

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.1 CHLORINSITU® Electrolysis Systems

Chlorine and sodium hydroxide are produced in electrolysis in-situ by passing an electric current through salt water.

In **tubular cell electrolysis** (CHLORINSITU® II versions), the electrochemical reaction takes place in one chamber, so that the chlorine gas produced immediately reacts with sodium hydroxide to form sodium hypochlorite. Saturated brine is used as a salt solution which is produced in a separate salt-dissolving tank from salt of defined quality. The advantage of tubular cell electrolysis is the simple design of the equipment. The disadvantage is the relatively poor yield which leads to a high entrainment of chloride in the water to be treated and the relatively low chlorine concentrations in the reaction mixture.

In **membrane electrolysis**, the electrochemical reaction takes place in two electrode chambers separated by a membrane, so that the formation of the chlorine and sodium hydroxide is physically separated. CHLORINSITU® III type systems bring the reaction mixtures of both electrode chambers together again after the electrochemical reaction to produce a stock solution of sodium hypochlorite which can be stored temporarily and metered as needed. In compact CHLORINSITU® IV and CHLORINSITU® IV type systems, the chlorine is directly added to the water to be treated where it dissolves as hypochlorous acid. In CHLORINSITU® IV plus type systems, any excess chlorine gas produced is combined with the sodium hydroxide, as in the CHLORINSITU® III system, to form system hypochlorite and then stored temporarily. Hence the systems should thus only be designed for medium chlorine demand because capacity peaks are compensated for the temporary storage. In all CHLORINSITU® IV type systems the sodium hydroxide is stored temporarily and metered for pH value correction as required.

The **Dulco®Lyse** is a membrane electrolysis system for the production of ECA water (electrochemically activated water). The use of this systems engineering has been specially developed for processes in which the chloride content needs to be minimised to avoid corrosion of the system parts, e.g. in the food and beverage industry.

The advantage of membrane systems is the high efficiency and prevention of entrainment of chloride from the electrolysis cell into the water to be treated. In systems for the production of sodium hypochlorite, the high yield results in solutions which have a significantly higher chlorine content than when produced by tubular cell electrolysis.

- Disinfection based on cooking salt
- No handling of hazardous chemicals
- Economical method thanks to low salt and energy consumption
- Ultra-pure chlorine thanks to production in-situ and short temporary storage periods
- Water disinfection and pH correction using one system (CHLORINSITU® IV)
- Maximum operating safety thanks to design as a vacuum systems
- Improved working conditions for operating personnel
- No risk confusing dangerous chemical tanks

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4.2 Performance Overview

		CHLORINSITU® II	CHLORINSITU® III	CHLORINSITU® IV	CHLORINSITU® IV plus
Output [g/h]	4.000				
	3.000				
	2.000				
	1.000				
Production of HOCl				■	■
Production of NaOCl		■	■		■
Application					
Drinking water		■	■	■	■
Process water		■	■	■	■
Swimming pool water		■	■		■

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		DULCOLYSE	CHLORINSITU® III & IV compact
Output [g/h]	200		
	150		
	100		
	50		
Application			
ECA		■	
Swimming pool			■

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Note: larger systems available on request

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4.3 Questionnaire on the Design of a CHLORINSITU[®] Electrolysis System

Use of the electrolysis plant:

- | | |
|--|--|
| <input type="checkbox"/> for disinfection of | <input type="checkbox"/> Drinking water |
| | <input type="checkbox"/> Industrial water |
| | <input type="checkbox"/> Cooling water |
| | <input type="checkbox"/> Swimming pool water |
| | <input type="checkbox"/> _____ |

Water values:

- | | |
|---|--|
| Max. water flow rate _____ m ³ /h | Maximum water pressure _____ bar |
| Water flow rate <input type="checkbox"/> constant | <input type="checkbox"/> fluctuating from _____ m ³ /h to _____ m ³ /h |
| pH value _____ | Iron (Fe ²⁺) _____ mg/l |
| Temperature _____ °C | Manganese (Mn ²⁺) _____ mg/l |
| Solid fraction _____ mg/l | Nitrite (NO ₂ ⁻) _____ mg/l |
| Acid capacity K _{34,3} _____ mmol/l | Sulphide (S ²⁻) _____ mg/l |
| Total hardness _____ mmol/l | TOC (total organic carbon) _____ mg/l |
| Total hardness _____ °dH | Ammonia _____ mg/l |

Response time to application:

_____ m³ volume reaction tank or _____ minutes residence time in entire system.

Type of metering:

