K.C. LTD.

DRAWING TITLE	**FINAL DRAWING & OPERATION MANUAL**
ITEM	**ANTI-FOULING SYSTEM (M.G.P.S)**
CLIENT	**ISOICO**
PROJECT No.	**PG 109**
VESSEL TYPE	**35K DWT PRODUCT OIL/CHEMICAL TANKER**
K.C. LTD. REF. No.	**3080/B**

0	**ORIGINALLY PREPARED**		**S.C.O.**		**NOV.11,05**
REV	**DESCRIPTION**	**DWN.**	**CHD.**	**APP.**	**DATE**

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INTRODUCTION

The System is a patented method developed specifically for :-

1. The Control of marine growth in sea water systems.

2. The reduction of corrosion of metal in contact with water.

It is difficult to generalize on the economics, but it is normally no exaggeration to say that annual savings, taking into consideration out of service time, are sufficient to cover the capital cost of the System in two years or less.

Each installation is designed for its particular task and should therefore not be regarded as just another mass produced gadget which will cure all ills with no further attention. Very little supervision is necessary, but we do ask for your cooperation in following the simple instructions contained in this manual

The System, using our special anodes controls both marine growth infestation and corrosion - the former being virtually eliminated, while the latter will be reduced to a fraction of that normally to be expected.

The System is designed to give continuous and trouble free protection against marine growth and corrosion with the minimum maintenance. It will only operate for the full planned anode life and give complete protection, however, if the anode currents are maintained at the correct settings.

Excessive anode current will result in an excessive rate of consumption of the anodes, thus reducing their life and possibly leaving the water system unprotected if the anode is prematurely consumed.

Insufficient anode current will result in fouling of the water system.
Incorrect current setting either way can result in expensive cleaning operations which should not be necessary if the System is operated correctly at all times.

ANODE OPERATION

There are two types known as the Marine Growth (CU) anodes and Trap Corrosion (AL) anodes.

CU Anodes are manufactured from copper as major part for system. They release ions during electrolysis which combine with these released from the sea water to form an environment which discourages spat and any other minute organisms entering, and adhering in some area where they grow and start breeding. They are, instead, carried straight through to discharge and provided that no untreated water is allowed to enter at some point subsequent to the anodes, freedom from infestation is assured.

AL Anodes are manufactured from aluminium as supplementary part for use in a system with predominantly steel pipes where the reaction of the aluminium anode with seawater results in the formation of aluminium hydroxide. This disperses down the pipework positively charged, forming anti-corrosive barrier on the pipework which takes an insulation role preventing marine fouling from rooting and growing there.

INSTRUCTION FOR CONTROL PANEL

(KCAF TYPE)

MODULES

The panel contains module(s) according to the quantity of anode. These modules require no maintenance. Each module controls one pair of anodes or each anode via front mounted amperage selector knobs. The current level for each anode is shown on the digital display above each selector knob. Below each digital display unit there is a red led alarm indicator, which will illuminate if module(s) has failure causing either zero current or over current output.

FIXING

Two mounting bars with four holes for M10 are incorporated on the back plate of the panel.
We recommend a bulkhead mounting in close proximity to the anodes to avoid voltage drop and cutting cable run costs.

MAIN POWER SUPPLY CABLE

Run cable from available power source .... via gland to terminal marked 'Mains In'.
Be sure to connect correct cable to terminal.

SETTING UP

Once the cables have been run and connected, the System is ready to be switched on.
NOTE - the following procedure can only be carried out with the anodes in seawater.

1. Turn up the switch at the left-low side of control panel.
   A green neon on the right of switch will light up to confirm power on.

2. Set all anode currents by turning the knobs unless the readings of digital display correspond to each current specified in Operation Manual.

3. Switch off until ship’s engine starts and switch on when seawater pumps are running.

INSTRUCTION FOR FITTING ANODES

(JIS 5K-150A FLANGE WITH PIPE UPSTAND TYPE)

Before works, make sure anode overhaul height by the length of anode & mounting sleeve over the sea chest / strainer top.

1. Pipe upstand (150A #80) to be supplied and fitted by client. Pipe to have minimum bore of 130mm inside after coating or lining to ensure clearance of anode mounting assembly. Flange to be JIS 5K-150A.

   If K.C. Ltd. have supplied drawings for specific system.

   Burn a hole in the sea chest / strainer top plate to suit outside diameter of pipe in position stated on drawing.

   If K.C. Ltd. have not supplied drawings.

   Determine the position of the pipe upstand and burn a hole in the top plate of the sea chest to suit pipe outside diameter. The anodes must be positioned between the sea water inlet grid and suction pipes in the sea chest in case anode are installed in sea chest.
   Recommended minimum dimensions for anode positioning 300mm between anode center and anode center and 120mm between anode center and the nearest steelwork.

   Weld pipe upstand in position, ensuring:-

1.1 Pipe is welded to the sea chest / strainer top plate on both top and bottom surfaces.

1.2 Flange top surfaces must be horizontal unless otherwise stated.

1.3 We recommend that any special paint or coating applied to the sea chest is also applied to the pipe upstand.

2. Bolt flange mounting complete with anode to mating flange on pipe upstand.
   Remember to fit gasket between flanges and ensure no mechanical load is applied to cable.

WIRING OF SYSTEM

Client to supply all cables and connection boxes between :-

1. Power isolation switch and control panel.

2. Control panel and anodes including earth return leads.

Minimum Recommended Cable Specification

Marine rubber double insulated. Use one core per anode and one core per earth return. The minimum core size for all cable is as follows : -

0	-	25	metre cable run	Use 2.5 sq mm core.
25	-	50	metre cable run	Use 4.0 sq mm core.
50	-	100	metre cable run	Use 6.0 sq mm core.

Each anode is assembled with different cable color for easy identification as follows;

CU (Copper) Anode cable - Red

AL (Aluminium) Anode Cable - Blue

WIRING UP

An earth (-ve) return must be installed at each separate anode location i.e. if the system supplied is designed for 2 sea chests/strainers then 2 earth returns must be used. Use a min of 1 earth return for every 4 Anodes. Ensure that a separate core of a multicore cable or a completely separate cable is used for this purpose. Use cable as specified above. Connect to the terminals available in the rear of the control unit marked 'earth returns'.
We suggest the cable connections are made by welding a bolt on to the strainer or sea chest close to the anodes (but no nearer than 250mm).
Fit junction box close to anodes and wire to control panel using recommended cable as per attached wiring diagram and control box drawing.

After switching on, check the polarity of the anodes in relation to the hull.
All anodes are to be positive, relative to a negative hull.

TROUBLESHOOTING

NO LIGHTS ON AT ALL

1. Check mains fuse in the front of the control panel(above on - off switch).
2. Check circuit breaker in distribution box.
3. Check if anodes are immersed in the sea water.

ANY ONE DIGITAL DISPLAY WILL NOT SHOW A READING

1. Check anode fuse inside the module.
2. Check if any cable has been severed.
3. Check anode lead joint.
4. Check if inside sea chest/strainer is filled with air.
5. Change over any two modules to check if fault is in module or rest of system.

ALARM LED LIGHTS UP

1. Check if digital display is showing zero or max current.
2. If digital display is not showing a reading but led is light, module is fault.
   And then return K.C. LTD. for repair.

IN-SERVICE INSTRUCTIONS

DESCRIPTION

Once the System has been installed it will perform two functions : -

1. Eliminate marine growth and reduce the corrosion rate in the seawater service lines.

2. The System uses impressed current sacrificial anodes which last to designed life.
   Once in service the anodes will require renewal within designed life.
   Refer to instruction of anode renewal as specified separately.
   Please ensure a reasonable dispatch time when ordering replacement anodes.

You will require the following : -

ANODE	PART No.	Q'TY	ANODE LOCATION
CU (Copper)	KBCU 780	2	STRAINER
AL (Aluminium)	KBAL 780	2	

When ordering, inform of maker's reference number specified on the cover sheet of this drawing.

ADJUSTMENTS

The control panel is fully automatic and therefore does not require any adjustments in service.

CHECKING

We suggest that as a matter of course the Control Panel should be checked every week.

When checking, see that all the digital display ammeters are working, this will determine all is correct. When the anodes have nearly wasted, the digital display above the corresponding anode will start to fall. When this happens, turn the anode current knob back to zero and leave it until the anode renewal.
Reset once again at sea after renewal to current settings given previously.

WARNING (In case anodes are installed in strainer)

When opening the strainer lid for regular check inside strainer, do not fail to remove all anodes mounted onto the lid. Lifting up strainer lid without anodes removal and lifting it down gives serious stress to stud and results in anode breakage.

IN-SERVICE ADJUSTMENT AND CURRENT SETTINGS

The effective working of the system can only be determined by inspection and it is suggested that if after some 6 months of operation the opportunity to examine a strainer, length of pipe or heat exchanger, presents itself, this should be done.

In the event of there being signs of infestation, the current to each anode in this section should be increased by a maximum of 0.4 amps, but if no fouling is present the current to each anode within this section may be reduced by a maximum of 0.2 amps.

This routine can be repeated at intervals, the current being adjusted accordingly.

NOTE : The higher the current setting the shorter the anode life.
The lower the current setting the greater the anode life.

ANODE POSITION : STRAINER

ANODE REF	CURRENT SETTINGS
PORT	
CU 1	1.8 Amps
AL 1	2.0 Amps
STB'D	
CU 2	1.8 Amps
AL 2	2.0 Amps

NOTE : Turn the current setting down to 0.4 Amp for the strainer not in use but be sure to return to operating current as above when the strainer comes in use.

CAUTION

Customers are recommended for the purchase of genuine parts from us.
Imitated parts make the system get fatally damaged.

INSTRUCTIONS OF ANODE RENEWAL

Life of anodes is designed specified in specification, but it will be more or less depending upon the operation of the vessel and it will be noticed timing of anode exchange from falling down of digital display of each anode on control panel. Exchange of anodes can be carried out as following procedures.
K.C. Ltd. provide renewal anodes in a complete assembled set including all accessories, flange and cable. So customer is required to disconnect anode cable and flange bolts only for replacement.

NOTE

Anode positioned in sea chest : Renewal to be done during dry dock.
Anode positioned in strainer : Renewal to be done in afloat.
Prior to works secure sea valves are firmly closed.

1. Switch off main power supply on the control unit.

2. Disconnect anode cable in junction boxes.

3. Remove anode flange together with used anode from sea chest or strainer.

4. Mark anode kind on counter flange.

5. Install new anodes and connect up anode cables.
   Be sure to connect correct anode and to put gaskets between anode flanges.

6. Connect anode cable in junction box at the correct position and switch on control panel when sea water pumps are running.

7. Ensure current on control panel showing setting value given previously.

K.C.LTD.

SPECIFICATION FOR M.G.P.S

Client Project No	ISOICO PG 108/109(35,000 DWT PRODUCT OIL/CHEMICAL TANKER)
Sea water to be treated	1,700 m^3/h from either of 2 strainers
Weight provided by K.C.LTD. per strainer	Cu(Copper) : 780 mm×120ø = 78.8 Kgs Al(Aluminium) : 780 mm×120ø= 24.7 Kgs
Anode location Anode mounting type	1 Cu×1 Al in each of 2 strainers JIS 5K-150A flange mounting sleeve
Scope of supply	2×KBCU 780 anodes ass'y for 2.5 year working 2×KBAL 780 anodes ass'y for 2.5 year working 2×KBCU 780 anodes ass'y for 2.5 year spare 2×KBAL 780 anodes ass'y for 2.5 year spare 1×KCAF3040 control panel with cable glands 2×Plug & receptacle 4×Flange with pipe up-stand 1×Set standard spares
Painting colour Electric source Electric power consumption	Control panel to RAL 7032 AC 220V, 60Hz, 1PH Max 180 Watt
Life time of anodes	5 years (2.5 year working + 2.5 year spare)
Remark	Our spare anodes are ***supplied in completely assembled sets*** including all isolation materials, flange, cable and etc. for easy replacement and perfect insulation.

