CLEANING LABORATORY EVALUATION SUMMARY

SCL #:	1998
DateRun:	12/15/1998
Experimenters:	Jason Marshall
ClientType:	Metal Wire Manufacturer
ProjectNumber:	Project #1
Substrates:	Copper, Nickel
PartType:	Coupon
Contaminants:	Cutting/Tapping Fluids, Lubricating/Lapping Oils, Oil
Cleaning Methods:	
Analytical Methods:	
Purpose:	Reports based on wire cleaning trials performed at SCL
Experimental Procedure:	
Results:	I have enclosed to groups of reports. Both are based on wire cleaning trials performed at SCL. The group most similar to your conditions would be the Nickel-Copper testing. In it ultrasonic cleaning was performed at various conditions. Also, you could try to inspect your wire using a black light. Some oils and lubricants naturally fluoresce under black light. We have also been able to artificially make oils fluoresce. If you would like more information on what we use, give me a call or E-mail (Jason_Marshall@uml.edu). Another method of analysis could be to use optically stimulated electron emission (OSEE). I have included a listing of other methods for testing cleanliness. Excerpts by Carole LeBlanc from Aberdeen/Green Seal Degreaser Standard 3.2.1 Testing Methods OSEE: Optically Stimulated Electron Emission or PEE, Photo Electron Emission is based on the principle that metals and certain surfaces emit electrons upon illumination with ultraviolet (UV) light. These electrons can be collected, measured as current, converted to a voltage and digitally displayed. A surface contaminant will either enhance or attenuate this signal, depending on it own photoemissive nature. While OSEE will not identify a contaminant, it is a good comparative tool to determine the degree of contamination. This method is best suited for thin films (oils, etc.) and not particulate matter (dust, for example). Fluorescence: Some contaminants, in particular lubricants, naturally fluoresce. Examination under black light reveals the location and extent of this type of surface contamination. Artificial fluorescence is possible with the addition of chemical tags, similar to those used in forensics. This is a limited application, however. FT-IR Spectrometry: Fourier Transform Infrared spectroscopy correlates vibrational energy to a compound's molecular signature. Similar to other high-tech methods such as GC (gas chromatography), the curves generated in this analytical technique are both quantitative for species identification (the placement of the curve on the electromagnetic spectrum) and qualitative for amounts (the area under the curve). A relatively expensive instrument, an FT-IR spectrometer requires special training and care in sample preparation. Not all contaminants can be analyzed this way and interpretation of graphs can be difficult due to the presence of interfering peaks. It may be used in cleanrooms or disk drive manufacture where the origins of contamination may be entirely unknown and the amounts of contamination very low. Gravimetric Analysis: Employed properly, gravimetric analysis can be the most inexpensive and revealing of all surface measurement techniques. Ideally, the part or test coupon is weighed a total of three times with the same analytical balance and under the same atmospheric conditions. Weights are taken (1) before artificial contamination, (2) after artificial contamination and (3) after cleaning. These tests should be duplicated a number of times to ensure reproducibility of results. Percent soil removal and standard deviations can then be calculated. Some difficulty may arise in arriving at a pre-contamination weight under actual plant/production settings, though estimates may be possible. Care must be taken in selecting near-identical substrate pieces and applying the contaminant in a consistent manner. Goniometry: Like OSEE, laser or optical contact angle goniometry is the measurement of a secondary effect to extrapolate surface cleanliness. A small drop of deionized water is placed on the substrate of interest. A light is shown to reflect the droplet's interface with the surface. Usually, the higher the contact angle (that is, the height of the bubble), the greater the contamination. Conversely, water dropped on a clean surface generates a much smaller, flatter contact angle. An example of this effect is noticeable after waxing and then washing a car; the remaining wax acts as a contaminant and the residual water on the surface of the car 'bubbles up.' The technique is limited in that only the cleanliness under the tiny drop is measured so that several readings must be taken. Flat surfaces are more conducive to accuracy with this method. Microscopy with Photographic Capabilities: From SEM (scanning electron microscopy) with magnifications as high as several thousand that provide actual surface morphology to light microscopy with magnifications as low

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as decimal factors, there is a magnification range to suit almost every surface cleanliness application. Parts cleaning, as opposed to precision cleaning, can be viewed with a stereoscope and magnifications well under 1000X. Computer software packages exist that ‘count’ the soil load per photographic frame and store the information to disk for a permanent record.

Report also included the following SCL #:
98-679-01-2
98-679-02-4
98-679-03-4
98-679-04-4
98-679-05-4
98-679-06-4
95-413-01-6
95-413-02-2

Summary:

Conclusion: