

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2008

DateRun: 10/09/2008

Experimenters: Jason Marshall

ClientType: Electronics Manufacturer

ProjectNumber: Project #1

Substrates: Aluminum

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric

Purpose: To evaluate performance of possible aqueous based cleaning products for various oil removal.

Experimental Procedure: Eight products were selected from the lab's on-line database, www.cleanersolutions.org, based on past testing results matching client supplied information. A ninth product was requested by the client. All of these products were diluted to 5% using DI water in 400 ml beakers. All nine products were heated to 130 F on a hot plate.

Pewegh aluminum coupons were coated with the Houghton Houghto Draw 7007 (64742-52-5) metal working fluid using a handheld swab. The contaminant was allowed to dry for about an hour. Once dry, the coupons were weighed a second time to determine the amount of oil applied.

Three coupons were immersed into each solution and cleaned for 5 minutes using stir-bar agitation. Rinsing was performed for 15 seconds using tap water heated to 120 F and followed by 30 seconds of air blow off with dry compressed air at room temperature. Final weights were recorded, and efficiencies were calculated for each coupon cleaned.

Results: All nine products removed over 97% of the drawing fluid from the aluminum coupons within five minutes of immersion cleaning. Seven of the products removed more than 99%. The table lists the amount of soil added, the amount remaining and the efficiency for each coupon cleaned.

| Cleaner | Initial wt | Final wt | % Removed |
|-----------------------------|------------|----------|-----------|
| Green Soak | 0.6338 | 0.0022 | 99.65 |
| | 0.4244 | 0.0029 | 99.32 |
| | 0.3616 | 0.0030 | 99.17 |
| Aquavantage 1400 | 0.5210 | 0.0042 | 99.19 |
| | 0.6362 | 0.0009 | 99.86 |
| | 0.5279 | 0.0051 | 99.03 |
| Shopmaster LpH | 0.5401 | 0.0052 | 99.04 |
| | 0.5512 | 0.0028 | 99.49 |
| | 0.4438 | 0.0020 | 99.55 |
| FPC 100 | 0.5276 | 0.0027 | 99.49 |
| | 0.4234 | 0.0012 | 99.72 |
| | 0.4121 | 0.0011 | 99.73 |
| SC Aircraft & Metal Cleaner | 0.4747 | 0.0024 | 99.49 |
| | 0.5406 | 0.0011 | 99.80 |
| | 0.6116 | 0.0003 | 99.95 |
| Amberclean L12 | 0.5247 | 0.0020 | 99.62 |
| | 0.4638 | 0.0012 | 99.74 |
| | 0.7256 | 0.0037 | 99.49 |
| Metalnox M6381 | 0.4709 | 0.0075 | 98.41 |
| | 0.3637 | 0.0114 | 96.87 |
| | 0.3054 | 0.0043 | 98.59 |
| Inproclean 3800 | 0.3949 | 0.0205 | 94.81 |
| | 0.2855 | 0.0003 | 99.89 |
| | 0.4581 | 0.0021 | 99.54 |
| Ozzy Juice SW-3 | 0.5780 | 0.0007 | 99.88 |
| | 0.3330 | 0.0022 | 99.34 |

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| | 0.3834 | 0.0008 | 99.79 |
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Summary:

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|-------------------------------------|---|---------------|--------------------|-------------------------------------|----------------------|
| Substrates: | Aluminum | | | | |
| Contaminants: | Oil | | | | |
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| BCS Company | Green Spray 400 | 5 | 99.38 | <input checked="" type="checkbox"/> | |
| Brulin Corporation | Aquavantage 1400 | 5 | 99.36 | <input checked="" type="checkbox"/> | |
| Buckeye International | Shopmaster LPH | 5 | 99.36 | <input checked="" type="checkbox"/> | |
| Environmental Solution Products Inc | FPC 100 | 5 | 99.65 | <input checked="" type="checkbox"/> | |
| Gemtek Products | SC Aircraft & Metal Cleaner Super Concentrate | 5 | 99.75 | <input checked="" type="checkbox"/> | |
| Innovative Organics Inc | Amberclean L 12 | 5 | 99.62 | <input checked="" type="checkbox"/> | |
| Kyzen Corporation | Metalnox M6381 (For Comparison Only) | 5 | 97.95 | <input checked="" type="checkbox"/> | |
| Oakite Products | Inproclean 3800 | 5 | 98.08 | <input checked="" type="checkbox"/> | |
| Chem Free Corporation | SW-3 Ozzy Juice (Improved Low Odor) | 5 | 99.67 | <input checked="" type="checkbox"/> | |

Conclusion:

The top seven products will be used on the second supplied contaminant under the same cleaning conditions.