	BAC PART No.	CLIENT PART No.	Q'ty	DESCRIPTION	CHECK
2	539172		1 pcs.	Voltmeter for shaft-hull potential difference incl. amplifier for alarm.	
3	539170		2 pcs.	Silver alloy band for shaft (90% silver and 10% copper)	
4	539184		2 roll	El tape 33+	
5	539185		1 roll	Pressure sensitive tape	
6	539180		6 pcs.	Permanent holding straps in St. steel, 12,5mm x 0,7mm x (shaft) O.D.	
7	539182		6 pcs.	Bandtightener in St. steel,	
8	539264		4 pcs.	St. steel shaft $\varnothing$ 12.0 x 180mm	
9	539265		2 pcs.	Brass shaft holder	
10	539262		1 pcs.	Brass bushing for shaft	
11	539263		1 pcs.	ISO bushing for shaft	
12	539465		3 pcs.	Brush box	
13	539105		3 pcs.	Silver graphite brush (85% Ag)	
14	539230		1 pcs.	Grounding plate.	
15	523502		2 pcs.	Cable 35 [□] L=3m.	
16	526354		2 pcs.	35mm [□] cable socket with 10mm hole.	
17	526352		2 pcs.	35mm [□] cable socket with 8mm hole.	
18	520600		2 pcs.	Cable 6 [□] L=3m.	
19	526060		2 pcs.	6mm [□] cable socket with 8mm hole.	
20	539105		3 pcs.	Spare silver graphite brush (85% Ag) Recommend spare parts (option)	
22	539125		1 pcs.	Glass brush	
23	539300		3 pcs.	Manual for amplifier	
25	94116		1 pcs.	Silicone Sealant	
26	94118		1 pcs.	Preservations Oil, (Buy locally) BAC does not supply.	
27	94119		1 pcs.	Metal Cleaner, (Buy locally) BAC does not supply.	

BAC Corrosion Control A/S

BAC

PART-LIST FOR (MAN)
SHAFT-GROUNDING

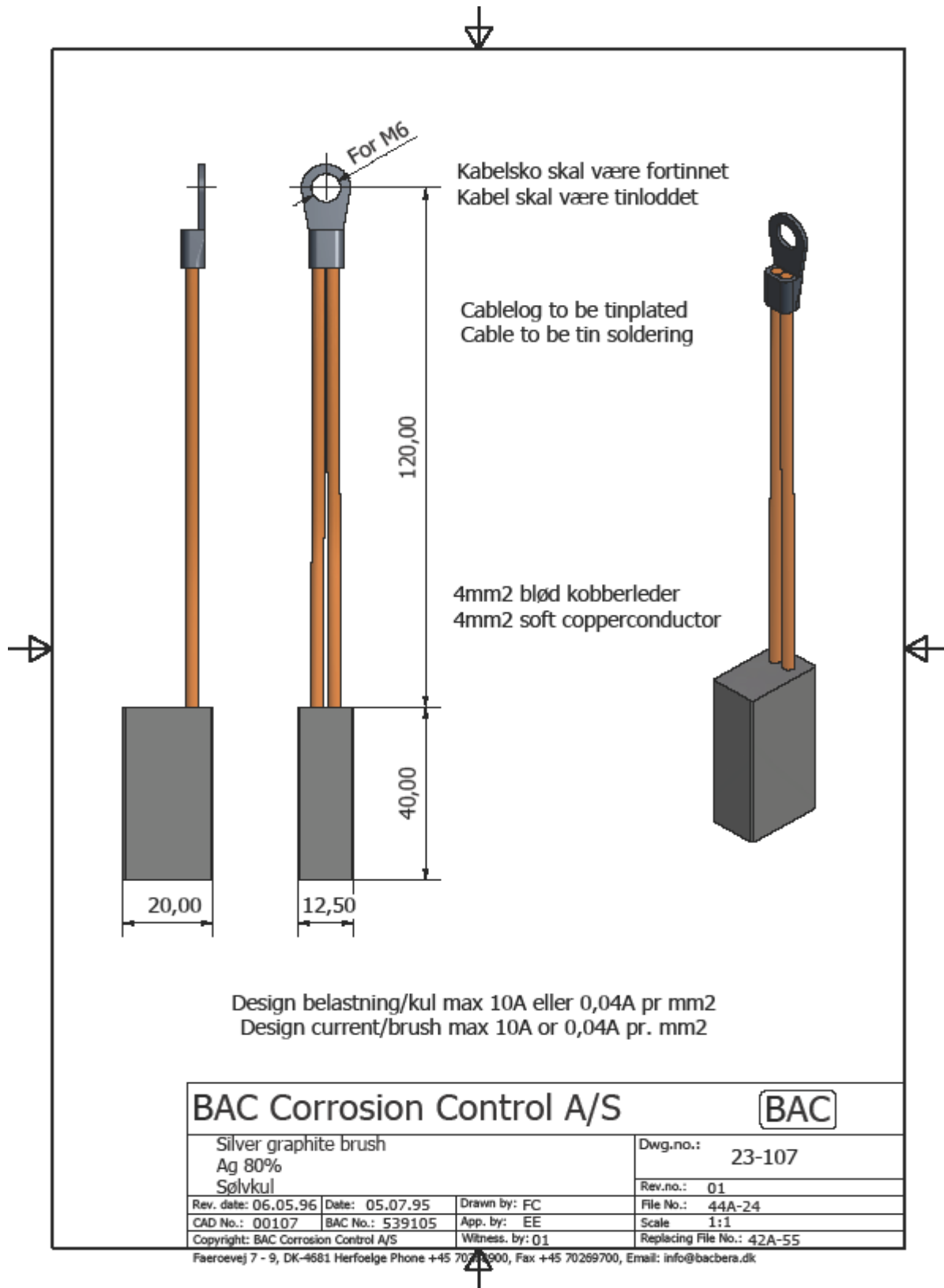
Drawing No.:
23-103-MAN

Rev. No.: 01

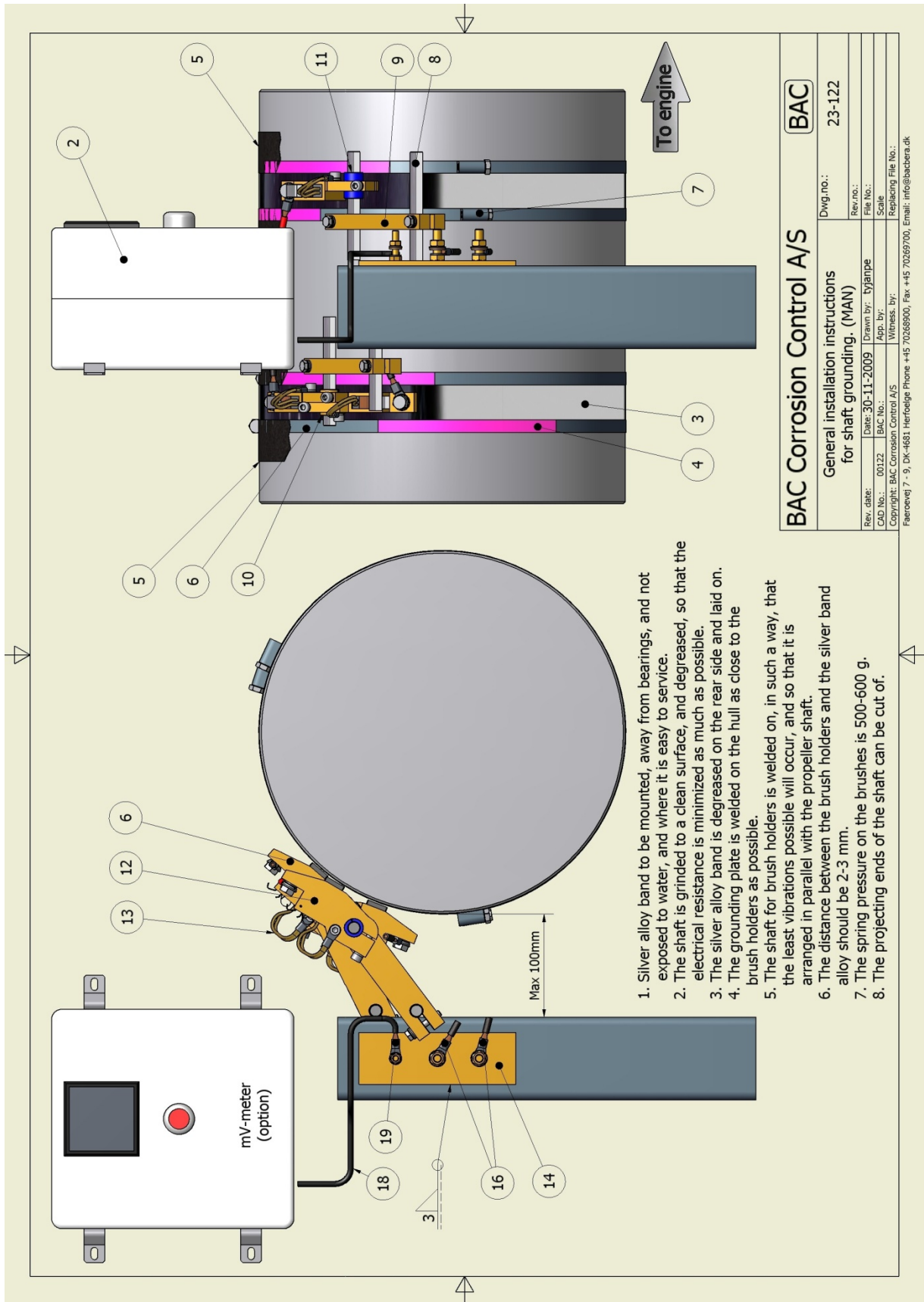
Rev. Date:	Date: 23.10.17	Draw. by: FC	File No.:
CAD No.:00103-MAN	BAC No.:539800	App. by: EE	Scale: 1 : 1
Copyright: BAC Corrosion Control A/S	Witness. by:	Replacing File No.:	

