CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2010
DateRun:	06/16/2010
Experimenters:	Jason Marshall, Timothy Weil, Johnny Le
ClientType:	Cleaner Manufacturer
ProjectNumber:	Project #1
Substrates:	Stainless Steel
PartType:	Coupon
Contaminants:	Oil
Cleaning Methods:	Ultrasonics
Analytical Methods:	Gravimetric
Purpose:	To conduct follow up test for GS 34 using ultrasonic cleaning

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 (clean mass = A) 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 cleaning product was diluted to 15:1 and 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 a Branson ultrasonic tank heated tank and allowing the temperature in the cleaning bath and beakers to equilibrate. Each beaker was degassed for 5 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 at the 40 kHz range.

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 cycle 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 = 0.0045 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 Calsoft L40 mix was successful using ultrasonic cleaning removing over 98% of both soils. The residual soil levels were well under the 2000 mg/m2 requirement set by GS 34 (222 mg/m2 M; 51.9 mg/m2 P).

Calsoft L40 mix	Initial mass of coupons (A)	Mass of coupon after	Mass of coupon after	Residual soil (mg/m2)	Mass difference control

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		soiling (B)	cleaning (C)		
M1	59.1025	59.1875	59.1040	333	-
M2	59.0271	59.1170	59.0276	111	-
M3	60.3038	60.3890	60.3048	222	-
MC	59.1302	59.1302	59.1301	-	-0.0001
Average				222	-
	Initial wt	Cont. wt	Clean wt.		
P1	60.2469	60.3463	60.2471	22.2	-
P2	59.2982	59.4051	59.2986	44.4	-
P3	59.1260	59.2147	59.1294	88.9	-
PC	59.1571	59.1572	59.1572	-	0.0000
Average				51.9	

Summary:

Conclusion: The Green Bridge reformulation mix with Calsoft L40 met the requirements for GS 34 for both the maintenance soil and the process soil when using ultrasonic cleaning.