Azienda Chimica Genovese
ACG ITALY

Since 1947…

MARIMPRESS ICCP

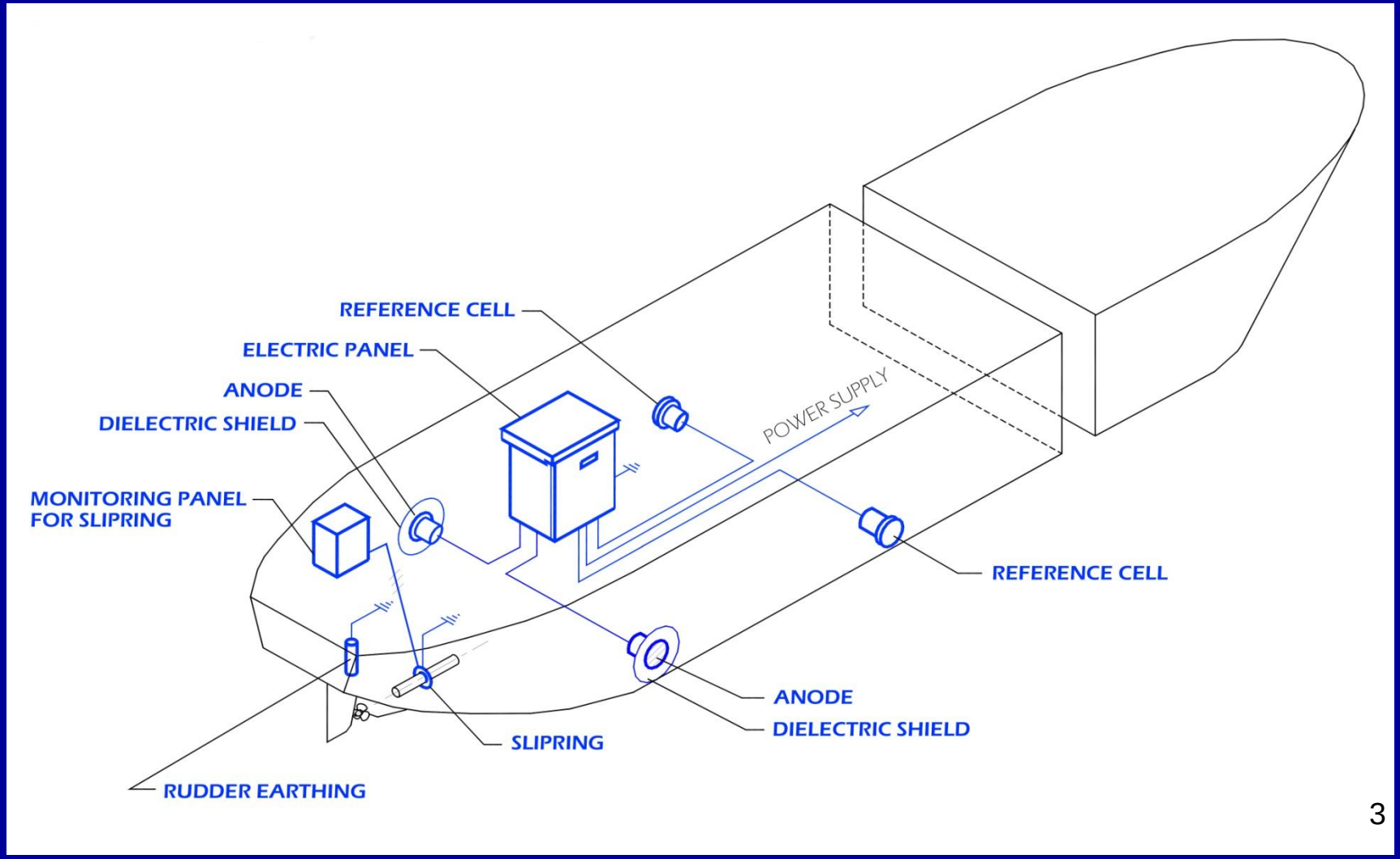
- MARIMPRESS impressed current cathodic protection system (ICCP) is used to protect ships' hulls, floating dry-docks, oil-rigs and other submerged steel structures from corrosion.

  The system operates by continually measuring the potential of the submerged steel surface using hull-mounted Zinc reference electrodes.
- If this potential starts to rise above the preset value (+220mV for steel hulls - at higher potentials corrosion will occur), the rectifier supplies the correct amount of DC current to hull-mounted activated Titanium anodes needed to maintain the preset value. In this way, not only the hull, but when earthed also the rudder, propeller, shaft and stabiliser fins are completely protected from corrosion.

  This system uses Titanium MMO coated anodes as opposed to sacrificial Zinc or Aluminium anodes, which last longer and cost less to replace.
- It also adjusts automatically to cope with changes in temperature and salinity of seawater, ships velocity or condition of the paintwork, all of which affect the rate of corrosion.