- constant
- flow-proportional
- depending on measured value

Desired dosing rate: _____ mg/l

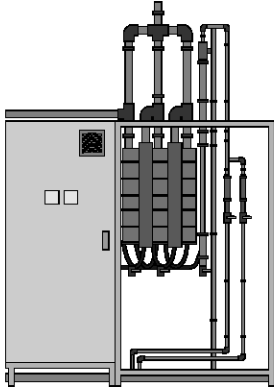
Disinfection method used up to now:

Consumption of disinfectant up to now: _____ kg/week

Other requirements:

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4.4 CHLORINSITU® II Tubular Cell Electrolysis Systems



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CHLORINSITU® II electrolysis systems generate sodium-calcium hypochlorite with a concentration of 5 g/l. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply), which, after appropriate dilution, is electrolysed in an open cell. The resulting solution is collected in a storage container and, from there, metered according to requirements using separate metering pumps. Due to its moderate pH value of 8.5 - 9, it affects the pH of the treated water significantly less than if conventional sodium-calcium hypochlorite with a pH of 12 - 13.5 were to be used. The hydrogen produced is diluted with fresh air through an ATEX-approved ventilator and discharged safely. Both the salt-dissolving and diluting water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

CHLORINSITU® II electrolysis systems are especially suitable for applications where a robust and clearly laid-out technology is required and where the carry-over of some sodium chloride into the water being treated is not a problem.

- Robust, simple technology
- Safe system control with remote diagnosis by modem
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Compact, space-saving design
- Improved working conditions for the operating personnel
- No risk of confusing dangerous chemical tanks

Technical Data

Type/output	Voltage supply	Power Uptake	Salt consumption	Process water consumption	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
50	230 V	0.78	0.2	11.0	–	1,050 x 600 x 1,550	130	300
100	230 V	1.15	0.4	22.0	–	1,050 x 600 x 1,550	130	500
150	3 x 400 V	1.53	0.6	32.0	–	1,050 x 600 x 1,550	200	700
200	3 x 400 V	1.90	0.8	43.0	–	1,050 x 600 x 1,550	200	1,000
300	3 x 400 V	2.65	1.1	65.0	–	1,050 x 600 x 1,550	200	1,500
400	3 x 400 V	3.40	1.5	86.0	–	1,250 x 600 x 2,000	380	2,000
500	3 x 400 V	4.15	1.9	108.0	–	1,250 x 600 x 2,000	380	2,500
600	3 x 400 V	4.90	2.3	129.0	–	1,250 x 600 x 2,000	380	3,000
800	3 x 400 V	6.40	3.0	172.0	–	1,250 x 600 x 2,000	520	3,500
1000	3 x 400 V	7.90	3.8	215.0	–	1,250 x 600 x 2,000	520	4,500
1200	3 x 400 V	9.40	4.6	258.0	–	1,250 x 600 x 2,000	520	5,500
1400	3 x 400 V	10.90	5.3	301.0	–	1,250 x 600 x 2,000	520	6,000
1600	3 x 400 V	12.40	6.1	344.0	–	1,250 x 600 x 2,000	760	7,000
1800	3 x 400 V	13.90	6.9	387.0	–	1,650 x 600 x 2,000	760	8,000
2000	3 x 400 V	15.40	7.7	430.0	–	1,650 x 600 x 2,000	760	9,000
2200	3 x 400 V	16.90	8.4	473.0	–	1,650 x 600 x 2,000	760	10,000
2400	3 x 400 V	18.40	9.2	516.0	–	1,650 x 600 x 2,000	760	11,000

Scope of supply:

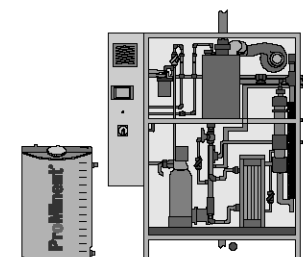
Connection-ready electrolysis system mounted on a powder-coated stainless steel frame with programmable logic controller (PLC) in a control cabinet, integrated softening system, electrolysis cell, ATEX-certified bleeding system and salt-dissolving tank supplied with level monitor. Level sensors to monitor the sodium-calcium hypochlorite storage tanks that are to be provided by the customer. Automatic monitoring of the water hardness downstream of the softening system for systems from 750 g/h.

Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

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4.5 CHLORINSITU® III Membrane Electrolysis Systems



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CHLORINSITU® III membrane electrolysis systems generate sodium hypochlorite with a concentration of approximately 20-25 g/l without major transfer of sodium chloride from the electrolytic cell into the finished product. A saturated solution of sodium chloride is produced in a salt-dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber, while chlorine gas and dilute residual brine are produced in the anode chamber, which is separated by the membrane from the cathode chamber. The chlorine gas produced binds to the sodium hydroxide solution and is collected in a storage container as sodium-calcium hypochlorite and from there metered according to requirements using separate metering pumps. Due to its moderate pH value of 9 - 9.5, it affects the pH of the treated water significantly less than if conventional sodium-calcium hypochlorite with a pH of 12 -13.5 were to be used. The hydrogen produced is diluted with fresh air through an ATEX-approved ventilator and discharged safely. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell. The efficiency of the electrolysis system is monitored by an integral pH value measurement of the sodium hydroxide solution production.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

CHLORINSITU® III electrolysis systems are especially suitable for applications in which sodium-calcium hypochlorite solution low in chloride and chlorate is required.

- Sodium-calcium hypochlorite low in chloride and chlorate with a high chlorine concentration
- Minimised acid consumption for pH correction
- Safe system control with remote diagnosis by modem
- Electrolytic cells are extremely durable
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output	Voltage supply	Power Uptake	Salt con- sumption	Process water con- sumption	Cooling water con- sumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
50	3 x 400 V	0.90	0.1	2.4	–	1,250 x 600 x 1,550	130	100
75	3 x 400 V	1.00	0.2	3.6	–	1,250 x 600 x 1,550	130	100
100	3 x 400 V	1.10	0.2	4.8	–	1,250 x 600 x 1,550	130	200
200	3 x 400 V	1.50	0.4	9.7	–	1,250 x 600 x 1,550	130	300
300	3 x 400 V	1.90	0.6	15.0	100	1,250 x 600 x 1,550	200	400
400	3 x 400 V	2.30	0.8	19.0	100	1,250 x 600 x 1,550	200	500
500	3 x 400 V	2.70	1.1	24.0	100	1,250 x 600 x 1,550	200	600
600	3 x 400 V	3.10	1.3	29.0	100	1,650 x 600 x 1,550	200	700
1000	3 x 400 V	4.70	2.1	48.0	100	1,650 x 600 x 2,000	380	1,200
1500	3 x 400 V	6.70	3.2	73.0	100	1,650 x 600 x 2,000	380	1,800
2000	3 x 400 V	8.70	4.2	97.0	200	1,650 x 600 x 2,000	520	2,500
2500	3 x 400 V	10.70	5.3	121.0	200	1,750 x 1,200 x 2,000	520	3,000
3000	3 x 400 V	12.70	6.3	145.0	200	1,750 x 1,200 x 2,000	520	3,300
3500	3 x 400 V	14.70	7.4	169.0	200	1,750 x 1,200 x 2,000	520	4,000

Scope of delivery:

Electrolysis plant mounted ready for operation on a powder-coated stainless steel frame with programmable logic controller (PLC) in control cabinet, integrated softener, electrolytic cell, pH value monitoring, ATEX-certified bleeding system and side salt-dissolving tank with level monitor. Level sensors to monitor the storage tanks for sodium hypochlorite to be provided by the customer. Automatic monitoring of the water hardness downstream of the softener and chlorine gas detector for plants from 750 g/h.

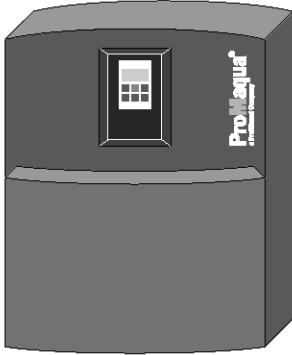
Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

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4.6 CHLORINSITU® III compact and CHLORINSITU® IV compact Membrane Electrolysis Systems

4.6.1 CHLORINSITU® III compact



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CHLORINSITU® III compact electrolysis systems produce a chlorine-based disinfectant. A saturated solution of sodium chloride is produced in a salt-dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The chlorine gas produced reacts in the reactor with the sodium hydroxide produced to form a disinfection solution. The hydrogen generated is discharged through a bleed line. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The microprocessor controller integrated in the system digitally indicates the current output and monitors all key functions. All operating and error messages are shown in plain text on the clear display. The output can be controlled manually, automatically (controller option) or externally.

CHLORINSITU® III compact electrolysis systems are especially suitable for use with smaller swimming pools in residential properties and hotels (indoor pools of up to 2,000 m³).

Advantages

- Water disinfection and pH correction with one system
- Cost-effective operation, thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption
- Optional integrated chlorine and pH control
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output g/h	Voltage supply	Power Uptake kW	Salt consumption g/h	Process water consumption l/h	Dimensions L x W x H (mm)	Brine tank l
25	230 V / 50 Hz	0.11	65	1.5	590 x 355 x 650	130
50	230 V / 50 Hz	0.22	131	3	590 x 355 x 650	130

Scope of supply:

Wall plate-mounted, connection-ready chlorine electrolysis system with integrated microprocessor control and softener system.