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3.3 Silver brush drawing



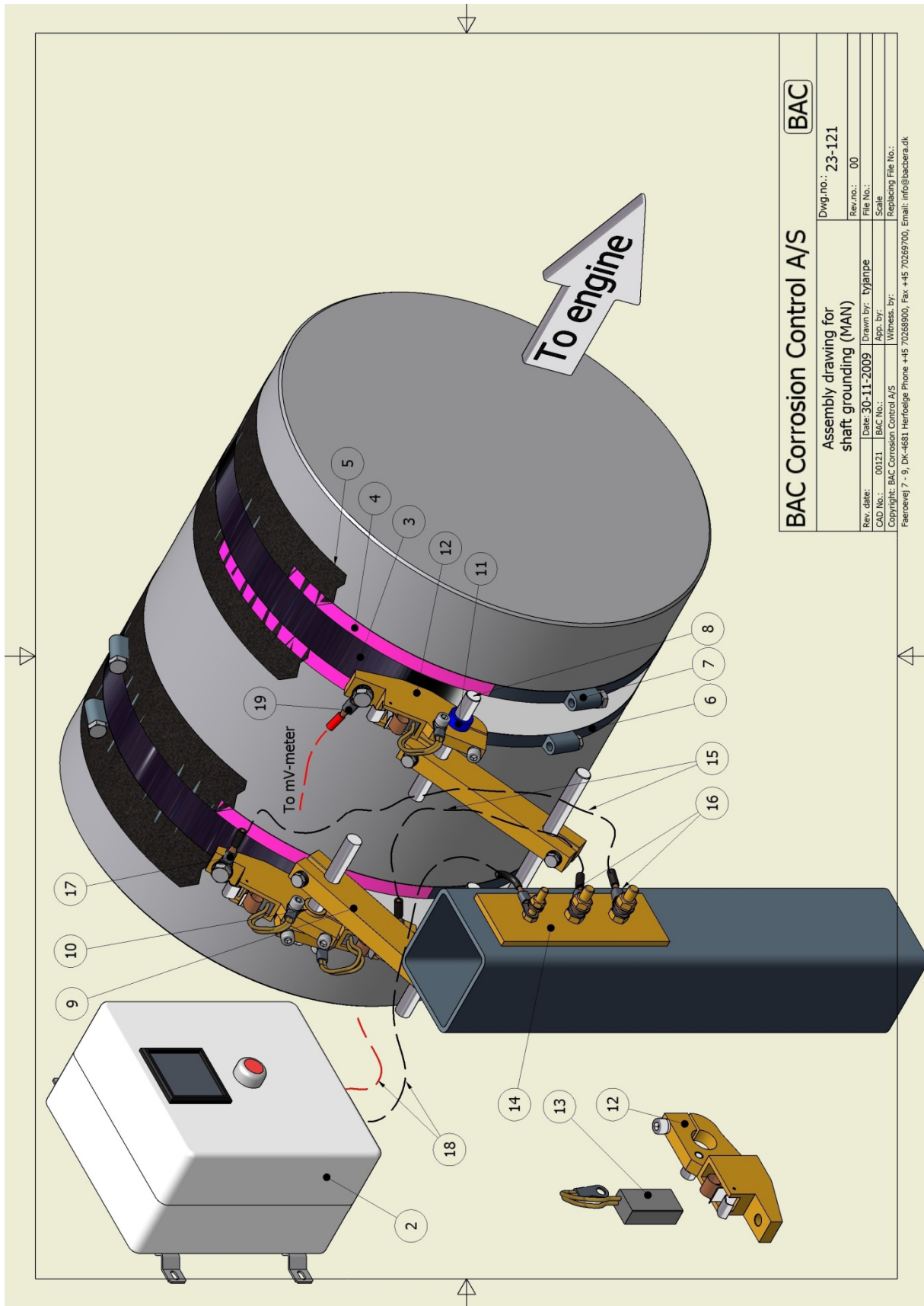
3.4 Installation instruction



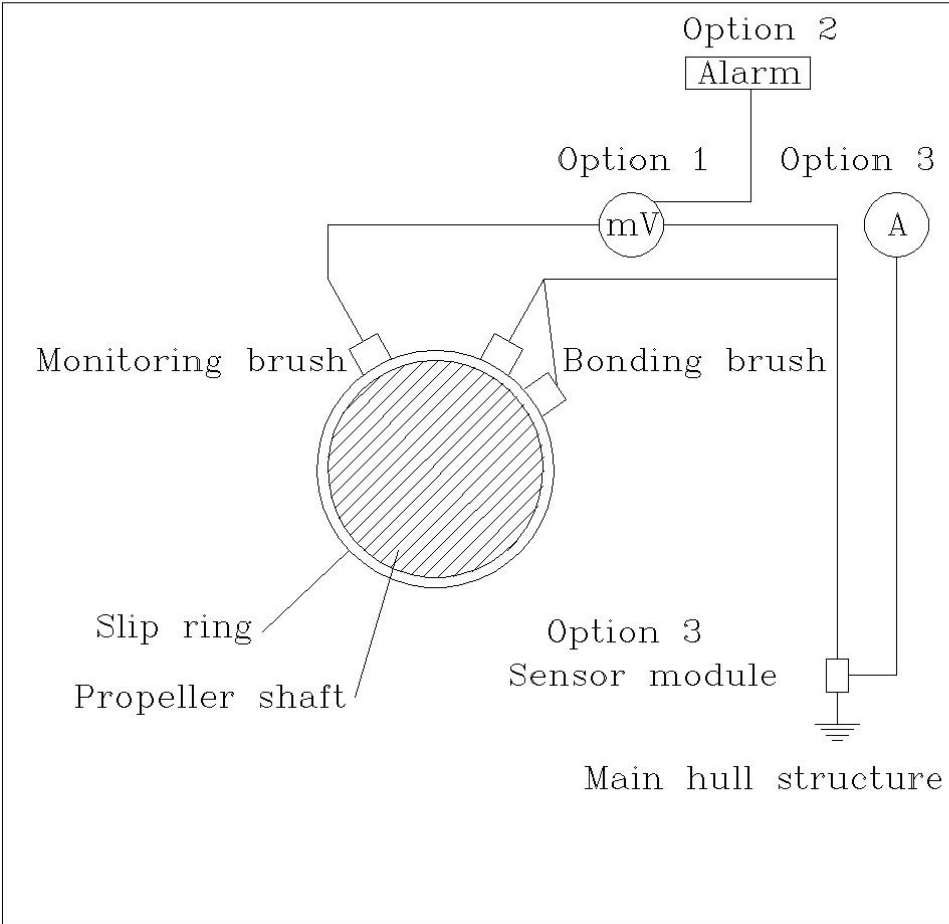
3.5 Installation instruction picture



3.6 Principdiagram for mounting



3.7 Principdiagram for montage