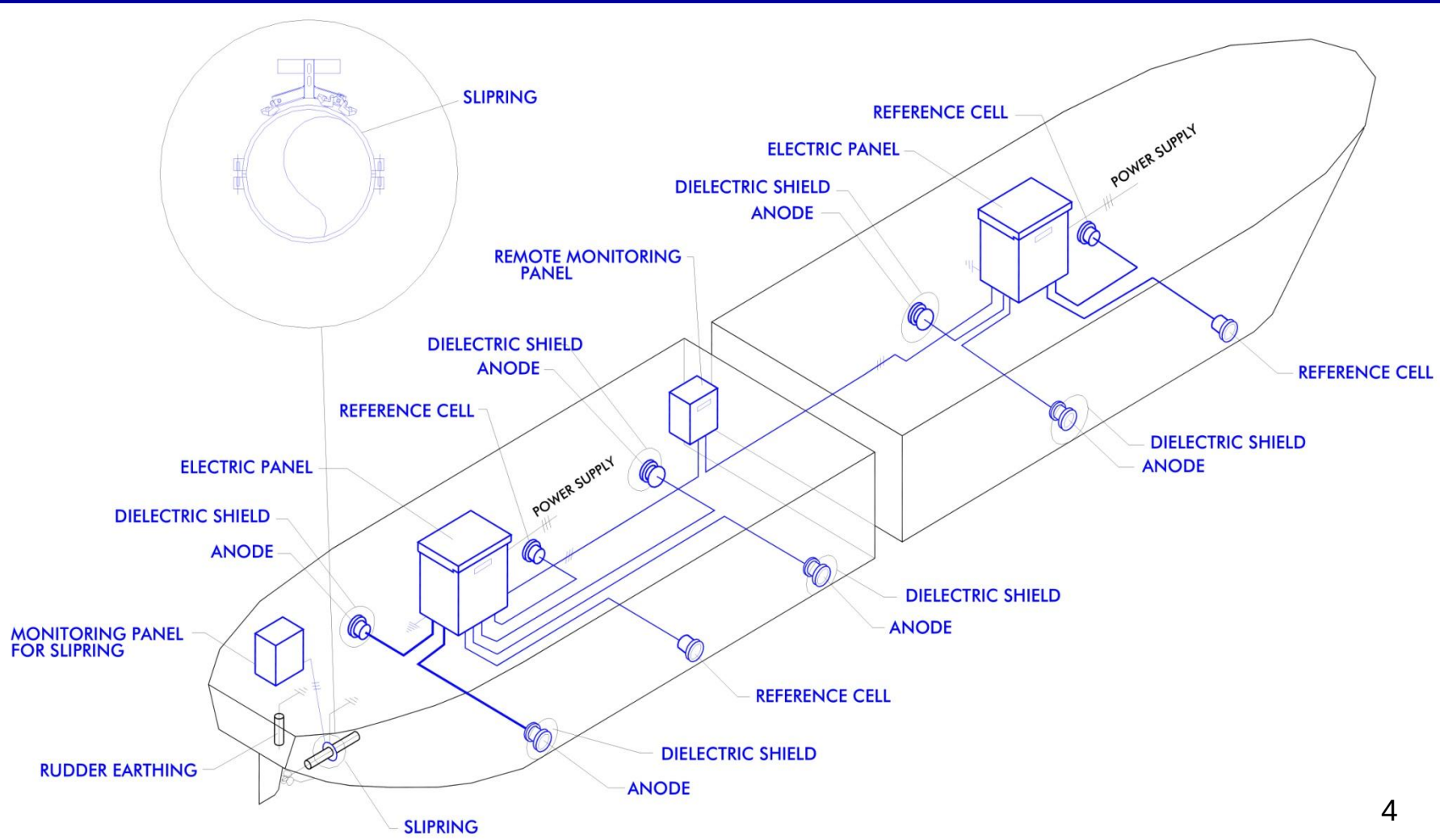
Schematic Diagram Configuration n. 1

Configuration for a ship with length <180 m



Schematic Diagram Configuration n. 2

Configuration for a ship with length >180 m



Hardware Configuration n. 1

- The system consists at least of three main parts :
- Control panel (located in the engine room)
- Titanium anodes (located strategically on the hull)
- Zinc reference cells (located on the hull)
- The zinc reference cells continually measure the potential of the submerged steel surface, feeding measurements back to the control panel, which uses solid state technology to automatically calculate the correct compensating current to be output by the activated titanium anodes which are strategically positioned on the surface.
- The anodes polarise cathodically the surface thus protecting it from corrosion.
- Shaft Earthing Device : It is also possible to protect the ship's propeller shaft axle by short-circuiting it using a ring (slip-ring) and Silver/Graphite brushes. Similarly it is possible to protect the rudder and any other appendages by earthing them.
-

Hardware Configuration n. 2

- The system consists of two MARIMPRESS System:
- At Forward:
- Control panel (located in the engine room)
- Titanium anodes (located strategically on the hull)
- Zinc reference cells (located on the hull)
- The zinc reference cells continually measure the potential of the submerged steel surface, feeding measurements back to the control panel, which uses solid state technology to automatically calculate the correct compensating current to be output by the activated titanium anodes which are strategically positioned on the surface.
- The anodes polarise cathodically the surface thus protecting it from corrosion.
  At After: the same system as aforesaid
- No 1 Remote Control Panel connected to FWD and AFT System
- Shaft Earthing Device : It is also possible to protect the ship's propeller shaft axle by short-circuiting it using a ring (slip-ring) and Silver/Graphite brushes. Similarly it is possible to protect the rudder and any other appendages by earthing them.

Benefits of Marimpress

- provides total corrosion protection for ships' hulls, rudder and propeller shaft
- low running costs
- fully automatic, no manual intervention required
- titanium anodes have a long life
- safe and ecological

Cost savings for the ship owner

- extends the periods between dry-dockings
- extends life of hull, rudder and propeller shaft
- increases life of paint
- Titanium anodes have longer life and cost less to replace than sacrificial anodes
- reduces fuel consumption
- runs maintenance free for years

Theory of Cathodic Protection

- The aim of cathodic protection is to polarise cathodically the surface to be protected, the ship, using various types of anodes. The current output by the anodes counteracts the corrosion current.
- There is only one way to check the condition of the immersed hull; that is to measure the potential on the hull using a probe (reference cell).
- The reference cell can be made of Zn or Ag/AgCl.
- Zinc is used for the cathodic protection of hulls whose projected potential is not more than +450 mV. A hull is protected if its potential lies between +220 and +250 mV.
- If the hull's potential falls below +10 mV, then the hull becomes over-protected which can cause problems with the paintwork.
- It is very important therefore not only that the hull doesn't become under-protected, but also that it doesn't become over-protected.
- There are two main types of cathodic protection: see the next slides.

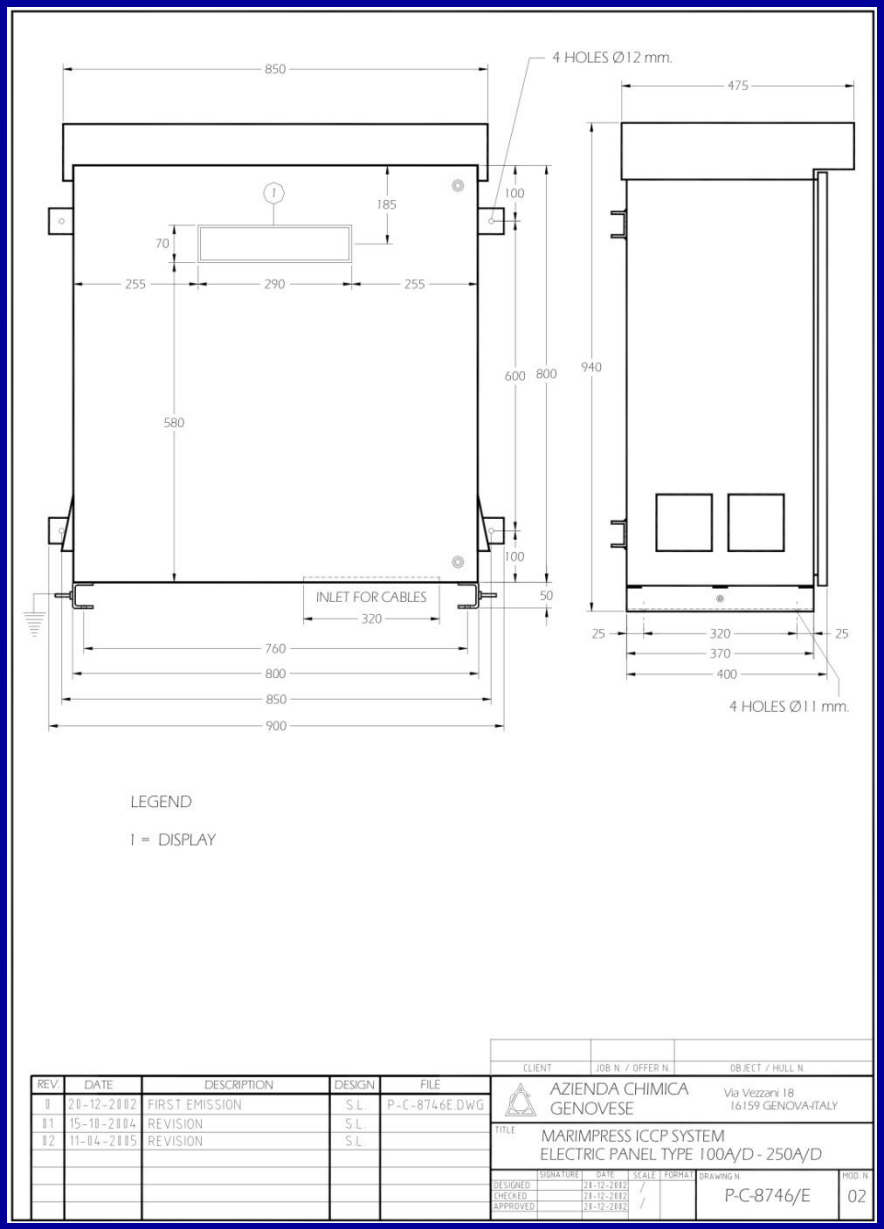
Impressed Current (ICCP)