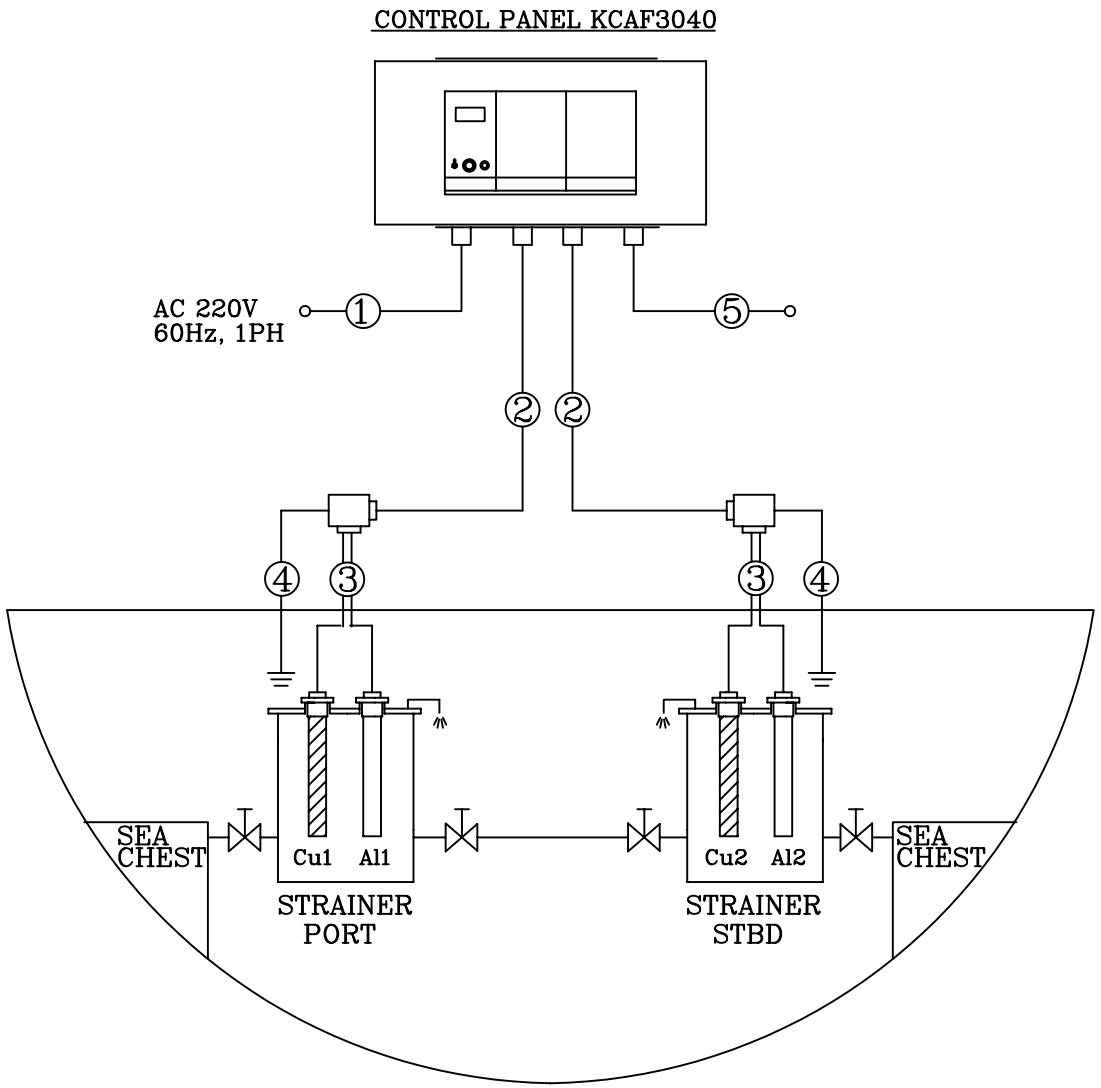
SCOPE OF SUPPLY AND WEIGHTS PER HULL

S/N	Item	Type	Q'ty	Wt. Each	Total weight
①	Cu(Copper) anode ass'y for 2.5 year working	KB CU 780	2pc	100.3 kg	200.6 kg
②	Al(Aluminium) anode ass'y for 2.5 year working	KB AL 780	2pc	46.2 kg	92.4 kg
③	Cu(Copper) anode ass'y for 2.5 year spare	KB CU 780	2pc	100.3 kg	200.6 kg
④	Al(Aluminium) anode ass'y for 2.5 year spare	KB AL 780	2pc	46.2 kg	92.4 kg
⑤	Control Panel	KCAF3040	1pc	20.0 kg	20.0 kg
⑥	Plug & receptacle	MJ05	2pc	2.0 kg	4.0 kg
⑦	Flange with pipe upstand	-	4pc	10.7 kg	42.8 kg
⑧	On board spares	-	1set		
			Total net weight of system		652.8 kg

ON BOARD SPARES

Only spares required for first 2.5 years operation are :
2 off 5 amp fuses for control panel modules and 2 off 2.5 amp fuses for control panel power unit &
1 power on led, spares are supplied with separate spare box .
For replacement anodes required after 2.5 year replace on board spare anodes for further 2.5 year working.
After 5 year working, replacement anodes required(see list above).

Replacement anode or guarantee work if required contact :
K.C.LTD.(see first page)



CABLE INFORMATION					
NO.	CABLE REF.	TYPE	RUN(M)	Q'TY	SUPPLY
1	MAIN POWER	DPYC 2.5	–	1	YARD
2	ANODE CONNECTION CABLE	TPYC 4	–	2	YARD
3	ANODE CABLE TAIL	SPY 2.5	3	4	MAKER
4	EARTH RETURN	Y/G 3.5	0.5	2	MAKER
5	ALARM CABLE	DPYC 1.5	–	1	YARD

SYMBOL	DESCRIPTION	Q'TY	SUPPLY
	Cu(COPPER) ANODE ASS'Y	2	MAKER
	Al(ALUMINIUM) ANODE ASS'Y	2	MAKER
	PLUG & RECEPTACLE	2	MAKER
	CABLE GLAND TO SUIT YARD CABLE	4	MAKER

REV NO	DATE	MODIFICATION
0	JUL.03,98	ORIGINALLY PREPARED
HISTORY		

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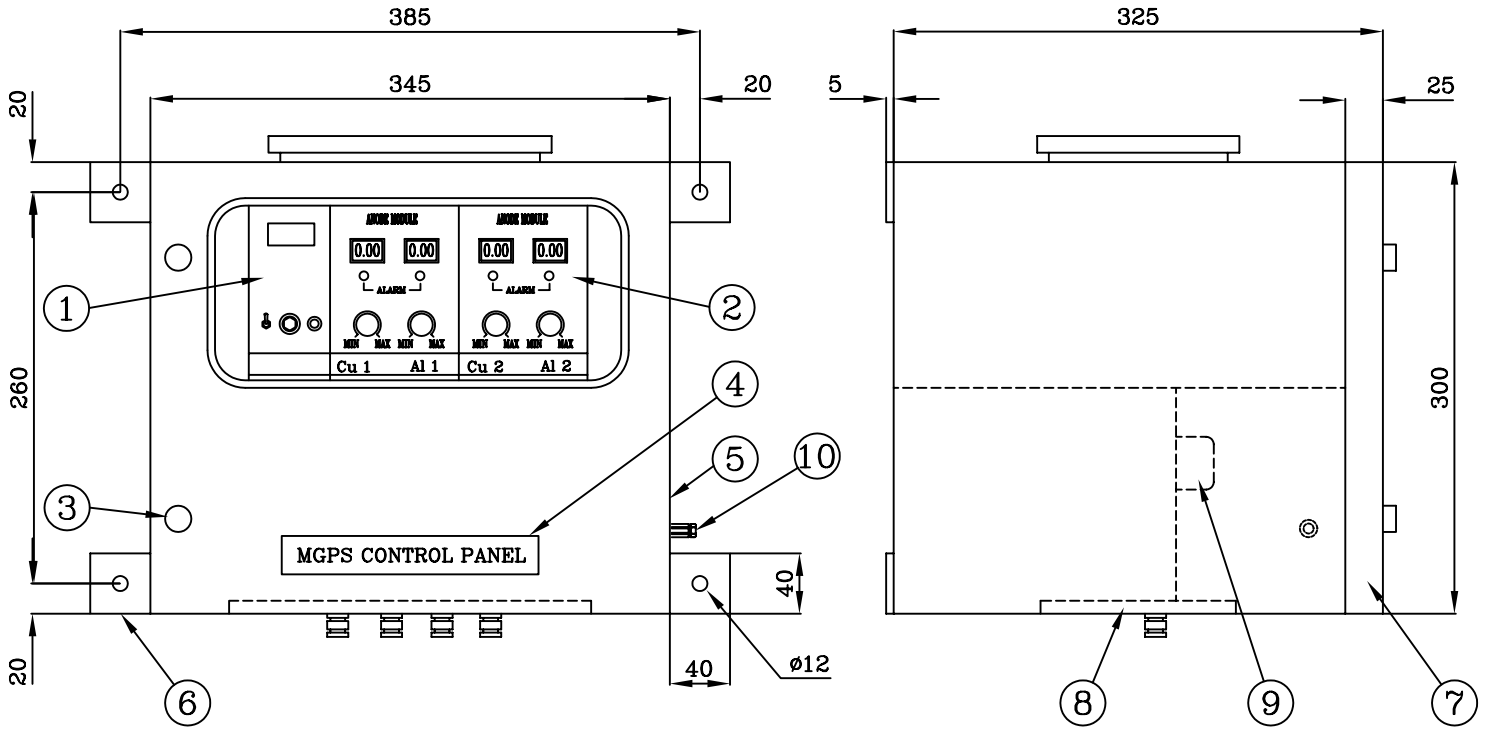
TITLE
SYSTEM WIRING DIAGRAM

