

# CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2017

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ClientType: Capacitor Manufacturer

ProjectNumber: Project #3

Substrates: Aluminum

PartType: Coupon

Contaminants: Oil

Cleaning Methods: Immersion/Soak

Analytical Methods: Gravimetric

Purpose: To find the effectivity of a set of cleaners against various oils on an aluminum surface.

Experimental Procedure: Aluminum coupons were selected and arranged into sets of three for each cleaner. The substrates were wiped off with Kimwipes and initial weights were taken. Then the coupons were soiled with the respective oil and allowed to air dry for one hour before taking dirty weights. The coupons were cleaned by immersion in the cleaners at 49°C or 120°F. The coupons were allowed 15 minutes for lighter oils and 30 minutes for the epoxidized soybean oil, inspecting them every 10 minutes. Coupons were taken out once cleaning was complete and rinsed in a bath of water, to later be blown off with pressurized air for 5 minutes. After allowing the coupons to dry about five minutes, clean weights were taken.

Results: The MacDermid Adherite cleaner was not effectively compatible with the aluminum coupons and seemed to deteriorate the substrate, darkening the surface as shown in Figure 1. This was the reason for the percentages being over 100% for the Nisseki soil. The same effect was observed on at least three of the four oils. No reaction was observed with canola oil. It proved difficult to clean silicone and epoxidized soybean oil, because a lot of residue was left on the coupons. Blow off with pressurized air did very little except spread the oil along the surface.

| MacDermid Clepo Adherite 590 |            |          |           |          |             |
|------------------------------|------------|----------|-----------|----------|-------------|
| Products                     | Initial Wt | Final Wt | % Removal | Soil Ave | Overall Ave |
| Nisseki SAS 601E             |            |          |           |          |             |
|                              | 0.0561     | 0.0039   | 106.95    | 103.52   | 92.25       |
|                              | 0.0955     | 0.0029   | 103.04    |          |             |
|                              | 0.1542     | 0.0009   | 100.58    |          |             |
| Silicone Fluid               |            |          |           |          |             |
|                              | 0.0673     | 0.0055   | 91.83     | 93.36    |             |
|                              | 0.1253     | 0.0079   | 93.7      |          |             |
|                              | 0.1211     | 0.0066   | 94.55     |          |             |
| Canola Oil                   |            |          |           |          |             |
|                              | 0.1143     | 0.0145   | 87.31     | 84.9     |             |
|                              | 0.1173     | 0.0152   | 87.04     |          |             |
|                              | 0.1795     | 0.0353   | 80.33     |          |             |
| Epoxidized Soybean Oil       |            |          |           |          |             |
|                              | 0.0736     | 0.0026   | 96.47     | 87.21    |             |
|                              | 0.0565     | 0.0146   | 74.16     |          |             |
|                              | 0.1499     | 0.0135   | 90.99     |          |             |
| Brulin Aquavantage 1400      |            |          |           |          |             |
| Nisseki SAS 601E             |            |          |           |          |             |
|                              | 0.1514     | 0.0073   | 95.18     | 93.17    | 82.17       |
|                              | 0.0795     | 0.0081   | 89.81     |          |             |
|                              | 0.064      | 0.0035   | 94.53     |          |             |
| Silicone Fluid               |            |          |           |          |             |
|                              | 0.1272     | 0.0104   | 91.82     | 94.6     |             |
|                              | 0.0957     | 0.0028   | 97.07     |          |             |
|                              | 0.1587     | 0.0081   | 94.9      |          |             |
| Canola Oil                   |            |          |           |          |             |
|                              | 0.1681     | 0.0394   | 76.56     | 79.03    |             |

