Water Process Solutions

Operating and Maintenance Manual WPS-PX200 / 400

Electrochlorination system Revision 1

Water Process Solutions

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Contents

Contents

Health & Safety.

Health & Safety.

The process of creating Sodium hypochlorite is achieved by passing current through a controlled brine dilution, by means of specialised electrodes. The process introduces a number of primary and secondary hazards which must all be controlled to ensure safe and operation of the Electrochlorinator.

On the following pages a detailed risk assessment for the MP Electrochlorinator is given to allow a better understanding of the hazards involved in the process and the means by which these are controlled and monitored.

Definitions.

Sodium Hypochlorite:

The final product of the electrochlorination process is a sodium hypochlorite solution of less than 1%. At this strength the solution is deemed a mild irritant although special care should be taken not to ingest the solution and to avoid the eye area. If sodium hypochlorite is ingested do NOT induce vomiting but do seek medical assistance. If sodium hypochlorite is introduced to the eye, irrigate immediately and for 10-15 minutes or until all irritation has ceased. All other minor splashes to the skin or clothing can be removed by immediate rinsing of the affected area.

Electric Shock:

Great care should always be taken with any electrical equipment. Any and all isolations should be made properly and checked before any work is undertaken on the Electrochlorinator.

Hydrogen Gas:

The electrolytic process of converting brine into sodium hypochlorite generates hydrogen gas as a secondary product. Hydrogen gas is highly explosive when introduced into an oxygen rich environment.

The MP Electrochlorinator is designed to dilute the generated hydrogen gas to at least ¼ of the gas's lower explosive limit (LEL). At all times

up to the dilution point any area which could contain hydrogen gas is dual contained. Once diluted below ¼ LEL the diluted hydrogen is vented to a safe ventilation point away from any sources of heat or ignition, at a minimum of 3m above any walkway.

Hydrochloric acid:

From time to time the Electrolyser may need to be cleaned to remove calcium carbonate deposits on the electrode plates in the event of the Softener having failed. Protective clothing and goggles must be worn. In the event of any splashes onto skin, rinse area thoroughly in running water, removing any affected clothing. If the eye is affected, irrigate immediately for at least 15 minutes.

Brine / Salt:

Only Pure vacuum dried salt should be used for the electrochlorination process, without any added anti-caking agents. Although salt is often deemed as completely harmless introduction of salt or brine to clothing or the eye area should be irrigated immediately.

MSDS Material Safety Data Sheet.

Section 1: Company and product identification

Product Identification NaOCl Sodium Hypochlorite <1%	
Manufacturers Name: Water Process Solutions Ltd	Emergency contact +44(0)1622719945
Company Address: Unit 10 Mill Hall Business Estate Aylesford, Kent ME20 7JZ UK	Revision 0

Section 2: Composition

Component	Concentration	ACGIH TLV	OSHA PEL
NaOCL	<1%	Not available	Not available
NaCl	<2%	Not available	Not available
Softened water	>97%	Not available	Not available

Section 3: Hazard Identification

Emergency overview: Irritating to the eyes and stomach, a slight rash may result from contact with the skin. Irrigate all contact areas immediately. If ingested dilute with water, do not induce vomiting and seek medical assistance.

Eyes: May cause irritation, redness and tearing.

Skin: May cause irritation.

Ingestion: May cause erosion of mucous membranes.

Chronic effects Carcinogenicity: None

IARC: No classifiable Carcinogenic effects.

OSHA: No

Section 4: First aid measures

In all cases seek appropriate medical advice.

Contact with eye area: Immediately irrigate with clean water and continue for 10 – 15 minutes or until symptoms subside.

Ingestion: Immediately dilute with water, vomiting may be spontaneous but do not induce vomiting, immediately seek medical advice

Section 5: Risk of fire

Flash Point: Not available

LFL / LEL: Not available

Extinguishing media: Use the correct means for extinguishing surrounding fire.

Fire and explosive hazards: Solution is not deemed to be explosive.

Section 6: Accidental release measures

Dilute with water and then flush to drain, if local regulations allow. If not allowed then recover for recycling at an approved facility. Always dispose of in accordance with local regulations.

Section 7: Handling and storage

As with all chemicals wash hands thoroughly after handling. Avoid contact with eyes or skin. Protect from freezing and physical damage. **Safety storage code: Irritant**

Section 8: Exposure control and protective equipment

Respiratory protection: Normal room ventilation is adequate

Skin protection: Chemical resistant gloves

Eye protection: Safety glasses or goggles.

Section 9: Physical and chemical properties

Appearance: Clear greenish liquid

Ph: Alkaline (8.5)

Odour: Chlorine odour

Boiling pt: 100°C

Solubility in water: Infinite

Melting pt: 0° C

Specific gravity: Approximately 1

Principles of operation

Principles of operation.

The production of Sodium hypochlorite is achieved through a continuous process of the electrolysing of a controlled brine dilution.

The process of electrochlorination can be broken down into the three main areas of the assembly:

1. Brine tank (Salt saturator).
2. Electrochlorinator Assembly.
3. Product storage tank.

Brine tank (Salt saturator).

The brine tank consists of a float valve, pure vacuum dried (PVD) salt, a gravel layer and filter laterals. The brine tank allows the flow of softened water through a float valve to dissolve (PVD) salt into a saturated brine solution. As the solution saturates it falls through the gravel bed removing any large impurities and through a set of filter laterals to remove any smaller particles.

Electrochlorinator assembly.

The electrochlorinator assembly consists of two main areas, the electrolyser (and degassing) module and the electrical control cabinet.

Water and brine at a controlled rate passes through the electrolyser module where it is subjected to a DC Voltage at a controlled current. This provides an electrolysed sodium hypochlorite solution which travels into a degassing vessel to remove all entrained hydrogen from the process. Once all of the hydrogen has ‘gassed off’ the solution drops to the bottom of the degassing column where it passes out of the module via the ‘dip pipe’ and connective pipework to the product storage tank.

The electrical control cabinet via an operator interface (HMI) constantly monitors tank demand. On initiation of a low signal from the product storage tank, flow of the diluted brine solution initiated. Once the electrolyser is submerged power is initiated across the electrolyser and voltage constantly monitored. Prior to power being initiated a forced ventilation fan is started to ensure the correct dilution of hydrogen to a maximum of ¼ LEL.

The electrical control cabinet constantly monitors the voltage and current across the electrolyser and air flow rate into the cabinet and adjusts airflow and brine dilution to ensure the electrolyser runs at its optimum efficiency.

