APPLICATION NOTE

Liquid Analyzers for Electrolysis Plants

Industry: Chemical
Product: Liquid Analyzers

Introduction

Process liquid analyzers such as pH meters, conductivity meters, ORP meters, and density meters play an important role at electrolysis plants in the control of concentrations of various process solutions. This requires both precision and stability under harsh conditions that include highly corrosive substances, high temperatures, and many impurities.

Expected Benefits

- Ensures stable, continuous measurement in heavily contaminated liquids
- Reduces operating costs
- Eliminates the need for manual cleaning

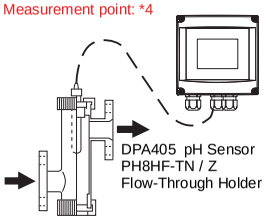
List of Analyzers

Type	Measurement point	Objective
pH meter	1) Supersaturated brine at raw salt dissolver outlet *1	pH control for impurity removal in brine Control value: 10.8 to 11.0 pH
	2) Refined brine *2	Control of precipitation of impurities Acid range
	3) Brine at electrolysis tank inlet *3	pH control of electrolysis tank brine inflow: 3 to 6 pH
	4) Return brine at electrolysis tank outlet *4	Efficiency control in dechlorination tank Acid range
	5) Desalinated water at dechlorination tank outlet *5	Desalinated water control
	6) Hydrochloric acid plant drainage *6	Drainage control
Conductivity meter	1) Supersaturated brine at electrolysis tank outlet *7	Brine concentration control: concentration: 300 to 320 g/l
	2) Refined brine *8	Refined brine concentration control
	3) Sulfuric acid concentration used for drying in chlorine gas drying line *9	Concentration control of recovered sulfuric acid: approximately 74 %
	4) Hydrochloric acid concentration in hydrochloric acid plant *10	Hydrochloric acid concentration control: approximately 35 wt%
	5) Sodium hypochlorite concentration in a soda hypochlorite plant *11	Sodium hypochlorite concentration control: Available chlorine : 10 to 15 % Residual caustic soda: 0.1 to 1% (approximately 10 g/l)
Oxidation reduction Potential (ORP) meter	1) Desalinated water at dechlorination tank outlet *12	Confirmation of dechlorination reaction
	2) Soda hypochlorite plant adsorption tank outlet *13	End control of caustic soda chlorination reaction
Vibration type liquid density meter	1) Anode solution at electrolysis tank outlet *14	Anode solution caustic soda concentration control
	2) Caustic soda concentration at concentrate drum outlet *15	Product caustic soda concentration control

YOKOGAWA

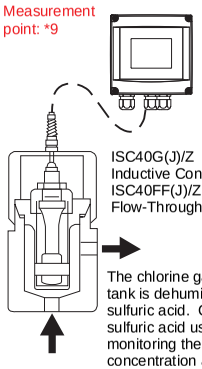
Solution Details

Measurement point: *4



pH control of desalinated water at the inlet of dechlorination tank is extremely important to keep the dechlorination efficiency in the dechlorination tank. Since the desalinated water contains chlorine gas, the DPA405 pH Sensor, with a special anticorrosive ability and high-viscosity gel for internal electrolysis quality, is used for pH measurement in this tank.

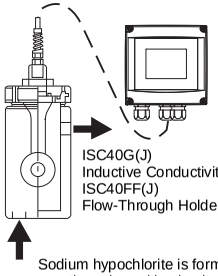
Measurement point: *9



The chlorine gas discharged from an electrolysis tank is dehumidified and dried with concentrated sulfuric acid. Control of the concentration of sulfuric acid used for drying is very important in monitoring the drying rate. The sulfuric acid concentration at the drying tower's inlet is 74wt%, and the concentration at the outlet is 98wt%. The FLXA21 Inductive Conductivity Meter is used here as a concentration analyzer.

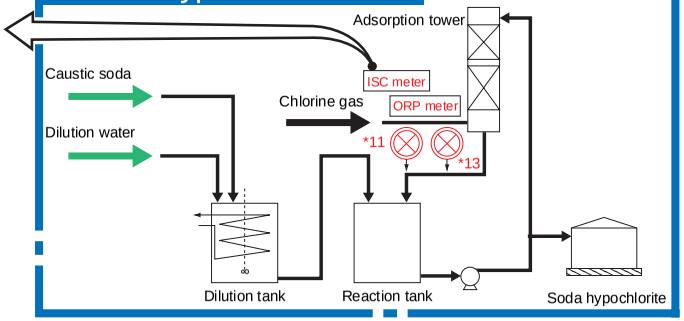
Water content in gas at dryer tower inlet: 20°C supersaturated
Water content in gas at dryer tower outlet:
0.1 to 0.3 mg/Nl. (126 to 378 vol ppm)