REF.	DATE	SCALE
	JUL.03,98	N.S

DWN.	CHD.	APP.	DRG NO
HYL	SHJ	SHJ	MW50



SPECIFICATION	
PAINTING COLOR	RAL 7032
ENCLOSURE	I.P. 44
WEIGHT	20 KGS

No	ITEM
1	POWER MODULE
2	ANODE MODULE
3	LOCK
4	NAME PLATE
5	HINGE
6	MOUNTING BAR WITH HOLE FOR M10
7	DOOR
8	GLAND PLATE FITTED WITH CABLE GLANDS
9	TERMINAL BLOCK
10	EARTH BOLT

EARTH	11	
MAIN POWER	10	POWER INPUT AC 220V 60HZ 1PH
	9	
ALARM	8	TO ALARM SYSTEM NORMALLY CLOSED RELAY CONTACT
	7	
Al 2	6	CABLES FROM ANODES AND EARTH RETURNS BY CLIENT
Cu 2	5	
Al 1	4	
Cu 1	3	
EARTH RETURN	2	
	1	

WIRING CONNECTION
ON THE TERMINAL BLOCK

REV NO	DATE	HISTORY
0	DEC.26,97	ORIGINALLY PREPARED

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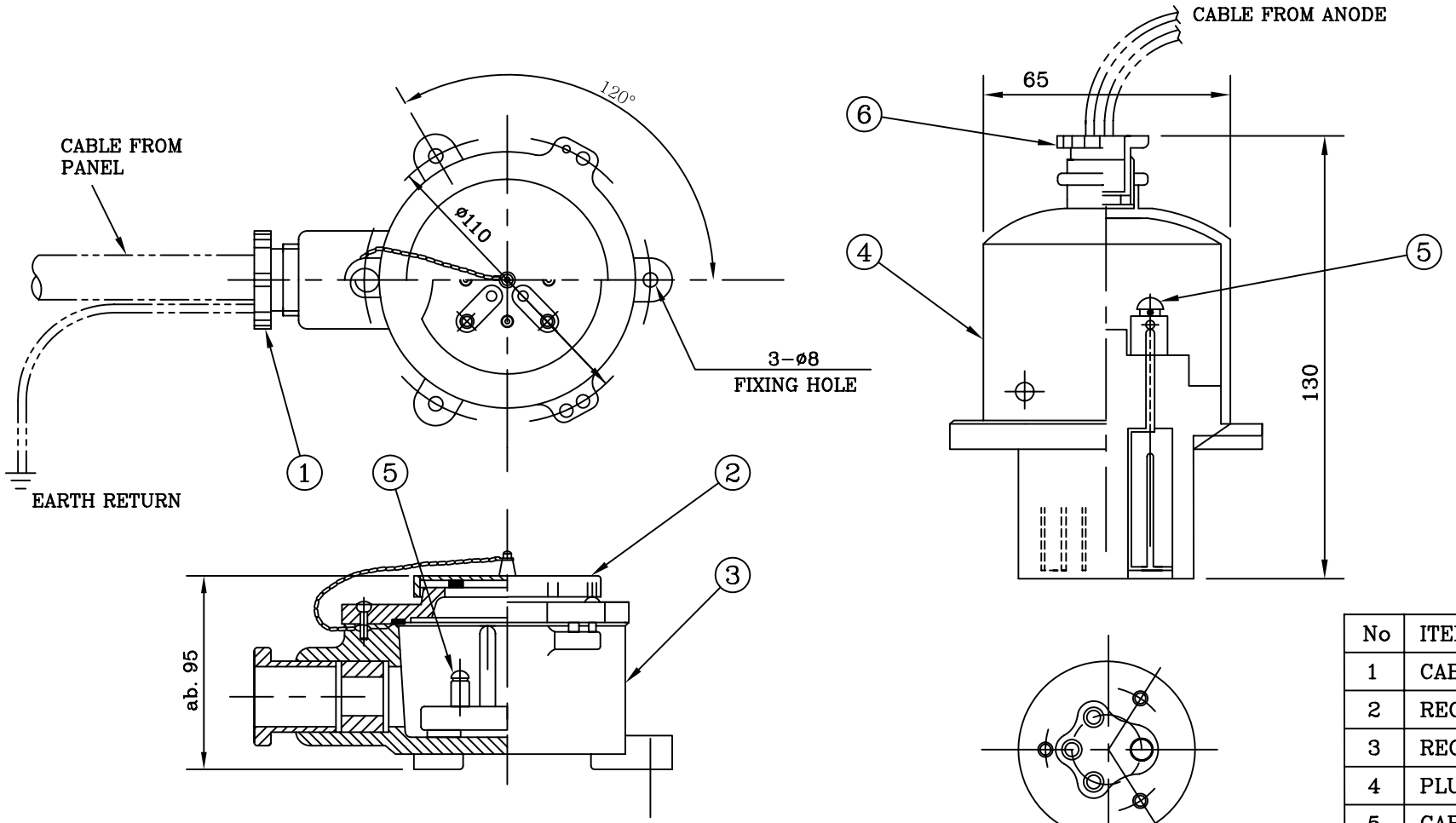
TITLE
MGPS CONTROL PANEL (KCAF3040)