Electrolytic cell, separate salt-dissolving tank with level monitor.

Additionally a product tank is required and a metering pump for each point of injection (not part of the scope of supply)

	Order no.
CHLORINSITU® III compact 25	1041399
CHLORINSITU® III compact 50	1041401
CHLORINSITU® III compact 25 with integral pH and chlorine controller	1041400
CHLORINSITU® III compact 50 with integral pH and chlorine controller	1041402

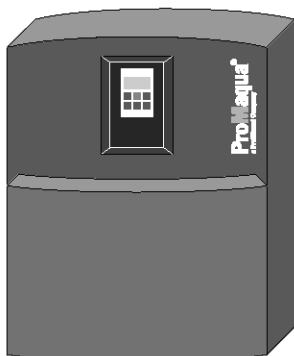
Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	CHLORINSITU® III compact 25	1041407
Annual maintenance kit	CHLORINSITU® III compact 50	1041409
3-yearly maintenance kit	CHLORINSITU® III compact 25	1041408
3-yearly maintenance kit	CHLORINSITU® III compact 50	1041410

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4.6.2

CHLORINSITU® IV compact



P_PMA_EL_0007_SW

CHLORINSITU® IV compact electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The resulting chlorine gas is suctioned off through an injector integrated in the system and dissolved as hypochlorous acid in the water being treated. The hydrogen generated is discharged through a bleed line. The sodium hydroxide is disposed of or optionally used with a metering pump integrated in the system to correct the pH of the water being treated. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The microprocessor controller integrated in the system digitally indicates the current output and monitors all key functions. All operating and error messages are shown in full text on the clear display. The output can be controlled manually or externally.

CHLORINSITU® IV compact electrolysis systems are especially suitable for use with smaller swimming pools in residential properties and hotels (indoor pools of up to 2,000 m³).

- Production and metering of ultra-pure hypochlorous acid
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Water disinfection and pH correction with one system
- Safe vacuum system technology
- Optional integrated chlorine and pH control
- Robust, simple technology
- Compact, space-saving design

Technical Data

Type/ output g/h	Voltage supply	Power Uptake kW	Salt consumption g/h	Process water consumption l/h	Dimensions L x W x H (mm)	Brine tank l
25	230 V/50 Hz	0.11	65	1.5	590 x 355 x 650	130
50	230 V/50 Hz	0.22	131	3	590 x 355 x 650	130

Scope of delivery:

Chlorine electrolysis plant mounted on a wall plate, wired ready for connection, with integrated microprocessor control and softener system. Electrolytic cell with vacuum monitor, separate salt dissolving tank with level monitor. Fitted injector and metering equipment for sodium hydroxide (optional).

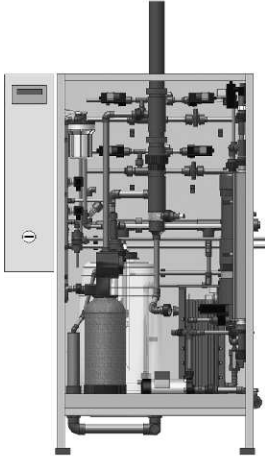
	Order no.
CHLORINSITU® IV compact 25	1036461
CHLORINSITU® IV compact 25 with pH correction	1036462
CHLORINSITU® IV compact 50	1036463
CHLORINSITU® IV compact 50 with pH correction	1036464
CHLORINSITU® IV compact 25 with integral pH and chlorine controller	1041405
CHLORINSITU® IV compact 25 with integral pH and chlorine controller plus pH correction	1041403
CHLORINSITU® IV compact 50 with integral pH and chlorine controller	1041406
CHLORINSITU® IV compact 50 with integral pH and chlorine controller plus pH correction	1041404

Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	CHLORINSITU® IV compact 25	1041415
Annual maintenance kit	CHLORINSITU® IV compact 50	1041417
3-yearly maintenance kit	CHLORINSITU® IV compact 25	1041416
3-yearly maintenance kit	CHLORINSITU® IV compact 50	1041418
Membrane cell	CHLORINSITU® IV compact 25	1041419
Membrane cell	CHLORINSITU® IV compact 50	1041420
Membrane	CHLORINSITU® IV compact 25	1041421
Membrane	CHLORINSITU® IV compact 50	1041422

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4.7 CHLORINSITU® IV Membrane Electrolysis Systems



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CHLORINSITU® IV electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Chloride-free sodium hydroxide and hydrogen are produced in the cathode chamber, while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The chlorine gas produced is suctioned off through an injector (contained in the scope of supply) and dissolved as hypochlorous acid in the water being treated. The chloride-free sodium hydroxide is stored temporarily and can be transferred into the water through the same injector to adjust the pH value. To achieve this, an external pH value controller is directly connected to the system's control. The generated hydrogen is diluted with fresh air through an ATEX-certified ventilator and discharged safely and the diluted residual brine is disposed of. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting. The chlorine metering and the pH value correction are controlled as standard via contact inputs.

