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Installation, Operation, and Maintenance Manual

For ChlorTech On-site Sodium Hypochlorite Generators
Models AC-5, AC-25, AC-50, AC-100, and AC-200



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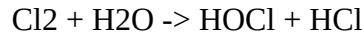
System Overview The ChlorTech **system** provides an effective disinfectant that eliminates waterborne diseases such as cholera, typhoid, hepatitis, and others. The hypochlorite concentration generated is safe for the operator and the environment while maintaining high disinfecting power.

The system consists of a generating electrode and a power source. The generating electrode converts a 3% brine solution into a 0.6% (6,000 ppm) sodium hypochlorite solution. This solution may be used for any application requiring this disinfectant.

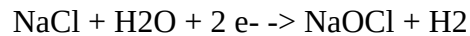
TECHNICAL SPECIFICATIONS					
Generating Electrode	AC-5	AC-25	AC-50	AC-100	AC-200
Production cycle	24 hours	24 hours	24 hours	24 hours	24 hours
Production per hour	6 grams / hour	25 grams / hour	50 grams / hour	100 grams / hour	200 grams / hour
Equivalent chlorine	144 grams / cycle	600 grams / cycle	1,200 grams / cycle	2,400 grams / cycle	4,800 grams / cycle
Concentration of solution	6 grams / liter	6 grams / liter	6 grams / liter	6 grams / liter	6 grams / liter
Consumption per Cycle					
Salt	840 grams	3.5 kilograms	7 kilograms	14 kilograms	28 kilograms
Electricity	1.2 Kwh.	5.0 Kwh.	8.25 Kwh.	18 Kwh.	36 Kwh.
Water	24 liters	100 liters	165 liters	330 liters	630 liters
Dimensions					
Electrode size	21 cm	66 cm	81 cm	112 cm	145 cm
Cable length	152 cm	213 cm	309 cm	295 cm	29.5 cm
Weight	1.78 kg	2.5 kg	4.0 kg	7.70 kg	10.0 kg
Power Source					
Type (Fixed amperage Variable voltage)	Switching	Switching	Switching	Switching	Switching
Timer/Switch Electromechanical	24 hours, variable	24 hours, variable	24 hours, variable	24 hours, variable	24 hours, variable
Power input	120/240VAC,	120/240VAC,	120/240VAC,	120/240VAC,	120/240VAC,
Power	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Power output	~11VDC, 10a	~11VDC, 15a	~11VDC, 25A	~11VDC, 55A	2 x ~11VDC,
Power		55A			
Additional Equipment					
Electrolysis vessel (not supplied)	1 to 24 liters	20 to 100 liters	100 to 200 liters	200 liters +++	300 liters +++

Chemical Reactions

Chlorine gas (Cl₂) disinfects water according to the following reactions:



Hypochlorous acid, HOCl, decomposes into hypochlorite ion, ClO⁻. This ion is the available free chlorine and the true disinfecting agent. Half of the dosed chlorine forms hydrochloric acid (HCl), which is not a disinfectant, so half of the dosed chlorine is lost. Sodium hypochlorite generated by the **ChlorTech** system is produced according to:



Sodium hypochlorite (NaOCl) and hypochlorous acid (HOCl) decompose to form hypochlorite ion ClO⁻, which constitutes the available free chlorine used for disinfection.

Precautions Read all instructions before installing or operating the system.

First Aid

- **Eye burns** (due to contact with sodium hypochlorite, acid, or vinegar) Flush eyes with plenty of water for 10 minutes. Seek medical treatment.
- **Skin burns** (due to contact with sodium hypochlorite, vinegar, or acid) Wash the affected area with plenty of water for 10 minutes. Seek medical treatment.
- **Oral ingestion of sodium hypochlorite.**
Do not induce vomiting. Give milk or an antacid. Seek urgent medical care.
- **Oral ingestion of acid or vinegar.**
Do not induce vomiting. Seek urgent medical care.
- **Electrical shock.**
Do not touch the person before disconnecting the electrical source causing the shock. Disconnect power and assist the person. If necessary, seek medical care.

Installation

Equipment Description

The system consists **of a** sodium hypochlorite generating **electrode, an electrolysis vessel,** and **a transformer/rectifier** (power source). The electrolysis vessel must be obtained locally according to the specifications listed below.