REF.	DATE	SCALE
	DEC.26,97	N.S

DWN.	CHD.	APP.	DRG NO
HCK	SCO	SHJ	MCKC26



No	ITEM
1	CABLE GLAND JIS 25
2	RECEPTACLE LID
3	RECEPTACLE
4	PLUG
5	CABLE FIXING BOLT
6	CABLE GLAND JIS 20

3P + 1 EARTH

SPECIFICATION	
CAPACITY	MAX 250V, 30AMP
MATERIAL	CAST BRASS
FINISH COLOR	NATURAL
WEIGHT	2.0 KG
SUPPLY Q'TY	2 SETS PER SHIP
ENCLOSURE	IP 55

REV NO	DATE	MODIFICATION
2	JAN.17,05	EARTH CABLE POSITION REVISED
1	JUN.30,03	EARTH RETURN MENTIONED
0	NOV.10,97	ORIGINALLY PREPARED

HISTORY

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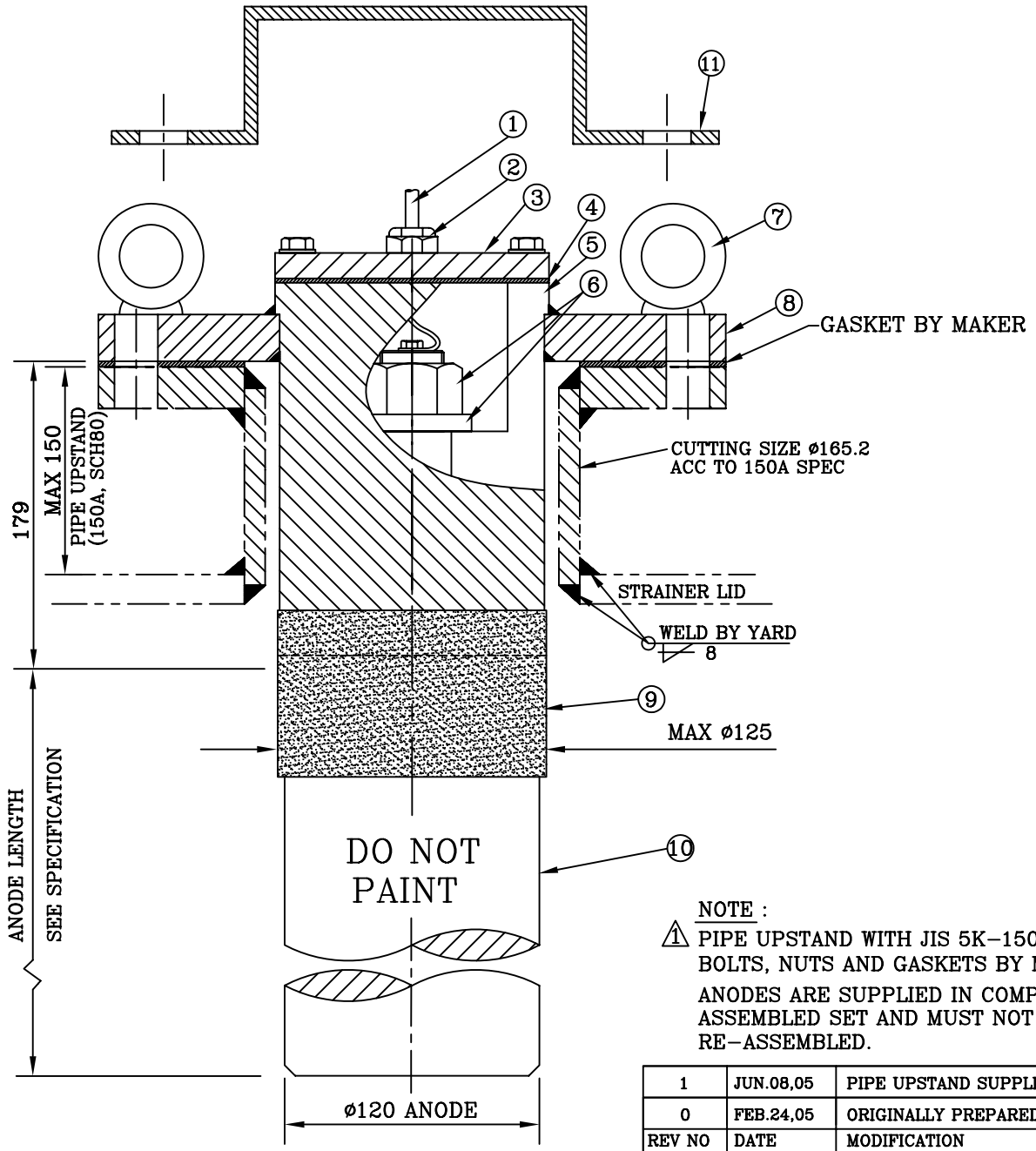
TITLE

