# CLEANING LABORATORY EVALUATION SUMMARY

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|---|---|
| SCL #: | 1996 |
| DateRun: | 04/17/1996 |
| Experimenters: | Jay Jankauskas, Sutherman Ramesh |
| ClientType: | Steel Collar Clamp Manufacturer |
| ProjectNumber: | Project #1 |
| Substrates: | Steel |
| PartType: | Part |
| Contaminants: | Cutting/Tapping Fluids |
| Cleaning Methods: | |
| Analytical Methods: | FTIR, OSEE |
| Purpose: | To determine possible cause of problems |

Experimental Procedure:

The purpose of this trial is to determine the possible cause for Steel Collar Clamp Manufacturer's heat-treating problems. A secondary purpose is to find a possible drop-in replacement for the Chemtrol 328 soap used by Steel Collar Clamp Manufacturer.
This experiment was divided into four parts:
1) Analysis of clamp collars received from Steel Collar Clamp Manufacturer using Optically Stimulated Electron Emission (OSEE) and Fourier Transform Infrared Spectroscopy (FTIR). One part from each cleaning process received was then heat-treated.
2) Initial cleaning trial. Eight in-house aqueous chemistries were tested against the Chemtrol 328 and visually inspected.
3) Secondary cleaning trials. Any chemistries from part 2 that showed potential of outperforming Chemtrol 328 were further evaluated.
4) Heat treatment of clamp collars. One batch of three collars contaminated with a small amount of residual cleaning chemistry were heat-treated. The three parts that were successfully cleaned in Part 3 were also heat treated after cleaning.

SUBSTRATE MATERIAL: Steel Collar Clamps
CONTAMINANTS: Cutting oil

Results:

Part One: Clamp collars obtained from Steel Collar Clamp Manufacturer were analyzed with FTIR and OSEE. FTIR showed no major noticeable differences in organic contamination between the three different systems. OSEE readings showed a difference in cleanliness between the parts (OSEE results are shown in the table on the following page). The vibrate and bead blast clamp collar was the cleanest (high readings correspond to a cleaner part). Since contamination was shown on the OSEE and not the FTIR the contaminant is most likely inorganic Chemtrol 328 soap residue.
One clamp collar from each cleaning process was heat treated on a hot plate at full power for two hours. After treatment, the clamp collars were then sealed in plastic. The vibrate and bead blast clamp collar came out with a more consistent shade of black than the other two processes.

**OSEE Data for Part One**

| Reading # | Vibrate & Bead Blast | Vibrate & Degrease | Vibrate Only |
|---|---|---|---|
| 1 | 557 | 577 | 222 |
| 2 | 667 | 446 | 611 |
| 3 | 643 | 646 | 428 |
| 4 | 688 | 459 | 585 |
| 5 | 723 | 584 | 549 |
| 6 | 736 | 374 | 746 |
| 7 | 739 | 550 | 794 |
| 8 | 521 | 534 | 677 |
| Average | 659 | 521 | 577 |
| Std. Dev. | 82 | 88 | 184 |

Part Two: Eight different aqueous cleaning chemistries from the lab were tested against the Chemtrol 328. Cleaning was performed for 5 minutes in a 600 ml beaker with stirbar agitation and at 140 F. The clamp collars were rinsed in room temperature tap water and then dried with a hand held heat gun. The effectiveness of each chemistry was determined by a visual inspection for residual cutting oil. All chemistries were used at a 5% concentration except the Hubbard Hall Ram charger which was used at full strength.

| Company | Product | Results |
|---|---|---|
| Brulin Corporation | 815 GD | FAIL |

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|---|---|---|
| Cleaning Systems Inc. | Release | PASS |
| Hubbard Hall Inc. | Ram Charger | FAIL |
| Gemtek | SC Aircraft | FAIL |
| Innovative Organics | L-12 | FAIL |
| Oakite Products Inc. | Inproclean 1300 | PASS |
| Mirachem Corp. | Mirachem 500 | PASS |
| AW Chesterton Inc. | KPC 820N | PASS |
| Precision Finishing Inc. | Chemtrol 328 | Showed slight residual oil in screw holes |

Part Three: Another cleaning trial was performed with the cleaning chemistries that passed part 2 testing. This time cleaning was performed for 10 minutes in a 600 ml beaker agitated with a stirbar at 140 F. The clamp collars were again rinsed with room temperature tap water and dried with a hand-held heat gun. Cleanliness was based on a visual inspection for residual cutting oil. Two cleaning chemistries did no pass this test. The KPC 820N showed quite a bit of rust formation. The Release did not remove all of the cutting oil from the screw holes. The collars cleaned with the three passing cleaning chemistries were then heat-treated in part 4 testing.

Part Four: Three clamp collars contaminated with a small amount of Chemtrol 328, Inproclean 1300 and Mirachem 500 were heat treated as per part 1 procedure. It was noticed that each cleaning residue caused a purplish tint on the collars during heat treating. This purplish tint was also noticed on two of the cleaned parts obtained from Steel Collar Clamp Manufacturer (the vibrate and degrease and the degrease only). The clamp collars cleaned in part three were also heat-treated as per the procedure in part one. The clamp collar cleaned with Mirachem 500 showed a slight purplish tint. The clamp collar cleaned with the Inproclean 1300 seemed to be a more consistent shade of black than the clamp collar cleaned with the Chemtrol 328.

Summary:

| **Substrates:** | Steel | | | | |
|---|---|---|---|---|---|
| **Contaminants:** | Cutting/Tapping Fluids | | | | |
| **Company Name:** | **Product Name:** | **Conc.:** | **Efficiency:** | **Effective:** | **Observations:** |
| Brulin Corporation | Formula 815 GD | 5 | 0.00 | ☐ | |
| Cleaning Systems | Release | 5 | 0.00 | ☐ | |
| Hubbard Hall Inc | Ram Charger | 100 | 0.00 | ☐ | |
| Gemtek Products | SC Aircraft & Metal Cleaner Super Concentrate | 5 | 0.00 | ☐ | |
| Innovative Organics Inc | Amberclean SC 11 | 5 | 0.00 | ☐ | |
| Oakite Products | Inproclean 1300 | 5 | 0.00 | ☐ | |
| Mirachem Corporation | Mirachem 500 | 5 | 0.00 | ☐ | |
| AW Chesterton | KPC 820 N | 5 | 0.00 | ☐ | |
| Precision Finishing Inc | Chemtrol 328 | 5 | 0.00 | ☐ | |

Conclusion:

It appears that the best cleanliness was achieved by the combination of vibratory cleaning and bead blasting. Out of the chemistries tested in the lab, the only aqueous chemistry that performed as well as the Chemtrol 328 was the Inproclean 1300. The clamp collar in Part 4 testing were heat treated on April 23rd. So it will be interesting to see if the black oxide will rub off after a week or so.