Azienda Chimica Genovese
ACG ITALY

Since 1947…

ECOLCELL R (MGPS)

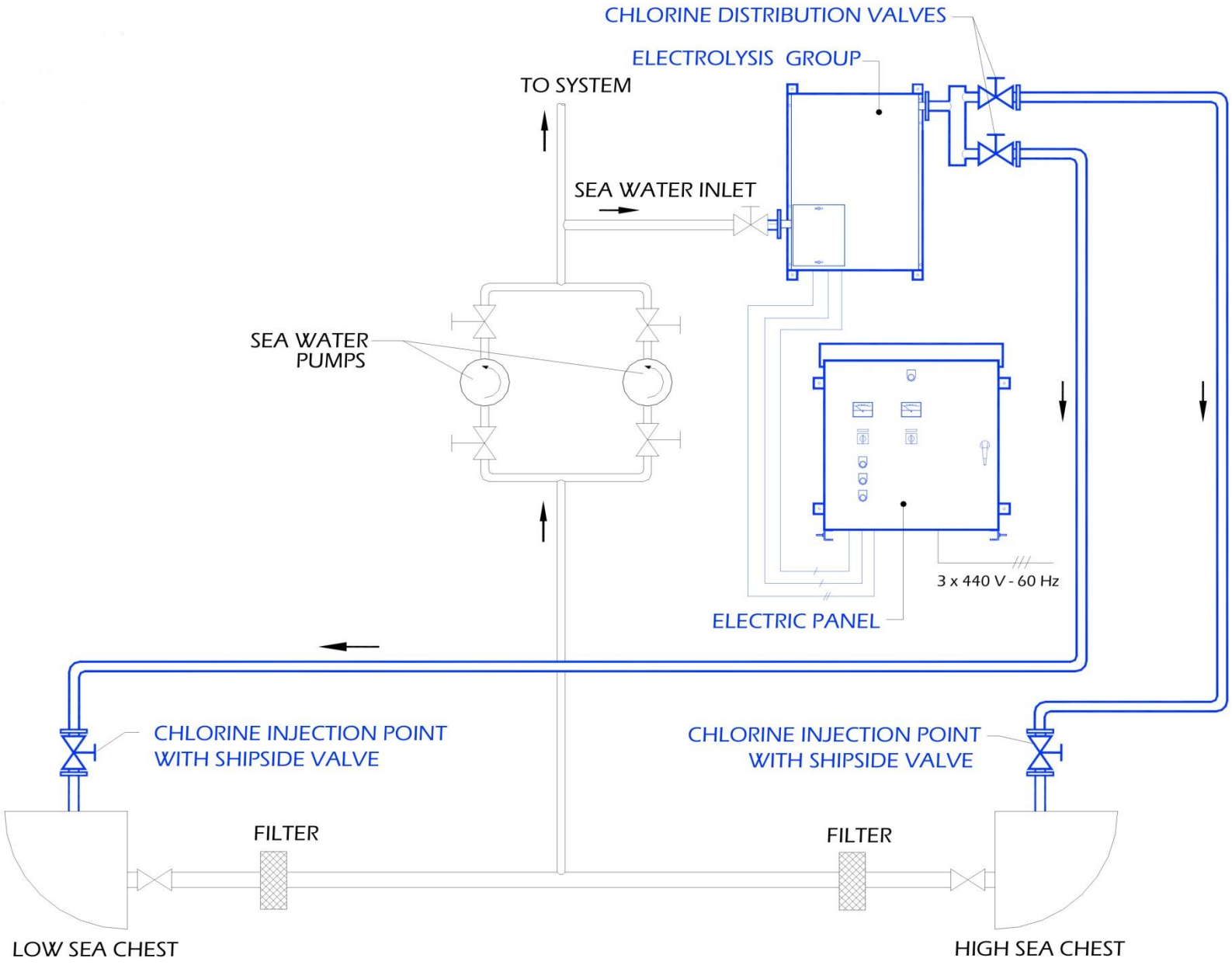
- ECOLCELL R electrochlorination system combats both macro and micro marine fouling in the seawater lines on board ships, oil-rigs and power plants. Marine fouling, shellfish, seaweed, slime, bacteria, etc find their way into sea water cooling systems on board ships usually as micro-organisms, settle and grow and if not combated go on to block and partially block pipes, filters, valves, intake grids, heat exchangers etc. and can incur significant costs for the ship owner.

- ECOLCELL R operates by using an electrolytic cell containing Titanium anodes MMO coated to transform the Sodium Chloride (NaCl) in seawater into Sodium Hypochlorite (NaOCl) through a process of electrolysis.

- This antifouling agent is injected into the sea chests from where it is dispersed through the whole sea water system.

- Only a small concentration of this Sodium Hypochlorite is required to combat marine fouling, 0.1 to 0.3 ppm.

ECOLCELL MGPS SYSTEM – INSTALLATION DIAGRAM



ECOLCELL R
Electrochlorination System

- Electrochlorination systems use Sodium Hypochlorite as an antifouling agent.
- The Sodium Hypochlorite is produced by electrolysis of the Sodium chloride (NaCl) contained in seawater.
- The electrolysis is obtained by passing seawater through a cell containing two electrodes (anode and cathode), which are energized with a low voltage DC and high current (Amp)

ECOLCELL R
Electrochlorination System

- The chemical and electrochemical reactions that occur in the cell are as follows:
- 1) at the anode free chlorine is formed
- $2\ Cl^- \rightarrow Cl_2 + 2e^-$
- 2) at the cathode OH- ions are formed
- $2\ H2O + 2e^- \rightarrow 2\ OH^- + H_2$
- 3) around the anode the OH- ions react with the Na+ ions and Cl2 to produce Sodium Hypochlorite
- $2\ NaOH + Cl_2 \rightarrow NaOCl + NaCl + H2O$

Comments

- Alongside these principal reactions, which bring about the production of Sodium Hypochlorite (NaOCl), secondary reactions occur due to other ions that are present in seawater such as Calcium and Magnesium, forming hydrates and carbonates.
- The Sodium Hypochlorite solution leaving the cell is piped to the Chlorine injection points situated on the sea chests to be mixed with the incoming seawater flow.
- The Chlorine-active contained in the solution oxidizes the organic substances found in the seawater.
- The adult organisms, such as mussels, are able to resist the effects of chlorine-active by closing themselves inside their shells. However unable to feed, they will not settle in an environment where chlorine-active is present.
- One of the key selling points of this system is that the Sodium Hypochlorite is produced directly out of seawater, and due to its chemical behaviour reverts back to salt and water after the oxidation has taken place and leaves behind no residual.
- Hence the electrochlorination system is an eco-friendly way of combating marine fouling.

