# CLEANING LABORATORY EVALUATION SUMMARY

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|---|---|
| SCL #: | 2009 |
| DateRun: | 05/11/2009 |
| Experimenters: | Jason Marshall, Junhee Cho |
| ClientType: | Cleaner Manufacturer |
| ProjectNumber: | Project #1 |
| Substrates: | Stainless Steel |
| PartType: | Coupon |
| Contaminants: | Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil |
| Cleaning Methods: | Ultrasonics |
| Analytical Methods: | Gravimetric |
| Purpose: | To evaluate new product formulation for Green Seal GS 34 Degreaser standard. |

Experimental Procedure:

According to Green Seal, GS 34 is a procedure for evaluating the ability of a degreaser to remove soil and is based on ASTM G-122, (1996), MIL-PRF-87937C (DOD, 1997) and MIL-C-29602 (DOD, 1995).

Two types of soils were prepared individually. The first soil, maintenance soil, consisted of 10 grams of carbon black, 10 grams iron oxide, 100 ml WD-40, 100 ml hydraulic oil, and 100 ml gear oil. Each component was placed in a 750 beaker and mixed for 20 minutes at room temperature using a magnetic stirrer. The second soil, production soil, was made by mixing 200 ml Quench Oil and 200 ml cutting oil for 20 minutes at room temperature using a magnetic stirrer in a second 750 ml beaker.

Approximately 100 mg of each soil was applied to a precleaned and preweighed stainless steel coupon onto one side only with a handheld swab. No soil was applied to the two control coupons. The maintenance soil for all three coupons was baked in an oven for 30 minutes at a temperature of 40° C (105 F). For the production soil, all three coupons were baked in an oven for thirty minutes at 105° C (220 F). The coupons were then allowed to cool to room temperature and weigh a second time (soiled mass = B).

The product was used at the recommended concentration (35:1 as supplied). The solutions were preheated to 40 C (105 F). Four 600 mL beakers were filled with enough fresh degreaser solution to completely submerge the coupons in the degreasing solution without any overflow. The four beakers were suspended in the heated Branson 40 kHz ultrasonic tank and allowing the temperature in the cleaning bath and beakers to equilibrate. The degreaser was degassed for five minutes.

Each coupon was suspended in a beaker, allowing the entire contaminated surface to be submerged in the cleaning solution. The coupons were washed for 20 minutes using ultrasonic cleaning.

The washing was followed by two ultrasonic rinse steps. The coupons were drained for 30 seconds prior to each rinse step. For each rinse step a 20 minute soak was utilized. After the two rinse steps, all coupons were first allowed to air dry for 30 minutes and then dried in an oven at 105° C for 30 minutes. The coupons were then cooled to room temperature and final weights were measured (mass of the coupon after cleaning = C).

The control coupons were examined to determine if there were any visible signs of corrosion. Next, the control coupon was weighed to determine if there was any lost mass, which might occur if corrosion was in progress; or gained mass, which might occur if the degreaser had left a residue on the coupons. The following equation was applied:
[MCC - MCB] < 0.1 mg (which is the maximum balance error).
Where:
MCC = mass of the control coupon after washing and rinsing
MCB = mass of the control coupon before washing and rinsing

For the cleaned coupons, the amount of residual soil per surface area was calculated, using the following formula:
RS = (C-A)/ Ar
Where:
RS = amount of residual soil (mg/m2)
C = mass of the coupon after cleaning
A = initial coupon mass
Ar = surface area = 0.0035 m2

If the average residual maintenance soil loading, and the average residual performance soil loading are each less than 2,000 mg/m2, the degreaser meets the cleaning performance criteria.

Results:

The supplied cleaning product was successful at removing both soils using ultrasonic cleaning at 105F. The residual soil levels were both under the 2000 mg/m2 level. Efficiencies were calculated to be in the table lists the weights of the coupons and the calculated RS values.

STC 300 Degreaser - 2.9% with ultrasonic cleaning

| Coupon | Initial mass of | Mass of coupon | Mass of coupon | Residual soil | Mass difference |
|---|---|---|---|---|---|

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| | coupons -g (A) | after - g soiling (B) | after - g cleaning (C) | (mg/ m2) | control (mg) |
|---|---|---|---|---|---|
| M1 | 53.7109 | 53.8241 | 53.7110 | 25 | - |
| M2 | 54.1510 | 54.2646 | 54.1510 | 0 | - |
| M3 | 54.1440 | 54.2293 | 54.1439 | -25 | - |
| MC | | 54.0575 | 54.0575 | - | 0.0000 |
| Average | | | | 0 | |
| P1 | 53.9877 | 54.0991 | 53.988 | 75 | - |
| P2 | 53.7578 | 53.8667 | 53.758 | 50 | - |
| P3 | 53.6892 | 53.7988 | 53.6894 | 50 | - |
| PC | | 53.6939 | 53.6939 | - | 0.0000 |
| Average | | | | 58 | |

Summary:

| **Substrates:** | Stainless Steel | | | | |
|---|---|---|---|---|---|
| **Contaminants:** | Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil | | | | |
| **Company Name:** | **Product Name:** | **Conc.:** | **Efficiency:** | **Effective:** | **Observations:** |
| Safe-Tee Chemical | STC 300 Degreaser | 2.9 | 99.90 | ☑ | |

Conclusion: The supplied cleaning product was successful for both of the two soils with the removal rate (29 mg/m2) was under the Green Seal GS 34 requirement of 2000 mg/m2 using ultrasonic cleaning.