- The impressed current systems are based on the continual measurement of the potential on the hull using Zinc (or Ag/AgCl) reference cells, which regulate the amount of compensating current output by the permanently activated titanium anodes. The anodes are strategically positioned on the hull in order to provide optimum and total hull protection. The reference cells are positioned on both sides of the hull.
- The electric cabinet can output up to 20 Vdc allowing for impressed currents tens of times greater than that available with sacrificial anodes, and as such can cope with the full range of possible hull potentials.
- The ideal potential (OFFSET) is set to +220 mV for steel hulls and any deviation from this potential is immediately corrected by automatically outputting an impressed current. In this way the potential on the hull is maintained as near as possible to the ideal value under which the hull is immune from corrosion.
- It is also possible to protect the ship's propeller shaft axle by short-circuiting it using a ring (slip-ring) and Silver/Graphite brushes. Similarly it is possible to protect the rudder and any other appendages by earthing them.

Sacrificial Anodes

- The sacrificial anodes consist of a material less noble than the hull, which they protect.
- They are connected directly (shorted) to the hull. They are called sacrificial anodes because they are consumed by the heavy action of protecting the hull.
- The intensity of the current they produce for the protection of the hull is proportional to the rate that they are consumed.
- For the protection of steel hulls in seawater Zinc anodes are most commonly used. Because the anode potential between Zinc and the hull is only 0.5 Vdc, the maximum current output depends on the size of the anode.
- A certain number of zinc anodes are fixed to the hull especially near the stern.
- The current output by Zinc anodes cannot be controlled or regulated automatically.
- The system will not automatically respond to the continuous variations in current demand due to different situations (e.g. ship speed, sea water temperature/salinity, etc.)
- Zinc anodes are consumed during the protection process and must therefore be renewed on a regular basis (every dry-docking).

MARIMPRESS ICCP SYSTEM – ELECTRIC PANEL TYPE 100A / 400A



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	20-12-2002	FIRST EMISSION	S.L.	P-C-8746E.DWG
01	15-10-2004	REVISION	S.L.	
02	11-04-2005	REVISION	S.L.	

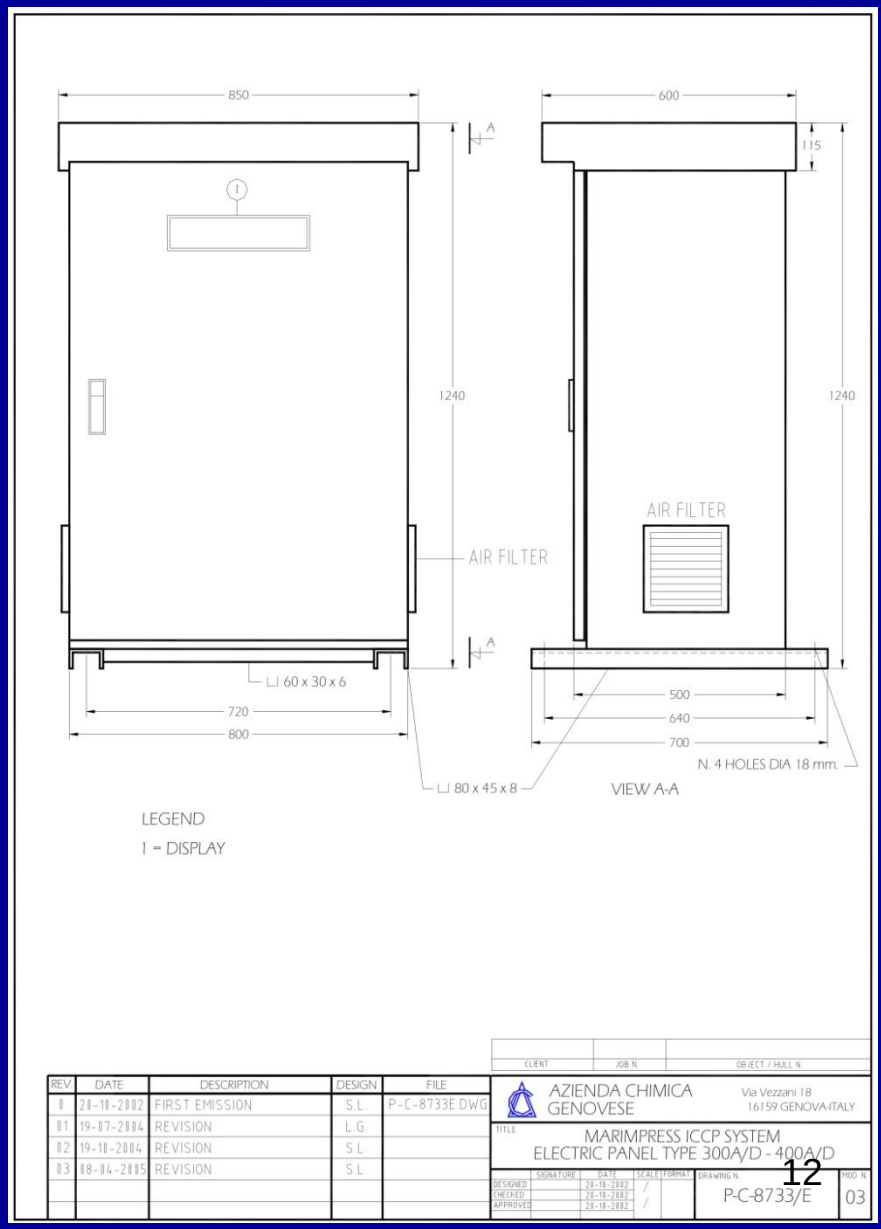
CLIENT | JOB N. / OFFER N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE — Via Vezzani 18, 16159 GENOVA-ITALY

TITLE: MARIMPRESS ICCP SYSTEM
ELECTRIC PANEL TYPE 100A/D - 250A/D

	SIGNATURE	DATE	SCALE	FORMAT
DESIGNED		21-12-2002	/	
CHECKED		21-12-2002	/	
APPROVED		21-12-2002		

DRAWING N. P-C-8746/E — MOD. N. 02



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	20-10-2002	FIRST EMISSION	S.L.	P-C-8733E.DWG
01	19-07-2004	REVISION	L.G.	
02	19-10-2004	REVISION	S.L.	
03	18-04-2005	REVISION	S.L.	