Comments

- Sodium Hypochlorite is acknowledged at being the best antifouling agent[1] and is:
- effective against both macro and micro marine fouling
- eco-friendly, produced directly from sea water and reverts to salt and water when RedOx reaction is complete
- small concentrations used guarantee that the corrosiveness of seawater is not increased, i.e.: no galvanic corrosion.

[1] In 1995 University of Genoa – Italy - completed a study to show that the Chlorine residual of our electrochlorination system is not toxic to the environment.

- The concentration of Chlorine residual is well below the recommended international levels.

Hardware & Process part n.1

- The system consists of three parts:
- Control Panel (located near electrolysis group)
- Electrolysis Group (located in the engine room/vicinity of sea chests)
- Injection nozzles (installed on the sea chests, connected to the electrolysis group via pipes and control valves. specially designed ACG pipes can also be used).
- The electrolytic cell needs seawater feed (Q_{min} = 5-12 m^3/h, P_{min}=2,5 bar) from the seawater pump.
  Before entering the cell, the seawater is filtered and then monitored by a flow-switch. The cell is fed with DC current supplied from the electric control panel. The flow-switch gives consent for electrical operation to begin only if the flow rate is above a certain level.
- Electrolysis begins when the current is switched on at the control panel and the valves are opened.
- Once electrolysis operation begins, part of the Sodium Chloride [NaCl] contained in the seawater passing through the cell is transformed into Sodium Hypochlorite.
- The resulting Sodium Hypochlorite is piped to the injection nozzles where the disinfecting agent is injected into the sea chests to mix with incoming seawater to prevent fouling in the whole seawater system.

Hardware & Process part n. 2

- The antifouling solution leaving the cell is piped to the injection points installed on the sea chests and mixed with the incoming seawater flow. The ships onboard pumps, when running, suck the treated sea water and pump it through the ship's whole sea water system thus keeping the internal circuits and equipment right up to the overboard discharges, free from fouling. When the ship's onboard pumps are not running the solution diffuses in the sea chests and then filters outwards thus protecting the sea chest, the intake grills and the areas around the sea chests free from fouling.
- This antifouling solution oxidises the organic substances present in seawater (marine fouling); the presence of residual Chlorine is a sure sign that the antifouling treatment is completely effective. It is possible to check the residual chlorine using a residual Chlorine test kit.
- It is possible to regulate the production of Sodium Hypochlorite using the #2# position "CHLORINE" switch in the electric cabinet. Normally this switch is left in position #1# (left); but if the residual chlorine test is negative then it should be switched to position #2# (right).
- The periodic electrochemical cleaning of the cathode (water passes through the cell not energized) is controlled automatically by a cyclic timer located in the electric cabinet. This "WASHING" is required to wash away the Calcium and Magnesium hydrates that deposit on the cathode during electrolysis.

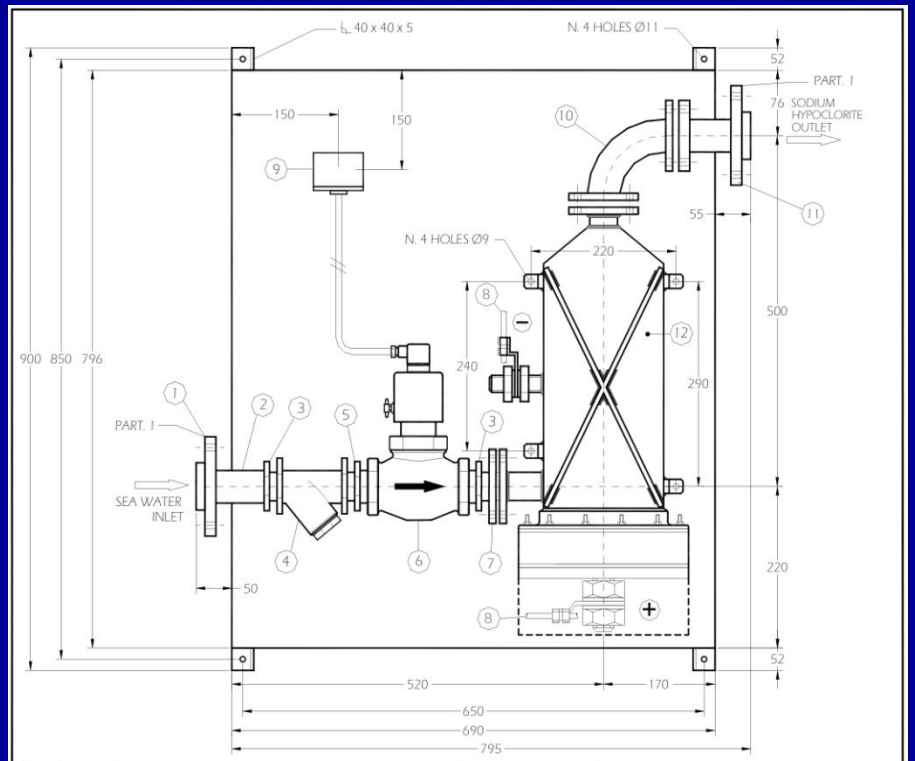
Benefits of ECOLCELL R

- Complete effective against all types of marine fouling even in the toughest conditions
- can be installed in new buildings or as retrofit
- ensures heat exchangers operate at 100% efficiency
- automatic system, requires no manual intervention
- system has a long life with replacement anodes being relatively inexpensive
- disinfecting agent can be taken from cell and used for sewage treatment
- ensures no blockage of fire-fighting and sprinkler systems.

