CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2010
DateRun:	06/09/2010
Experimenters:	Jason Marshall, Timothy Weil
ClientType:	Cleaner Manufacturer
ProjectNumber:	Project #1
Substrates:	Stainless Steel
PartType:	Coupon
Contaminants:	Oil
Cleaning Methods:	Immersion/Soak
Analytical Methods:	Gravimetric
Purpose:	To evaluate second supplied product for Green Seal GS 34 degreasing 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 (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 XX% 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 the heated tank and allowing the temperature in the cleaning bath and beakers to equilibrate. 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 immersion cleaning only. The washing was followed by two 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 = 0.0045 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 Nutrisol-Calsoft L40 mix met the standard removal rate for Process soil (1763 mg/m2) but did not for the maintenance soil (3430 mg/m2). The formulation did work better than the existing formulation (P-1926, M-8719). A quick check of the product at a higher concentration resulted in an improvement for the maintenance soil (3111) but still did not meet the required removal rate of 2000 mg/m2. A quick check also was performed on a second formulation option. The results were promising (1659 mg/m2) but the initial soil loading was not within the standard required range and would need to be retested to ensure

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proper soil removal rates. The table lists the values for each coupon cleaned for both soils using immersion cleaning.

Calsoft L40 mix	Initial mass of coupons (A)	Mass of coupon after soiling (B)	Mass of coupon after cleaning (C)	Residual soil (mg/ m2)	Mass difference control
M1	62.5826	62.6728	62.5913	1933	
M2	62.7810	62.8711	62.7934	2756	
M3	64.3747	64.5073	64.3999	5600	
MC	60.2934		60.2935		-0.0001
Average				3430	
P1	62.5021	62.6011	62.5104	1844	
P2	62.7543	62.8968	62.7615	1844	
P3	59.0830	59.1365	59.0849	1600	
PC	59.0962		59.0962		0.0000
Average				1763	
Green Bridge Original Formula					
M1	62.9454	63.0675	62.9579	2778	
M2	62.6956	62.8449	62.7657	15578	
M3	60.2190	60.3614	60.2541	7800	
MC	62.2156		62.2155		0.0001
Average				8719	
P1	60.1899	60.2774	60.1962	1400	
P2	59.8873	59.9872	59.9005	2933	
P3	62.5879	62.6932	62.5944	1444	
PC	62.8415		62.8415		0.0000
Average				1926	
SugaNate 160					
M1	59.083	59.1365	59.0849	422	
M2	62.1892	62.2478	62.2094	4489	
M3	60.2938	60.3598	60.2941	67	
MC	62.1154		62.1154		0.0000
Average				1659	
Calsoft L40 3:1					
M1	62.726	62.8417	62.7362	2267	
M2	62.7052	62.8482	62.7194	3156	
M3	62.7426	62.8589	62.7602	3911	
MC	62.8415		62.8416		-0.0001
Average				3111	

Summary:

Conclusion: The Calsoft L40 mix was not successful on the maintenance soil using immersion cleaning at 40 C (105 F). A follow up test will be conducted using ultrasonic cleaning. If the solution passes the removal rate under these conditions, the second performance test (oil-water separation) will be conducted.