CLIENT | JOB N. | OBJECT / HULL N.

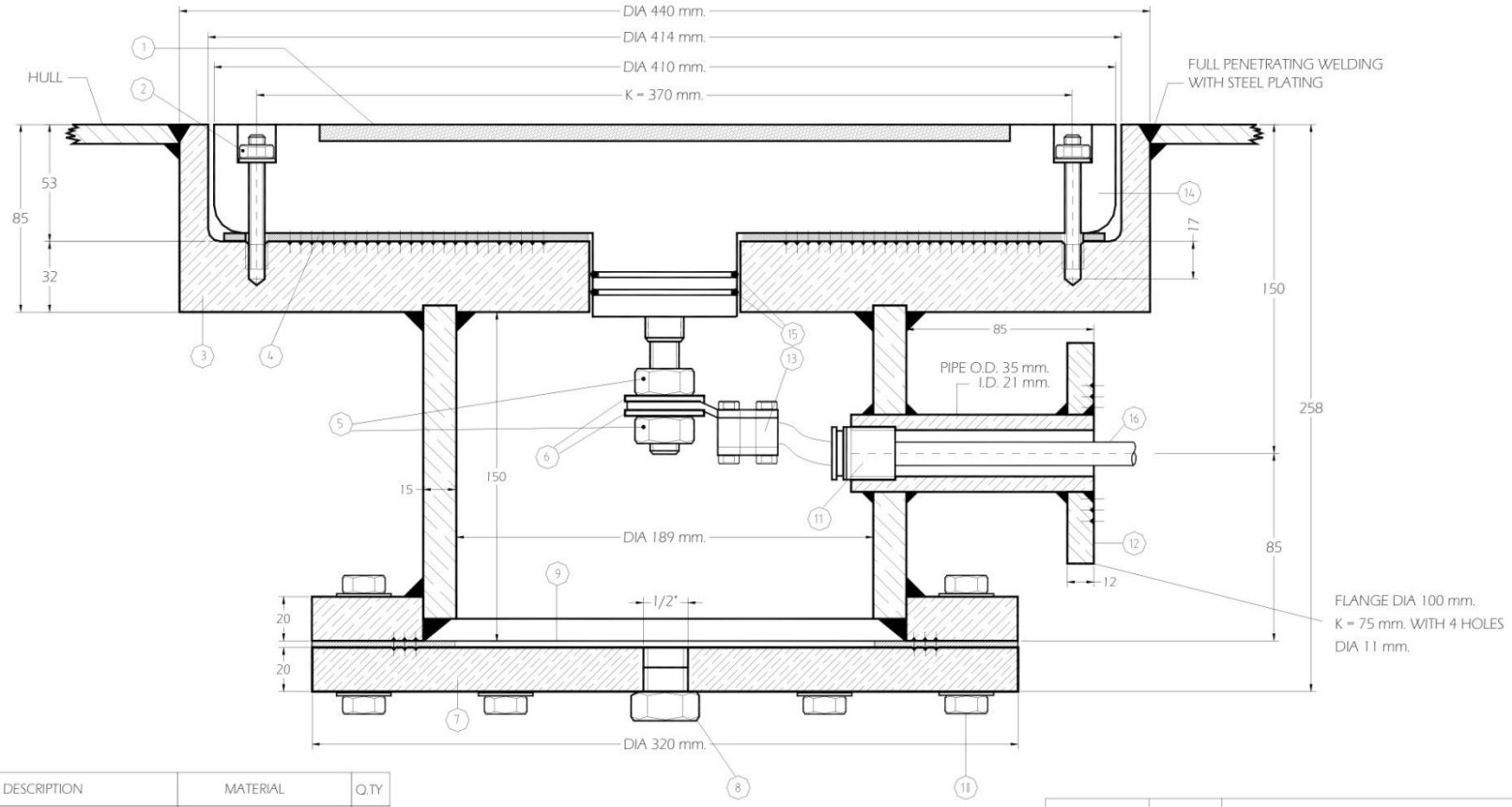
AZIENDA CHIMICA GENOVESE — Via Vezzani 18, 16159 GENOVA-ITALY

TITLE: MARIMPRESS ICCP SYSTEM
ELECTRIC PANEL TYPE 300A/D - 400A/D

	SIGNATURE	DATE	SCALE	FORMAT
DESIGNED		20-10-2002	/	
CHECKED		20-10-2002	/	
APPROVED		20-10-2002		

DRAWING N. P-C-8733/E — MOD. N. 03

MARIMPRESS ICCP SYSTEM – ANODE TYPE 75A/100A



POS.	DESCRIPTION	MATERIAL	Q.TY
1	ANODE	ACTIVATED TITANIUM	1
2	FIXING M10 x 50 ANODE STUDS	INOX	12
3	COFFERDAM	GRADE A	1
4	GASKET	RUBBER	1
5	M14 NUT	BRASS	2
6	WASHER	BRASS	2
7	COVER	STEEL	1
8	1/2" INSPECTION CAP	STEEL	1
9	GASKET	RUBBER	1
10	M16 x 70 FIXING COVER STUDS	INOX	8
11	CABLE GLAND	BRASS	1
12	FLANGE	STEEL	1
13	LUG	BRASS	1
14	ISOLATING HEAD	PVC	1
15	O-RING	RUBBER	2
16	ELECTRIC CABLE		1

REV	DATE	DESCRIPTION	DESIGN	FILE
0	13-09-1996	FIRST EMISSION	S.F.	P-C-2412.DWG
01	20-01-1997	REVISION DIMENSIONS	S.F.	
02	16-07-1997	REVISION DIMENSIONS	S.F.	
03	29-07-1997	REVISION DIMENSIONS	S.F.	
04	30-10-1997	REVISION DIMENSIONS	S.F.	
05	20-12-1997	REVISION DIMENSIONS	S.F.	
06	20-01-1998	REVISION DIMENSIONS	S.L.	
07	10-03-1998	REVISION DIMENSIONS	S.L.	
08	19-07-2000	REVISION DIMENSIONS	S.L.	
09	19-03-2001	REVISION DIMENSIONS	S.L.	
10	21-09-2001	REVISION WELDINGS	S.L.	
11	11-10-2007	REVISION LEGEND	S.L.	
12	30-10-2007	REVISION (CHANGE DESCRIPTION LEGEND)	S.L.	
13	30-11-2007	REVISION (CHANGE LEGEND & WELDINGS)	S.L.	

CLIENT | JOB N. | OBJECT / HULL N.