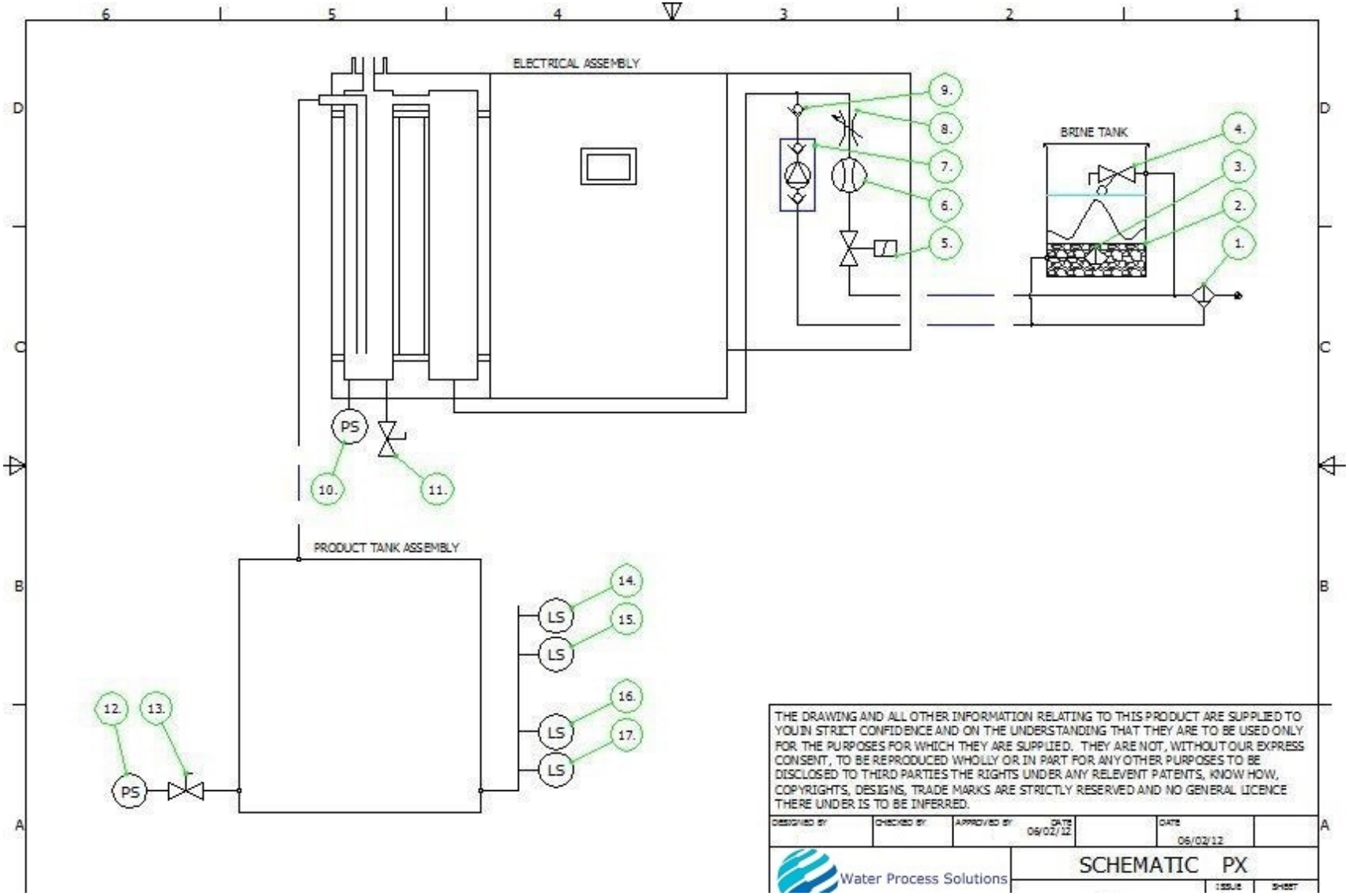
Product storage tank.

The product storage tank is fitted with one of two methods to control the electrochlorination process. Firstly the tank can be fitted with up to 4 level switches to control the tank fill start, and stop point as well as the ability to include HH and LL alarm switches. Secondly the tank can be fitted with a pressure sensor to give an accurate tank level at all times, with settable Start, Stop, HH, & LL levels in the OSEC V control PLC.

Identifier	Description	Qty
1	Water softener	TBC
2	Gravel bed	1
3	Filter lateral	1
4	Float valve	1
5	Solenoid valve	1
6	Variable area flow meter	1
7	Brine pump	1
8	Flow metering valve	1
9	Injector	1
10	Pressure level sensor	1
11	Sample valve	1
12	Tank level sensor (option 1)	1
13	Sensor isolation valve (option 1)	1
14	High high tank level switch (option 2)	1
15	High tank level switch (option 2)	1
16	Low tank level switch (option 2)	1
17	Low low tank level switch (option 2)	1

