

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2017

DateRun: 08/16/2017

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ClientType: General

ProjectNumber: Project #1

Substrates: Aluminum

PartType: Coupon

Contaminants: Cutting/Tapping Fluids, Lubricating/Lapping Oils

Cleaning Methods: Immersion/Soak

Analytical Methods: Goniometry, Visual

Purpose: To compare the contact angle of TCE cleaned aluminum parts and potential alternatives as a basis for measuring cleanliness.

Experimental Procedure: Contact angles for TCE (CAS 79-01-6) cleaned solid and fin parts were averaged and then used as a reference for cleanliness during this test. The dirty parts were pre-soiled with Oak 7a lubricant (CAS: 64742-53-6; 68909-65-9), and each solvent used one solid and one fin part for testing. The fin parts were flattened using a hammer on one side to record the dirty contact angle and the other half of the part was kept intact (See Appendix for an image of solid and fin parts).

Parts were immersed, one at a time, in a heated beaker (80 F) filled with Fluosolv NC-786 and repeated for the Honeywell products at room temperature (68 F) for five minutes. The clean contact angles were measured shortly after cleaning, and the intact fin parts were flattened to compare both sides of the part to ensure more complex geometries were cleaned.

Results: TCE Cleaned Parts:

| Solid | | Fin | |
|---------|----------------|---------|----------------|
| Part# | Contact Angle° | Part# | Contact Angle° |
| 1 | 79.44 | 7 | 72.42 |
| 2 | 66.52 | 8 | 66.23 |
| 3 | 70.65 | 9 | 79.36 |
| 4 | 63.7 | 10 | 76.23 |
| 5 | 65.52 | 11 | 89.25 |
| 6 | 71.67 | 12 | 72.43 |
| Average | 69.58 | Average | 75.99 |

Solid Part

| Cleaner | Fluosolv NC 786 | Solstice PF | Solstice PF-2A |
|-----------------------------|-----------------|-------------|----------------|
| Contact Angle° Before | 54.55 | 34.7 | 33.65 |
| Contact Angle° After | 85.64 | 93.52 | 88.83 |
| Fin Part | | | |
| Cleaner | Fluosolv NC 786 | Solstice PF | Solstice PF-2A |
| Contact Angle° Before | 59.25 | 44.23 | 57.34 |
| Contact Angle° After | 73.53 | 70.68 | 82.58 |
| Contact Angle° Intact After | 76.34 | 77.05 | 70.73 |

Summary:

| | | | | | | |
|--------------------------------|--|--|---------------|--------------------|-------------------------------------|----------------------|
| Substrates: | | Aluminum | | | | |
| Contaminants: | | Cutting/Tapping Fluids, Lubricating/Lapping Oils | | | | |
| Company Name: | | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| NuGeneration Technologies, LLC | | FluoSolv NC 786 | 100 | | <input checked="" type="checkbox"/> | |
| Honeywell | | Solstice PF with N2 | 100 | | <input checked="" type="checkbox"/> | |

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|-----------|------------------------|-----|--|-------------------------------------|--|
| Honeywell | Solstice PF-2A with N2 | 100 | | <input checked="" type="checkbox"/> | |
|-----------|------------------------|-----|--|-------------------------------------|--|

Conclusion: All three alternatives are as effective at removing Oak 7a from both solid and fin parts as TCE.