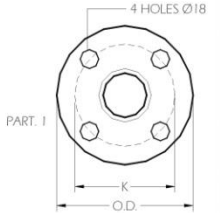
Cost savings for ship owner

- reduces the need for costly cleaning and maintenance of ships' cooling systems
- saves on fuel bills by eliminating the need for increased pumping power due to blockages
- very low daily running costs
- increases pipe life by reducing biological and galvanic corrosion
- ensures that important fire fighting and sprinkler systems do not become blocked

ECOLCELL MGPS SYSTEM – ELECTROLYSIS GROUP TYPE R700/R1000



POS.	Q.TY	DESCRIPTION	MATERIAL
1	1	ND32 NP10 OR ND40 NP10 FLANGE	STEEL
2	1	INLET PIPE	BRONZE
3	2	1" 1/4 x 1" 1/2 FITTING	BRONZE
4	1	FILTER	BRONZE
5	1	1" 1/2 FITTING	BRONZE
6	1	FLOWSWITCH	BRONZE
7	1	INTERCONNECTION PIPE	PVC / STEEL
8	2	LUG	BRASS
9	1	JUNCTION BOX	PVC
10	1	ELBOW	PVC / ACC
11	1	OUTLET PIPE WITH ND32 OR ND40 FLANGE	PVC / ACC
12	1	ELECTROLYTIC CELL	STEEL



ND32 NP10 FLANGE K = 100 mm. O.D. = 140 mm.
ND40 NP10 FLANGE K = 110 mm. O.D. = 150 mm.

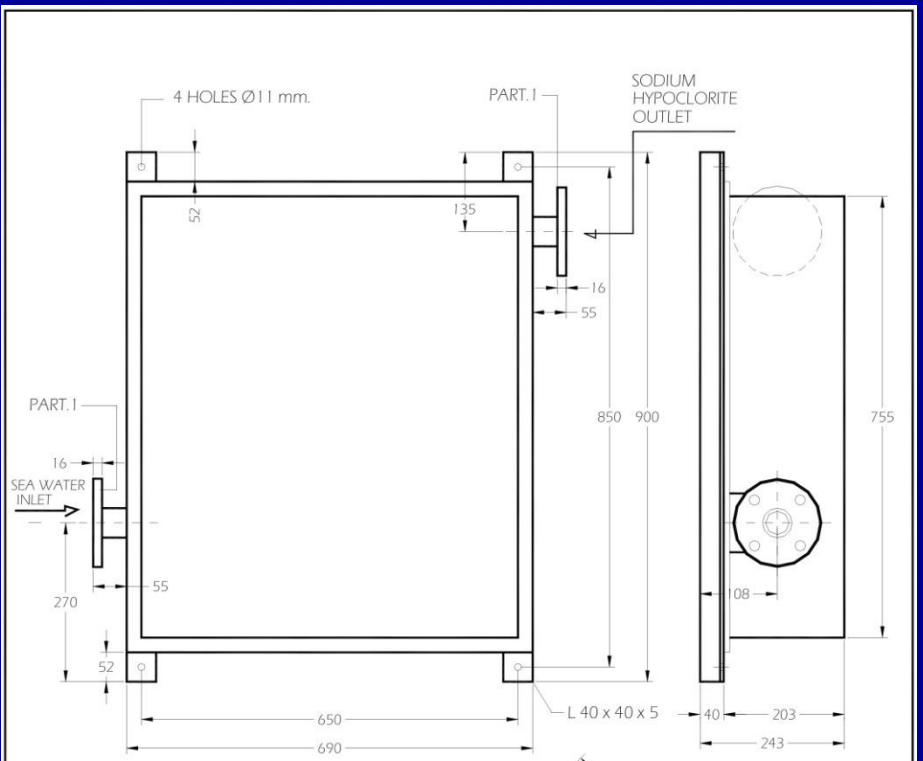
REV.	DATE	DESCRIPTION	DESIGN	FILE
0	18-05-1996	FIRST EMISSION	S.F.	A-C-2118E.DWG
01	28-05-1997	REVISION	S.L.	
02	15-06-1999	REVISION	S.L.	
03	25-11-1999	REVISION	S.L.	
04	29-05-2000	REVISION	S.L.	
05	04-07-2000	REVISION	S.L.	
06	27-03-2003	REVISION	S.L.	
07	19-07-2006	REVISION	S.L.	

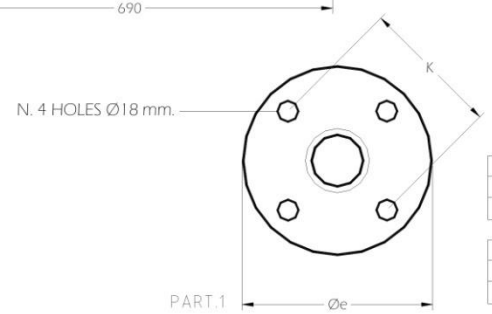
CLIENT | JOB N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM
ELECTROLYSIS GROUP TYPE R300 - R700 - R1000
INTERNAL VIEW

SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N.
DESIGNED		/		A-C-2118/E	07
CHECKED		/			
APPROVED					





ND32 FLANGE
Øe = 140 mm.
K = 100 mm.

ND40 FLANGE
Øe = 150 mm.
K = 110 mm.

REV.	DATE	DESCRIPTION	DESIGN	FILE
0	09-09-1995	FIRST EMISSION	S.F.	A-C-8272.DWG
01	01-02-1997	REVISION	S.L.	