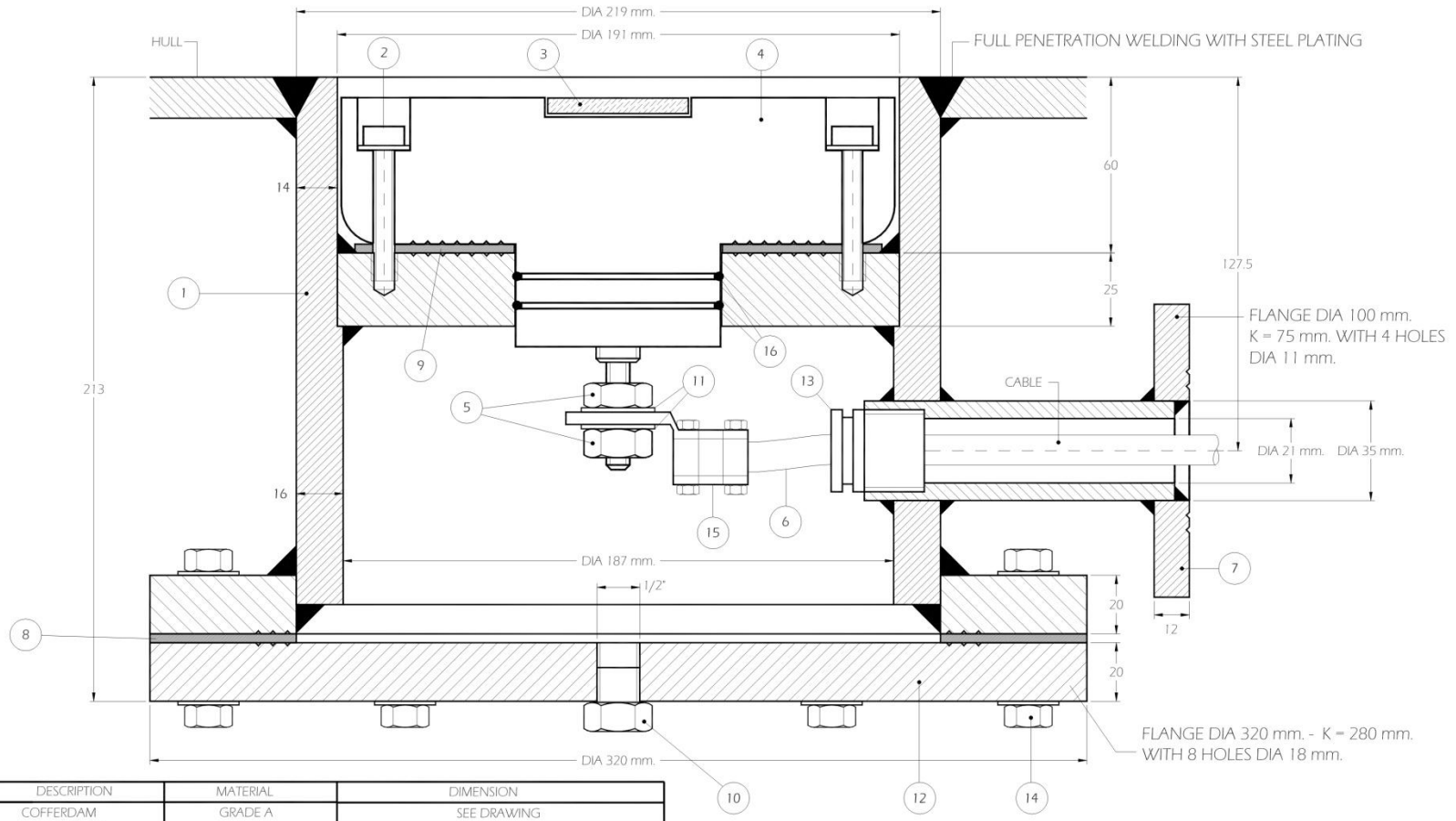
AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE
MARIMPRESS ICCP SYSTEM
ANODE TYPE 75A / 100A - ASSEMBLY

	SIGNATURE	DATE	SCALE	FORMAT
DESIGNED		13-09-1996	/	
CHECKED		13-09-1996	/	
APPROVED		13-09-1996		

DRAWING N. P-C-2412 | MOD. N. 13

MARIMPRESS ICCP SYSTEM – REFERENCE CELL



POS.	Q.	DESCRIPTION	MATERIAL	DIMENSION
1	1	COFFERDAM	GRADE A	SEE DRAWING
2	6	FIXING BOLTS	STAINLESS STEEL	M8 x 45
3	1	REFERENCE CELL	ZINC	Diam.48 mm. H= 70 mm.
4	1	HEAD	PVC	Diam.: 190 mm.
5	2	NUT	BRASS	M8
6	1	CABLE	COPPER	2 x 2.5 mm^2 SHIELDED
7	1	CABLE FLANGE	STEEL	DIA ext.: 100 mm. K = 75 mm. with 4 holes DIA 11 mm.
8	1	GASKET	RUBBER	Diam.ext.= 315 mm. Diam.int. = 190 mm. Thick = 3 mm.
9	1	GASKET	RUBBER	Diam.ext.=180 mm. Diam.int. = 71 mm.Thick. = 3 mm.
10	1	INSPECTION CAP	STEEL	1/2"
11	2	WASHER	BRASS	DIAM.= 14 mm.
12	1	COVER	STEEL	DIA.=320 mm. K = 280 mm. WITH 8 HOLES DIA.= 18 mm.
13	1	CABLE GLAND	BRASS	3/4"
14	8	FIXING COVER STUDS	STAINLESS STEEL	M16 x 70
15	1	LUG	BRASS	
16	2	O-RING	RUBBER	

REV.	DATE	DESCRIPTION	DESIGN	FILE
0	09/97	FIRST EMISSION	S.F.	P-C-2442.DWG
01	10/97	DIMENSION REVISION	S.F.	
02	11/97	rev.dim.cover - high cofferdam	S.F.	
03	12/97	REMOVED HOLES OF FLANGE	S.F.	
04	03/98	DIMENSION REVISION	S.L.	
05	27-04-1999	REVISION	S.L.	
06	11-07-2000	REVISION	S.L.	
07	21-09-2001	REVISION	S.L.	
08	15-02-2005	REVISION	S.L.	
09	17-01-2007	REVISION COMPONENT LIST	S.L.	
10	30-10-2007	REVISION COMPONENT LIST	S.L.	
11	25-03-2008	REVISION (CHANGE HULL WELDINGS)	S.L.	
12	10-04-2008	REVISION (CHANGE PVC HEAD FIXING BOLTS)	S.L.	