Measurement point: *11

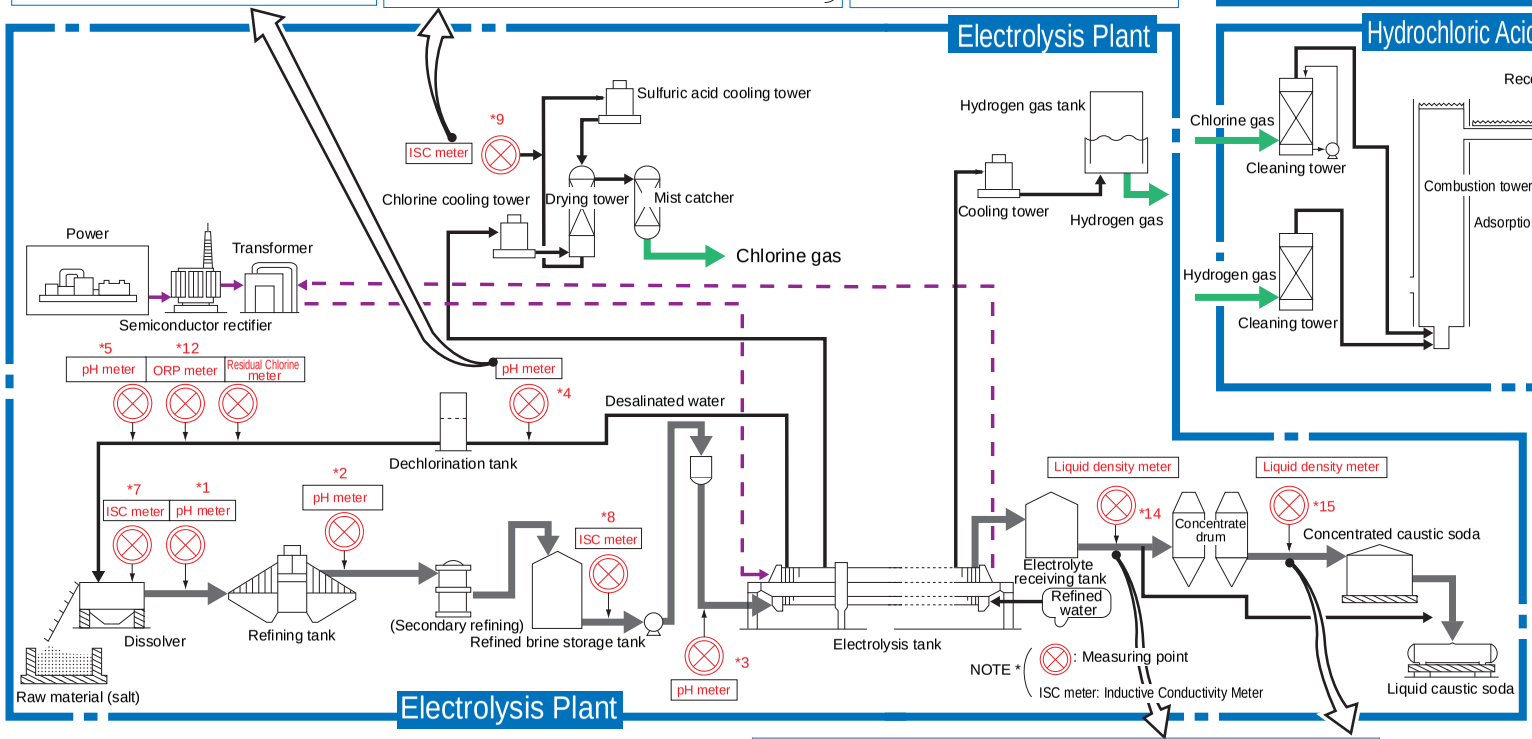


Sodium hypochlorite is formed by diluting caustic soda and having it react with chlorine gas. The FLXA21 Inductive Conductivity Meter is used to control the reaction conditions, and the ORP meter is used to control the end of the reaction.

Sodium Hypochlorite Plant



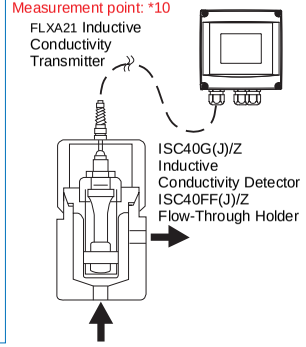
Electrolysis Plant



Electrolysis Plant

Hydrochloric Acid Plant

Measurement point: *10



Chlorine gas, a byproduct in an electrolysis tank, and hydrogen are burned, forming hydrogen chloride, and this is adsorbed in raw water (demineralized water) to form a 35% solution of hydrochloric acid. The FLXA21 Inductive Conductivity Meter, whose sensor has superior anticorrosive properties, is used to control the concentration of the product hydrochloric acid.