Option 1: Tank pressure level sensor

Option 2: Sight glass and proximity level switches



DESIGNED BY	CHECKED BY	APPROVED BY	DATE 06/02/12		DATE 06/02/12	

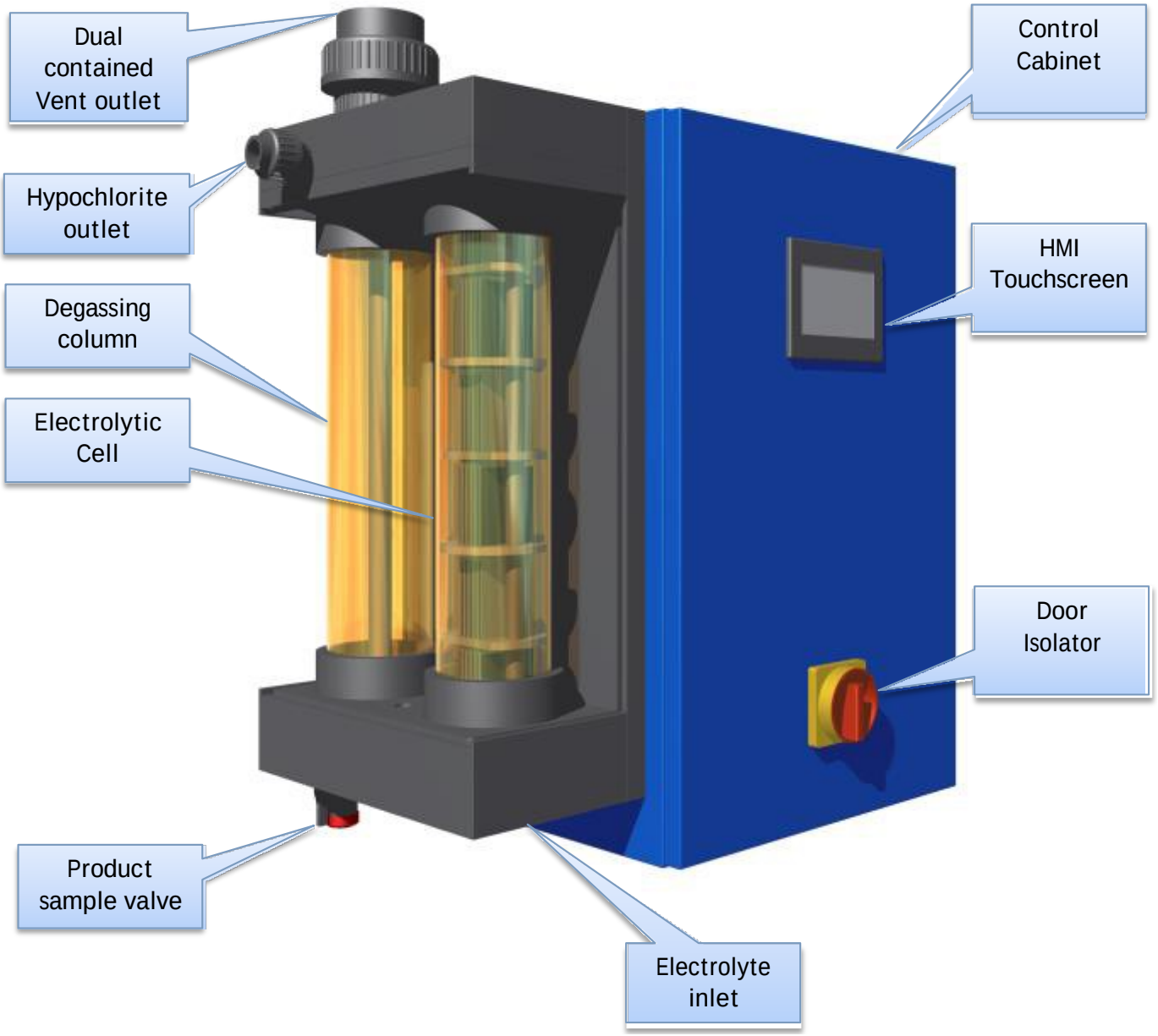
Water Process Solutions

SCHEMATIC PX

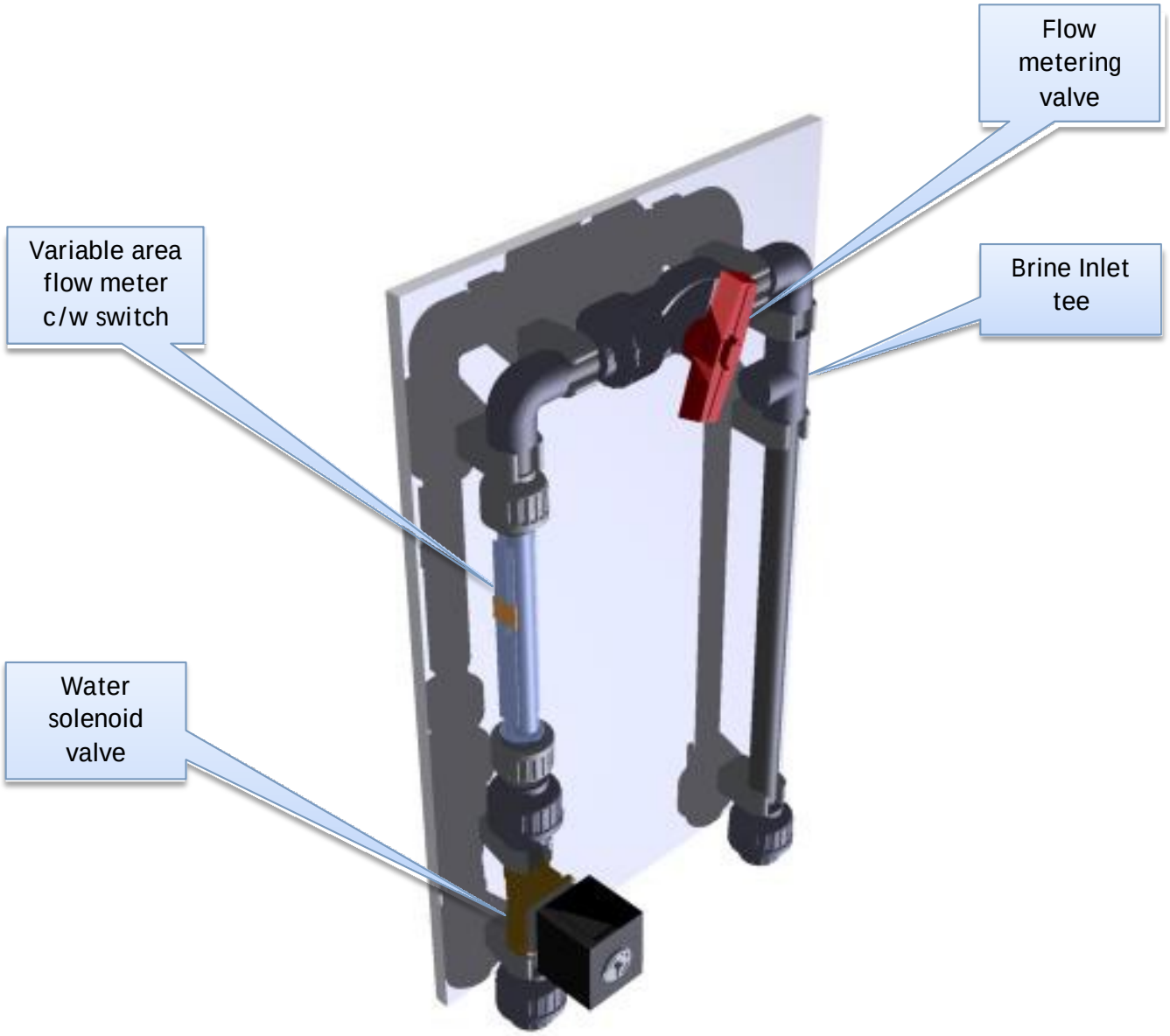
ISSUE | SHEET

Overview:

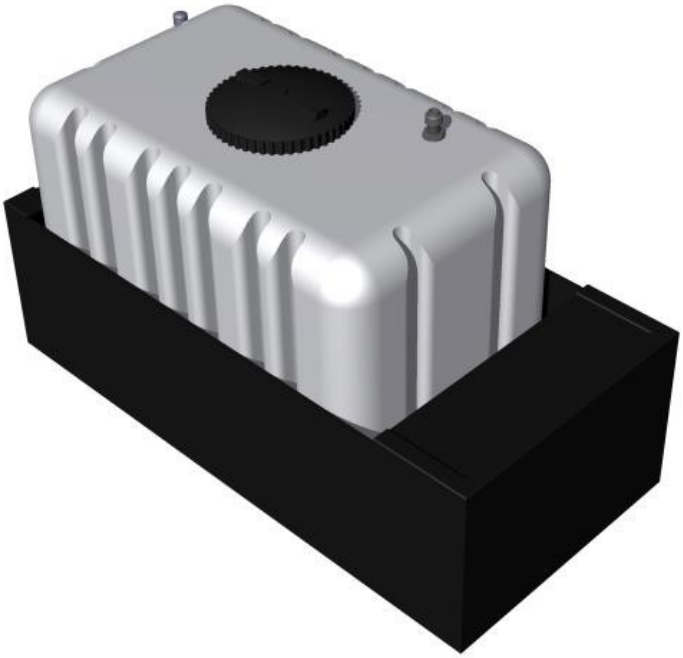
MP Electrochlorinator:



Hydraulic flow board:



Installation Instructions



Installation instructions.

It is recommended that all installation pipework and fittings should be of WRAS (or equivalent) approved un-plasticised Polyvinyl Chloride (u-PVC) products.

Product Tank Level Sensor:

The position of the level sensor should be situated at the lowest point of the Product Storage Tank.

Inlet Water Supply:

Good quality filtered water is required at a pressure of 2 - 5 bar. If there is insufficient pressure, then either a booster pump or a non-standard softener can be provided. Where the product is to be dosed into drinking water, it is preferable to use final treated mains water.

Specification:

Component	Limit
pH	6.5 – 8.5
Hardness (Ca / Mg)	<10 ppm (at outlet of water softener)
Total organic content	<1 ppm
Iron	<200 ppb
Manganese	<10 ppb
Nickel	<5 ppm
Flouride	<2 ppm
Copper	<5 ppb

Water Softener:

The drain for the softener should be piped to an open, unpressurised drain point. The drain point should not be situated higher than 2m above the water softener outlet.

Salt:

The saturator must include a filter bed of a minimum of 150mm of 4 – 6mm washed gravel. A break tank should be installed before the softener and Electrochlorinator when a bulk salt saturator is installed.