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|                             |        |        |       |       |       |
|-----------------------------|--------|--------|-------|-------|-------|
|                             | 0.1371 | 0.0112 | 91.83 |       |       |
|                             | 0.1256 | 0.0393 | 68.71 |       |       |
| Epoxidized Soybean Oil      |        |        |       |       |       |
|                             | 0.1334 | 0.0425 | 68.14 | 61.87 |       |
|                             | 0.0957 | 0.0456 | 52.35 |       |       |
|                             | 0.1465 | 0.0511 | 65.12 |       |       |
| Chemetall Inproclean 3800   |        |        |       |       |       |
| Nisseki SAS 601E            |        |        |       |       |       |
|                             | 0.1124 | 0.0021 | 98.13 | 98.65 | 87.68 |
|                             | 0.1546 | 0.0017 | 98.9  |       |       |
|                             | 0.1196 | 0.0013 | 98.91 |       |       |
| Silicone Fluid              |        |        |       |       |       |
|                             | 0.0691 | 0.0031 | 95.51 | 97.38 |       |
|                             | 0.1346 | 0.0028 | 97.92 |       |       |
|                             | 0.146  | 0.0019 | 98.7  |       |       |
| Canola Oil                  |        |        |       |       |       |
|                             | 0.1707 | 0.0078 | 95.43 | 91.71 |       |
|                             | 0.2622 | 0.0236 | 91    |       |       |
|                             | 0.223  | 0.0252 | 88.7  |       |       |
| Epoxidized Soybean Oil      |        |        |       |       |       |
|                             | 0.1404 | 0.0197 | 85.97 | 62.99 |       |
|                             | 0.1611 | 0.0758 | 52.95 |       |       |
|                             | 0.0887 | 0.0443 | 50.06 |       |       |
| Bio Circle Aero             |        |        |       |       |       |
| Nisseki SAS 601E            |        |        |       |       |       |
|                             | 0.0626 | 0.0033 | 94.73 | 95.81 | 78.88 |
|                             | 0.1311 | 0.005  | 96.19 |       |       |
|                             | 0.1205 | 0.0042 | 96.51 |       |       |
| Silicone Fluid              |        |        |       |       |       |
|                             | 0.1287 | 0.0097 | 92.46 | 84.5  |       |
|                             | 0.0864 | 0.0126 | 85.42 |       |       |
|                             | 0.0824 | 0.0201 | 75.61 |       |       |
| Canola Oil                  |        |        |       |       |       |
|                             | 0.227  | 0.0457 | 79.87 | 78.72 |       |
|                             | 0.1153 | 0.02   | 82.65 |       |       |
|                             | 0.1487 | 0.0392 | 73.64 |       |       |
| Epoxidized Soybean Oil      |        |        |       |       |       |
|                             | 0.1621 | 0.0437 | 73.04 | 56.51 |       |
|                             | 0.0628 | 0.0348 | 44.59 |       |       |
|                             | 0.1148 | 0.0552 | 51.92 |       |       |
| Gemtek SC Aircraft          |        |        |       |       |       |
| Nisseki SAS 601E            |        |        |       |       |       |
|                             | 0.1118 | 0.0455 | 59.3  | 74.77 | 82.18 |
|                             | 0.0578 | 0.0153 | 73.53 |       |       |
|                             | 0.1479 | 0.0126 | 91.48 |       |       |
| Silicone Fluid              |        |        |       |       |       |
|                             | 0.1928 | 0.0029 | 98.5  | 98.78 |       |
|                             | 0.6433 | 0.0041 | 99.36 |       |       |
|                             | 0.1705 | 0.0026 | 98.48 |       |       |
| Canola Oil                  |        |        |       |       |       |
|                             | 0.2955 | 0.0453 | 84.67 | 88.94 |       |
|                             | 0.3296 | 0.0155 | 95.3  |       |       |
|                             | 0.1278 | 0.0168 | 86.85 |       |       |
| Epoxidized Soybean Oil      |        |        |       |       |       |
|                             | 0.075  | 0.0445 | 40.67 | 66.22 |       |
|                             | 0.2514 | 0.0069 | 97.26 |       |       |
|                             | 0.2043 | 0.0802 | 60.74 |       |       |
| Polychem Polyspray Jet 790P |        |        |       |       |       |