CLIENT	JOB N.	OBJECT

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE

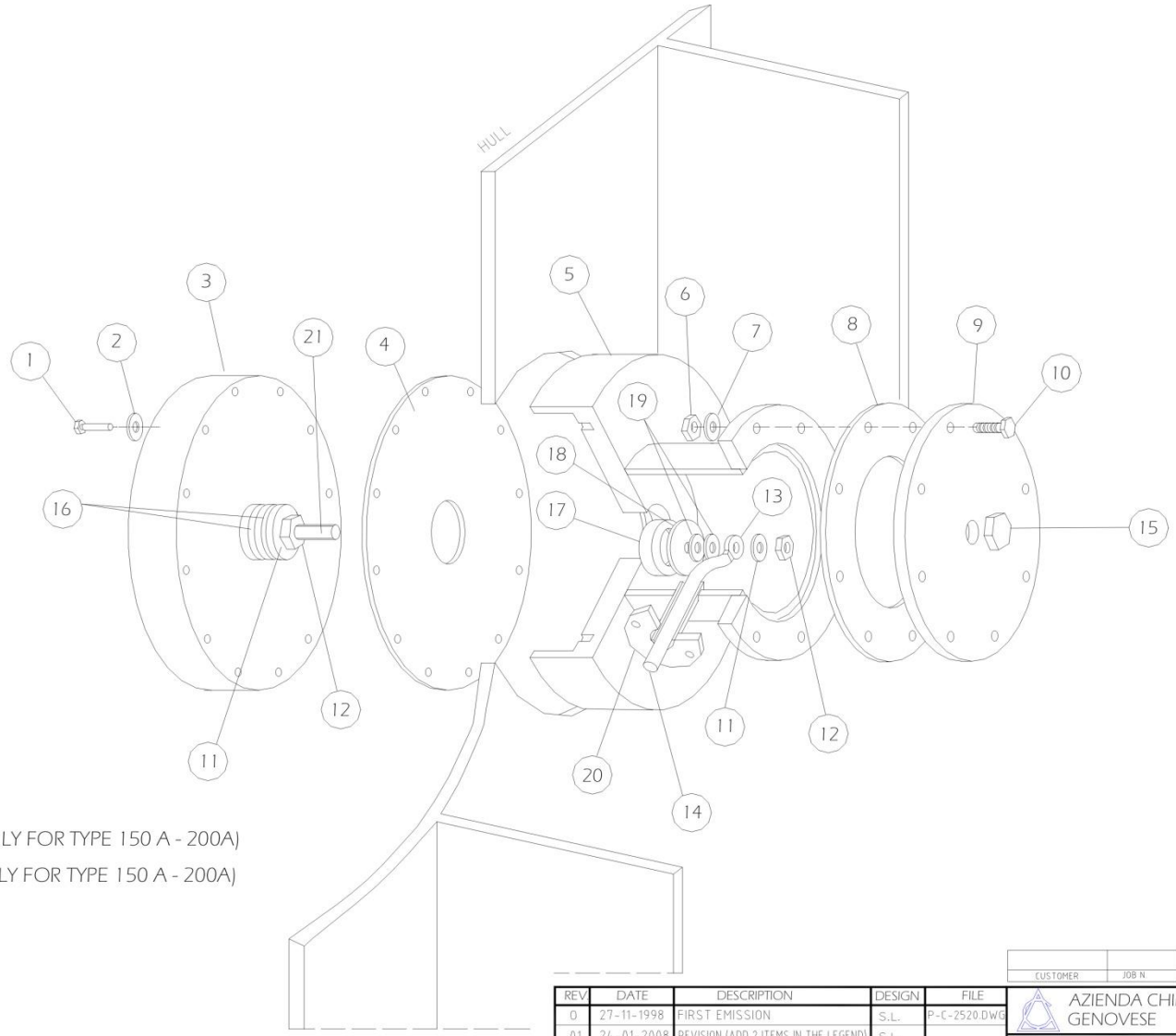
MARIMPRESS ICCP SYSTEM
REFERENCE CELL WITH FLANGED PIPE

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		20-09-1997	/		P-C-2442	12
CHECKED		20-09-1997				
APPROVED		20-09-1997	/			

MARIMPRESS ICCP SYSTEM – ANODE ASSEMBLY

LEGEND

1 = BOLT
2 = WASHER
3 = ANODE
4 = RUBBER GASKET
5 = COFFERDAM
6 = NUT
7 = WASHER
8 = GASKET
9 = COVER
10 = BOLT
11 = WASHER
12 = NUT
13 = CABLE LUG
14 = CABLE
15 = TAP
16 = ORING
17 = PVC SLEEVE (ONLY FOR TYPE 150 A - 200A)
18 = SS WASHER (ONLY FOR TYPE 150 A - 200A)
19 = 2 WASHER
20 = CABLE FLANGE
21 = DISK ROD



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	27-11-1998	FIRST EMISSION	S.L.	P-C-2520.DWG
01	24-01-2008	REVISION (ADD 2 ITEMS IN THE LEGEND)	S.L.	

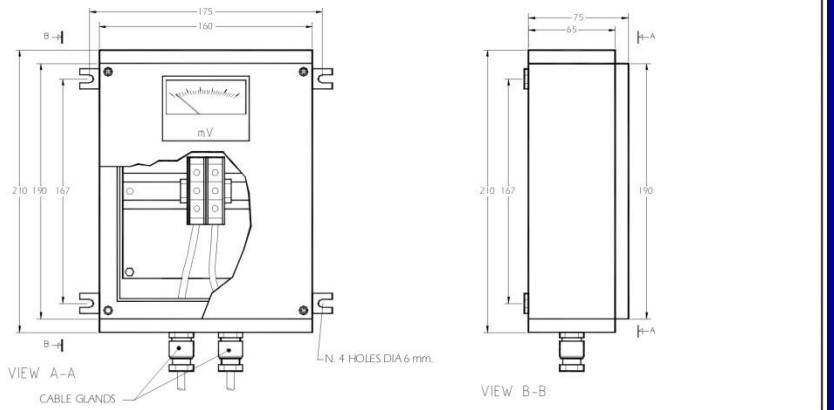
CUSTOMER	JOB N.	OBJECT / HULL

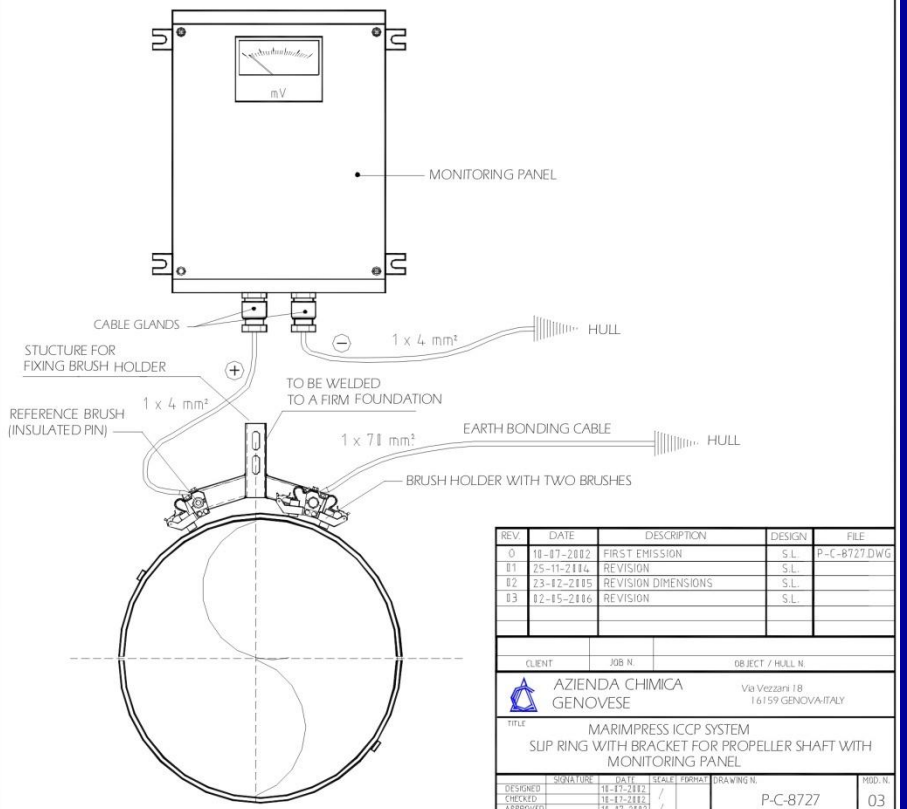
AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: MARIMPRESS ICCP - ANODE ASSEMBLY