Specification:

As per BS 998:1990

PVD SALT DATA:

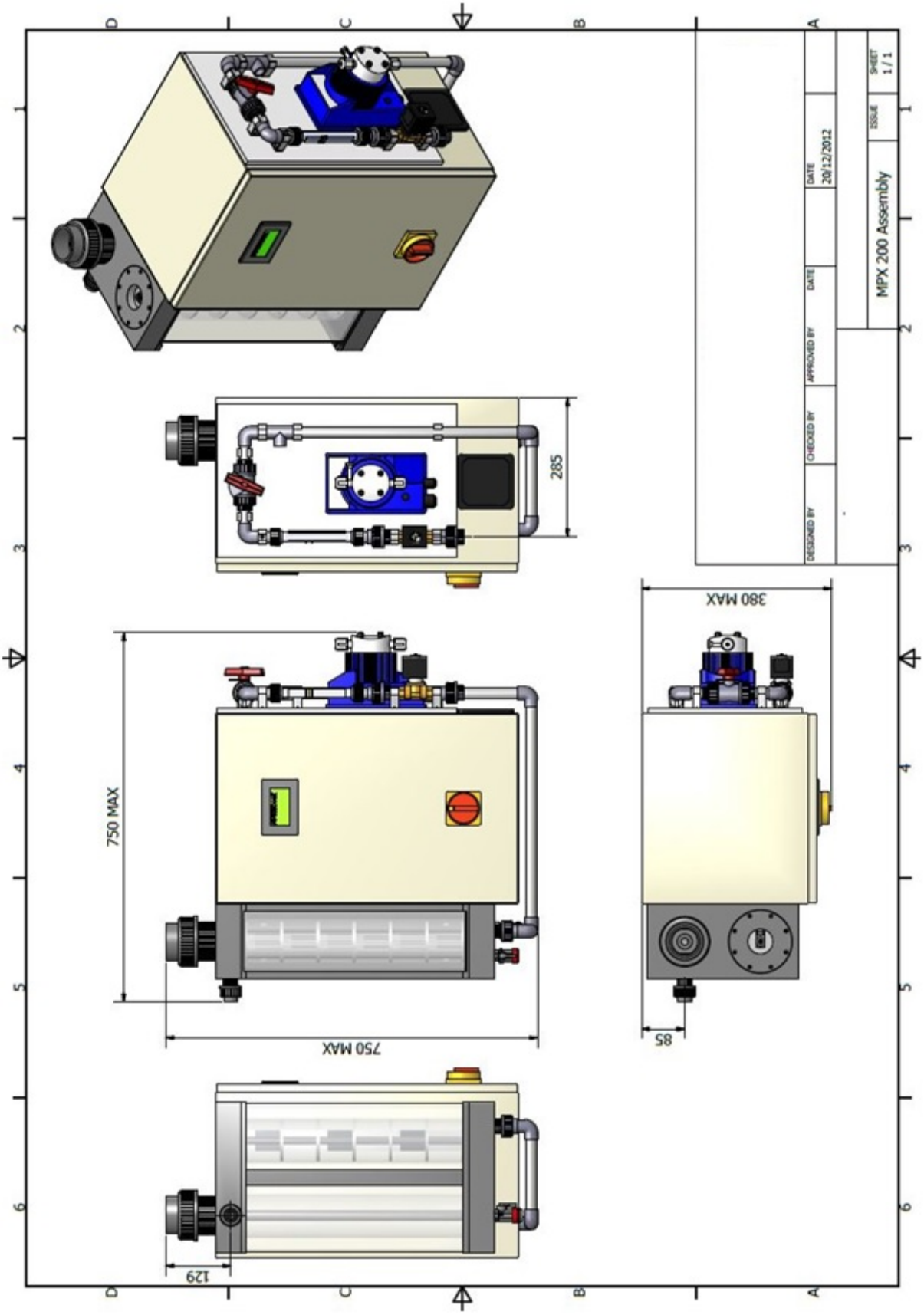
BS998:1990 'Vacuum salt for food use'

Component	Limit	Unit	Max / min
Sodium chloride as NaCl	99.6	%	minimum
H_2O moisture	0.2	%	maximum
Insoluble matter	300	ppm	maximum
Sulphur as Na_2SO_4	3000	ppm	maximum
Calcium as Ca	100	ppm	maximum
Magnesium as Mg	100	ppm	maximum
Cadmium as Cd	0.2	ppm	maximum
Arsenic as As	0.5	ppm	maximum
Copper as Cu	2	ppm	maximum
Lead as Pb	1	ppm	maximum
Mercury as Hg	0.05	ppm	maximum
Alcalinity as Na_2CO_3	300	ppm	maximum
Total Iron as Fe	10	ppm	maximum
Anticaking as $Fe(Cn)_6$	15	ppm	maximum

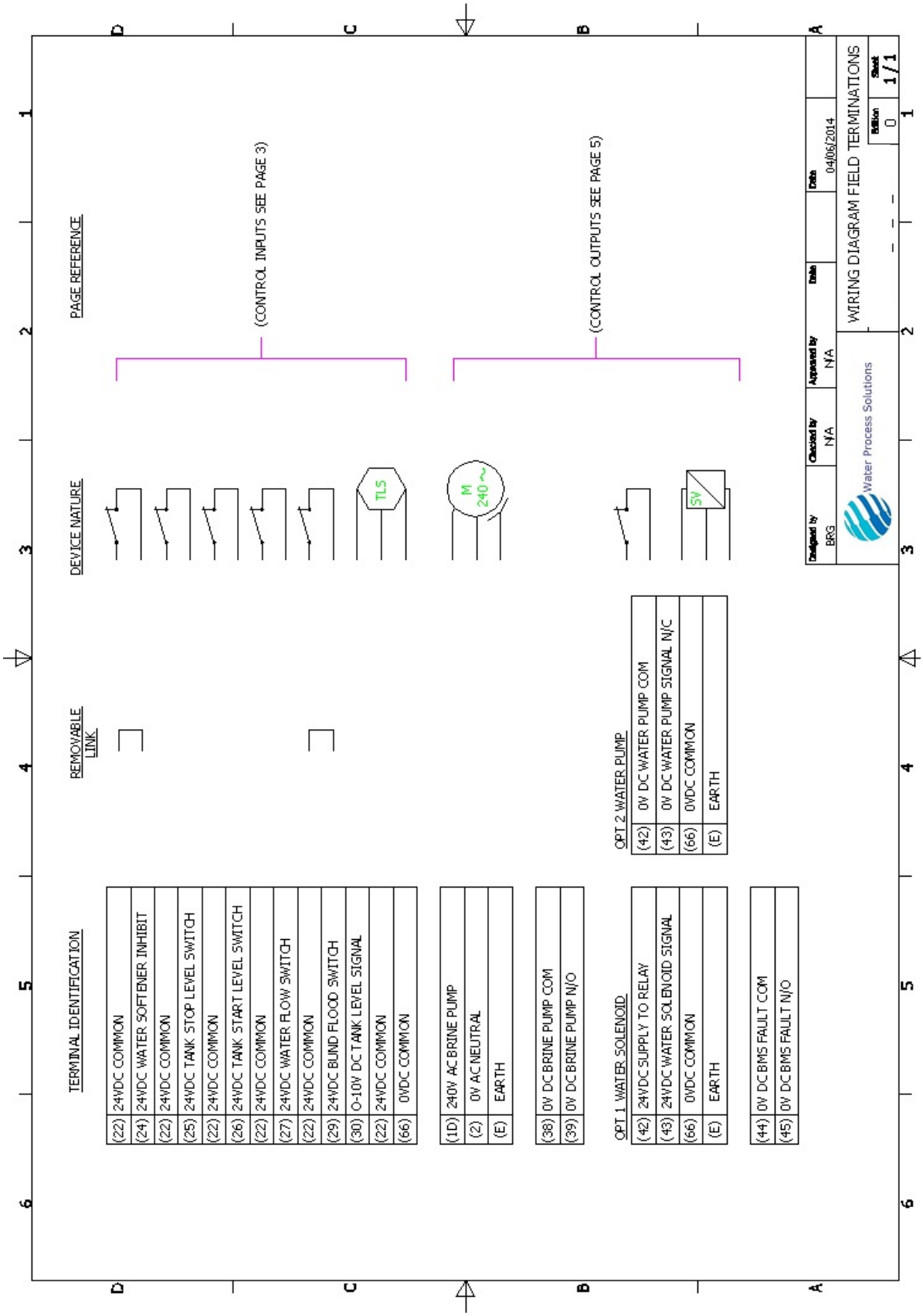
Vent Piping - <u>Very Important</u>:

Run internal and external ventilation piping to the exterior of the building, as direct and straight as possible and always upward from discharge point on the top of the Electrochlorinator to a safe discharge point within 10 metres of electrochlorination unit. Pipework should continuously rise at no less than 12.5° to the horizontal.