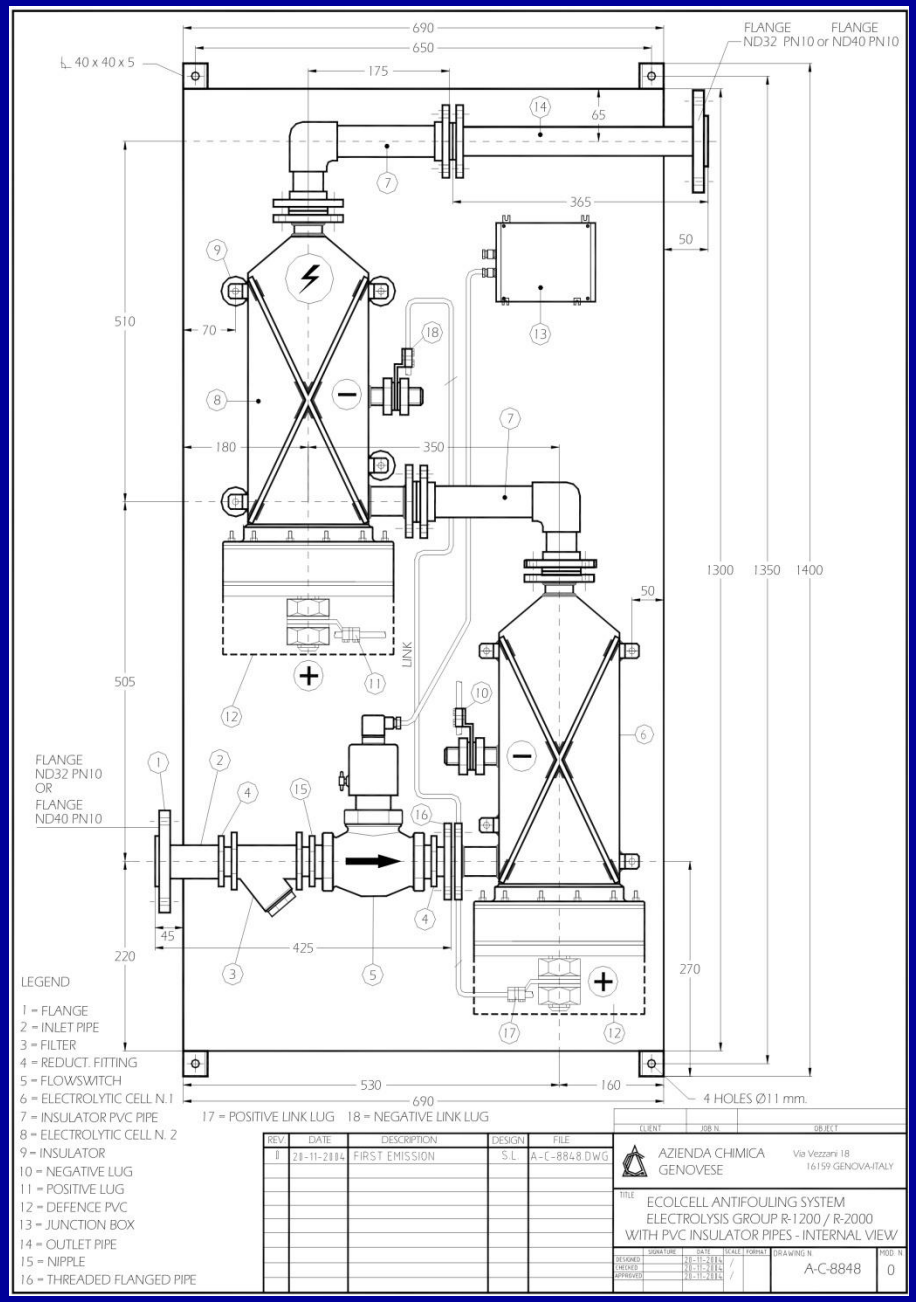
CLIENT | JOB NO. | OBJECT / HULL N.

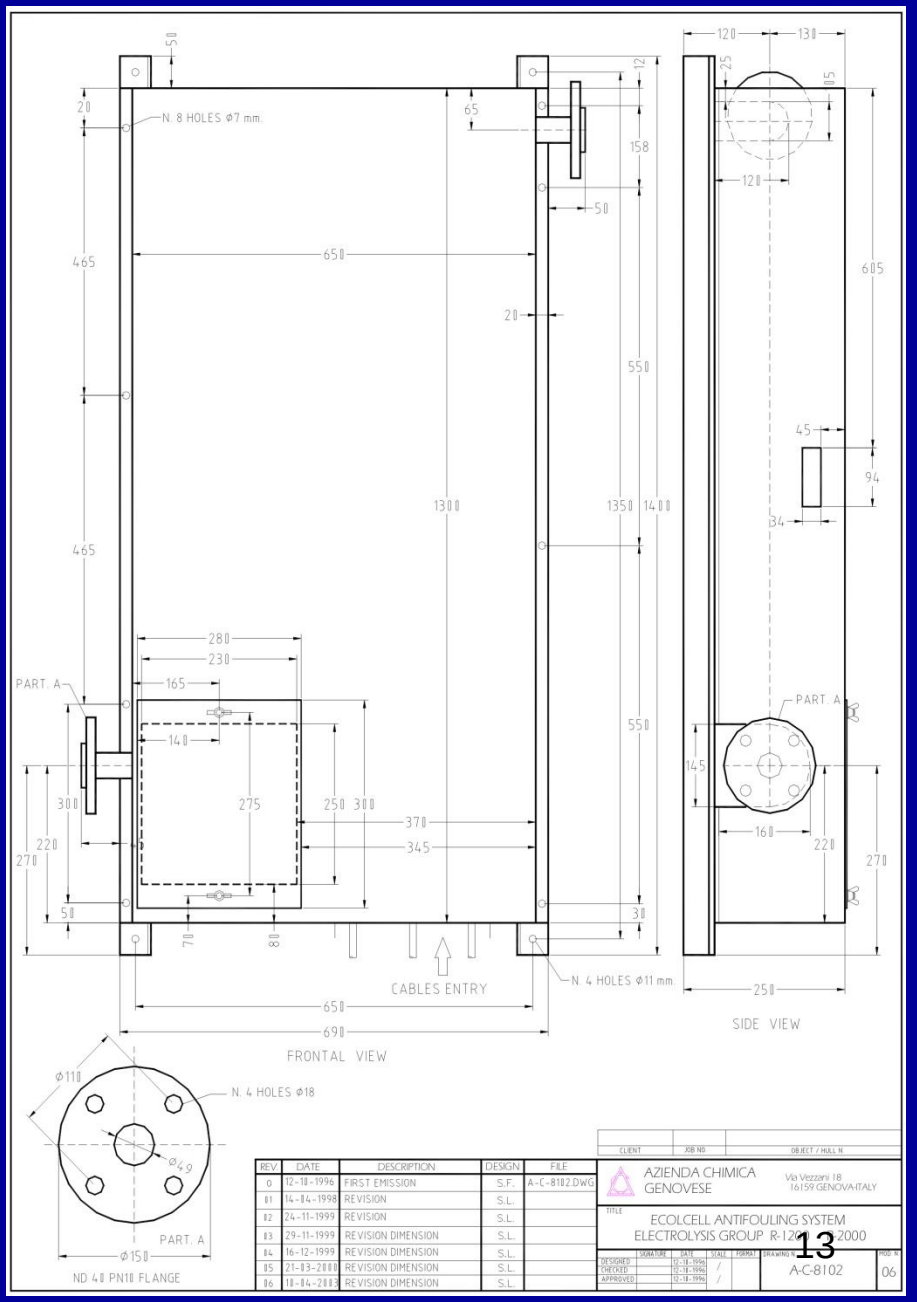
AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM TYPE R700
ELECTROLYSIS GROUP