Options:

- Analog input
- MOD-bus or PROFIBUS®
- Several points of injection

CHLORINSITU® IV electrolysis systems are suitable for all applications that require simultaneous hypochlorous acid metering and pH value correction.

- Production and metering of ultra-pure hypochlorous acid without temporary storage
- Chlorination and pH correction using a single system
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Safe vacuum system technology
- Robust technology
- Compact, space-saving design

Technical Data

Type/ output	Voltage supply	Power Uptake	Salt consumption	Process water consumption	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
100	230 V	1.10	0.2	0.8	–	1,150 x 600 x 1,550	130	–
150	3 x 400 V	1.30	0.3	1.3	–	1,150 x 600 x 1,550	130	–
200	3 x 400 V	1.50	0.4	1.7	–	1,150 x 600 x 1,550	200	–
300	3 x 400 V	1.90	0.6	2.5	–	1,150 x 600 x 1,550	200	–
400	3 x 400 V	2.30	0.8	3.4	–	1,150 x 600 x 1,550	200	–
500	3 x 400 V	2.70	1.1	4.2	–	1,150 x 600 x 1,550	200	–
600	3 x 400 V	3.10	1.3	5.0	–	2,900 x 600 x 2,000	200	–
750	3 x 400 V	3.70	1.6	6.3	–	2,900 x 600 x 2,000	380	–
1000	3 x 400 V	4.70	2.1	8.4	–	2,900 x 600 x 2,000	380	–
1250	3 x 400 V	5.70	2.6	11.0	–	2,900 x 600 x 2,000	380	–
1500	3 x 400 V	6.70	3.2	13.0	–	2,900 x 600 x 2,000	380	–
1750	3 x 400 V	7.70	3.7	15.0	–	3,300 x 600 x 2,000	380	–
2000	3 x 400 V	8.70	4.2	17.0	200	3,300 x 600 x 2,000	520	–
2500	3 x 400 V	10.70	5.3	21.0	200	3,300 x 600 x 2,000	520	–
3000	3 x 400 V	12.70	6.3	25.0	200	3,300 x 600 x 2,000	520	–
3500	3 x 400 V	14.70	7.4	29.0	200	3,300 x 600 x 2,000	520	–

Scope of supply:

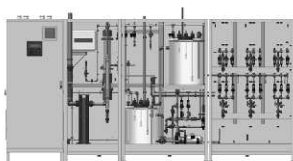
Electrolysis system mounted ready for operation on a powder coated stainless steel frame with programmable logic controller (PLC) in control cabinet, integrated softening system, electrolysis cell, pH value monitoring of the electrolysis, ATEX-certified bleeding system and salt-dissolving tank supplied with level monitor. The scope of supply also includes a central injector system matched to the system to meter chlorine gas and sodium hydroxide, inclusive of a booster pump. Automatic monitoring of the water hardness downstream of the softening system and chlorine gas detector for systems from 750 g/h.

Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

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4.8 CHLORINSITU® IV plus Membrane Electrolysis Systems



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CHLORINSITU® IV plus electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated solution of sodium chloride is produced in a salt dissolving tank (included in the scope of supply) for this purpose, which is then electrolysed in a membrane cell. Chloride-free sodium hydroxide and hydrogen are produced in the cathode chamber, while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber, separated by the membrane from the cathode chamber. The resulting chlorine gas is further processed in two ways. Firstly, as with CHLORINSITU® IV systems, the gas is suctioned off through an injector that forms part of the scope of supply and dissolved as hypochlorous acid in the water being treated. If the complete production output is not needed, excess chlorine gas can also be combined with the sodium hydroxide produced and then temporarily stored as sodium hypochlorite, as is the case with CHLORINSITU® III systems. The system thus does not have to be dimensioned according to the maximum chlorine gas demand rather according to the average daily demand. Peaks in demand are met by the additional metering of sodium-calcium hypochlorite from the temporary storage. As with chlorine gas, metering is done through a central injector system.

The chloride-free sodium hydroxide is likewise stored temporarily and can be transferred into the water being treated through the central injector system to adjust the pH value. To achieve this, an external pH value controller is directly connected to the system's control. The generated hydrogen is diluted with fresh air through an ATEX-certified ventilator and discharged safely and the diluted residual brine is disposed of. The salt-dissolving water comes from a softener integrated in the system, thereby preventing the formation of limescale and ensuring the long service life of the electrolytic cell.

