Lubricant Cleanliness Matters
Purpose

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

Chevron Rando® HD 32 - **ISOCLEAN® Certified**

vs.

Typical Hydraulic Fluid ISO 32
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 filter easily maintained cleanliness level when starting with ISOCLEAN® Certified product.

System filter gradually clean fluid however damage occurred during the process.

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<tbody>
<tr>
<td>Stage 1</td>
<td>0 Hours (Fresh Fluid Fill)</td>
<td>22/21/19</td>
<td>15/14/12</td>
<td>17/15/12</td>
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<td>10 Hours</td>
<td>20/15/8</td>
<td>17/15/12</td>
<td>17/15/12</td>
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<td>25 Hours</td>
<td>18/13/6</td>
<td>17/15/12</td>
<td>17/15/12</td>
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<tr>
<td></td>
<td>50 Hours (Drain Fluid)</td>
<td>16/14/11</td>
<td>15/14/11</td>
<td>17/15/12</td>
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<tr>
<td>Stage 2</td>
<td>51 Hours (Fresh Fluid Fill)</td>
<td>22/21/16</td>
<td>16/13/9</td>
<td>17/15/12</td>
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<td>100 Hours (Drain Fluid)</td>
<td>17/14/10</td>
<td>16/15/10</td>
<td>17/15/12</td>
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<tr>
<td>Stage 3</td>
<td>101 Hours (Fresh Fluid Fill)</td>
<td>22/20/14</td>
<td>17/15/12</td>
<td>17/15/12</td>
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<td></td>
<td>150 Hours (End of Test)</td>
<td>18/14/11</td>
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<td>17/15/12</td>
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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

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

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

Cavitation damage
Associated with chips in vanes.

Cavitation due to vane edge
not sealing properly.
Rotor Polishing Wear Depth

- **Prior to In-Service**

- **New**

- **Chevron Rando® HD 32 ISOCLEAN® Certified System Filter**

- **150 h**

- **Typical Hydraulic Fluid B ISO 32 System Filter**

- **150 h**

- **Typical Hydraulic Fluid C ISO 32 (Filter Bypass)**

- **1 h**

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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)

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

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

Typical Hydraulic Fluid B ISO 32 (System Filter)

New plate 50 hours 100 hours 150 hours
Cavitation Erosion

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

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

![Graph showing pressure control curve over time.](image1)

![Valve cylinder bore showing no wear rings.](image2)

![Valve piston showing undamaged condition.](image3)
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**

![Graph showing pressure over time](image1)

![Image of valve cylinder bore with wear](image2)

![Image of valve piston with sandblasting](image3)
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
Pressure control valve *loses* ability to provide stable, smooth pressure.
Fluid Pressure Test using End of Test Parts

Chevron Rando® HD 32 ISOCLEAN® Certified

Typical Hydraulic Fluid B ISO 32 (System Filter)

Chevron Rando® HD 32 ISOCLEAN® Certified

Using End of Test (150 hrs.) Damaged Parts from Typical Hydraulic Fluid B ISO 32

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.

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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.
Learn More

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