



***Contamination Control
and
Clean Hydraulic Hose
Assembly Procedures***

Ultra Clean Technologies Corp

Educational Training for Hose and Tube Fabricators

- The Costs of Contamination to your Customer! *Video*
- *Waste Management ISO-4406-99 test report*
- How to minimize failures from occurring with Ultra Clean! (***Clean Hydraulic Hose Assembly Procedures***)

The Costs of Contamination



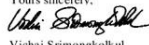
Hose Cleanliness Evaluation Report

Conducted by an independent lab ... Oilpure Systems

- The Hyd. Hose for this test was 1" I.D. X 28" OAL, 4 Spiral with Male Pipe ends.
- Abrasive Wheel and Metal Scalloped Blade saws were used to show which blade generates more contamination.

Results based on:

1. No cleaning
2. Air blow (10 seconds @ 100PSI)
3. Ultra Clean Procedures and UC style Projectiles

Hose Cleanliness Evaluation Report		OILPURE SYSTEMS The Machine Reliability Company							
Company: <u>Ultra Clean Technologies Corp.</u>		Test Date: <u>September 5, 2008</u>							
Address: <u>746 Shiloh Pike</u>		New Oil for Evaluation: <u>AW46 Hydraulic Oil</u>							
City: <u>Bridgeton</u> State: <u>NJ</u> Zip: <u>08302</u>		Hose Type: <u>-16 1" x 28" oal, 4 spiral</u>							
Telephone: <u>1-800-791-9111</u> Fax: <u>856-453-4975</u>		hyd hose assembly							
Contact: <u>Bruce Riley</u>		w 1" Male NPT EE							
Title: <u>President</u>		Note: _____							
E-mail: <u>briley@ultracleantech.com</u>		_____							
Dear Bruce									
Test Procedure									
1. The hose was rinsed with new hydraulic oil several times with non-contact flow technique.									
2. The hose is washed with the same oil quantity of new oil each time.									
3. New hydraulic oil is AW46 viscosity grade and filtered to a low ISO code cleanliness before testing.									
4. Laser light particle count is used as particle count analysis. Particle counter is made by HIAC/ROYCO and uses the ISO:4406-99 standard for particle count method. Special quality control for particle count testing is made to make sure that the particle count shows accurate reading.									
5. All oil samples were tested twice to make sure that particle count reading confirms accuracy.									
We hope that this test data will provide sufficient information regarding hose cleanliness evaluation.									
Yours sincerely,  Vichai Srimongkolkul Technical Director									
Item No.	Hose I.D.	Hose Descriptions	Solid Contamination Particle Count in 1 cc						ISO Code
			4µ	5µ	14µ	20µ	30µ	40µ	
1	NEW	New AW 46 Hydraulic Oil as base line comparison	214	64	23	9	1	0	15 / 13 / 12
2	A1	Chop saw with abrasive wheel - no cleaning	99,999	99,999	92,618	67,576	29K	19K	24 / 24 / 24
3	A2	Chop saw with abrasive wheel - 10 second air blow	96,508	52,827	4,546	1,013	53	13	24 / 23 / 19
3	A3	Chop saw with abrasive wheel - Ultra Clean Projectiles	1,824	511	54	20	2	0	18 / 16 / 13
4	A4	Chop saw with metal scalloped blade - no cleaning	99,999	99,999	54,879	29,617	6,4K	2.5K	24 / 24 / 23
5	A5	Chop saw with metal scalloped blade - 10 second air blow	99,999	84,470	18,539	5,725	752	247	24 / 24 / 21
6	A6	Chop saw with metal scalloped blade - Ultra Clean Projectiles	2,354	638	73	22	5	1	18 / 16 / 13

The Cutting Process & *Cleaning*

- The cutting process is the biggest generator of internal contamination to the hydraulic hose assembly.
- Two main choices of saw blade types are the abrasive wheel & metal scalloped blade.