The systems are controlled using a modern PLC with large, illuminated display and integrated modem for remote diagnosis and troubleshooting. The chlorine metering and the pH value correction are controlled as standard via contact inputs; analog inputs are likewise available.

CHLORINSITU® IV plus electrolysis systems are a particularly economical alternative for all applications that require simultaneous hypochlorous acid metering and pH value correction.

- Simultaneous production and metering of ultra-pure hypochlorous acid and sodium-calcium hypochlorite
- Chlorination and pH correction using a single system
- Cost-effective operation thanks to the use of sodium chloride as an inexpensive raw material and lower chemical consumption for pH correction
- Safe vacuum system technology
- Robust technology
- Compact, space-saving design

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Technical Data

Type/ output	Voltage supply	Power Uptake	Salt consumption	Process water consumption *	Cooling water consumption	Dimensions L x W x H (mm)	Brine tank	Recommended capacity storage tank
g/h		kW	kg/h	l/h	l/h		l	l
100	230 V	1.10	0.2	11	–	1,950 x 600 x 1,550	130	150
150	3 x 400 V	1.30	0.3	16	–	1,950 x 600 x 1,550	130	200
200	3 x 400 V	1.50	0.4	22	–	1,950 x 600 x 1,550	200	250
300	3 x 400 V	1.90	0.6	33	–	1,950 x 600 x 1,550	200	400
400	3 x 400 V	2.30	0.8	43	–	1,950 x 600 x 1,550	200	500
500	3 x 400 V	2.70	1.1	54	–	3,700 x 600 x 2,000	200	600
600	3 x 400 V	3.10	1.3	65	–	3,700 x 600 x 2,000	200	700
750	3 x 400 V	3.70	1.6	81	–	3,700 x 600 x 2,000	380	850
1000	3 x 400 V	4.70	2.1	108	–	3,700 x 600 x 2,000	380	1,100
1250	3 x 400 V	5.70	2.6	136	–	3,700 x 600 x 2,000	380	1,400
1500	3 x 400 V	6.70	3.2	163	–	3,700 x 600 x 2,000	380	1,700
1750	3 x 400 V	7.70	3.7	190	–	3,700 x 600 x 2,000	380	2,000
2000	3 x 400 V	8.70	4.2	217	200	4,100 x 600 x 2,000	520	2,200
2500	3 x 400 V	10.70	5.3	271	200	4,100 x 600 x 2,000	520	2,800
3000	3 x 400 V	12.70	6.3	325	200	4,100 x 600 x 2,000	520	3,300
3500	3 x 400 V	14.70	7.4	379	200	4,100 x 600 x 2,000	520	3,900

* The process water consumption depends on the ratio between chlorine gas and stock production. Here, the value for a ratio 50 % : 50 % is given.

Capacities > 3,500 g/h upon request

Scope of supply:

Electrolysis system mounted ready for operation on a powder coated stainless steel frame with programmable logic controller (PLC) in a control cabinet, integrated softening system, electrolysis cell, pH value monitoring of the electrolysis, ATEX-certified bleeding system and supplied salt-dissolving tank with level monitor. Level sensors to monitor the sodium-calcium hypochlorite storage tanks that are to be provided by the customer. The scope of supply also includes a central injector system matched to the system to meter chlorine gas, sodium-calcium hypochlorite and sodium hydroxide, inclusive of a booster pump. Automatic monitoring of the water hardness downstream of the softening system and chlorine gas detector for systems from 750 g/h.

Remarks:

CHLORINSITU® II, III, IV and IV plus electrolysis systems are offered and planned according to customer specifications. This is true both for the system documentation and the subsequent spare parts supply and maintenance.

4 CHLORINSITU[®] and Dulco[®]Lyse Electrolysis Systems

4.9 Questionnaire on the Design of an ECA Water System

Application

- Bottler flushing
- CIP
- Other _____

Applicational details

Number of bottlers: _____

Flushing duration: _____

Required volume to be added to bottler: _____ Recommendation with material SS 316 L 2-4 ppm

Number of CIP points of injection: _____

Duration of CIP: _____

Required volume to be added for CIP: _____ Recommendation 10-15 ppm

Water data:

Max. volume of water to be treated _____ m³/h maximum water pressure _____ bar

Water flow constant fluctuating from _____ m³/h to _____ m³/h

pH value _____ (iron (Fe²⁺) _____ mg/l)

Temperature _____ °C (manganese (Mn²⁺) _____ mg/l)

Proportion of solids _____ mg/l (nitrite (NO₂⁻) _____ mg/l)

Acid capacity K_{S4,3} _____ mmol/l (sulphide (S²⁻) _____ mg/l)