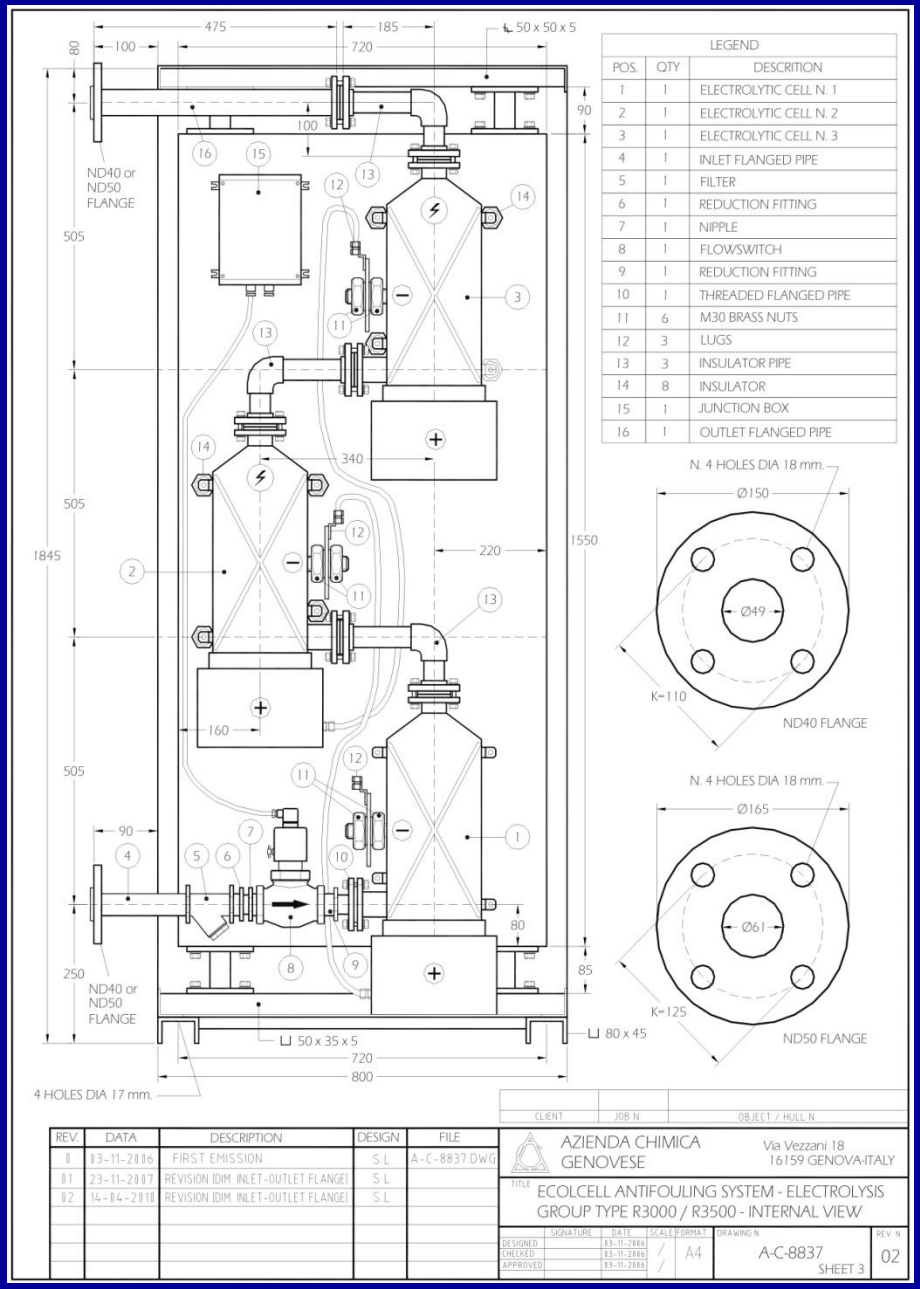
SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD.
DESIGNED		/	A4	A-C-8272	01
CHECKED		/			
APPROVED					

ECOLCELL MGPS SYSTEM – ELECTROLYSIS GROUP TYPE R700/R3500





ECOLCELL MGPS SYSTEM – ELECTROLYSIS GROUP TYPE R2500/R1000



LEGEND		
POS.	QTY	DESCRITION
1	1	ELECTROLYTIC CELL N. 1
2	1	ELECTROLYTIC CELL N. 2
3	1	ELECTROLYTIC CELL N. 3
4	1	INLET FLANGED PIPE
5	1	FILTER
6	1	REDUCTION FITTING
7	1	NIPPLE
8	1	FLOWSWITCH
9	1	REDUCTION FITTING
10	1	THREADED FLANGED PIPE
11	6	M30 BRASS NUTS
12	3	LUGS
13	3	INSULATOR PIPE
14	8	INSULATOR
15	1	JUNCTION BOX
16	1	OUTLET FLANGED PIPE

REV.	DATA	DESCRIPTION	DESIGN.	FILE
0	03-11-2006	FIRST EMISSION	S.L.	A-C-8837.DWG
01	23-11-2007	REVISION IDIM. INLET-OUTLET FLANGE	S.L.	
02	14-04-2010	REVISION IDIM. INLET-OUTLET FLANGE	S.L.	

