

ARP

INSTRUMENTS, INC.

SSM MODEL # RPCT-07-001

**IMPROVING QUALITY
THROUGH INNOVATION:
A FULLY AUTOMATED
SOLUBLE SALT
METER**



**For more information contact:
ARP Instruments, Inc.
www.arpinstruments.biz
arp.instruments@gmail.com
Phone: 540-752-7651
Fax: 540-752-5226**

The Soluble Salt Meter (SSM) Model #RPCT-07-001 was developed specifically to improve current methods of establishing surface cleanliness for flat and curved surfaces. ARP Instruments' goals in developing the SSM were to:

- Improve the time, quality, and accuracy in field analysis
- Eliminate use of syringe needles
- Develop a paperless instrument
- Automate water dosing and washing system
- Eliminate consumables (patches and syringes)
- Exactly replicate the Bresle patch protocol
- Eliminate residue left behind from Bresle and other adhesive patches

The SSM has been independently tested both in laboratory and Navy shipyard facilities. It is the only approved alternative by the US Navy's Naval Sea Systems Command (NAVSEA) for use as a replacement to the Bresle patch method in NAVSEA Standard Item 009-32.

Background

The presence of soluble salts on a surface is detrimental to applied protective coatings. As such, the Navy has set stringent requirements for maximum allowable soluble salt concentrations for various applications. In order to test for surface cleanliness, surface contaminants must be extracted and analyzed. In the Bresle method, which is described in ISO 8502-6, a flexible cell is applied to the surface in question and injected by syringe with deionized water. Surface salts are dissolved into this solution that is removed and tested for conductivity. Conductivity measurements, recorded in microsiemens per centimeter ($\mu\text{S}/\text{cm}$), correspond to the concentration of dissolved ions in the solution. A high conductivity measurement indicates a high level of dissolved ions and in turn salt contamination on the surface. ISO 8502-9 provides a method to convert conductivity measurements to equivalent concentration of NaCl. Concentration limits are used in most international shipbuilding.

The Navy has stringent requirements for conductivity measurements on prepared surfaces.

For US Navy applications, NAVSEA has specified the total number of measurements required per inspection area and the limits for individual conductivity measurements. These limits, as described in NAVSEA Process Procedure Instructions (PPI) Core 6.6.2 and NSTM 631, are as follows.

- Conductivity due to soluble salts shall not exceed:
 - 30 $\mu\text{S}/\text{cm}$ (immersed applications)
 - 70 $\mu\text{S}/\text{cm}$ (non-immersed applications)
- The number of measurements are:
 - “Five (5) measurements every 1,000 ft^2 (90 m^2)”
 - “Areas less than 1000 ft^2 (90 m^2) shall have (5) measurements made.”

Current Method

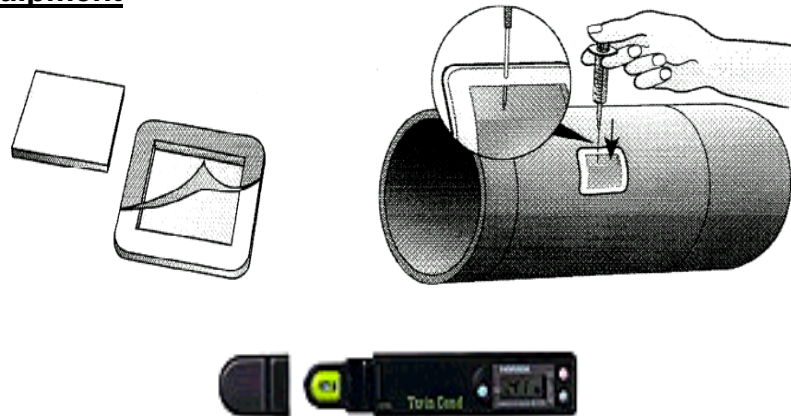
The Bresle method is outdated, tedious, and time consuming.

Conventional methods approved by NAVSEA for measuring the soluble salts remaining on a substrate prior to paint application (specifically the Bresle patch method) are tedious, time consuming (approximately 8 minutes per test), and may leave adhesive residue on the surface. In addition these methods can be expensive (e.g. each Bresle patch costs \$6.50 and can be used only once).

- Current technology utilized for measuring the soluble salts (specifically the Bresle patch method)
 - Tedious & time consuming (8 minutes)
 - Leaves residue on the surface
 - Each Bresle patch costs ~\$6.50 – *One use*
 - Manual record keeping
 - Uses syringes in industrial practices

Equipment

Equipment for the approved Bresle method includes messy patches, needles, and a separate meter for measurements.



Drawbacks

The currently approved Navy method has several drawbacks.

- Time Requirements for Bresle method
 - Approximately four minutes per test (field reported average time)
 - NAVSEA requires five measurements every 1,000 ft² or 1 measurement every 200 ft²
- Requires Post Clean-up Process
 - Removal of sticky film
- Seventeen Step Process
- Built in Errors
- Results in Poor Quality Assurance and Inspection
 - Due to tedious process
- Bresle method (each measurement)
 - Time \approx 8 minutes/test
 - QA Inspector Labor= \$50/hour (\$0.83/minute)
 - Bresle Patch=\$6.50

The Solution: Soluble Salt Meter (SSM) #RPCT-07-001

A new inspection tool has been developed and manufactured to replace the Bresle patch method for soluble salt determination. This Soluble Salt Meter (SSM), for which United States Patent No. 6,946,844 was issued on 20 September 2005, was designed around the current US Navy Bresle patch salt inspection method. The SSM test protocol exactly duplicates the Bresle process, except that measurements are automated and there are no consumables. The complete test sequence requires only one minute ten seconds (verified by NAVSEA). NAVSEA has approved the SSM Model # RPCT-07-001 as an authorized alternative to the Bresle patch method.