Measurement point: *14, *15

With IM electrolysis, the NaOH concentration in the electrolyte at the electrolysis tank cathode chamber outlet is 20 to 35%. The water content of this solution is evaporated in the concentrate drum, and the solution is concentrated to 48 to 49% NaOH. The DM8 Vibration Liquid Density Meter is used in concentration control, but the concentration values are displayed on a separately installed computer.

Conclusion

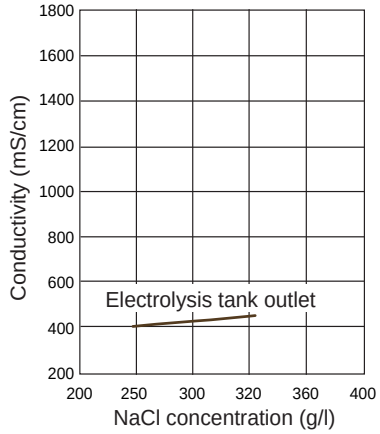
Yokogawa process solution analyzers deliver stable, long-term measurements under the harsh conditions present in electrolysis plants. The ISC202 Inductive Conductivity Meter is specially designed to detect the concentrations of hydrochloric acid, sulfuric acid, and caustic soda. The DPA405 pH Electrode for Chemical Processes can measure pH in a wide variety of processes.

Field Data

Each graph shows a correlation between concentration and conductivity at measurement points, the numbers of which correspond to the ones in the previous page. The ISC inductive conductivity meter's range can be specified, thereby allowing high-resolution measurements in the target concentration range.

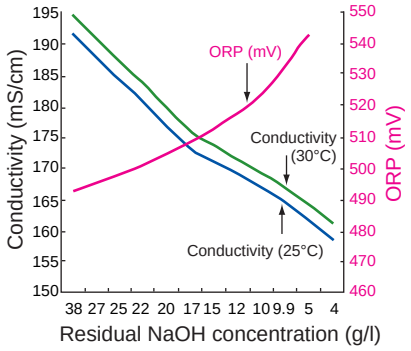
Measurement point: *7

NaCl concentration - Conductivity (60 °C)



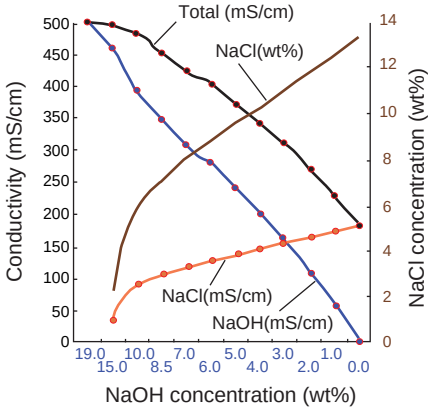
Measurement point: *11, *13

NaOCl Plant
Residual NaOH Concentration and Conductivity - ORP



Measurement point: *11

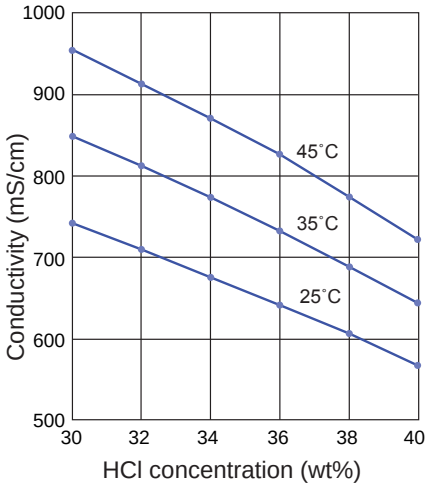
NaOCl Plant
Conductivity when Cl_2 is adsorbed in NaOH



The correlation between concentration and conductivity is largely affected by solution temperature. The ISC inductive conductivity meter provides automatic temperature compensation using the build-in temperature sensor.

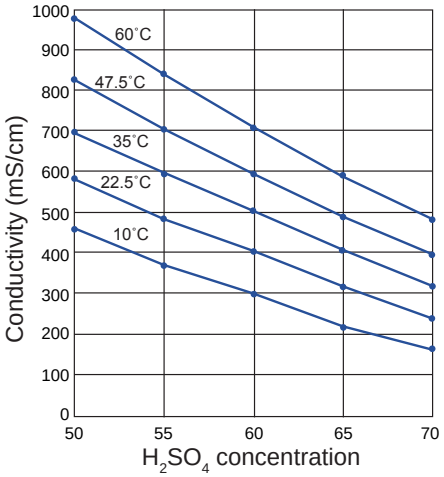
Measurement point: *10

HCl Concentration - Conductivity



Measurement point: *9

H_2SO_4 Concentration - Conductivity



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