Total hardness _____ mmol/l (TOC (total organic carbon) _____ mg/l)

Total hardness _____ °dH (ammonium _____ mg/l)

Reaction time to application:

_____ m³ volume of reaction tank or _____ minutes dwell time in the total system.

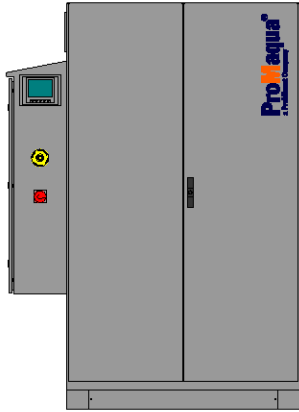
Disinfection method used to date:

Disinfectant consumed to date: _____ kg/week

Other requirements:

4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.10 Dulco® Lyse ECA Water System



Dulcolyse_100-300gram_SW1

ECA water (electrochemically activated water) from the Dulco®Lyse is used wherever safe disinfection is required combined with simultaneous protection of the system components against corrosion.

Dulco®Lyse electrolysis systems generate ultra-pure chlorine gas in a vacuum process. A saturated salt solution is produced in the supplied salt dissolving tank for this purpose, which is then electrolysed in a membrane cell. Sodium hydroxide and hydrogen are produced in the cathode chamber while ultra-pure chlorine gas and dilute residual brine are produced in the anode chamber from which it is separated by the membrane. The resulting chlorine gas is immediately separated from the residual brine and dissolved in hypochlorous acid. The sodium hydroxide is temporarily stored and added to hypochlorous acid using a metering pump. The result is a neutral, highly-effective and extremely low-chlorine disinfection solution, which is temporarily stored in the product tank up until metering via separate metering stations. The hydrogen generated is diluted with fresh air through an ATEX-certified ventilator and discharged safely. The salt-dissolving water comes from a softening system integrated in the Dulco®Lyse system, thereby preventing the formation of lime deposits and ensuring the long service life of the electrolysis cell.

The systems are controlled by a modern PLC with a large, illuminated display and integrated modem for remote diagnosis and troubleshooting.

Advantages of the Dulco®Lyse system for the production and provision of pure, low-chlorine ECA water:

- Handling of chemicals is reduced (only sodium chloride is required)
- Compact, space-saving design
- Economic operation thanks to use of inexpensive sodium chloride as a raw material
- Control of the system with an integrated modem for remote diagnostics

Technical Data

Type/ Output *	ECA production at 400 ppm	No. of cells	Voltage supply	Power uptake	Dimensions H x W x D *	Salt solution tank volume	
g/h	l/h			kW	mm	l	
Dulco®Lyse 100	100	250	4	230 V / 50 Hz	1.95	2,100 x 1,500 x 355	130

* Greater outputs upon request, dimensions applicable up to 300 g/h

Scope of supply:

Dulco®Lyse electrolysis systems are assembled connection-ready in a stainless steel housing

- PLC (programmable logic controller) in attached control cabinet
- Integrated softening system
- Electrolysis cell(s)
- ATEX-certified bleeding system
- Integrated salt tank with level monitoring
- Automatic monitoring of the water hardness downstream of the softening system

	Order no.
Dulco®Lyse 100	1041424

Spare parts and maintenance kits

	Type	Order no.
Annual maintenance kit	Dulco®Lyse 100	1041427
3-yearly maintenance kit	Dulco®Lyse 100	1041430
Membrane cell	Dulco®Lyse 100	1041433
Membrane	Dulco®Lyse 100	1041436

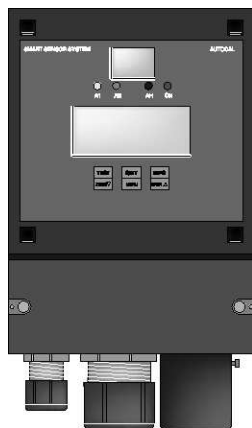
4 CHLORINSITU® and Dulco®Lyse Electrolysis Systems

4.11 Gas Warning Device for Monitoring for Chlorine Gas

The GMA 36 chlorine gas warning device is a compact measuring and switching unit designed for monitoring the surrounding air for dangerous concentrations of chlorine gas.

Gas warning device GMA 36

for monitoring chlorine gas



pk_7_004_1
Gas warning devices GMA 36

Type	Chlorine
Warning at approx.	2.0 ppm/vol%
Alarm at approx.	4.0 ppm/vol%
Permissible ambient temperature	-15...45°C
Protection class housing	IP 54
Dimensions (without PGs, without sensor) H x W x D	247 x 135 x 95 mm
Supply	85 – 264 / 50 – 60 V/Hz
Power consumption	5 W
Warm-up phase max.	150 s
"Warning" relay contact, self-resetting	230 / 1 V/A
"Alarm" relay contact, latching	230 / 1 V/A
"Horn" relay contact, latching, can be acknowledged	230 / 1 V/A
Sensor measuring principle	electrochemical
Sensor service life (depending on environmental cond.)	2–3 years

Note: The sensor reacts to all oxidising gases.