CLIENT | JOB N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
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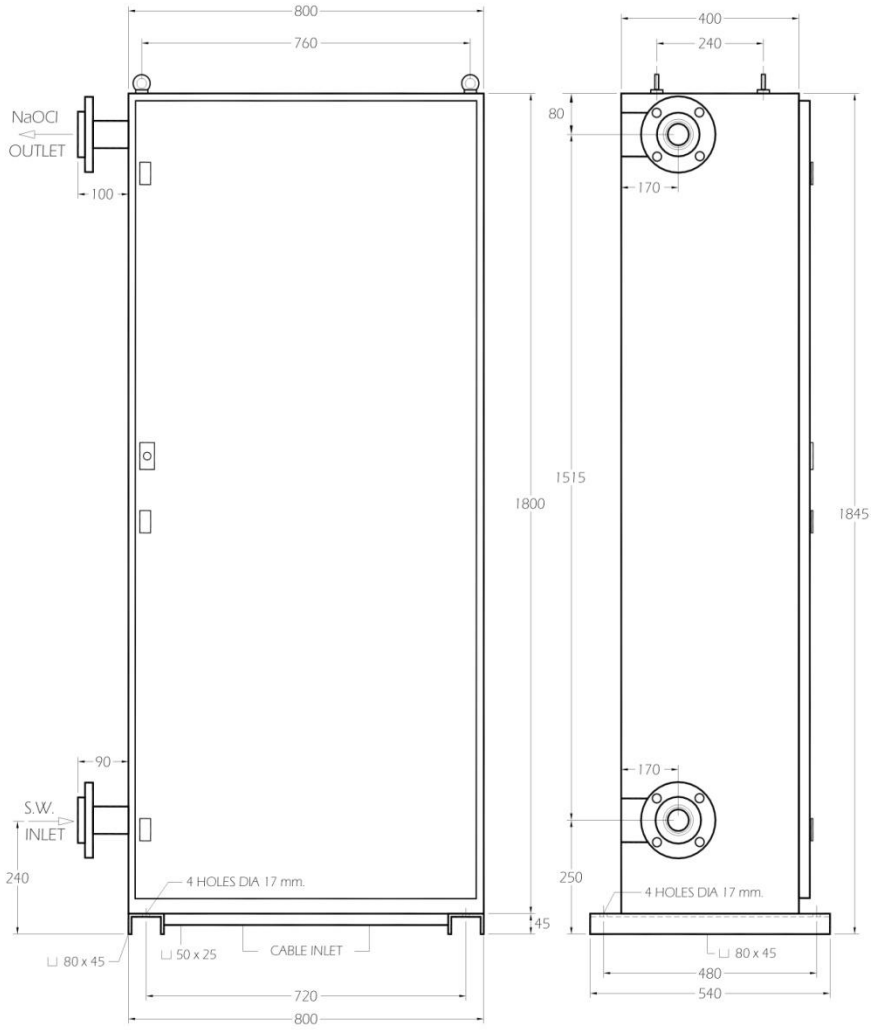
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM - ELECTROLYSIS GROUP TYPE R3000 / R3500 - INTERNAL VIEW

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	REV. N
DESIGNED		03-11-2006	/	A4	A-C-8837	02
CHECKED		03-11-2006	/			
APPROVED		03-11-2006	/		SHEET 3	



REV.	DATE	DESCRIPTION	DESIGN	FILE
0	25-03-1996	FIRST EMISSION	S.L.	A-C-8229.DWG
01	21-10-1999	REVISION	S.L.	
02	21-03-2000	REVISION DIMENSIONS	S.L.	
03	27-06-2000	REVISION	S.L.	
04	20-03-2003	REVISION DIMENSIONS	S.L.	

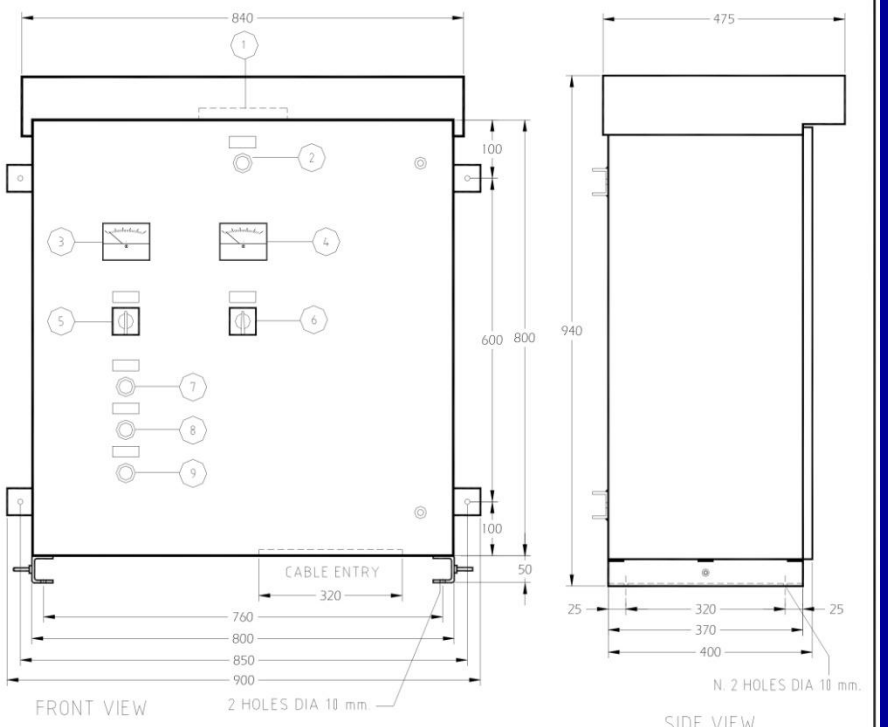
CLIENT | JOB N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM ELECTROLYSIS GROUP TYPE R-2500 / R-3500

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N
DESIGNED		25-03-1996	/		A-C-8229	04
CHECKED		25-03-1996	/			
APPROVED		25-03-1996	/			

ECOLCELL MGPS SYSTEM – ELECTRIC PANEL TYPE R700/R8000



LEGEND

1 = FAN
2 = "POWER ON" LAMP
3 = VOLTMETER
4 = AMMETER
5 = "MAIN POWER ON" SWITCH
6 = "CHLORINE PRODUCTION" SWITCH
7 = "NO SEA WATER" LAMP
8 = "WORKING" LAMP
9 = "WASHING" LAMP

REV.	DATE	DESCRIPTION	DESIGN	FILE
0	17-06-1998	FIRST EMISSION	S.L.	A-C-8271.DWG
01	02-11-1999	REVISION	S.L.	
02	20-04-2001	REVISION	S.L.	
03	18-04-2003	REVISION	S.L.	

