

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2019

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Experimenters: Othon Pagounes, Harry Rankin

ClientType: Adhesive Manufacturer

ProjectNumber: Project #3

Substrates: Stainless Steel

PartType: Part

Contaminants: Adhesive

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric, Visual

Purpose: To evaluate the effectiveness of a solvent and aqueous based cleaners on the removal of acrylic and silicone adhesives from stainless steel coupons using unheated and heated immersion as a replacement for NMP.

Experimental Procedure: Twelve pre-weighed stainless steel coupons, three for each cleaner, were soiled for each contaminant tested. Approximately 0.5 g of the soil was applied using a hand held swab. Each set of coupons were placed into a beaker and immersed for 30 minutes. During this process, any noticeable soil removal was observed at ten minute intervals. Coupons were allowed to dry for 24 hours, and afterwards final weights were recorded as well as efficiency of removal was calculated for each coupon cleaned. This process was then repeated with the application of a heated immersion.

Results: Table 1: Unheated Immersion Acrylic

| Cleaner                       | Conc. | Initial wt. of cont. (g) | Final wt. of cont. (g) | % Cont. Removed | % Average |
|-------------------------------|-------|--------------------------|------------------------|-----------------|-----------|
| Aquavantage 1400 GD           | 10%   | 0.5078                   | 0.4125                 | 18.77           | 19.04     |
|                               |       | 0.4132                   | 0.3398                 | 17.76           |           |
|                               |       | 0.7461                   | 0.5924                 | 20.60           |           |
| Surface Clean 930             | 2%    | 0.4284                   | 0.3319                 | 22.53           | 26.40     |
|                               |       | 0.5068                   | 0.3369                 | 33.52           |           |
|                               |       | 0.4074                   | 0.3131                 | 23.15           |           |
| SC Aircraft and Metal Cleaner | 1%    | 0.3893                   | 0.2876                 | 26.12           | 25.95     |
|                               |       | 0.5171                   | 0.4175                 | 19.26           |           |
|                               |       | 0.636                    | 0.4296                 | 32.45           |           |
| Sta-Sol® ESS 160              | 100%  | 0.4052                   | 0.3683                 | 9.11            | 18.67     |
|                               |       | 0.5334                   | 0.4288                 | 19.61           |           |
|                               |       | 0.5471                   | 0.3977                 | 27.31           |           |

Table 2: Unheated Immersion Silicone

| Cleaner                       | Conc. | Initial wt. of cont. (g) | Final wt. of cont. (g) | % Cont. Removed | % Average |
|-------------------------------|-------|--------------------------|------------------------|-----------------|-----------|
| Aquavantage 1400 GD           | 10%   | 0.5603                   | 0.502                  | 10.41           | 7.24      |
|                               |       | 0.591                    | 0.5456                 | 7.68            |           |
|                               |       | 0.552                    | 0.532                  | 3.62            |           |
| Surface Clean 930             | 2%    | 0.4133                   | 0.391                  | 5.40            | 6.06      |
|                               |       | 0.6106                   | 0.5706                 | 6.55            |           |
|                               |       | 0.519                    | 0.4866                 | 6.24            |           |
| SC Aircraft and Metal Cleaner | 1%    | 0.5225                   | 0.4986                 | 4.57            | 5.21      |
|                               |       | 0.5579                   | 0.5226                 | 6.33            |           |
|                               |       | 0.4982                   | 0.4747                 | 4.72            |           |
| Sta-Sol® ESS 160              | 100%  | 0.5504                   | 0.5473                 | 0.56            | 1.78      |
|                               |       | 0.5818                   | 0.5639                 | 3.08            |           |
|                               |       | 0.4602                   | 0.4524                 | 1.69            |           |

Table 3: Heated Immersion Acrylic

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| Cleaner                       | Conc. | Temp.  | Initial wt. of cont. | Final wt. of cont. | % Cont. Removed | % Average |
|-------------------------------|-------|--------|----------------------|--------------------|-----------------|-----------|
| Aquavantage 1400 GD           | 10%   | 145° F | 0.4011               | 0.291              | 27.45           | 25.67     |
|                               |       |        | 0.4632               | 0.37               | 20.12           |           |
|                               |       |        | 0.5516               | 0.3892             | 29.44           |           |
| Surface Clean 930             | 2%    | 90° F  | 0.5563               | 0.4179             | 24.88           | 26.98     |
|                               |       |        | 0.293                | 0.212              | 27.65           |           |
|                               |       |        | 0.5133               | 0.3674             | 28.42           |           |
| SC Aircraft and Metal Cleaner | 1%    | 140° F | 0.4291               | 0.3647             | 15.01           | 16.27     |
|                               |       |        | 0.3131               | 0.264              | 15.68           |           |
|                               |       |        | 0.3738               | 0.3061             | 18.11           |           |
| Sta-Sol® ESS 160              | 100%  | 130° F | 0.5067               | 0.379              | 25.20           | 18.82     |
|                               |       |        | 0.3531               | 0.3376             | 4.39            |           |
|                               |       |        | 0.5076               | 0.3712             | 26.87           |           |

