CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1997
DateRun:	10/22/1997
Experimenters:	Jason Marshall, Prashant Trivedi
ClientType:	Manufacturers of Precision Parts and Assemblies
ProjectNumber:	Project #2
Substrates:	Stainless Steel
PartType:	Coupon
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	Ultrasonics
Analytical Methods:	Black light, Gravimetric
Purpose:	Compare aqueous cleaners to perchloroethylene

Experimental Procedure:

The goal of the experiment was to find and compare aqueous cleaners to the current cleaning chemistry perchloroethylene. A second purpose was to determine if the aqueous cleaners would not induce rusting of the parts.

The first step in the experiment was to weigh out five clean empty 250 ml beakers. The beakers were then filled with the samples. Then the beaker/samples were weighed again. After this weighing, the contaminant oil, treated with a fluorescent tag, was added to the beaker. A contaminated weight was determined.

Four cleaners were selected from the laboratory's inventory based on past performances and compatibility with the selected source of mechanical energy. A fifth cleaner was supplied by the client. The five cleaning chemistries were then made into 5% solutions in separate beakers. The solutions were heated to 130 F on a hot plate. At this point, a 40 KHz ultrasonic tank was filled with water and heated to the same temperature as the cleaning solutions.

The solutions were added to the beakers containing the sample pieces. These beakers were then placed into the ultrasonic tank and cleaned for five minutes. At the end of the cleaning time, the cleaning solutions were decanted off into a waste beaker. Next the beaker with the cleaned samples was submerged into a tap water rinse bath at 130 F for fifteen seconds. Following this rinse, the water was emptied out by inverting the beaker onto a metal screen. A second 130 F tap water rinse was performed in the same way as the first. The samples went through a final rinse using DI water at room temperature for fifteen seconds.

Samples were then placed into the black light chamber and observed for any signs of fluorescence. Final weight measurements were made after the samples were allowed to air dry overnight until a consistent weight was obtained.

SUBSTRATE MATERIAL: 303 Stainless steel
CONTAMINANTS: C-Eblis oil (sulfur based)

Results:

When the cleaned samples were observed in the black light chamber and compared to the initial dirty observation, there was no sign of fluorescence. This initial set of results allowed for a quick assessment of the outcome of the cleaning trial.

The gravimetric analysis yielded more concrete answers. Table 1 lists the percent removal of the contaminants for each cleaning chemistry after each day of drying. Figure 1 gives a graphical representation of these figures.

Table 1 Dry Weights

	%Removal		
Cleaner	Day 1	Day 2	Final
1-M-Auto	39.7	90.4	93.9
2-InproClean	33.3	77.0	95.5
3-ND-17	48.6	95.0	98.2
4-F02085M	45.6	92.8	99.3
5-Daraguard	89.2	93.6	93.3

All of the cleaners showed increase in the percent removal from one day to the next. This was due to the remaining water evaporating. The Daraguard cleaner had the most consistent removal, but F02085M and ND-17 had the most efficient cleaning of the parts. Following the weighing, observations were made to determine if any rusting had occurred. Each cleaner demonstrated no rusting.

Summary:

Substrates:	Stainless Steel
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil

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Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Church & Dwight Co Inc.	Armakleen M Auto	5	93.92	☑	
Oakite Products	Inproclean 3800	5	95.52	☑	
MacDermid Industrial Products	ND 17	5	98.21	☑	
Magnaflux	Daraclean 212	5	99.25	☑	

Conclusion:

Having determined the percent removal of contaminants from the sample, it was initially determined that Daraguard 212 was the most efficient cleaner of the five selected. However, due to the conditions in the lab, a longer ambient drying time was needed to remove the residual water. After a five day period, three weight measurements were made. At the end, the best two cleaners were, ND-17 and F02085M. These two cleaners will be used in the next phase of testing. The parts appeared to have not rusted even though they were simply dried at ambient conditions. This would indicate that corrosion will not be a problem if a typical drying cycle is incorporated into the cleaning process.

In the next experiment, the provided metal baskets will be used in cleaning a larger volume of parts. The rest of the cleaning protocol will remain the same.