Equipment

The SSM seals, injects water, extracts salts, collects and stores measurements in one self contained system WITHOUT the use of patches or syringes.



Benefits

- Accurate, easy measurements
- Repeatable results
- Rugged, industrial hardened measurement device
- Simple operating instructions
- Reduced process steps (17 steps reduced to 6 steps)
- Reduced process time (only one minute reading to reading)
- Eliminate process induced surface contamination (sticky residue)
- Equipment easily transportable (tank inspections)
- Improved safety (syringes/needles eliminated)
- Operator error minimized
 - Metered water injection
 - Automatic data recording feature (configured to work with NAVSEA QA database systems)
- Automatically records both conductivity and equivalent NaCl concentration
- Electronic data can be exchanged to any Coating Technical File (CTF)

Side-By-Side Comparison

Technical Specifications

Bresle Patch

- Compartment Area: $1250 \pm 13 \text{ mm}^2$ (square)
 - Can vary 5% due to stretching
- Attachment Method: Adhesive
 - Leaves residue
 - Requires post measurement cleanup
- Water Injection Method: Syringe
 - Prone to human error and injury
- Air Evacuation of patch:
 - Syringe
 - Time consuming
 - Prone to human error

SSM

- Compartment Area: 1250 mm^2 (circular)
 - Fixed footprint
- Attachment Method: Magnetic
 - No effect on surface quality
 - Proven to seal over deep pits
- Water Injection Method: Automated
 - Accurate metering valve ($3.0 \pm 0.04 \text{ ml}$)
- Air Evacuation: Automated
 - Chamber relaxes automatically
 - No time delays

Process Procedures

Bresle Patch

1. Select Bresle patch, remove the protective paper and the punched-out material;
2. Adhere patch to surface (attempting to minimize trapped air);
3. Fill syringe with 3ml deionized water;
4. Inject half of the water into the patch.
5. Reposition needle and evacuate air.
6. Remove the needle from the patch. Holding the syringe with the needle pointing upwards, expel the air.
7. Re-insert the needle into the compartment and inject the remainder of the solvent;
8. Agitate Bresle patch with finger for 10-20 seconds;
9. Extract solution using syringe;
10. Transfer solution in syringe to Horiba B-173 meter;
11. Take reading;
12. Record reading by hand on QA sheet;
NOTE: ISO 8502-6 dictates that during steps 3 to 10, it is essential that no solvent be lost from the patch or syringe. If any solvent is lost, the solution obtained shall be rejected.
13. Remove Bresle patch from surface;
14. Wipe remaining water from surface with rag
15. Clean any adhesive remaining on surface;
16. Clean and rinse out syringe;
17. Clean Horiba meter.

17 Total Steps (~8 min)

SSM

1. Attach meter to surface;
2. Inject deionized water into measurement chamber with one press of the dose bottle;
3. Meter automatically agitates solution (~ 40 seconds);
4. Meter automatically takes reading;
 - Displays reading on LCD screen
 - Stores values electronically
5. Wipe remaining water from surface after removing SSM
6. Flush meter by turning over and injecting water from dose bottle.

6 Total Steps (1 min)

Cost Comparison

This section includes a cost comparison between the Bresle method and the SSM. The time per test is approximated to be 8 minutes per test* for inspectors and reflects additional time required to enter and track measurements by hand. The SSM stores all data electronically, allowing easy data management and tracking.

Bresle Patch

Time = 8 min/test
Labor = \$50/hr (\$0.83/min)
Bresle Patch = \$6.50

~\$13.00 per measurement

~\$23,300 per year**

SSM

Time = 1 min/test
Labor = \$50/hr (\$0.83/min)
No consumable

~\$0.83 per measurement

~\$1,400 per year**

*Based on observational data of actual shipyard inspections.

** This is an estimate based on the *labor and materials cost* for 1700 measurements per year. These figures do not include expenses such as syringes, deionized water, and conductivity meters.

The initial SSM investment cost is returned with approximately 430 measurements. Depending on usage this could be as little as 3 months.

The SSM, a vast improvement over the Bresle method, is the most reliable, accurate, and repeatable method for measuring surface cleanliness

Summary

The SSM overcomes many of the inherent challenges of taking QA measurements. By reducing test cycle time and automating data measurement and tracking, the SSM will save money and improve QA.

The SSM:

- Cuts sampling/inspection time;
- Simplifies the measurement process (17 steps reduced to 6 steps);
- Improves safety by eliminating the need for syringes and needles;
- Minimizes operator error through automatic metered water injection and electronic recording of measurements;
- Doesn't leave sticky residue on the substrate;
- Extracts surface salts more reliably for more accurate readings;
- Is equivalent to ISO Standard 8502-6 *Extraction of soluble contaminants for analysis -- The Bresle method*;
- Meets the requirements of ISO Standard 8502-9 *Field method for the conductometric determination of water-soluble salts*.

Cost: Contact us for a price quote.

Model Number: RPCT- 07-001

Distributed by: ARP Instruments, Inc.