Table 4: Heated Immersion Silicone

| Cleaner                       | Conc. | Temp.  | Initial wt. of cont. | Final wt. of cont. | % Cont. Removed | % Average |
|-------------------------------|-------|--------|----------------------|--------------------|-----------------|-----------|
| Aquavantage 1400 GD           | 10%   | 145° F | 0.6875               | 0.6757             | 1.72            | 5.67      |
|                               |       |        | 0.6501               | 0.6277             | 3.45            |           |
|                               |       |        | 0.3591               | 0.3165             | 11.86           |           |
| Surface Clean 930             | 2%    | 90° F  | 0.504                | 0.5                | 0.79            | 1.80      |
|                               |       |        | 0.5575               | 0.5328             | 4.43            |           |
|                               |       |        | 0.5587               | 0.5577             | 0.18            |           |
| SC Aircraft and Metal Cleaner | 1%    | 140° F | 0.4012               | 0.2981             | 25.70           | 11.25     |
|                               |       |        | 0.634                | 0.6167             | 2.73            |           |
|                               |       |        | 0.7278               | 0.689              | 5.33            |           |
| Sta-Sol                       | 100%  | 130° F | 0.5114               | 0.4913             | 3.93            | 3.79      |
|                               |       |        | 0.4732               | 0.452              | 4.48            |           |
|                               |       |        | 0.5676               | 0.5508             | 2.96            |           |

| Manufacturer           | Product Name                       | Immersion Method | Acrylic Adhesive | Silicone Adhesive |
|------------------------|------------------------------------|------------------|------------------|-------------------|
|                        |                                    |                  | Efficiency %     | Efficiency %      |
| Brulin Holding Company | Aquavantage 1400 GD (10%)          | Unheated         | 19.04            | 7.24              |
|                        |                                    | Heated (145° F)  | 25.67            | 5.67              |
| International Products | Surface Clean 930 (2%)             | Unheated         | 26.40            | 6.06              |
|                        |                                    | Heated (90° F)   | 26.98            | 1.80              |
| Gemtek                 | SC Aircraft and Metal Cleaner (1%) | Unheated         | 25.95            | 5.21              |
|                        |                                    | Heated (140° F)  | 16.27            | 11.25             |
| JR Hess                | Sta-Sol® ESS 160                   | Unheated         | 18.67            | 1.78              |
|                        |                                    | Heated (130° F)  | 18.82            | 3.79              |

Summary:

| <b>Substrates:</b>   |                  | Stainless Steel |             |                          |                   |
|----------------------|------------------|-----------------|-------------|--------------------------|-------------------|
| <b>Contaminants:</b> |                  | Adhesive        |             |                          |                   |
| Company Name:        | Product Name:    | Conc.:          | Efficiency: | Effective:               | Observations:     |
| Brulin Corporation   | Aquavantage 1400 | 10%             | 19.04       | <input type="checkbox"/> | Acrylic Adhesive  |
| Brulin Corporation   | Aquavantage 1400 | 10%             | 25.67       | <input type="checkbox"/> | Acrylic Adhesive  |
| Brulin Corporation   | Aquavantage 1400 | 10%             | 7.24        | <input type="checkbox"/> | Silicone Adhesive |

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|                                    |   |      |       |                          |   |
|------------------------------------|---|------|-------|--------------------------|---|
| Brulin Corporation                 | Aquavantage 1400                              | 10%  | 5.67  | <input type="checkbox"/> | Silicone Adhesive. Heat didn't really impact this adhesive.                               |
| International Products Corporation | Surface Cleanse Concentrated Neutral 930      | 2%   | 26.40 | <input type="checkbox"/> | Acrylic Adhesive  |
| International Products Corporation | Surface Cleanse Concentrated Neutral 930      | 2%   | 26.98 | <input type="checkbox"/> | Acrylic Adhesive. Heat didn't improve effectiveness.                                      |
| International Products Corporation | Surface Cleanse Concentrated Neutral 930      | 2%   | 6.06  | <input type="checkbox"/> | Silicone Adhesive   |
| International Products Corporation | Surface Cleanse Concentrated Neutral 930      | 2%   | 1.80  | <input type="checkbox"/> | Silicone Adhesive. Heat didn't improve effectiveness.                                     |
| Gemtek Products                    | SC Aircraft & Metal Cleaner Super Concentrate | 1%   | 25.95 | <input type="checkbox"/> | Acrylic Adhesive  |
| Gemtek Products                    | SC Aircraft & Metal Cleaner Super Concentrate | 1%   | 16.27 | <input type="checkbox"/> | Acrylic adhesive. Heat didn't improve effectiveness.                                      |
| Gemtek Products                    | SC Aircraft & Metal Cleaner Super Concentrate | 1%   | 5.21  | <input type="checkbox"/> | Silicone Adhesive   |
| Gemtek Products                    | SC Aircraft & Metal Cleaner Super Concentrate | 1%   | 11.25 | <input type="checkbox"/> | Silicone Adhesive. Heat did slightly improve effectiveness.                               |
| JR Hess & Co., Inc.                | Sta-Sol ESS 160                               | 100% | 18.67 | <input type="checkbox"/> | Acrylic Adhesive  |
| JR Hess & Co., Inc.                | Sta-Sol ESS 160                               | 100% | 18.82 | <input type="checkbox"/> | Acrylic Adhesive. Sta Sol ESS 160 seems to do better from previous tests around 140/150F. |
| JR Hess & Co., Inc.                | Sta-Sol ESS 160                               | 100% | 1.78  | <input type="checkbox"/> | Silicone Adhesive   |
| JR Hess & Co., Inc.                | Sta-Sol ESS 160                               | 100% | 3.79  | <input type="checkbox"/> | Silicone Adhesive. Heat barely improved effectiveness.                                    |

**Conclusion:**

All of the chemistries evaluated were not efficient in the removal of acrylic or silicone adhesive in both unheated and heated immersion, but an improvement was seen with heat. The next step will be to apply agitation using ultrasonics. Silicone will be the only contaminant tested going forward due to it being the hardest contaminant to remove thus far.