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|------------------------|--------|--------|-------|-------|-------|
| Nisseki SAS 601E       |        |        |       |       |       |
|                        | 0.0535 | 0.005  | 90.65 | 92.98 | 92.05 |
|                        | 0.0496 | 0.003  | 93.95 |       |       |
|                        | 0.0599 | 0.0034 | 94.32 |       |       |
| Silicone Fluid         |        |        |       |       |       |
|                        | 0.646  | 0.0246 | 96.19 | 95.51 |       |
|                        | 0.2296 | 0.0187 | 91.86 |       |       |
|                        | 0.97   | 0.0146 | 98.49 |       |       |
| Canola Oil             |        |        |       |       |       |
|                        | 0.2574 | 0.0108 | 95.8  | 95.74 |       |
|                        | 0.2528 | 0.0136 | 94.62 |       |       |
|                        | 0.9234 | 0.0295 | 96.81 |       |       |
| Epoxidized Soybean Oil |        |        |       |       |       |
|                        | 0.1297 | 0.017  | 86.89 | 83.98 |       |
|                        | 0.2173 | 0.0328 | 84.91 |       |       |
|                        | 0.2051 | 0.0407 | 80.16 |       |       |
| MacDermid Keykote 84   |        |        |       |       |       |
| Nisseki SAS 601E       |        |        |       |       |       |
|                        | 0.0791 | 0.0067 | 91.53 | 92.57 | 87.3  |
|                        | 0.0575 | 0.0044 | 92.35 |       |       |
|                        | 0.0987 | 0.0061 | 93.82 |       |       |
| Silicone Fluid         |        |        |       |       |       |
|                        | 0.4979 | 0.0152 | 96.95 | 81.58 |       |
|                        | 0.4549 | 0.1142 | 125.1 |       |       |
|                        | 0.1687 | 0.1304 | 22.7  |       |       |
| Canola Oil             |        |        |       |       |       |
|                        | 0.1838 | 0.0214 | 88.36 | 88.13 |       |
|                        | 0.1873 | 0.0205 | 89.05 |       |       |
|                        | 0.1553 | 0.0202 | 86.99 |       |       |
| Epoxidized Soybean Oil |        |        |       |       |       |
|                        | 0.1873 | 0.0179 | 90.44 | 86.92 |       |
|                        | 0.109  | 0.0115 | 89.45 |       |       |
|                        | 0.1386 | 0.0265 | 80.88 |       |       |

Summary:

| <b>Substrates:</b>            |   | Aluminum |             |                                     |                          |  |
|-------------------------------|---|----------|-------------|-------------------------------------|--------------------------|--|
| <b>Contaminants:</b>          |   | Oil      |             |                                     |                          |  |
| Company Name:                 | Product Name:                                 | Conc.:   | Efficiency: | Effective:                          | Observations:            |  |
| Fisher Scientific             | Absolute Ethanol                              | 0        | 0.00        | <input type="checkbox"/>            |                          |  |
| MacDermid Industrial Products | Clepo Adherite 590                            | 5        | 92.25       | <input type="checkbox"/>            | caused damage to coupons |  |
| Brulin Corporation            | Aquavantage 1400                              | 5        | 82.17       | <input checked="" type="checkbox"/> |                          |  |
| Oakite Products               | Inproclean 3800                               | 5        | 87.68       | <input checked="" type="checkbox"/> |                          |  |
| J Walter Inc.                 | Bio Circle Aero                               | 5        | 78.88       | <input type="checkbox"/>            |                          |  |
| Gemtek Products               | SC Aircraft & Metal Cleaner Super Concentrate | 5        | 82.18       | <input checked="" type="checkbox"/> |                          |  |
| US Polychem Corporation       | Polyspray Jet 790 P                           | 5        | 92.05       | <input checked="" type="checkbox"/> |                          |  |
| MacDermid Industrial Products | Keykote 84                                    | 5        | 87.30       | <input checked="" type="checkbox"/> |                          |  |

Conclusion:

The best cleaner was likely Polychem's Polyspray Jet 790P as it performed consistently across all soils. The next best cleaners were Chemetall Inproclean 3800 and MacDermid Keykote 84, respectively.