Electrochlorinator Assembly



Field Wiring Terminations



Water softeners

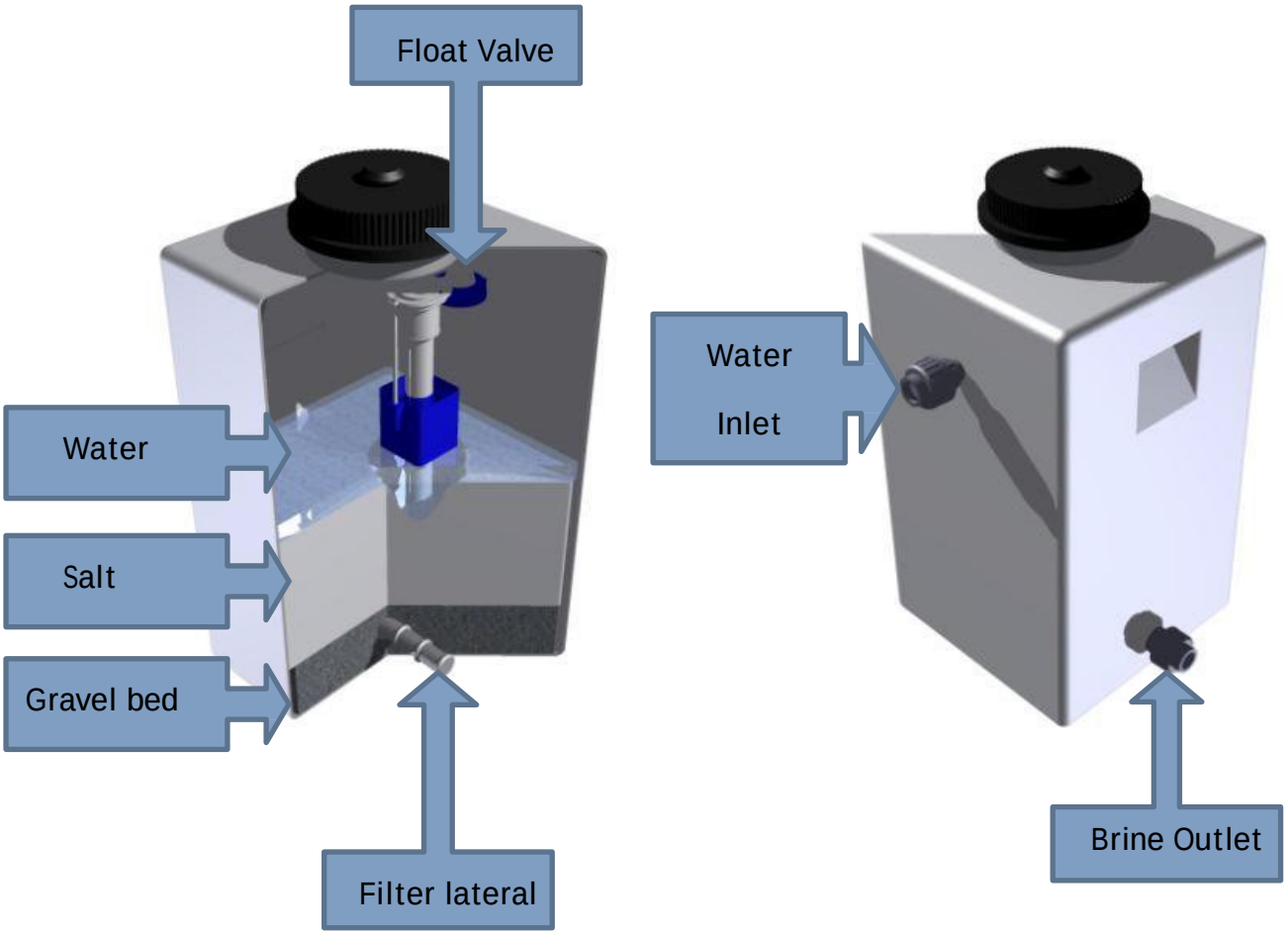
Electrochlorination requires the use of softened water, failure to use soft water will result in the build-up of calcium carbonate on the electrodes dramatically reducing the efficiency of the electrolyser. To ensure this we always advise the use of water softener with a timed regeneration.

In the case of a softener failure the build-up of calcium carbonate will need to be removed by acid washing. The MP systems have an integral acid washing system which can be accessed within the operator level of the PLC management system. This can be easily accessed from the HMI and offers the operator a step by step instruction to guide them through the acid washing process. Further information on acid washing can be found in the Help screens.

Brine Tanks (Salt saturators)

A correctly sized brine tank ensures that the Electrochlorinator and water softener have a constant supply of saturated brine solution at the lowest practicable level of refilling with PVD salt.

The diagram below shows the typical layout of a salt saturator.



Ventilation pipework.

The ventilation pipework into and out of the unit is key to the safe operation of any Electrochlorinator. The MP design allows air to flow from the electrical control cabinet past a quantative airflow sensor and into the Electrochlorinator assembly to create a constantly changing jacket of air around the electrolyser and degassing column.