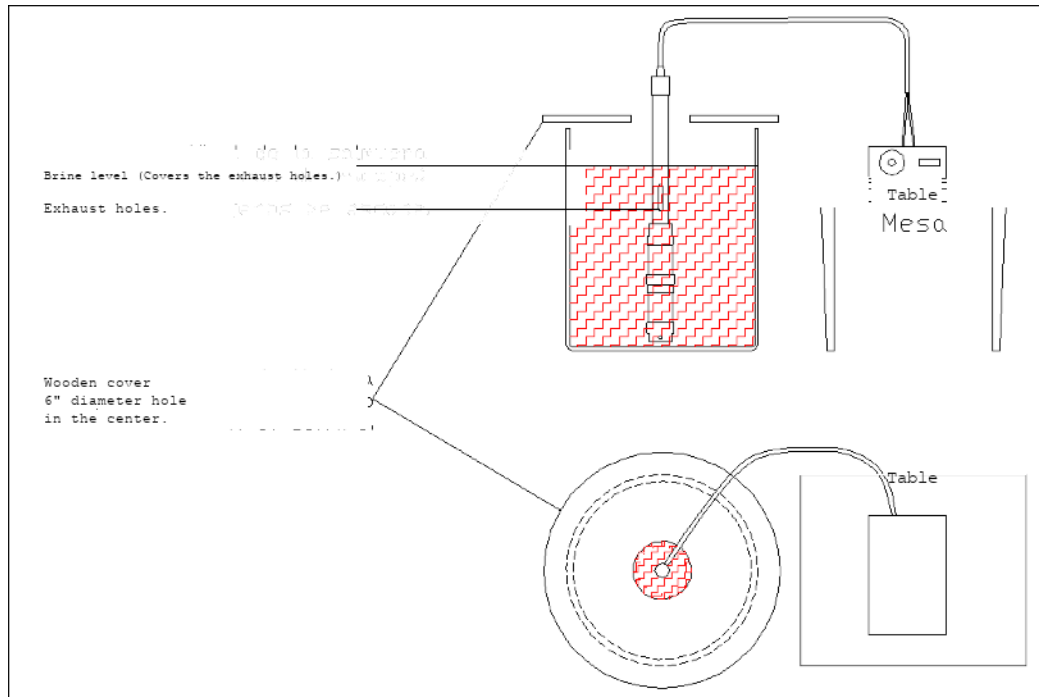


Figure 1



The brine level must reach the middle of the upper vent port.

The **electrolysis vessel** holds the brine that will be converted into sodium hypochlorite. The vessel must be made of a material resistant to salt water and sodium hypochlorite. PVC or polypropylene vessels are suitable; **metal** vessels are not. The vessel must have a vented cover to prevent debris intrusion. Because the generating electrode is submerged in brine, vessel dimensions **are important**. The brine level must at **minimum cover the** vent slots around the generating electrode (**Figure 1**).

Installation Precautions

- ❑ Place the power source as high as possible relative to the reaction tank to avoid liquid spills.
- ❑ Ensure the power source is connected correctly. The system operates on 110 or 220 volts, 50-60 Hz. Voltage and frequency are factory-set and not adjustable.
- ❑ Ensure the electrode is connected correctly: positive (+) to positive (+) and negative (-) to negative (-). Reversed polarity causes permanent electrode damage.
- ❑ Chlorine generation produces small amounts of hydrogen. Install the system in a well-ventilated area.



Damage to an electrode connected with reversed polarity

A vessel **for** dissolving salt is recommended but not required. In this vessel salt is dissolved to facilitate brine preparation. Generally a small two-gallon bucket is adequate.

A **measuring container may** be used instead of a scale. It should have volume marks corresponding to salt weight. Calibrate locally because local salt density may vary.

The acid wash vessel included with the system is used to clean the generating electrode after each batch. Fill it with pure white vinegar or 5% hydrochloric acid (muriatic acid). Submerge the electrode in this solution.

IMPORTANT: ACID STRONGER THAN 5% WILL DAMAGE THE ELECTRODE. COMMERCIAL MURIATIC ACID IS TYPICALLY ABOUT 25% AND MUST BE DILUTED BEFORE USE.

Installation Description

The ChlorTech system is designed for permanent installation.

Install only after reading this manual.

Site Selection

Select a permanent installation site according to safety specifications and considerations. The transformer requires 110 VAC or 240 VAC. Voltage is fixed and must match the transformer label.

The generation system is not immune to the elements. The transformer is electronic and vulnerable to moisture. Generation produces hydrogen and chlorine mist that must be vented and kept away from the transformer. Select a site that protects the transformer and provides ventilation. Place the transformer as high and far from the electrode as the cable allows (Figure 3).