CLIENT | JOB NO | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
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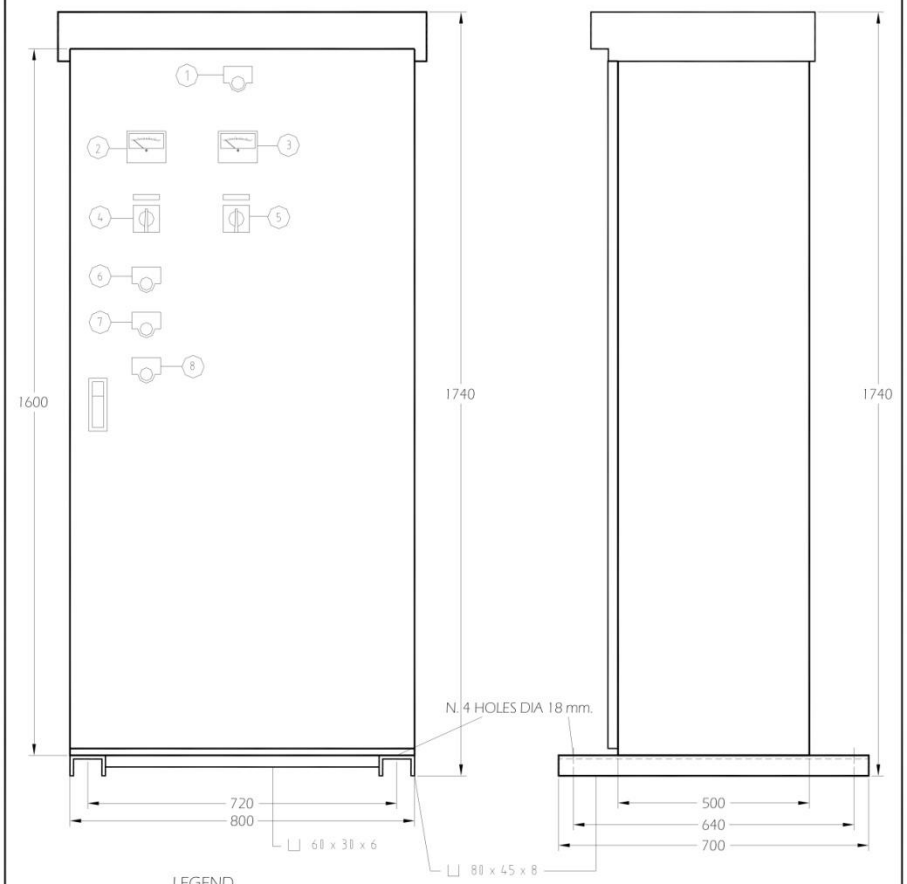
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM
ELECTRIC PANEL TYPE R700 / R1500 / R2000

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N
DESIGNED		17-06-1998	/		A-C-8271/E	03
CHECKED		17-06-1998				
APPROVED		17-06-1998	/			



LEGEND

1 = "POWER ON" LAMP
2 = VOLTMETER
3 = A-METER
4 = MAIN SWITCH
5 = "CHLORINE PRODUCTION" SWITCH
6 = "NO SEA WATER" LAMP
7 = "WORKING" LAMP
8 = "WASHING" LAMP

REV.	DATE	DESCRIPTION	DESIGN	FILE
0	16-06-1997	FIRST EMISSION	S.L.	A-C-8262.DWG
01	12-07-1999	REVISION	S.L.	
02	28-03-2000	REVISION	S.L.	
03	25-11-2002	REVISION DIMENSIONS		

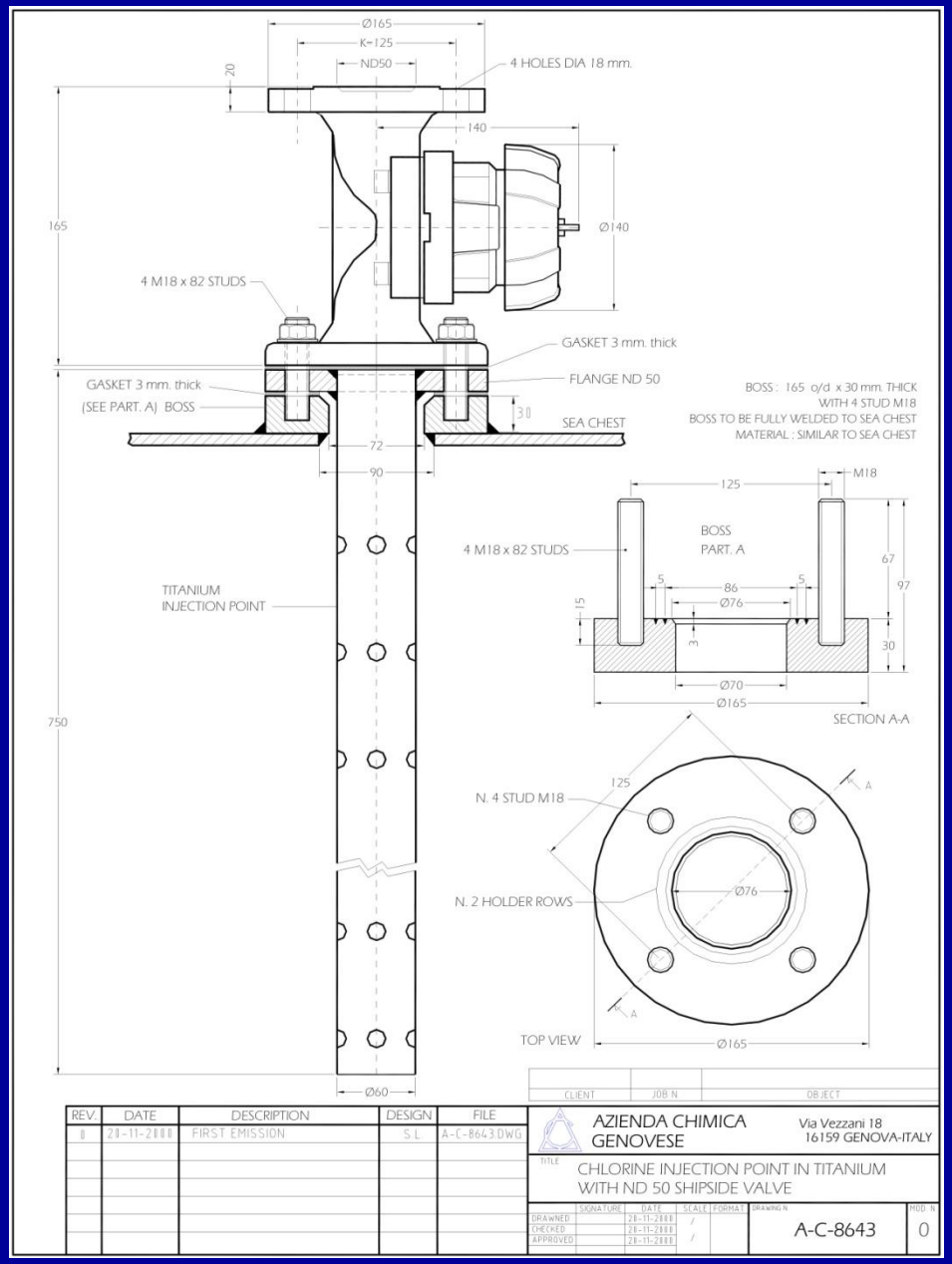
CLIENT | JOB N. / OFFER N. | OBJECT / HULL N.