	Order no.
GMA 36 chlorine gas detector	1023157

Spare parts

		Order no.
Replacement sensor	for chlorine, chlorine dioxide, ozone	1023314
Replacement sensor	for gas warning devices in the Life CGM range	1003009

4.12 Accessories

Water hardness measuring kit

for manual determination of the overall hardness

	Order no.
Water hardness measuring kit for overall hardness	505505

5 ProCal Calcium Hypochlorite System

5.1 ProCal Calcium Hypochlorite System

When dissolved in water, calcium hypochlorite provides a highly effective disinfectant solution. The resulting solution not only contains the freely acting chlorine but also the lime deposits of the dissolving water and the non-soluble fractions of the calcium hypochlorite salt. After dilution, the solution is very stable and can be metered directly for disinfection purposes.

Calcium hypochlorite is very widely available and, in contrast to sodium hypochlorite, calcium hypochlorite can be stored as a salt. It is only dissolved when required.

Advantages of calcium hypochlorite:

- Very easy to handle.
- Excellent disinfection effect.
- Low proportion of side-products (dependent on the granulate used).

5.1.1 General Applications of Calcium Hypochlorite

Municipal water companies

- Emergency chlorination systems for disinfecting potable water

Industry

- Cooling water treatment
- Bleaching agent for use in the paper, cellulose and textile industries
- Disinfection of process water

Swimming pools (public and private)

- Disinfection of swimming pool water The ProCal has been specially developed for these uses.

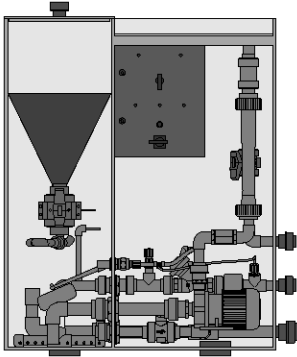
5.1.2 ProCal Systems Engineering

The ProCal system is incorporated in a constant flow bypass in the pool circuit. Dependent on requirements, calcium hypochlorite is metered as a granulate into a mixing chamber to form a solution and then added to the pool circuit by means of a booster pump. The calcium hypochlorite itself is kept in a storage tank above the mixing chamber. To avoid lime deposits in the system and the bypass lines, a time-controlled acid rinse can be integrated.

The control signal for the correct chlorine concentration in the pool comes from a swimming pool controller (D1C, D2C, DSR or DULCOMARIN® II) as a pulse-pause signal. This signal controls the adding of granulate to the mixing chamber.

5 ProCal Calcium Hypochlorite System

5.1.3 ProCal Calcium Hypochlorite System



ProCal_3240A_SW1

The ProCal disinfection system is used for the simple and economic disinfection of swimming pool water using calcium hypochlorite.

At low cost and with simple handling the ProCal granulate metering device can be used to produce calcium hypochlorite solution from dry calcium hypochlorite. The effective, low-chlorine disinfectant solution is used, ready prepared, with the integral, fully automated metering unit and added to the swimming pool water via a bypass line.

Measuring and control units from the DULCOMETER® D1C, D2C product range or the DULCOMARIN® II multi-channel unit can be used to provide controlled metering. Hence the swimming pool water of small to medium-sized pool systems can be reliably and economically disinfected in accordance with DIN 19643-1.

Application	Private and public swimming pools with circulating capacities of up to 2,000 m ³ /h (2,000 m ³ /h for inside pools, 400 m ³ /h for outside pools)
Disinfectant	Calcium hypochlorite
Electrical connection	230 V, 50 Hz
Process integration	Bypass input and output DN 25 for 3 m ³ /h Drain outlet/overflow DN 32
Option	Point of injection for acid cleaning
Signal outputs	Operating/Fault
Control inputs	Control input, potential-free contact for start/stop operation Pause input, potential-free contact for remote release
Dimensions H x W x D	1,100 x 900 x 500

	Order no.
ProCal calcium hypochlorite system	1040728
ProCal calcium hypochlorite system with acid rinse	1041481

Spare parts and maintenance kits

	Order no.
Annual maintenance kit (without acid rinse)	1041482
3-yearly maintenance kit (without acid rinse)	1041483
Annual maintenance kit (with acid rinse)	1041494
3-yearly maintenance kit (with acid rinse)	1041495