Sodium hypochlorite production has hazards. Only trained personnel aware of these hazards should access the equipment. Choose a site that restricts access, especially for children.

Electrical Connection

Connect the generating electrode to the transformer terminals. It is essential to connect the positive transformer terminal (+) to the red electrode cable and the negative terminal (-) to the black electrode cable.

Operation

Operation Precautions

- ❑ Do not smoke or have open flames near the equipment.
- ❑ Avoid contact of chlorine solution with eyes or skin.
- ❑ Avoid contact of chlorine solution with clothing.
- ❑ Do not energize the transformer until the electrode is submerged in brine.
- ❑ Do not remove the electrode from brine while the transformer is energized.
- ❑ Do not operate the electrode longer than recommended. This only wastes energy without significantly increasing chlorine production.
- ❑ Brine water must be free of visible particles. If necessary, filter the water with a cloth filter.

Operation Summary

To operate the system, first prepare the brine. Water and salt quantities are given in Table 1. Submerge the electrode in the brine and activate the transformer using the timer. Electrolysis time is also given in Table 1. When the cycle ends, remove the electrode. The brine has been converted to sodium hypochlorite and is ready for disinfection.

Materials

To generate sodium hypochlorite you only need salt, water, and electricity. Use the cleanest water possible for electrolysis brine. Use the purest salt available; impurities increase scale buildup on the cathode.

1. Brine preparation

Table 1

DOSING TABLE									
Water Volume (Liters)	Salt (Kg)	Time (Hours)					Total Chlorine (Grams)	Total Chlorine (Liters)	Liters of Clean Water (2 PPM)
		AC-5	AC-25	AC-50	AC-100	AC-200			
1	0.03	1					6	1	3,125
4	0.12	4	1				24	4	12,500
6	0.22	6	1.5				36	6	18,750
8.3	0.3	8.3	2	1			50	8	25,000
16.7	0.6	16.7	4	2	1		100	17	50,000
24	0.87	24	6	3	1.5		144	24	75,000
33.3	1.2		8	4	2		200	33	100,000
66.7	2.3		16	8	4		400	67	200,000
83.3	2.9		20	10	5		500	83	250,000
100	3.5		24	12	6		600	100	300,000
166.7	5			20	10		1000	167	500,000
200	7			24	12	6	1200	200	600,000
333.4	10				20	10	2000	333	1,000,000
400	14				24	12	2400	400	1,200,000
666.8	17.2					20	4000	667	2,000,000
800	28					24	4800	800	2,400,000

Fill the electrolysis vessel with water and measure 30 grams of salt per liter of water. For evaporated salt use 35-40 grams to compensate for minerals. Mix until fully dissolved to produce 3% brine. Large rock salt should be crushed to facilitate preparation.

2. Electrode activation

IMPORTANT: SUBMERGING THE GENERATING ELECTRODE IN BRINE WHILE THE POWER SOURCE IS ENERGIZED CAN DAMAGE BOTH THE POWER SOURCE AND THE ELECTRODE. TURN OFF POWER BEFORE SUBMERGING THE ELECTRODE IN BRINE.

Before submerging the electrode, ensure the transformer panel switch is off. Turn the timer left to "0". Current and voltage indicators must be off.

Submerge the electrode in brine. If the power source has a switch, turn it on. Turn the timer right and set electrolysis time per Table 1.

While active, the generating electrode produces hydrogen, visible as white foam exiting through the electrode vent slots.

3. End of cycle.

The timer automatically de-energizes the transformer at the end of the cycle. If municipal power fails, the timer stops and resumes when power returns; no re-adjustment is needed.

At cycle end the timer should read "0" and current/voltage indicators should be off. Remove the electrode.

Equivalent chlorine concentration in the electrolysis vessel after the cycle is at least 6 grams per liter (0.6%). Disinfectant dose depends on many factors and should be determined by a water purification expert.

Maintenance

Maintenance Precautions

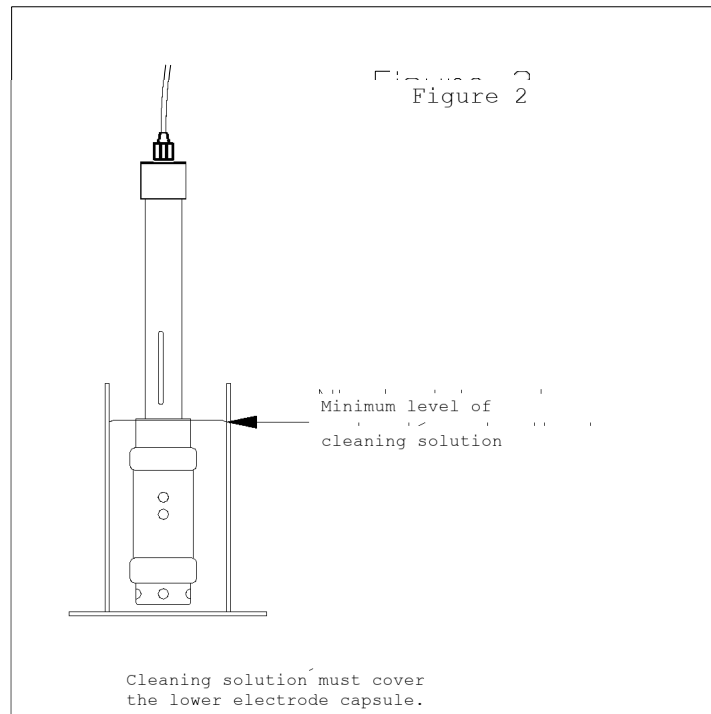
- ❑ The electrode must be de-energized before placing it in the cleaning vessel.
- ❑ Rinse the electrode with water before and after acid cleaning.

Never mix cleaning acid with sodium hypochlorite.

Impurities in water and salt accumulate inside the electrode and must be removed periodically with dilute acid. Failure to clean may damage the electrode and power source.

The electrode must be cleaned after each use as follows:

1. Rinse the electrode with water.
2. Submerge the lower capsule of the electrode in pure white vinegar or 5% muriatic acid. See Figure 2.



3. After 15 minutes, remove the electrode and rinse with water.



Mineral deposits on an electrode permanently damaged by lack of acid cleaning

IMPORTANT: NEVER MIX VINEGAR OR ACID SOLUTION WITH SODIUM HYPOCHLORITE. NEVER USE MURIATIC ACID STRONGER THAN 5% TO CLEAN THE ELECTRODE. NEVER ENERGIZE THE POWER SOURCE WHILE THE ELECTRODE IS IN ACID SOLUTION.

Table 2

Dosing

Tank capacity dosing with 0.6% NaOCl solution										
		2 PPM			3 PPM			4 PPM		
Gals.	Ltrs.	Ltrs.	Gals.	Grams Cl ₂	Ltrs.	Gals.	Grams Cl ₂	Ltrs.	Gals.	Grams Cl ₂
1000	3785	1.3	0.33	7.57	1.9	0.50	11.36	2.5	0.67	15.14
5000	18927	6.3	1.67	37.85	9.5	2.50	56.78	12.6	3.33	75.71
6000	22712	7.6	2.00	45.42	11.4	3.00	68.14	15.1	4.00	90.85
7000	26498	8.8	2.33	53.00	13.2	3.50	79.49	17.7	4.67	105.99
8000	30283	10.1	2.67	60.57	15.1	4.00	90.85	20.2	5.33	121.13
9000	34069	11.4	3.00	68.14	17.0	4.50	102.21	22.7	6.00	136.27
10000	37854	12.6	3.33	75.71	18.9	5.00	113.56	25.2	6.67	151.42
16000	60567	20.2	5.33	121.13	30.3	8.00	181.70	40.4	10.67	242.27

Example: One liter of 0.6% sodium hypochlorite mixed with 6,000 liters of water equals one part per million (1 PPM) of chlorine. For 2 PPM concentration, use 2 liters of hypochlorite in 6,000 liters of water.

DOSE: 2 PPM		
LITERS	DROPS	TABLESPOONS
1	7	
5	35	
10	70	
20	140	2
40	280	4

Verification

Periodically verify the concentration of sodium hypochlorite produced. Two methods are the iodometric process and the dilution process. Iodometric is more accurate but requires more equipment. Dilution is easy and sufficiently precise for effectiveness checks.

Iodometric Process

Equipment

1. 0.01N Na₂S₂O₃ solution
2. 10% KI solution
3. 50% H₂SO₄ solution
4. Starch indicator
5. 125 ml flask
6. 5 ml graduated pipette
7. 10 ml graduated pipette
8. 25 ml burette
9. Glass dropper

Procedure

1. Using the 10 ml pipette, add 20 ml KI solution to the 125 ml flask.
2. Using the dropper, add 6 drops H₂SO₄.
3. Using the 5 ml pipette, add 3 ml sample. Mixture should change color.
4. Titrate immediately with 0.01N Na₂S₂O₃ to light yellow.
5. Add three drops starch indicator.
6. Complete titration with 0.01N Na₂S₂O₃ until colorless.

To calculate available chlorine concentration:

Concentration in grams of chlorine per liter:

$$= (\text{Na}_2\text{S}_2\text{O}_3 \text{ used in ml}) \times (0.01) \times (1000) \times (35.5) / (3)$$

Dilution Process

Equipment

1. 5 ml graduated pipette
2. Two 10 ml graduated cylinders
3. DPD colorimetric chlorine tester (commonly used for pools)
4. Distilled water.

Procedure

1. Using the 5 ml pipette, mix 1 ml sample with 9 ml distilled water in the first cylinder.
2. Mix 0.1 ml from the first cylinder with 9.9 ml distilled water in the second cylinder.
3. Measure chlorine in the second cylinder with the DPD tester per manufacturer instructions.

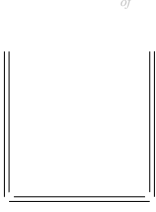
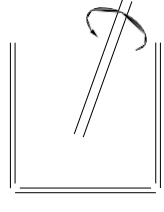
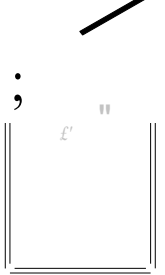
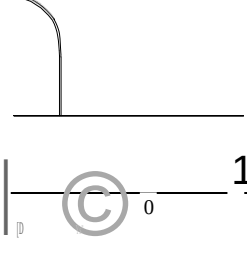
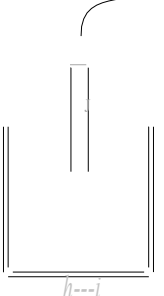
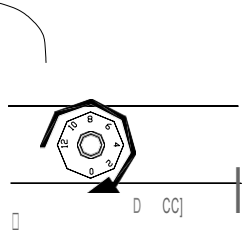
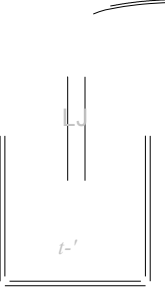
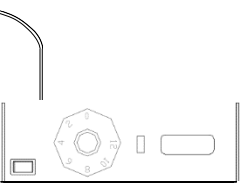
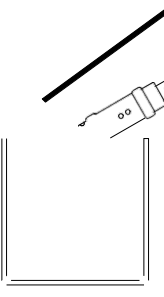
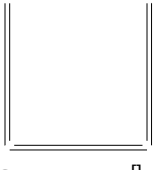
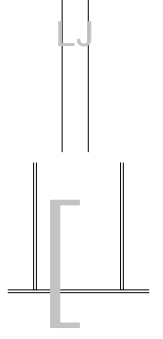
Alternative procedure

1. Measure exactly 200 ml distilled water.
2. Mix exactly 4 drops of sample.
3. Measure chlorine with the DPD tester per manufacturer instructions.

To calculate available chlorine concentration:

The colorimeter scale may be read directly as grams of chlorine per liter of solution.

Operation Summary

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CHLORTECH EQUIPMENT WARRANTY

The CHLORTECH system offers the following warranty:

One-year warranty from date of purchase on electrical and mechanical parts, operation, efficiency, hypochlorite generation concentration, and physical integrity of the carrier tube, anode/cathode capsule, electrical connectors, and general wiring. Valid when installation, operation, and maintenance instructions in the supplied manual are followed.

Electrode cleaning with 5% muriatic acid or pure white vinegar must follow instructions for warranty validity. A special cleaning vessel is supplied.

If electrodes or the power source fail, they will be sent to the factory to determine cause and will be repaired or replaced at the factory's discretion when failure is due to manufacturing defect despite proper use. Shipping to factory or local workshop is at customer expense.

This warranty does not cover the following:

- Improper installation
- Transport damage
- Misuse, abuse, accidents, alterations, poor maintenance
- Reversed polarity or incorrect current/voltage connections
- Opening the power source
- Disassembling electrodes
- Liquid spill or ingress into power source
- Lightning electrical surges

SPECIAL COATING WARRANTY

Coating and general system parts carry a one-year full warranty. Coating life is additionally guaranteed for 24 months with prorated electrode replacement cost for coating failure, increased amperage, or failure to achieve 0.6% sodium hypochlorite within manual parameters, contingent on maintenance as described, especially acid washing and correct polarity.