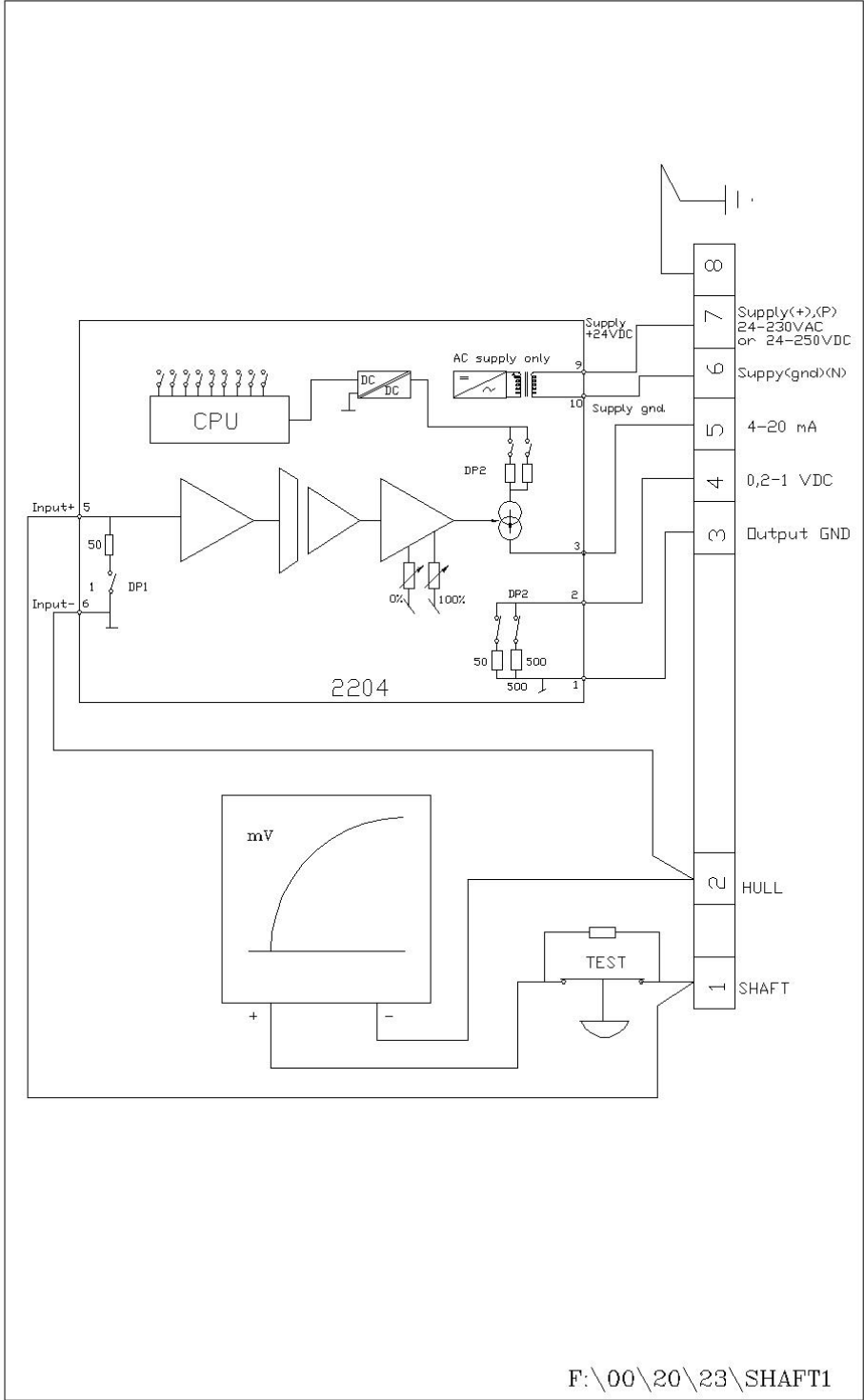


BAC Corrosion Control A/S		BAC	
Principdiagram for montage SHAFT-GROUNDING with mV/A		Drawing No.: 23-diagram2	
		Rev. No.: 01	
Rev. Date:	Date: 15.05.95	Draw. by: FC	File No.:
CAD No.:Diagram2	BAC No.:	App. by: EE	Scale: 1 : 1
Copyright: BAC Corrosion Kontrol A/S		Witness. by:	Replacing File No.:

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4 SHAFT-HULL MILLIVOLTMETER ASSY

Shaft-Hull Millivoltmeter Assy. with Isolation Amplifier.



5 ISOLATION AMPLIFIER 2204

**Input galvanically separated from output and supply Current – or voltage input.
Signal conversion.
Current – and voltage output.
24 VDC supply or 24/115/230 VAC
applicable**

5.1 Applications

Galvanic separation of analogue signal (ground loop elimination).

Measurement of floating signals.

Signal conversion within the ranges: 0...10 VDC or 0...50 mA on the input and 0...20 mA and 0...10 VDC in fixed ranges on the output.

5.2 Description

The 2204 uses microprocessor technology for the selection of gain and zero offset, yet the signal conditioning is analogue with a fast response time of less than 25 ms.

5.3 Technical characteristics

In standard ranges, the 2204 is programmable by use of internal dipswitches within the input – and output ranges of the order schedule. Provided that front adjustments are still sealed, the unit needs no adjustment after programming. AC-supplied units are galvanically separated between input, supply, and output.

5.4 Input

Current or voltage in standard or special ranges within the measuring range.

Standard input voltage: 0/0.2...1 V, 0/0.5...2.5 V and 0/2...10 V.

Input resistance: type. 10 M Ω .

Standard input current: 0/1...5 mA or 0/4...20 mA.

Input resistance: norm 50 Ω (0/4...20 mA).

5.5 Output

The output can be ordered for standard current and voltages or special versions within the signal range.

5.6 Standard output current

(Pin 3) 0/4...20 mA and 0/1...5 mA acc. to order current limit: 23...28 mA.

5.7 Standard voltage output

(Pin 2) is achieved by short-circuiting pins 2 and 3. For voltage signals in the ranges 0...1 VDC, a 50 Ω shunt (DP 2-1) is applied; in the ranges 0...10 VDC, a 500 Ω shunt (DP 2-2) is applied. Using both signals simultaneously, the mA loop to ground must go through the internal shunt.

Fine adjustment of 0 and 100 % is possible at the front ± 10 %, but please note that the basic calibration is thereby lost.

5.8 Electrical specifications

Specification range:

(@ - 20⁰ C to + 60⁰ C)

Common specifications:

Supply voltage	24 VDC $\pm$ 20 % 24/115/230 VAC, 50...60 Hz
Max. Consumption (24 VDC)	1.3 W
Max. Consumption (24/115/230VAC)	2.7 W
Isolation, test/operation	3.75 kVAC/250/ VAC
Linearity error	< $\pm$ 0.1 % of span
Temperature coefficient	< $\pm$ 0.01 % OF SPAN/ ⁰ C
Signal/noise ratio	min. 60 dB
Effect of supply voltage change	< $\pm$ 0,002 % of span/%V
EMC-immunity influence	< $\pm$ 0.5 % of span
Response time (0...90%)	< 25 ms.
Relative air humidity	0...90% RH (non cond.)
Dimensions (HxWxD)	80.5 x 35.5 x 84.5 mm
Tightness	IP 50
Weight DC/AC	125 g / 275 g

5.9 Input

Current input:

Measurement range	0...50 mADC
Min. measurement range (span)	4 mADC
Max. Offset	20 % of selected max.value
Input resistance	nom. 50 Ω

Voltage:

Measurement range	0...10 VDC
Min. measurement range (span)	0.2 VDC
Max. Offset	20 % of selected max. Value
Input resistance	10 M Ω

