CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	2001
DateRun:	11/04/2001
Experimenters:	Jason Marshall
ClientType:	Metal
ProjectNumber:	Project #1
Substrates:	Steel
PartType:	Coupon
Contaminants:	Coatings, Lubricating/Lapping Oils
Cleaning Methods:	Ultrasonics
Analytical Methods:	Gravimetric
Purpose:	To evaluate ultrasonic energy with successful cleaners.
Experimental Procedure:	The three successful cleaners from the previous trials and the two client supplied cleaners were diluted to 5% using DI water in 600 ml beakers. Each solution was suspended in Crest 40 kHz ultrasonic tank heated to 130 F and degassed for 5 minutes. Sixty preweighed coupons were coated with the four different contaminants and allowed to dry overnight. A second weighing was made. Three coupons of the same contaminant were cleaned in each solution for 3 minutes. Coupons were rinsed in tap water at 120 F for 30 seconds and dried with a Master Appliance Heat Gun at 500 F for 1 minute. Once coupons cooled to room temperature, final clean weights were recorded and efficiencies calculated. Substrate: 1010 and 1020 Steel Contaminants: Houghton Rust Veto C3; Rust Preventatives: Castrol Rustilo DWX 30 (64742-82-1; 61790-48-5; 112-34-5),; Rust Preventatives: Castrol Industrial, Inc Rustilo DW 924 HF (64742-53-6, 61790-48-5, 64742-47-8); Lubricant; ITW Fluid Products Power Stamp II (5:1)
Results:	Ultrasonic cleaning was very successful in removing all of the contaminants from the steel coupons. The overall cleaning average for all the cleaners and all the contaminants was 100% removal. The following table lists the efficiencies for each cleaner and the corresponding contaminant.

Table 1. Calculated Efficiencies

Cleaner	Contaminant	Coupon 1	Coupon 2	Coupon 3
Multikleen	Stamp II	105.61	101.85	97.52
Multikleen	DW 924	86.89	100.35	100.99
Multikleen	BWX 30	101.32	100.81	101.67
Multikleen	Veto C3	99.63	96.67	97.34
Inproclean	Stamp II	99.96	100.75	101.48
Inproclean	DW 924	100.21	118.52	101.25
Inproclean	BWX 30	102.69	106.58	98.96
Inproclean	Veto C3	100.88	93.71	103.38
Beyond	Stamp II	102.09	101.69	100.94
Beyond	DW 924	108.99	100.00	103.47
Beyond	BWX 30	104.81	113.00	100.09
Beyond	Veto C3	99.05	100.12	98.59
Dasco	Stamp II	100.61	98.23	99.34
Dasco	DW 924	99.94	102.97	100.15
Dasco	BWX 30	101.18	104.27	99.19
Dasco	Veto C3	76.06	102.94	100.34
Certa	Stamp II	101.31	101.26	104.86
Certa	DW 924	90.83	85.59	98.17
Certa	BWX 30	99.77	82.82	110.39
Certa	Veto C3	95.01	97.90	97.68

When comparing ultrasonic cleaning results to the immersion cleaning results, ultrasonic cleaning was found to be more effective than immrersion cleaning was for all but one contaminant. The Veto C3 was the only contaminant that cleaned better in immrsion cleaning. The second table is a comparison of the average cleaning efficiencies for the cleaning methods.

Table 2. Comparison of Cleaning Methods

Immersion	Stamp II	DW 924	DWX 30	Veto C3

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Multikleen	97.76	98.82	99.49	99.59
Inproclean	89.33	99.17	99.80	99.99
Beyond	96.13	98.21	99.51	99.44
Dasco	97.35	98.68	99.68	99.27
Certa Clean	91.98	83.47	89.87	98.15
Ultrasonics	Stamp II	DW 924	DWX 30	Veto C3
Multikleen	101.66	96.08	101.27	97.88
Inproclean	100.73	106.66	102.74	99.32
Beyond	101.57	104.15	105.96	99.26
Dasco	99.39	101.02	101.55	93.11
Certa Clean	102.48	91.53	97.66	96.86

Summary:

Substrates:	Steel
Contaminants:	Coatings, Lubricating/Lapping Oils

Company Name:	Product Name:	Conc.:	Efficiency:	Effective:	Observations:
Heatbath Corporation	Multi-Kleen 1568	5	101.66	☑	Stamp II
Heatbath Corporation	Multi-Kleen 1568	5	96.08	☐	DW 924
Heatbath Corporation	Multi-Kleen 1568	5	101.27	☑	DWX 30
Heatbath Corporation	Multi-Kleen 1568	5	97.88	☐	Veto C3
Oakite Products	Inproclean 3800	5	100.73	☑	Stamp II
Oakite Products	Inproclean 3800	5	106.00	☑	DW 924
Oakite Products	Inproclean 3800	5	102.74	☑	DWX 30
Oakite Products	Inproclean 3800	5	99.32	☐	Veto C3
Today & Beyond	Beyond 2001	5	101.57	☑	Stamp II
Today & Beyond	Beyond 2001	5	104.50	☑	DW 924
Today & Beyond	Beyond 2001	5	105.96	☑	DWX 30
Today & Beyond	Beyond 2001	5	99.26	☑	Veto C3
DA Stuart Company	Dasco Kleen 3250	5	99.39	☑	Stamp II
DA Stuart Company	Dasco Kleen 3250	5	101.02	☑	DW 924
DA Stuart Company	Dasco Kleen 3250	5	101.55	☑	DWX 30
DA Stuart Company	Dasco Kleen 3250	5	93.11	☐	Veto C3
Houghton International	Cerfa Kleen 5387	5	102.48	☑	Stamp II
Houghton International	Cerfa Kleen 5387	5	91.53	☑	DW 924
Houghton International	Cerfa Kleen 5387	5	97.66	☑	DWX 30
Houghton International	Cerfa Kleen 5387	5	96.86	☐	Veto C3

Conclusion:

Ultrasonic was more effective than immersion cleaning in all but one situation. In the ultrasonic trial, this contaminant was the last contaminant cleaned, therefore it was in the dirtiest solution. In the immersion test, the contaminant was the only one cleaned and therefore in a clean solution. A follow test will be performed comparing immersion and ultrasonic for the Veto C3 contaminant.