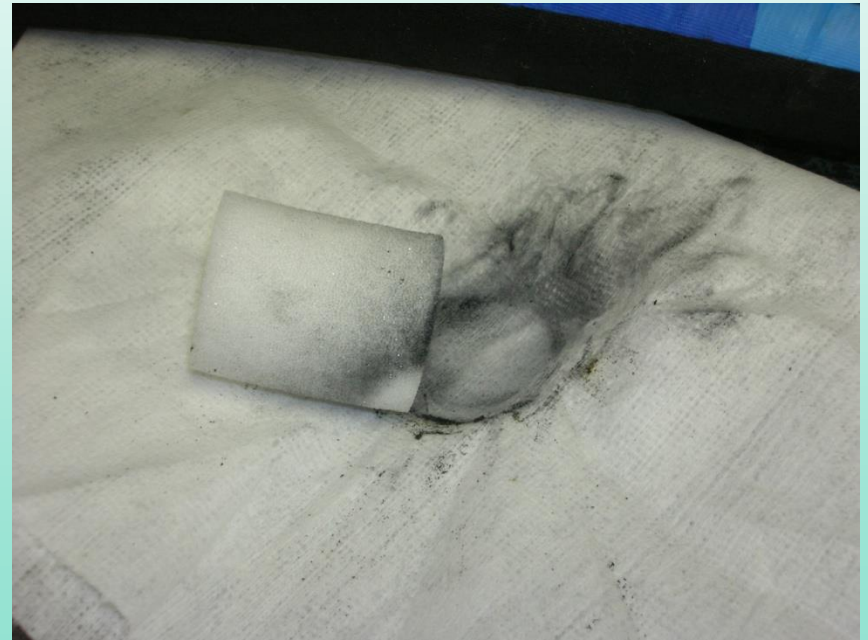
Contamination from the Cutting Process

1" I.D. 4 Spiral Hose

- Abrasive Wheel




- Metal Blade



Unclean Hose vs. Air Blown vs. Ultra Clean

Item No.	Hose I.D.	Hose Descriptions	Solid Contamination Particle Count in 1 cc						ISO Code
			4 μ	6 μ	14 μ	20 μ	30 μ	40 μ	
	NEW	New AW 46 Hydraulic Oil as base line comparison	214	64	23	9	1	0	15 / 13 / 12
1	A1	Chop saw with abrasive wheel - no cleaning	99,999	99,999	92,618	67,576	29K	15K	24 / 24 / 24
2	A2	Chop saw with abrasive wheel - 10 second air blow	96,508	52,827	4,546	1,013	53	13	24 / 23 / 19
3	A3	Chop saw with abrasive wheel - Ultra Clean Projectiles	1,824	511	54	20	2	0	18 / 16 / 13
4	A4	Chop saw with metal scalloped blade - no cleaning	99,999	99,999	54,879	29,617	6.4K	2.5K	24 / 24 / 23
5	A5	Chop saw with metal scalloped blade - 10 second air blow	99,999	84,470	18,639	5,725	752	247	24 / 24 / 21
6	A6	Chop saw with metal scalloped blade - Ultra Clean Projectiles	2,354	638	73	22	5	1	18 / 16 / 13

Unclean Hose vs. Air Blown vs. Ultra Clean

Item No.	Hose I.D.	Hose Descriptions	Solid Contamination Particle Count in 1 cc						ISO Code
			4 μ	6 μ	14 μ	20 μ	30 μ	40 μ	
	NEW	New AW 46 Hydraulic Oil as base line comparison	214	64	23	9	1	0	15 / 13 / 12
1	A1	Chop saw with abrasive wheel - <u>no cleaning</u> 	99,999	99,999	92,618	67,576	29K	15K	24 / 24 / 24
2	A2	Chop saw with abrasive wheel - 10 second air blow	96,508	52,827	4,546	1,013	53	13	24 / 23 / 19
3	A3	Chop saw with abrasive wheel - Ultra Clean	1,824	511	54	20	2	0	18 / 16 / 13
		Projectiles							
4	A4	Chop saw with metal scalloped blade - no cleaning	99,999	99,999	54,879	29,617	6.4K	2.5K	24 / 24 / 23
5	A5	Chop saw with metal scalloped blade - 10 second air blow	99,999	84,470	18,639	5,725	752	247	24 / 24 / 21
6	A6	Chop saw with metal scalloped blade - Ultra Clean	2,354	638	73	22	5	1	18 / 16 / 13
		Projectiles							

Unclean Hose vs. Air Blown vs. Ultra Clean

Item No.	Hose I.D.	Hose Descriptions	Solid Contamination Particle Count in 1 cc						ISO Code
			4 μ	6 μ	14 μ	20 μ	30 μ	40 μ	
	NEW	New AW 46 Hydraulic Oil as base line comparison	214	64	23	9	1	0	15 / 13 / 12
1	A1	Chop saw with abrasive wheel - no cleaning	99,999	99,999	92,618	67,576	29K	15K	24 / 24 / 24
2	A2	Chop saw with abrasive wheel - <u>10 second air blow</u> →	96,508	52,827	4,546	1,013	53	13	24 / 23 / 19
3	A3	Chop saw with abrasive wheel - Ultra Clean Projectiles	1,824	511	54	20	2	0	18 / 16 / 13
4	A4	Chop saw with metal scalloped blade - no cleaning	99,999	99,999	54,879	29,617	6.4K	2.5K	24 / 24 / 23
5	A5	Chop saw with metal scalloped blade - 10 second air blow	99,999	84,470	18,639	5,725	752	247	24 / 24 / 21
6	A6	Chop saw with metal scalloped blade - Ultra Clean Projectiles	2,354	638	73	22	5	1	18 / 16 / 13

