# STEAM AND SOEC WATER CHEMISTRY ACCEPTANCE STANDARD

Document Class: Technical Acceptance Standard

Applies To: SOEC Feedwater, Steam Headers, Condensate Return, Steam Generators

Use Case: RFQ Attachment, FAT/SAT Acceptance, Insurer Review, Warranty Enforcement

Failure Class: Equipment Protection, Warranty Voiding, Insurability Gate

## 1. PURPOSE

This document establishes mandatory water and steam chemistry limits required for the protection of Solid Oxide Electrolysis Cells (SOEC), steam generators, turbines, and associated balance-of-plant equipment. All limits herein are enforceable acceptance criteria.

## 2. CHEMISTRY LIMITS - ACCEPTANCE TABLE

| Parameter | Location | Limit | Units | Test Method | Acceptance Condition |
|---|---|---|---|---|---|
| Silica (SiO2) | SOEC Steam Inlet | <= 5 | ppb | Online molybdate analyzer | 24 hr steady-state <= limit |
| Silica (SiO2) | Main Steam Header | <= 10 | ppb | Lab ICP | PASS |
| Conductivity (degassed) | Feedwater | <= 0.15 | uS/cm | Online degassed conductivity | PASS |
| Conductivity (degassed) | Steam | <= 0.05 | uS/cm | Online degassed conductivity | PASS |
| Dissolved Oxygen | Feedwater | <= 7 | ppb | Optical DO probe | PASS |
| Dissolved Oxygen | Condensate | <= 10 | ppb | Optical DO probe | PASS |
| TOC | Feedwater | <= 200 | ppb | Online TOC analyzer | PASS |
| Chloride | Boiler Water | <= 5 | ppb | Ion chromatography | PASS |
| Sulfate | Boiler Water | <= 5 | ppb | Ion chromatography | PASS |
| Sodium | Steam | <= 2 | ppb | ICP-MS | PASS |
| Iron (Total) | Feedwater | <= 5 | ppb | Online iron monitor | PASS |
| Copper | Condensate | <= 2 | ppb | ICP-MS | PASS |
| pH (25C) | Feedwater | 9.6 - 10.2 | - | Online pH | PASS |

## 3. MATERIAL COMPATIBILITY REQUIREMENTS

| Component | Material Requirement | Notes |
|---|---|---|
| Steam Sampling Lines | Inconel 625 or 316L SS | Mandatory above 400C |
| Wet Racks | 316L SS | No carbon steel |
| High-Temperature Probes | Nickel alloy sheath | Required |
| SOEC Steam Piping | 316L SS | Chloride limit mandatory |

| Component | Material Requirement | Notes |
|---|---|---|
| Valves (>400C) | Nickel alloy | No brass |
| Corrosion Coupons | Carbon Steel + 316L | Both required |

## 4. SAMPLING AND INSTRUMENTATION LOCATIONS

Mandatory sampling points include makeup water post-polishing, feedwater upstream of economizer, boiler drum or steam generator outlet, main steam header pre-SOEC, condensate return prior to deaerator, SOEC steam inlet, and continuous blowdown line.

## 5. CORROSION AND DEPOSIT MONITORING

| Location | Monitoring Method | Frequency |
|---|---|---|
| Feedwater | Carbon steel coupon | 90 days |
| Condensate | 316L coupon | 90 days |
| Economizer Inlet | Iron transport monitor | Continuous |
| Steam Header | Sodium carryover analysis | Weekly |

## 6. FAT REQUIREMENTS

Vendor must demonstrate chemistry stability within all limits for a minimum of 72 continuous hours. No silica excursions are permitted during load transients. Instrument drift must remain below 2 percent.

## 7. SAT REQUIREMENTS

Site Acceptance Testing requires 24-hour steady-state operation at design pressure with three load ramp cycles. Any excursion invalidates acceptance. Automatic silica trip functionality must be verified.

## 8. WARRANTY AND INSURANCE LANGUAGE

Failure to maintain chemistry within acceptance limits voids warranty coverage for SOEC stacks, steam generators, turbines, and associated balance-of-plant equipment.

## 9. GOVERNING STANDARDS

ASME PTC 19.11, ASME Boiler and Pressure Vessel Code, IAPWS Cycle Chemistry Guidance, ISO 5667, ASTM D859, ASTM D5127.