AZIENDA CHIMICA GENOVESE
Via Vezzani 18
16159 GENOVA-ITALY

TITLE: ECOLCELL ANTIFOULING SYSTEM TYPE R-3000
R-5000 / R-8000 - ELECTRIC PANEL

	SIGNATURE	DATE	SCALE	FORMAT	DRAWING N.	MOD. N
DESIGNED		16-06-1997	/		A-C-8262	03
CHECKED		16-06-1997				
APPROVED		16-06-1997	/			

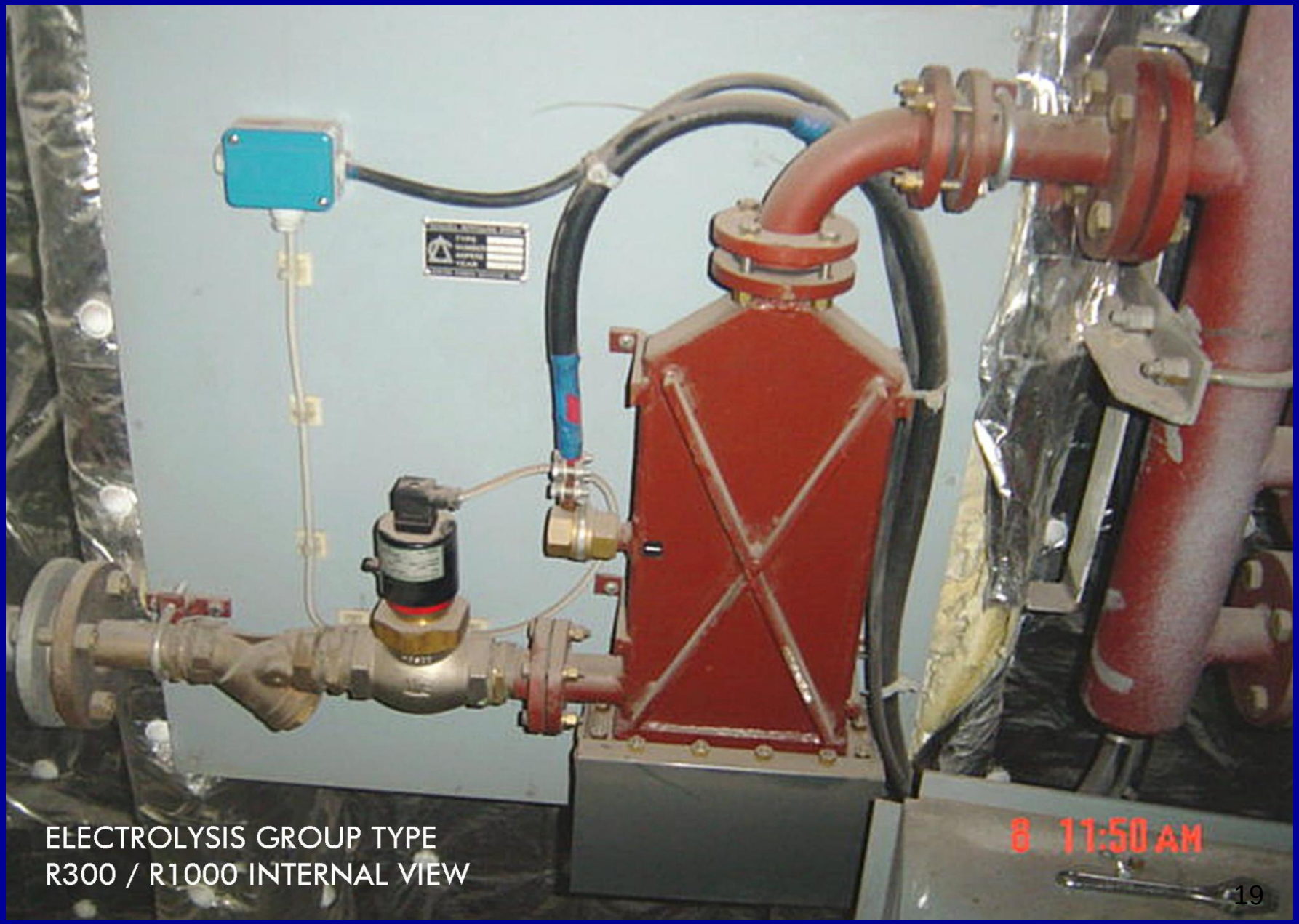
ECOLCELL MGPS SYSTEM
CHLORINE INJECTION POINT WITH SHIPSIDE VALVES



ECOLCELL MGPS SYSTEM TYPE R1500

ECOLCELL MGPS SYSTEM
CHLORINE INJECTION POINT WITH SHIPSIDE VALVES

ECOLCELL MGPS SYSTEM – ELECTROLYSIS GROUP TYPE R300/R1000



ELECTROLYSIS GROUP TYPE
R300 / R1000 INTERNAL VIEW

ECOLCELL MGPS SYSTEM – ELECTROLYSIS GROUP TYPE R300/R1000

ECOLCELL MGPS SYSTEM TYPE R700 / R2000

ECOLCELL MGPS SYSTEM – CHLORINE INJECTION POINT WITH VALVES

ECOLCELL MGPS SYSTEM – CHLORINE INJECTION POINT WITH VALVES