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD.
DESIGNED		27-11-1998	/		P-C-2520	01
CHECKED		27-11-1998	/			
APPROVED		27-11-1998				

MARIMPRESS ICCP SYSTEM – SLIPRING ARRANGEMENT





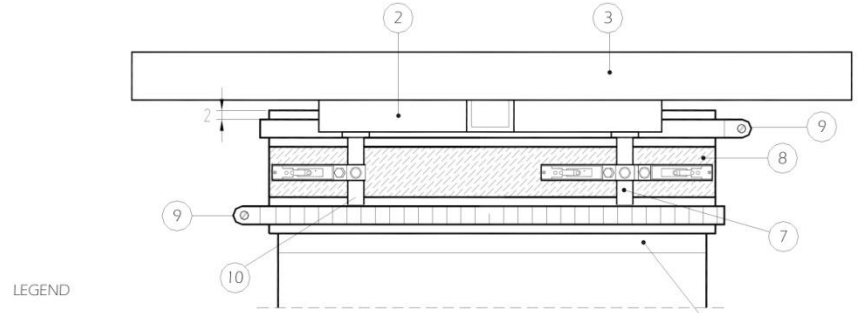
REV.	DATE	DESCRIPTION	DESIGN	FILE
0	10-07-2002	FIRST EMISSION	S.L.	P-C-8727.DWG
01	25-11-2004	REVISION	S.L.	
02	23-02-2005	REVISION DIMENSIONS	S.L.	
03	02-05-2006	REVISION	S.L.	

CLIENT | JOB N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE
MARIMPRESS ICCP SYSTEM
SLIP RING WITH BRACKET FOR PROPELLER SHAFT WITH MONITORING PANEL

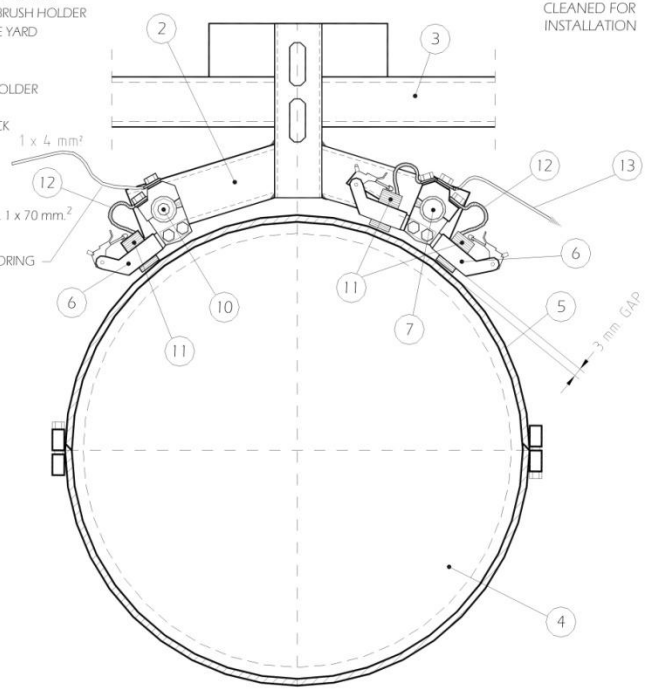
	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		10-07-2002	/		P-C-8727	03
CHECKED		10-07-2002	/			
APPROVED		10-07-2002	/			



LEGEND

1 = SHAFT MONITORING BRUSH HOLDER
2 = "Y" STRUCTURE FOR FIXING BRUSH HOLDER
3 = TO BE MOUNTING FOR THE YARD
4 = INTERMEDIATE SHAFT
5 = SLIPRING ASSEMBLY
6 = SHAFT EARTHING BRUSH HOLDER
7 = FIXING STUD
8 = SILVER PLATED BRUSH TRACK
9 = STAINLESS STEEL BAND
10 = ISOLATED PIN
11 = BRUSH
12 = BRUSH COPPER BRAID
13 = EARTHED CABLE TERMINAL 1 x 70 mm.²

130 mm. AREA TO BE CLEANED FOR INSTALLATION



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	20-10-2001	FIRST EMISSION	S.L.	P-C-8705.DWG

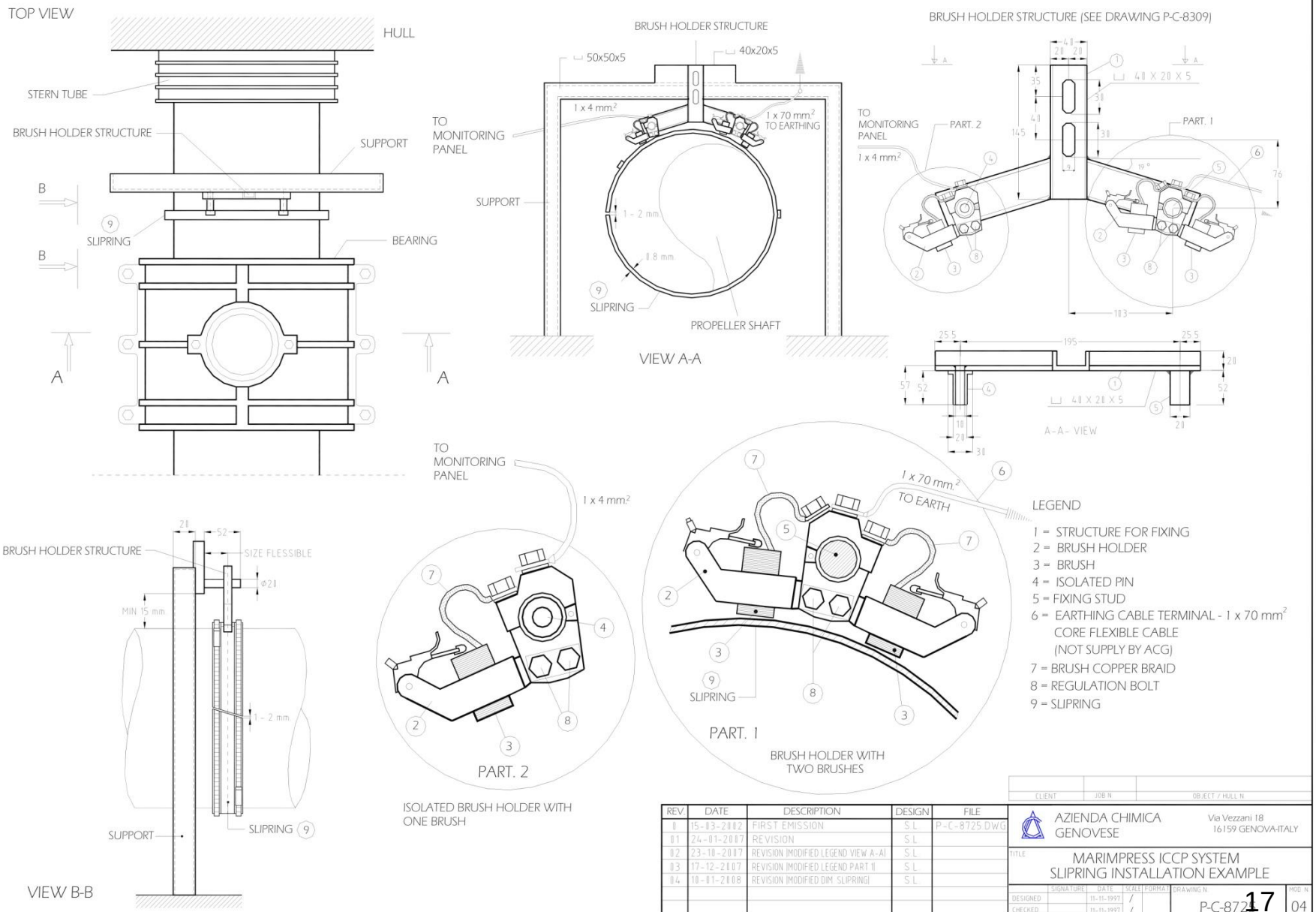
CLIENT | JOB NO. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE
MARIMPRESS ICCP SYSTEM
SLIPRING GENERAL ARRANGEMENT OF SHAFT EARTHING DEVICE