5.10 Output**Current output:**

Signal ranges	0...5 mA / 0...20 mA
Min. measurement range (span)	4 mA / 16 mA
Max. Offset	20 % of selected max. Value
Load (max)	20 mA/600 Ω /12 VDC
Load stability	< $\pm$ 0.01 % of span/100 Ω
Current limit	23...28 mA

Voltage output through internal shunt:

Signal ranges	0...0.25 V/0...1 V/0...2.5 V/0...10 V
Min. measurement range (span)	0.2 V / 0.8 V / 2.0 V / 8.0 V
Max. Offset	20 % of selected max. Value
Load (min)	500 k Ω
Output resistance	50 Ω /500 Ω

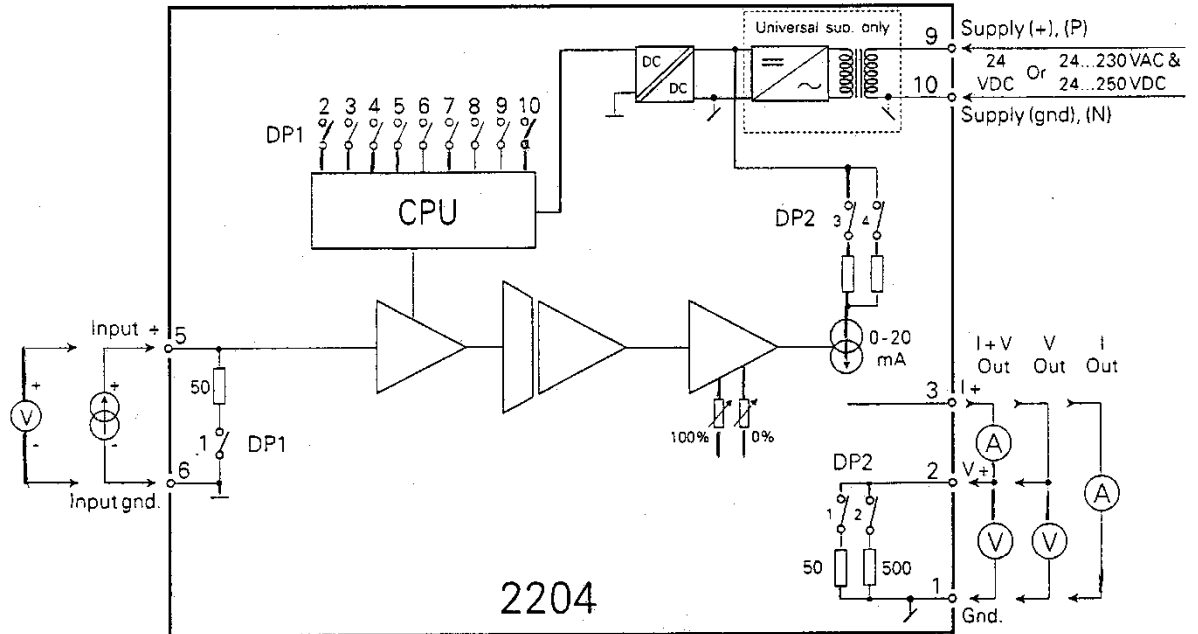
5.11 Observed authority requirements Standard

EMC 89/336/EEC, Emission	EN 50 081-1
Immunity	EN 50 082-2
LVD 73/23/EEC	EN 61 010-1
PELV/SELV	IEC 364-4-41 and EN 60 742
Of span = of the presently selected range	

5.12 Order

TYPE	INPUT	OUTPUT	SUPPLY
2204	0...20mA : A	Special : 0	24 VDC : D
Our Standard System	4...20mA : B	0...20mA : 1	24...230 VAC &
	0...1 V : C	14...20mA : 2	24...250 VDC : P
	0.2...1 V : D	0...5mA : 3	
	0...10 V : E	0...1 V : 4	
	2...10 V : F	0.2...1 V : 5	
	Special : X	0...10 V : 6	
		2...10 V : 7	

5.13 Block diagram



PROGRAMMING:

INPUT PROGRAMMING	DP1 (10-pole) SW 1, 2, 3, 4, 5	
	SW ON	SW OFF
0...5 mA		
0...20 mA	1, 3	2, 4, 5
0...1 V	1, 4	2, 3, 5
0...2.5 V	2, 3	1, 4, 5
0...10 V	2, 4	1, 3, 5
	2, 3, 4	1, 5
For 20 % offset on input, set DP1 SW5 ON e.g. input 4...20 mA	1, 4, 5	2, 3

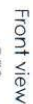
OUTPUT PROGRAMMING	DP2 (4-POLE) SW 1 - 4		DP1 (10-pole) SW 6,7,8,9,10	
	SW ON	SW OFF	ON	OFF
0...5 mA	4	1, 2, 3	7	6, 8, 9, 10
0...20 mA	3	1, 2, 4	8	6, 7, 9, 10
0...5 mA / 0...250 mV	1, 4	2, 3	6	7, 8, 9, 10
0...20 mA / 0...1 V	1, 3	2, 4	6, 7	8, 9, 10
0...5 mA / 0...2.5 V	2, 4	1, 3	6, 8	7, 9, 10
0...20 mA / 0...10 V	2, 3	1, 4	6, 7, 8	9, 10
For 20% offset output, set DP1 SW9 ON e.g. output 4...20 mA	3	1,2,4	8,9	6,7,10
For reversed output set DP1 SW10 ON e.g. output 20...4mA	3	1,2,4	8,9,10	5,6,7

For special ranges DP1 SW 2, 3, 4, 5, 6, 7, 8, 9 and 10 are OFF.
Please notice the setting on DP1 SW2 DP2 SW 1-4.

6 CONTROLBOX, PLACEMENTS OF HOLES



Sectional top view



Sectional side view

[illegible]

7 MAINTENANCE OF SHAFT-GROUNDING SYSTEMS

1. Always keep the system clear of dust, grease and water.
2. When cleaning the silver bands of grease and dust, a Metal cleaner should be used.
3. When polishing the silver bands, use the glass brush, which is delivered with the system.

Never use abrasive cloth, file or other abrasives.

4. Once a month (or when needed) clean the brushes and brush boxes of dust, because the dust can cause the brushes to stick in the brush box and thereby cause a bad connection between the silver band and the brush.
5. The spring pressure of the brushes should be 500-600 gr.
6. Make sure that there is always a good electrical contact at all screw- and bolt connections.
7. Make sure that the earthing plate is in welded connection with the hull all the times.

8 BAC SHAFT GROUNDING DEVICES

BAC NO: 539525

STANDARD SHAFT GROUNDING ASSEMBLY

This system forms connection between shaft and hull without any kind of monitoring, which means that there is no possibility of knowing if the connection and safety of the system is functioning correctly.

BAC NO: 539500

SHAFT GROUNDING ASSEMBLY WITH mV- METER FOR MONITORING

This system is identically with BAC Shaft Grounding for computer control, though this system consists of a steel box with instrument for monitoring.

BAC recommends this system as the most sold and versatile solution on the market

BAC NO: 539600

SHAFT GROUNDING ASSEMBLY WITH mV- METER AND AMPLIFIER FOR ALARM OUTPUTS

This system is identically with BAC Shaft Grounding assembly with mV-meter for monitoring, though this system is extended with an isolation amplifier. This makes it possible to connect the system directly to the alarm computer in the ship with a signal on 4-20 mA or it can be used with a signal on 0-20 mA.

BAC NO: 539800

SHAFT GROUNDING ASSEMBLY FOR MAN ENGINE

With reference to specification from MAN, info no. 300155, Ident no. 0792182-1. Shaftline earthing device.

Please note following:

When you order a BAC Shaft Grounding system the price of the silver band is depending on the size of the shaft, and therefore the cost of the silver band will be quoted separately. Please contact BAC; we can help you with commercial terms and calculations.

It is very important that the Shaft Grounding system is equipped with a kind of measuring instrument, which can show the function of the system.

BAC is able to update the different BAC Shaft Grounding systems. For instance with a mV-meter for monitoring or amplifier for alarm output giving you a better and precisely measure of the system.

BAC can further more offer you an alarm system to ensure that the connection between the shaft and hull is according to BAC standard specifications.

9 DOCUMENTATION ON CD

10 DATA SHEET

Metal cleaner

Preservation Oil