Lubricant Cleanliness Matters



PERFORMANCE TESTING





Research **damage** progression of hydraulic system components to levels of **lubricant cleanliness**.

Chevron Rando[®] HD 32 - **ISOCLEAN[®] Certified** vs. Typical Hydraulic Fluid ISO 32







High Pressure Vane Pump Test Eaton 35VQ25



ASTM D 6973 Test Criteria



	Test Fluid A Chevron Rando HD ISO 32 - ISOCLEAN® Certified	Test Fluid B Typical Hydraulic Fluid ISO 32	Test Fluid C Typical Hydraulic Fluid ISO 32
arget Start ISO 4406 Cleanliness ode	17/15/12	23/21/17	23/21/17
lter	Standard 25 micron Beta 200	Standard 25 micron Beta 200	In Bypass Mode (Removed)

Operating Parameters: 35-40 GPM, 2400 RPM, 3000 PSI, 93 °C

Test Volume: 50 gallon sump

Test Duration: Single cartridge for 150hrs with pump teardowns at 50hr intervals & fluid change

Two tests performed with Test Fluid B

First test failed @ 128 hours from pressure loss Second completed full 150 hour test

Test Fluid C (Bypass Filtration) failed in ~1 hour

Catastrophic failure to pump Not able to maintain full system pressure and flow rate

System Hydraulic Fluid Cleanliness Levels



System filter easily maintained cleanliness level when starting with ISOCLEAN® Certified product

System filter gradually clean fluid however damage occurred during the process

		Typical Hydraulic Oil AW 32 with System Filter	Chevron Rando HD 32 - ISOCLEAN® Certified with System Filter	Hydraulic OEM Lubricant Cleanliness Target
Test	Operating Time	ISO 4406 Cleanliness Code	ISO 4406 Cleanliness Code	ISO 4406 Cleanliness Code
Stage 1	0 Hours (Fresh Fluid Fill)	22/21/19	15/14/12	17/15/12
	10 Hours	20/15/8		17/15/12
	25 Hours	18/13/6		17/15/12
	50 Hours (Drain Fluid)	16/14/11	15/14/11	17/15/12
Stage 2	51 Hours (Fresh Fluid Fill)	22/21/16	16/13/9	17/15/12
	100 Hours (Drain Fluid)	17/14/10	16/15/10	17/15/12
Stage 3	101 Hours (Fresh Fluid Fill)	22/20/14		17/15/12
	150 Hours (End of Test)	18/14/11		17/15/12
1	NOTES	System Filter gradually cleaned fluid over operating time	System Filter easily maintained required system cleanliness	

* Particle Counts results from Spectro Laser Net Fines Q200

* System filter rating 25 micron beta 200

Vane Wear Progression End of Test







New Vane



Chevron Rando HD 32 – ISOCLEAN[®] Certified (150 hours) Typical Hydraulic Fluid B ISO 32 (128 hours)

Major impact on pump performance Leads to increased internal leakage causing cavitation. Diminishes proper flow & pressure efficiency.





Cam Ring Wear Progression

Chevron Rando[®] HD 32 – ISOCLEAN[®] Certified (System Filter)

End of Test (150 hours)

Typical wear in transition zone.

Pressure & flow rates within limits.

No signs of higher wear.

No operational concerns.



Cam Ring Wear Progression Typical Hydraulic Fluid B ISO 32 (System Filter)

End of Test (150 hours)

Cavitation damage Associated with chips in vanes.

Cavitation due to vane edge not sealing properly.

Rotor Polishing Wear Depth





Side Plate Wear Progression



Chevron Rando[®] HD 32 – ISOCLEAN[®] Certified (System Filter)



New plate



50 hours





100 hours





150 hours



Typical Hydraulic Fluid B ISO 32 (System Filter)

Side Plate V-Channel Wear Progression End of test (150 hours)



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Chevron Rando® HD 32 ISOCLEAN® Certified (System Filter)

Typical Hydraulic Fluid B ISO 32 (System Filter)



Side Plate Metering Edge Wear Progression





Slide Plate Metering Edge Wear Progression Typical Hydraulic Fluid B ISO 32 (System Filter)

Cavitation Erosion

Brass surface eroding due to particles and cavitation from Cam Ring.

Sandblasting & hammering (cavitation jet) action driving wear to support layer.



100 hours





Slide Plate Metering Edge Wear Progression Typical Hydraulic Fluid B ISO 32 (System Filter)

Particles deepening and widening channel.

Combination of particle erosion & cavitation causing damage

Damage has eroded through the top layer brass surface and almost completely through the below support surface.

128 hours (End of test)







Pressure Control Valve

Chevron Rando[®] HD 32 – ISOCLEAN[®] Certified (System Filter)

Smooth pressure control curve **No interruptions** or signs of valve problems Valve cylinder shows **no wear rings** Valve piston **undamaged**





Valve Cylinder Bore



Valve Piston



Pressure Control Valve

Typical Hydraulic Fluid B ISO 32 (System Filter)

Jumpy/jerky pressure control curve Signs of interruptions in valve caused by dirt or damage Valve cylinder shows signs of wear rings Valve piston shows slight sandblasting





Valve Cylinder Bore



Valve Piston



Pressure Control Valve

Typical Hydraulic Fluid C ISO 32 (Filter Bypass)

Extremely chaotic pressure control curve Signs of interruptions in valve caused by dirt or damage Valve cylinder shows clear wear ring Valve piston shows increased sandblasted area





Valve Cylinder Bore

Hydraulic System Fluid Pressure



Chevron Rando[®] HD 32 ISOCLEAN[®] Certified



Typical Hydraulic Fluid B ISO 32

Minutes

3100.0

2950.0

2800.0

2650.0

2500.0-

2350.0-

2200.0

2050.0

1900.0

PSI

Pressure

Typical Hydraulic Fluid C ISO 32 (Filter Bypass)



Pressure control valve loses ability to provide stable, smooth pressure.

Fluid Pressure Test using End of Test Parts





Increasing cleanliness of hydraulic fluid can lead to increase in system efficiency.

System fluid pressure could stabilized when using Chevron ISOCLEAN[®] Certified Lubricant in previously damaged valve.

Key Findings



Correlation between initial hydraulic fluid cleanliness and amount of wear on hydraulic system components. Hydraulic system filters are effective in maintaining fluid cleanliness. When required to reduce fluid cleanliness level component wear damage can occur during the process. (Additional damage can occur during continual drain and fill intervals.) System fluid pressure and efficiencies can be negatively impacted by fluid cleanliness including systems with some damage.



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