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		20-10-2001	/		P-C-8705	0
CHECKED		20-10-2001	/			
APPROVED		20-10-2001	/			

MARIMPRESS ICCP SYSTEM – SLIPRING INSTALLATION EXAMPLE



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	15-03-2002	FIRST EMISSION	S.L.	P-C-8725.DWG
01	24-01-2007	REVISION	S.L.	
02	23-10-2007	REVISION (MODIFIED LEGEND VIEW A-A)	S.L.	
03	17-12-2007	REVISION (MODIFIED LEGEND PART 1)	S.L.	
04	18-01-2008	REVISION (MODIFIED DIM. SLIPRING)	S.L.	

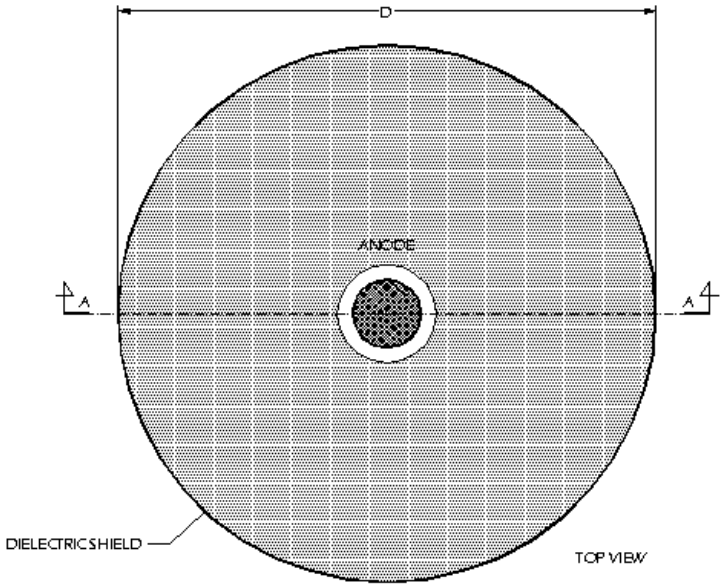
CLIENT | JOB N. | OBJECT / HULL N.

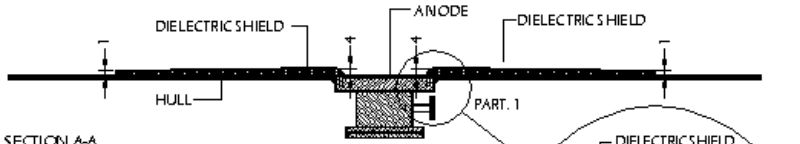
AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: MARIMPRESS ICCP SYSTEM SLIPRING INSTALLATION EXAMPLE

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		11-11-1997	/		P-C-8725	04
CHECKED		11-11-1997	/			
APPROVED		11-11-1997				

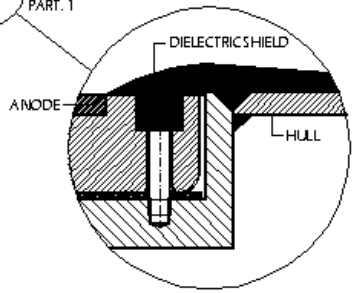
MARIMPRESS ICCP SYSTEM – DIELECTRIC SHIELD





SECTION A-A

ANODE TYPE	DIELECTRIC SHIELD DIAMETER (D)	QUANTITIES Lt / ANODE
20A	0.8 mt.	4 lt.
25A	0.8 mt.	4 lt.
50A	1 mt.	8 lt.
75A	2 mt.	16 lt.
100A	2 mt.	16 lt.
125A	3 mt.	24 lt.
150A	3 mt.	24 lt.
200A	3 mt.	24 lt.



CLIENT	JOB N.	OBJECT / HULL N.

REV.	DATE	DESCRIPTION	DESIGN	FILE
0	10-01-1998	FIRST EMISSION	S.F.	P-C-2461E.DWG
1	21-05-1998	REVISION	S.F.	
2	26-07-1999	REVISION	S.L.	
3	21-04-2001	REVISION	S.L.	
4	13-03-2001	REVISION	S.L.	
5	19-03-2001	REVISION	S.L.	
6	15-11-2003	REVISION	S.L.	
7	10-02-2015	REVISION	S.L.	
8	19-09-2019	REVISION (MOD. FIXING COVER BOLT)	S.L.	

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE
MARIMPRESS ICCP SYSTEM
DIELECTRIC SHIELD

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		10-1-1998	/		P-C-2461/E	08
CHECKED		10-1-1998	/			
APPROVED		10-1-1998	/			

MARIMPRESS ICCP SYSTEM – ANODE TYPE 100A INSTALLED

MARIMPRESS ICCP SYSTEM – ANODE TYPE 250A INSTALLED

MARIMPRESS ICCP SYSTEM – REFERENCE CELL INSTALLED

MARIMPRESS ICCP SYSTEM – ELECTRIC PANEL TYPE 300A / 500A

MARIMPRESS ICCP SYSTEM – SLIPRING EXAMPLE INSTALLATION

MARIMPRESS ICCP SYSTEM – DIELECTRIC SHIELD