Unclean Hose vs. Air Blown vs. Ultra Clean

Item No.	Hose I.D.	Hose Descriptions	Solid Contamination Particle Count in 1 cc						ISO Code
			4 μ	6 μ	14 μ	20 μ	30 μ	40 μ	
	NEW	New AW 46 Hydraulic Oil as base line comparison	214	64	23	9	1	0	15 / 13 / 12
1	A1	Chop saw with abrasive wheel - no cleaning	99,999	99,999	92,618	67,576	29K	15K	24 / 24 / 24
2	A2	Chop saw with abrasive wheel - 10 second air blow	96,508	52,827	4,546	1,013	53	13	24 / 23 / 19
3	A3	Chop saw with abrasive wheel - <u>Ultra Clean</u> →	1,824	511	54	20	2	0	18 / 16 / 13
		Projectiles							
4	A4	Chop saw with metal scalloped blade - no cleaning	99,999	99,999	54,879	29,617	6.4K	2.5K	24 / 24 / 23
5	A5	Chop saw with metal scalloped blade - 10 second air blow	99,999	84,470	18,639	5,725	752	247	24 / 24 / 21
6	A6	Chop saw with metal scalloped blade - Ultra Clean Projectiles	2,354	638	73	22	5	1	18 / 16 / 13



Caterpillar requires all its dealerships to maintain ISO 4406 Contamination Code of 18/16/13 or cleaner in all fluids used in Cat machinery (not just hydraulics).

Here is a display at a dealership showing the difference between contamination codes and the amount of dirt they represent (flowing through a pump in one year of operation).

32gpm x 8 hrs x 200 days per year

ISO 18/16/13 20lbs per year

ISO 23/21/18 630lbs per year

10 second air blow

ISO 24/23/19 2560lbs per year

How to Minimize Failures from Occurring with *Ultra Clean*



3 Main Reasons for *Cleaning* the Hose Immediately after Cutting

- Heat from the cutting process will cause the rubber & metal dust to stick or adhere to the hose tube as it cools. Contamination from freshly cut hose is much easier to remove.
- The Hose Stem is difficult to insert over the contamination at each end of the hose, removing the contaminants makes stem insertion easier.
- Contamination that is trapped between the hose stem and rubber tube could become an eventual leak path for the hydraulic fluid.

Clean Hose Stem Insertion

- The hose stems should be kept in a clean, sealed bag or box until they are ready to become part of the hose assembly.



Lubricating of Hose Stems

- Lubricants are generally very contaminated and can re-introduce contamination.
- Lubricants may not be compatible with your customers hydraulic fluid or system.
- Lubricants may not be necessary if your hose tube has just been cleaned.



Clean Hose Stem Insertion

- ***When is Hose Stem Lubrication Necessary?***
- When the Tube I.D. is smaller than the Stem O.D.
- Reusable and Field Attachable Hose Fittings
- Do not apply Lubricant to the Hose Tube
- Apply a Clean Lubricant to the Hose Stem O.D. ONLY.



ISO-4406-99 Test Results (***With and Without Stem Lubricants***)

$\frac{3}{4}$ " x 36" 2 wire braided assembly

OEM required Cleanliness Level **ISO-18-16-14**

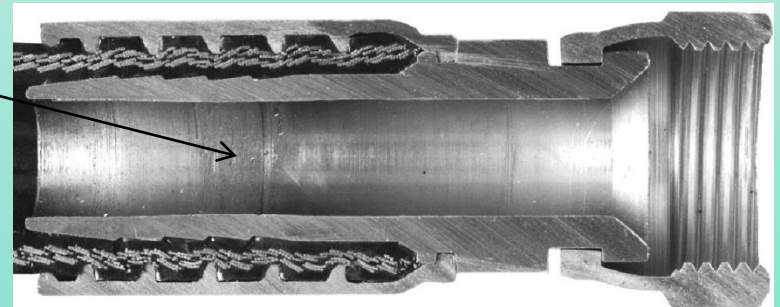
Contaminated Lubricant-Open Container **ISO-19-17-16**

UC Procedure - NO Lubrication **ISO-17-15-13**

4 TIMES CLEANER!!!!!!!

Crimping or Swaging of Hose Stem

- The Crimping or Swaging of the Hose Stem causes Stem Deformation.
- This is necessary for the proper Coupling Retention.
- Stem Deformation causes Metal & Plating Flash Inside of the Stem.
- Fire a third UC Projectile through the Assembly
- Cap Immediately



Clean Seal Capsules

Keep the Assembly CLEAN – Protect the Thread

- On and Off quickly.
- Will not generate contamination like plastic caps and plugs.
- Pre-stacked in stick form so the inside is always **CLEAN**
- Reduced inventory and shipping costs!



Cleaning After the Crimp