PLUG & RECEPTACLE

REF.	DATE	SCALE
	NOV.10,97	N.S

DWN.	CHD.	APP.	DRG NO
HYL	SCO	SHJ	MJ05



SPECIFICATION		
ANODE TYPE	ANODE LENGTH	Q'TY
CU (Copper) ANODE ASS'Y FOR WORKING	780 mm	2
AL (Aluminium) ANODE ASS'Y FOR WORKING	780 mm	2
CU (Copper) ANODE ASS'Y FOR SPARE	780 mm	2
AL (Aluminium) ANODE ASS'Y FOR SPARE	780 mm	2

NO.	DESCRIPTION	Q'TY
1	ANODE CABLE	3m
2	CABLE GLAND	1
3	LID FOR MOUNTING SLEEVE	1
4	GASKET	1
5	MOUNTING SLEEVE	1
6	ANODE MOUNTING ACCESSORY	EACH 1
7	EYE BOLT FOR LIFTING	2
8	ANODE MOUNTING FLANGE JIS 5K–150A	1
9	TUBE	1
10	ANODE	AS PER SPEC
11	ANODE CABLE PROTECTION PLATE	1

NOTE :

⚠1 PIPE UPSTAND WITH JIS 5K–150A FLANGE, BOLTS, NUTS AND GASKETS BY MAKER.

ANODES ARE SUPPLIED IN COMPLETELY ASSEMBLED SET AND MUST NOT BE RE–ASSEMBLED.

REV NO	DATE	MODIFICATION
1	JUN.08,05	PIPE UPSTAND SUPPLIED BY MAKER
0	FEB.24,05	ORIGINALLY PREPARED

HISTORY

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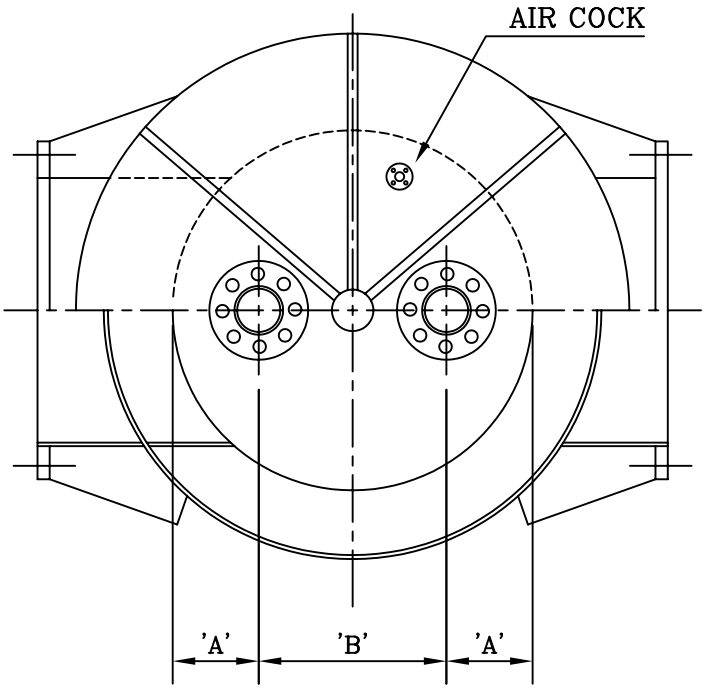
TITLE

DETAIL OF KB ANODE ASSEMBLY

REF.	DATE	SCALE
	FEB.24,05	N.S

DWN.	CHD.	APP.	DRG NO
SYH	SCO	SHJ	MAKB14



* SEE NOTE

NOTE :

CLIENT TO CHECK & ENSURE DIMENSION(MARKED 'A'&'B') FOR ANODE POSSESSION.

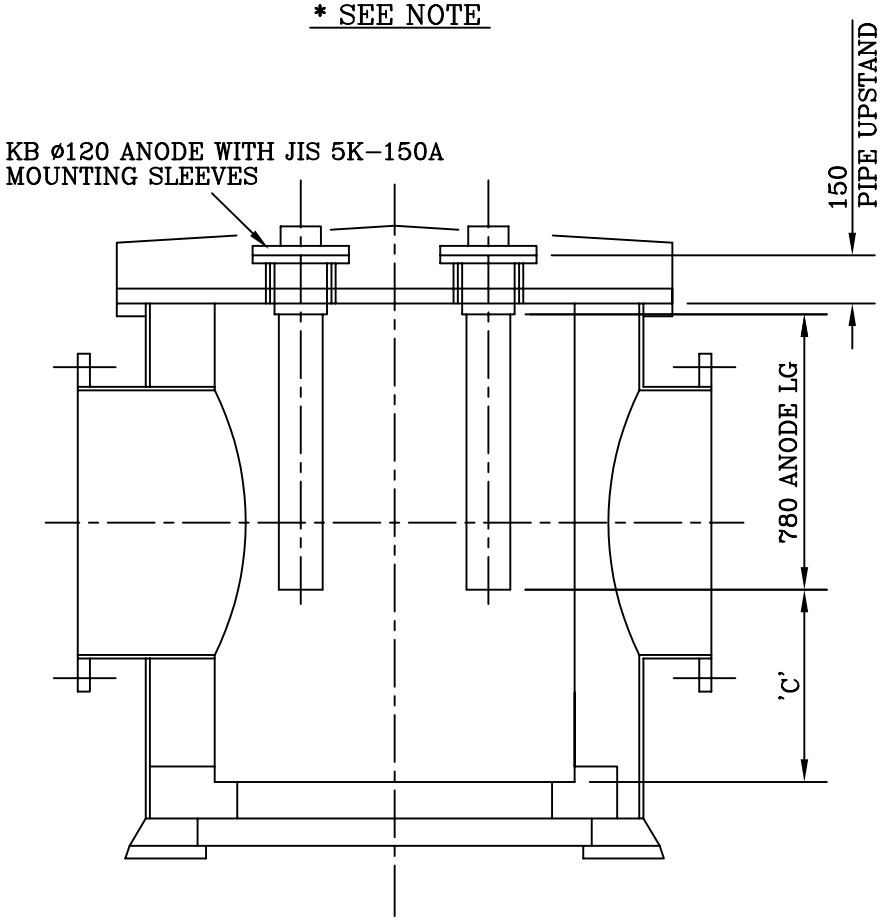
DIMENSION 'A'(ANODE CENTER & NEAREST STEEL) TO BE MIN 120mm.

DIMENSION 'B'(ANODE CENTER & ANODE CENTER) TO BE MIN 300mm.

DIMENSION "C"(ANODE EDGE & STRAINER INSIDE BOTTOM) TO BE MIN 100mm.

STRAINER FILTER TO BE ELECTRICALLY GROUNDING (BELOW THAN 4 OHM) TO STRAINER'S BODY

2 STRAINERS PER SHIP



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TITLE

ANODE POSITION IN JIS TYPE STRAINER

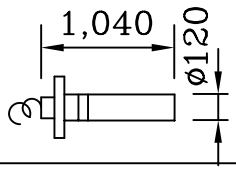
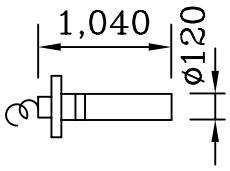
REV NO	DATE	MODIFICATION
0	NOV.11,98	ORIGINALLY PREPARED

HISTORY

CLIENT	DATE	SCALE
	NOV.11,98	N.S

DWN.	CHD.	APP.	DRG NO
HCK	SHJ	SHJ	MAPST02

PROJECT No. : PG 108/109 (35,000 DWT PRODUCT OIL/CHEMICAL TANKER)

No	NAME	TYPE	PART No	SUPPLY		REMARK
				WORKING	SPARE	
1	ANODE MODULE FUSE	5A	MAMF002	4	2	–
2	POWER MODULE FUSE	2.5A	MAMP001	1	2	–
3	LED	ø6 X 12	MMLED02	1	1	–
4	Cu (COPPER) ANODE ASS'Y		KBCU 780	2	2	100.3/EA INCL. MOUNTING SLEEVE
5	Al (ALUMINIUM) ANODE ASS'Y		KBAL 780	2	2	46.2/EA INCL. MOUNTING SLEEVE

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TITLE
SPARE PARTS LIST

REV NO	DATE	MODIFICATION
0	JAN.07,91	ORIGINALLY PREPARED

HISTORY

REF.	DATE	SCALE
	JAN.07,91	N.S

DWN.	CHD.	APP.	DRG NO
HYL	SHJ	SHJ	MSPR07-1