

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 1997
 DateRun: 07/25/1997
 Experimenters: Jason Marshall, Prashant Trivedi
 ClientType: Machine Construction Company
 ProjectNumber: Project #1
 Substrates: Stainless Steel
 PartType: Coupon
 Contaminants: Coatings
 Cleaning Methods: Immersion/Soak
 Analytical Methods: Black light, Gravimetric
 Purpose: Non-hardening rust preventive cleaning trial.

Experimental Procedure: Eighteen (18) coupons were weighed after being precleaned. The coupons were then contaminated with the slush like rust preventive compound. The coupons were allowed to set for about an hour and then weighed. Six chemistries were selected through analysis of experiments with similar conditions. Five percent solutions were prepared and heated to 150 F. Three coupons were placed in each cleaner with stir bar agitation for ten minutes. After cleaning, the coupons were rinsed in tap water at 120 F also with stir bar agitation and dried with a hot air gun for two minutes. Once the coupons cooled to room temperature, the final weights were obtained for the coupons. The coupons were then examined under black light since the contaminant fluoresces.
 SUBSTRATE MATERIAL: Stainless Steel
 CONTAMINANTS: Ferrocote 5802-HF, non-hardening rust preventive
 CONTAMINATING PROCESS USED: applied the rust preventive material using a swab onto pre-weighed coupons

Results:

| %Contaminant Removed | | | | | | |
|----------------------|-----------|-----------|--------|---------|--------|---------|
| | Blue Gold | Precision | 625-XL | AK-6215 | 2000XS | SP 2200 |
| | 99.97 | 99.92 | 99.22 | 99.05 | 99.93 | 98.91 |
| | 99.33 | 99.93 | 99.11 | 99.15 | 99.85 | 98.88 |
| | 100.02 | 99.93 | 99.36 | 99.55 | 99.89 | 99.50 |
| Average | 99.77 | 99.93 | 99.23 | 99.25 | 99.89 | 99.10 |
| Std Dev | 0.38 | 0.01 | 0.13 | 0.27 | 0.04 | 0.35 |
| Ranking | 3 | 1 | 5 | 4 | 2 | 6 |

All of the cleaners selected for the experiment showed excellent removal of the contaminant. The best cleaner was the Precision cleaner. Under the black light the coupons showed no visible sign of the contaminate, which compared nicely with the gravimetric results. The second best cleaner had little to no contaminate remaining then using the black light. The next best cleaner was Blue Gold, showing minimal amounts of contaminate. The remaining three cleaners, AK-6215, 625-XL and SP 2200, had moderate amounts of contaminate still visible under the black light. It was interesting to note that the order of cleanliness was the same using both observational methods.

Due to the high level of efficiency of all the cleaners, 99.1% - 99.9%, further observations were made during and after the experiment in order to help select the best cleaners. The conditions of the solutions were noted during the cleaning period, after the solution returned to room temperature and, finally, after the solutions were filtered through glass fiber filters.

| Black Light Rating | | | | | | |
|--------------------|-----------|-----------|-----------|---------|--------|---------|
| cleaner: | Blue Gold | Precision | 625-XL | AK-6215 | 2000XS | SP 2200 |
| Rating: | good/okay | excellent | okay/fair | okay | good | fair |

Key for Black Light Rating: excellent-good-okay-fair-poor

| Chemistry | Blue Gold | Precision | 625-XL | AK-6215 | 2000XS | SP 2200 |
|-----------------|--|----------------------|---|--|---|--|
| During Cleaning | surface contaminated, agitation helped to dissolve contamination | good cleaning action | large clumps on surface, majority was dissolved after 3-4 minutes | not all contaminate removed form coupons | big clumps on surface, majority was dissolved after 2-3 minutes | slow start, clumps at top, bath was cloudy |
| After Cleaning | most contaminate at top, some dissolved | contaminate at top | most contaminate at top, some dissolved | contaminate at top | contaminate dissolved | contaminate dissolved |

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|------------------|---------------------|----------------|------------------------|----------------|------------------------|--|
| After filtration | good, slightly hazy | good/excellent | okay/good-still cloudy | good/excellent | okay, long filter time | good/excellent, relatively free of contaminate |
|------------------|---------------------|----------------|------------------------|----------------|------------------------|--|

The during cleaning observations were based on visual inspection of the baths. After cleaning was determined using visual and black light observations. The after filtration observations were based using the black light. For an excellent observation, the solutions only fluoresces at the top with zero to minimal throughout the solution and for poor the solution would fluoresces throughout the entire solution.

Summary:

| | | | | | |
|-------------------------|------------------------------------|---------------|--------------------|-------------------------------------|----------------------|
| Substrates: | Stainless Steel | | | | |
| Contaminants: | Coatings | | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| Carroll Company | Blue Gold Heavy Industrial Cleaner | 5 | 99.78 | <input checked="" type="checkbox"/> | |
| LPS Laboratories | Precision Clean Concentrate | 5 | 99.93 | <input checked="" type="checkbox"/> | |
| Quaker Chemical | Formula 625 XL | 5 | 99.23 | <input checked="" type="checkbox"/> | |
| Calgon Corporation | AK 6215 | 5 | 99.25 | <input checked="" type="checkbox"/> | |
| US Polychem Corporation | Polychem A 2000 XS | 5 | 99.89 | <input checked="" type="checkbox"/> | |
| Valtech Corporation | Valtron SP 2200 | 5 | 99.10 | <input checked="" type="checkbox"/> | |

Conclusion:

All of the cleaners performed very well in the removal of the slush like rust preventive material from Quaker. The six cleaners were compared using gravimetric and black light. In each method the order of effectiveness was the same with Precision Clean being the best followed by 2000XS, Blue Gold, AK-6215, 625-XL and SP 2200.

Using the other methods of observations, Precision Clean again was the best. The next best cleaners were 625-XL, Blue Gold, AK-6215, SP 2200, and 2000XS. These were based on how easily the solutions could be maintained. Solutions that had the majority of the cleaner at the top would have a longer bath life due to the possible removal of contaminants via skimming or filtering out the solutions. The chemistries that had the contaminate dissolved throughout would eventually become saturated and have to be replaced. A further consideration in determining which cleaners to select will be how well the cleaners work at removing the second type of rust preventive substance. Therefore any recommendation will have to wait until after the next trial is performed and analyzed.