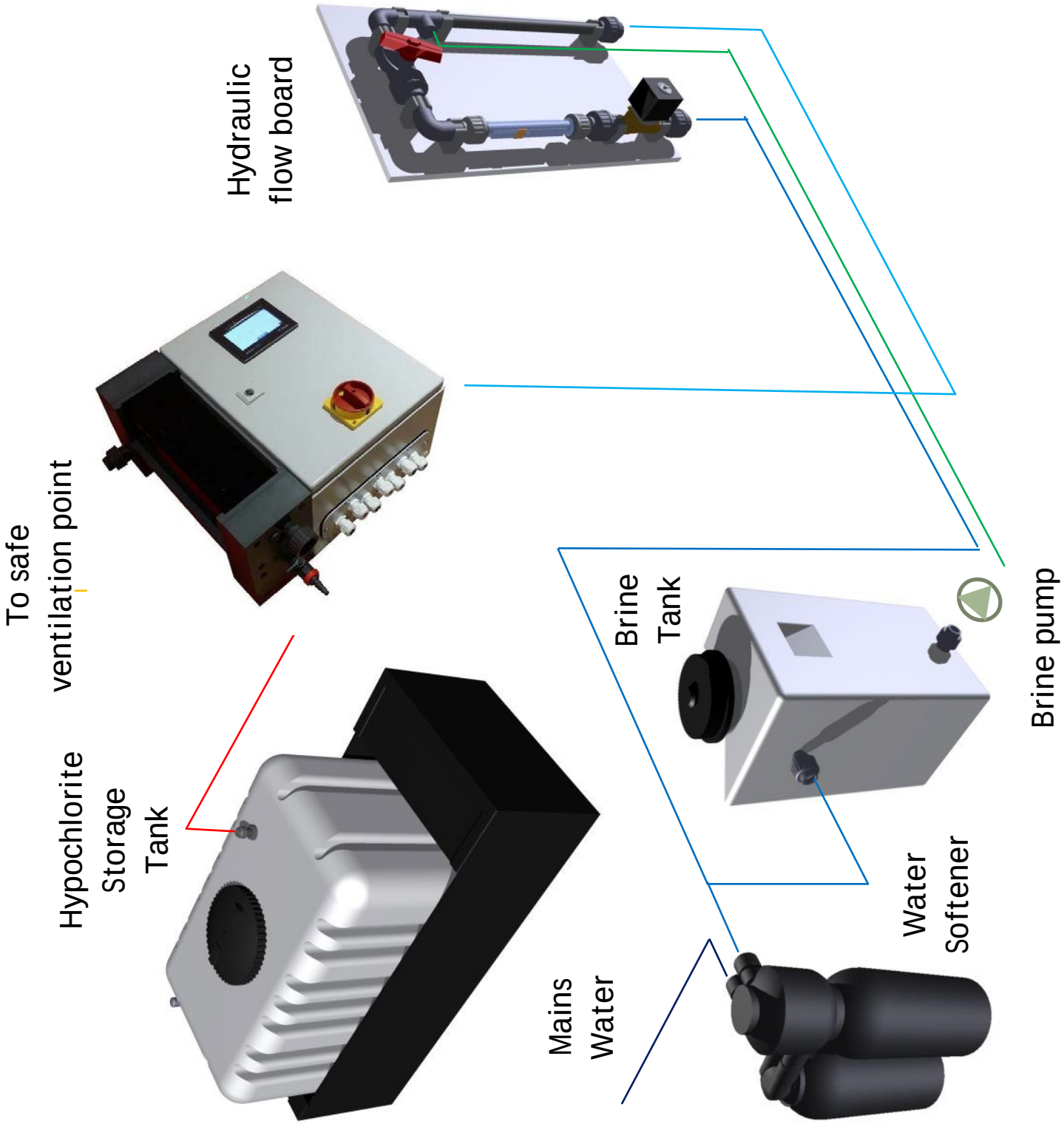
This ventilated air then provides a constant airflow around the hydrogen vent pipework (dual contained) finally diluting the generated hydrogen to below ¼ of its lowest explosive limit LEL.

It is critical when installing ventilation pipe work that no restrictions or leaks to the ventilation pipework are made. The vent pipework leaving the Electrochlorinator cabinet should travel vertically for at least 0.5m after leaving the cabinet and then using swept bends only travel the shortest possible route to the designated safe ventilation point. Vent runs should always be run at a slightly inclined angle towards the safe ventilation point and not consist of any dips where hydrogen could accumulate.

The inner hose carrying the ventilation should be run to almost the full length of the outer pipe and dilute the hydrogen as close to the safe ventilation point as possible.

Safe ventilation points should be specified that there is no risk of ignition or excessively heating the hydrogen gas. Vent points should also be fitted with a tee to encourage the dilution of hydrogen without exposing the vent pipework to rain ingress.

Proposed installation.



Setting up the Electrochlorinator.

Setting up the Electrochlorinator.

Once the installation is complete and all hydraulic and electrical terminations are made and tested the Electrochlorinator will require setting up. All Electrochlorinators already have basic running parameters saved in the PLC program from the Factory acceptance testing (FAT) process. Any site specific adjustments can be made at the electrical control panel HMI or the hydraulic control board.

Initial startup of the MP Electrochlorinator.

When starting the system for the first time, or after a prolonged shutdown, the system will need to be visibly checked and all relevant isolations are removed. Water and brine flow levels as well as fan operation will need to be checked before finally submerging the cell in electrolyte before starting the unit.

PLC Menu

The PLC can easily be accessed through the touch screen located on the front of the electrical control panel. This allows ease of control and adjustment by operator or service engineer.

Once the program has loaded the PLC will default to the main menu screen using the PLC Map on the following page the operator can easily be directed to the relevant screen.

PLC Map Basic operation (level 1 login).

1. Base Screen

The base screen is the default screen after start up, and offers the user the following options:

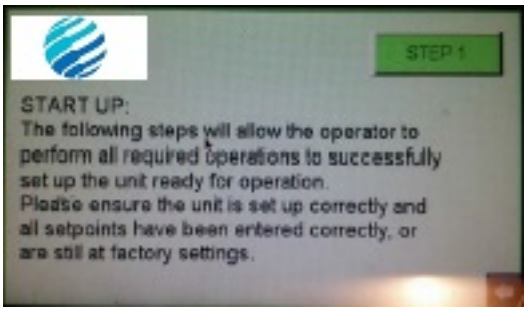
Depending on the login code used in the login screen differing levels of control of the unit can be accessed.

Level 1 is usually specified for operators and allows the operator to start up the unit, check the unit information, operate the unit, and check the running parameters of the unit.

Level 2 is usually specified for maintenance / service operations and allows the engineer to change fault alarm set points, observe live inputs and outputs to the PLC, replace failed components and test, and perform acid washing if required.

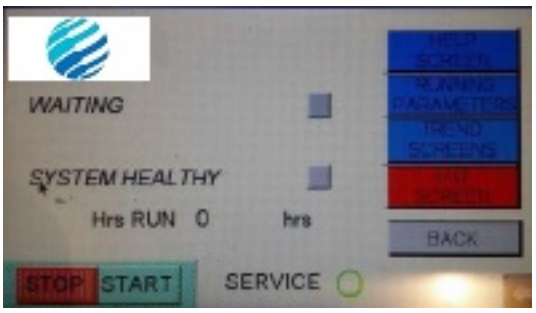
Level 3 is specified for specifically trained personnel only.

2. START UP Screens



The start-up screens are entered from the base screen menu and take the operator on a step by step guide through ensuring the unit is ready to operate prior to starting the unit. Once the Start up process has been completed the operator will be able to access the normal running screen.

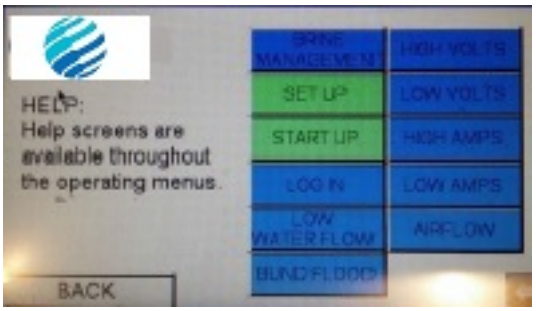
3. Normal running screen



The normal running screen displays the basic operating options available when the unit is running. It displays two text messages detailing the unit's operating condition, an hours run clock, a

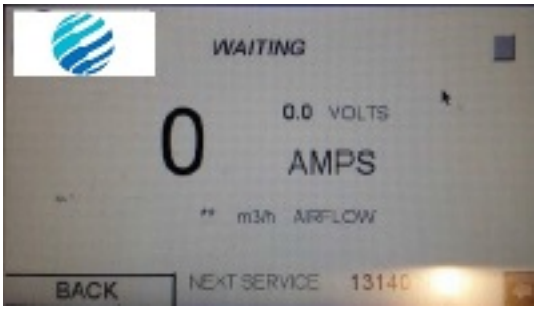
service due light and a number of options to enable the operator to observe the current running conditions of the unit. Help screens are also available to give the operator some basic assistance in the case of a fault occurring.

4. Help screens



The help screens offer specific assistance to the operator on all of the alarm modes, the start-up and the setup processes and unit set points, the help menu can be accessed at any time from the Normal running screen or the Base screen.

5. Running parameters



The running parameter screen offers the operator real time feedback of the operating conditions of the unit, and details the running hours before a next service is due.

6. Trend screen

The trend screens offer the operator a log of the last 24 hours of operation, trend screens are available for, Running volts, amps, airflow, and in the case of units fitted with a level sensor rather that level switches, tank level. These trend graphs offer a real time feedback which can be scrolled back and forward across the 24hr logging period to show the recent trends of the unit.

7. I/O Screen

Much like the running parameter screen the I/O screen offers the operator a visual representation of the actual inputs into the PLC, this allows an operator to contact a trained service engineer over the phone and fully describe the conditions of operation, regardless of set points and scaling factors.

Typical Unit Set points.

Below is a table of typical set points for the MP 50-100g/h range of Electrochlorinators it should only ever be used as a guide, as individual installations may require slight adjustment to ensure the Electrochlorinator functions at its optimal level.

Criteria	Units	MP200	MP400
Water Flow	lt/h	32	65
Water temp	°C	5-15	5-15
Brine flow	lt/h	3.5	7
Voltage	V	21	21
Amps	A	45	90
Airflow	m^3/h	50	50
Product Strength	g/l	6.5	6.5
Design capacity	g/hr	247	495

Sample Testing.

Regular sample testing is key to preventing maintenance and unit down time, regular samples of soft water, diluted brine and product strength should be taken at weekly intervals and recorded in the operator's log. Along with recorded values for airflow and voltage, and a visual inspection of the electrolyser for signs of precipitation on the electrodes or leaks from the hydraulic components and fittings.

Soft water sample testing

- Take a sample of water from the softener.
- Fill the plastic sample container to the 50ml mark
- Add two hardness Yes/No tablets to the sample, replace the lid and shake until the tablets have disintegrated.
- Sample turns RED – Softener requires regeneration
- Sample turns GREEN – Softened water is being produced

Product strength test using a comparator

- Fill a 1ml syringe with fresh product.
- Take a 100ml beaker and partially fill with mains water.
- Empty syringe into the beaker.
- Add more mains water up to the 100ml mark, shaking to mix.
- Fill a 10ml tube of the Comparator with the sample mixture.
- Add acid and a KI tablet (high rate chlorine test).Put in high rate yellow chlorine Disc 0 - 250 mg/l and read Comparator.
- Multiply reading by 100 (e.g. 65 mg/l is equivalent to 6500 mg/l which equals 6.5 grams/litre or 0.7%)

Maintenance

Maintenance

From time to time maintenance is required to ensure the correct running of the Electrochlorinator. Key requirements for service intervals and spares are given in the service section of this manual.

Weekly inspections

Once a week the Electrochlorinator should be visually inspected by operational staff to look for signs of leaks calcium carbonate precipitation on the electrodes, running volt levels of the electrolyser, salt levels in the brine tank, water softness, and product strength.

If all of this information is correctly logged for an Electrochlorination unit the time spent fault finding on site can generally be reduced by 75%.

Operator Log

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Water flow							
Brine pump	%	%	%	%	%	%	%
NaOCl Temp	°C		°C		°C		°C
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Operators initials							
	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Water flow							
Brine pump	%	%	%	%	%	%	%
NaOCl Temp		°C		°C		°C	
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Operators initials							

Operators notes

Operator Log

Date	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Water flow							
Brine pump	%	%	%	%	%	%	%
NaOCl Temp	°C		°C		°C		°C
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Operators initials							
	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Water flow							
Brine pump	%	%	%	%	%	%	
NaOCl Temp		°C		°C		°C	
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Operators initials							

Operators notes

Operator Log

	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Water flow							
Brine pump	%	%	%	%	%	%	%
NaOCl Temp		°C		°C		°C	
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Operators initials							
	Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Water flow							
Brine pump	%	%	%	%	%	%	
NaOCl Temp	°C		°C		°C		
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Operators initials							

Operators notes

Operator Log

	Week 40	Week 41	Week 42	Week 43	Week 44	Week 45	Week 46
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Water flow							
Brine pump	%	%	%	%	%	%	%
NaOCl Temp		°C		°C		°C	
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N
Operators initials							
	Week 47	Week 48	Week 49	Week 50	Week 51	Week 52	
Date							
Visual cell inspection	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Volts							
Amps							
Product strength							
Soft water	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Water flow							
Brine pump	%	%	%	%	%	%	
NaOCl Temp	°C		°C		°C		
Leaks	Y / N	Y / N	Y / N	Y / N	Y / N	Y / N	
Operators initials							

Operators notes

Service

Service

The following schedule details the twice yearly / yearly and two yearly recommended service actions to keep the Electrochlorinator system in good working order.

6 monthly service

Every six months the Electrochlorinator should be serviced by a competent engineer to ensure its correct operation. This service should but is not limited to the following actions:

- Inspect the operators log to look for any trends which may indicate the failure of key components.
- Check all lines are free of restrictions/blockages or air traps.
- Check correct operation of brine tank float valve.
- Check electrolyser connections at both the electrolyser and the control panel to ensure there is no corrosion or loose connections.
- Check all hydraulic fittings are tight and show no signs of leaks.
- Check correct operation of bund flood switch (if applicable).
- Check correct operation of air flow sensor.
- Check high and low volt alarms.
- Inspect all electrical components for signs of wear / burnout, replacing if necessary.
- Manually force the water softener into generation and test the water softness.
- Remove and replace peristaltic tubes. (peristaltic pump option only)
- Check dosing pump flow rate (dosing pump option only)
- Complete all checks required for a weekly inspection and complete operators log.

Yearly service

Once a year the Electrochlorinator should be serviced by a competent engineer to ensure its correct operation. This service should but is not limited to the following actions:

- Inspect the operators log to look for any trends which may indicate the failure of key components.
- Check all lines are free of restrictions/blockages or air traps.
- Check correct operation of brine tank float valve.
- Check electrolyser connections at both the electrolyser and the control panel to ensure there is no corrosion or loose connections.
- Check all hydraulic fittings are tight and show no signs of leaks.
- Check correct operation of bund flood switch (if applicable).
- Check correct operation of air flow sensor.
- Check high and low volt alarms.
- Inspect all electrical components for signs of wear / burnout, replacing if necessary.
- Manually force the water softener into generation and test the water softness.
- Remove and replace peristaltic pumps. (peristaltic pump option only)
- Check dosing pump flow rate (dosing pump option only)
- Remove and replace the brine & water pump diaphragm and inlet and outlet check valves, using a pump maintenance kit.
- Complete all checks required for a weekly inspection and complete operators log.

2 Yearly service

Every two years the Electrochlorinator unit should be given an overhaul replacing all high risk components, this service can take the place of the second yearly service.

As this service involves the removal and replacement of key components to the Electrochlorinator a ½ day shutdown should be planned to let the competent and properly trained engineer complete the service. The engineer should ensure that the product storage tank contains enough hypochlorite solution to allow site to continue dosing while the Electrochlorinator is isolated.

- Remove and overhaul solenoid valve replacing any worn of leaking seals, replacing the 24V actuator.
- Remove and replace brine tank float valve.
- Remove the water softener and replace the Ion exchange resin, before replacing the water softener.
- Remove and replace control panel temperature switch.
- Inspect electrolyser for any signs of precipitation / wear on the electrodes, acid washing if necessary.
- Inspect all fasteners for signs of hypochlorite corrosion and replace if necessary.
- Remove and replace run and fault relays.
- Remove and replace MCB's.
- Remove and replace 24V power supply.

As this replaces a scheduled service all of the actions detailed for the early service should also be undertaken and the operators log completed.

Service schedule.

Component / action	**Weekly inspection**	**Twice yearly service**	**Yearly service**	**Two yearly service**
Water and brine pump settings	Check / record	Check / record	Check / replace	Check / replace
Volts	Check / record	Check / record	Check / record	Check / record
Salt level in Brine tank	Check / refill	Check / refill	Check / refill	Check / refill
Brine tank float valve	Test	Test	Test	Replace and test
Water softener	Test	Regenerate and test	Regenerate and test	Replace resin and test.
Product strength	Test / record	Test / record	Test / record	Test / record
Brine / Product lines	No action	Check	Check	Replace seals and check
Airflow switch	No action	Check	Check	Check
Volt alarms	No action	Check	Check	Check
Bund switch	No action	Check	Check	Check
Electrolyser	Visual inspection	Check and tighten connections	Check and tighten connections	Check and tighten connections
Degassing column	Check for leaks	Check for leaks	Check for leaks	Check for leaks
Run / fault relays	No action	Check operation	Check operation	Replace
MCB's	No action	Check operation	Check operation	Replace
24V Power supply	No action	Check operation	Check operation	Replace
Solenoid valve	No action	Check for leaks / passing	Check for leaks / passing	Replace
Brine pump	No action	Check and adjust if required	Replace head kit and valves	Replace head kit and valves

Recommended Spares

WEEKLY INSPECTIONS

Item	Pt No	Qty
Salt		As required
Soft water test kit		1
Hydrometer		1
Product test kit		1
Operators log		1

TWICE YEARLY

Item	Pt No	Qty
Salt		As required
Soft water test kit		1
Hydrometer		1
Product test kit		1
Basic hand tools		1
Operators log		1

YEARLY SERVICE

Item	Pt No	Qty
Salt		As required
Soft water test kit		1
Hydrometer		1
Product test kit		1
Basic hand tools		1
PTFE Tape		1
Brine pump maintenance kit		1

TWO YEARLY SERVICE

Item	Pt No	Qty
Salt		As required
Soft water test kit		1
Hydrometer		1
Product test kit		1
Basic hand tools		1
PTFE Tape		1
Brine float valve		1
Ion exchange resin		1
50°C temp switch		1
24V DC relays		2
24V Power supply		1
MCB's		2
½" solenoid valve		1
Brine pump maintenance kit		1

Faults & Fault finding

Faults & Fault finding

The MP systems are governed by a set of alarms which constantly monitor the operation of the Electrochlorination process and will stop the electrochlorination process if any of the alarms trigger.

General Faults

High Volts

The alarm is triggered if the running volts of the Electrochlorinator rises above the predetermined limit set in the PLC program.

Low Volts

The alarm is triggered if the running volts of the Electrochlorinator falls below the predetermined limit set in the PLC program.

High Amps

The alarm is triggered if the running volts of the Electrochlorinator rises above the predetermined limit set in the PLC program.

Low Amps

The alarm is triggered if the running volts of the Electrochlorinator falls below the predetermined limit set in the PLC program.

Brine Management

The brine management system allows for slight fluctuations in salinity of the diluted brine solution by constantly monitoring the running parameters of the Electrochlorinator.

Airflow

The alarm is triggered if the dilution airflow through the Electrochlorinator rises above or drops below the predetermined limits set in the PLC program.

Panel temp

The alarm is triggered if a temperature above 50°C is sensed within the electronic control cabinet.

Bund alarm

The alarm is triggered if there is a leak into any bunded area with a bund alarm. If multiple bund alarms are fitted then they should be run in series to enable a single contact.

Causes and actions

High Volts / Low Amps

CAUSES:

A) Insufficient brine flow through the electrolyser.
B) Too much water flowing through the electrolyser.
C) Bad or loose connections to the electrolyser.
D) Scale on the electrodes.
E) Leak from Cell casing.
F) Electrolyser drain valve left open.
G) Insufficient output from Electrolyser power supply.
H) Incorrect alarm set point.

ACTIONS:

A) Check Sg is within 1.015 – 1.025 and adjust brine pump if required.
B) Check water flow to operators log, Electrochlorinator test sheet. Adjust water flow at the flow metering valve if required.
C) Check electrical connections at top and bottom of electrolyser for signs of corrosion or loose connections. Cleaning away any corrosion with a wire brush, and ensuring all connections are good and tight.
D) Visibly inspect the electrolyser for any signs of white precipitation on the electrolyser. This will be due to hard water entering the electrolyser from a water softener fault and will require further investigation into the failure of the water softener. An acid wash will be required to remove the precipitation on the electrodes.
E) Check the electrolyser cell casing for leaks, most leaks can be repaired by tightening electrical connections at the top and bottom of the electrolyser.
F) Check that the Sg sample valve is fully closed and not leaking.

Low Volts / High Amps

CAUSES:

A) Too much brine flow through the electrolyser.
B) Insufficient water flowing through the electrolyser
C) Insufficient output from Electrolyser power supply.
D) Incorrect alarm set point.

ACTIONS:

A) Check Sg is within 1.020 – 1.025 and adjust brine pump if required.
B) Check water flow to operators log, Electrochlorinator test sheet. Adjust water flow at the flow metering valve if required. And check water flow meter switch operation
C) Check the input current and voltage to each of the power supplies these two figures should be multiplied together and multiplied by 0.98 to give the total available power output of the power supplies. Check the voltage and current output from the power supplies and multiply these two figures together. If these two figures are equal then the power supply is working properly.

((Volts @ input) x (Amps at input) x 0.98 <= (Volts @ output) x (Amps @ output)) = Power supply working correctly.

((Volts @ input) x (Amps at input) x 0.98 > (Volts @ output) x (Amps @ output)) = Power supply under-performing and will need replacing.

Airflow

CAUSES:

A) Loose or damaged cover to the electrolyser enclosure.
B) Cracked or leaking dual ventilation pipe work.
C) Incorrect set point in PLC
D) Blocked ventilation pipe work
E) Blockage or back pressure at safe ventilation point

ACTIONS:

A) Replace, Electrolyser / Degasing enclosure Perspex covers.
B) Repair / remove and replace leaking pipe work sections.
C) Check ventilation pipe work for blockages, remove any blockages and replace any restrictive sections of pipe work.
D) Inspect safe ventilation point and remove any blockages. Check wind direction to ensure it naturally aids the ventilation process.

Panel Temp

CAUSES:

A) Failing power supply overheating.
B) Bad electrical connections to electrolyser.
C) Failed temperature switch.
D) Short within Electrolyser.

ACTIONS:

A) Check power supply efficiency as detailed in low volt actions).
B) Check electrical connections at power supply output for signs of corrosion or loose connections. Cleaning away any corrosion with a wire brush, and ensuring all connections are good and tight.
C) Remove and replace temperature switch.
D) Remove and replace Electrolyser.

Help Screens

Help screens are the MP's internal quick guide to trouble shooting. In many of the PLC Screens you will see the help button, pressing this button will take you to a number of help screens with a few brief points to point the operator towards the cause of a fault. There are also help screens designed to help the installation, setting, start-up, and servicing of the Electrochlorinator.

Training Register

Training Register

Candidate Name	Training	Trained by	Date
	Operation and maintenance of MP Electrchlorinator.		
	“ “		
	“ “		
	“ “		
	“ “		
	“ “		
	“ “		
	“ “		