



# Increasing Reliability & Profits by Reducing Hose Failures and Leaks

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WHEREVER THERE'S MINING



# Overview

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- Case Studies on Loss Due to Hose Failures
- Challenging the Underground Standard
- Caterpillar's Focus on Fluid Lines
- Increasing Reliability & Profits Underground

# Case Studies on Hose Failures and Leaks

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- R&P section had 417 hydraulic downtimes in a 512 day period
  - 357 hrs of downtime averaging 51 minutes each
- A study of a R&P mine with 7 roof bolters recorded 185 hose failures over 479 days
  - Resulted in a MTBF of 18.1 days per roof bolter
  - 2.6 days for the roof bolter fleet

# CM Case Studies on Hose Failures and Leaks

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- Midwest mine reported 90% of downtime due to hose failures on fleet of 5 CMs
  - 500K tons loss in production due to these failures
- A PA longwall operation lost the equivalent of 93 full shifts on a fleet of 6 miner bolters
  - 92% availability across the fleet
  - Hose failures and leaks make up 26% of downtime



# Challenging the Underground Standard

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## Underground

- JIC couplings
- Standard hose lengths
- No hard lines



## Surface

- ORFS couplings
- Customized hose lengths
- Hard lines

# ORFS can be a Direct Replacement for JIC

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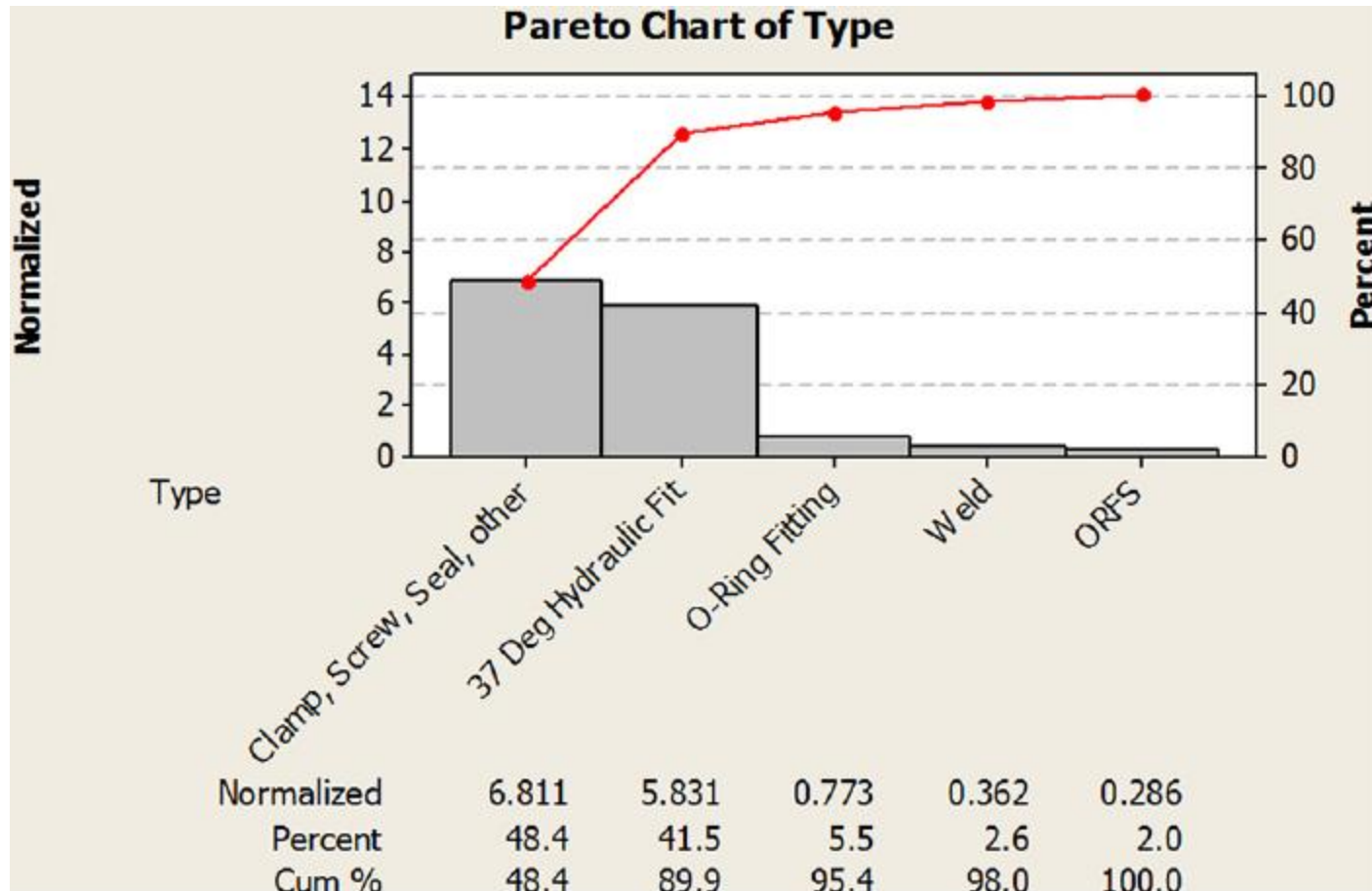


SAE Split Flange



ORFS and JIC Comparison

# Study shows JIC leaks 20 times more than ORFS

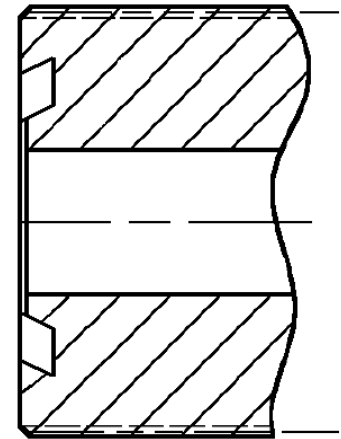


**Source:** Awad, Mahmoud and Alkelani, Ali, 2012, “Failure Mode Analysis of Mobile Equipment Hydraulic Leaks,”. *Journal of Pressure Vessel Technology*, Vol. 134.

# ORFS at Caterpillar

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- ORFS are the preferred connection at by CAT worldwide
- Large volumes at CAT have driven down cost
- ORFS have worldwide availability
- Many improvements have been made to ORFS

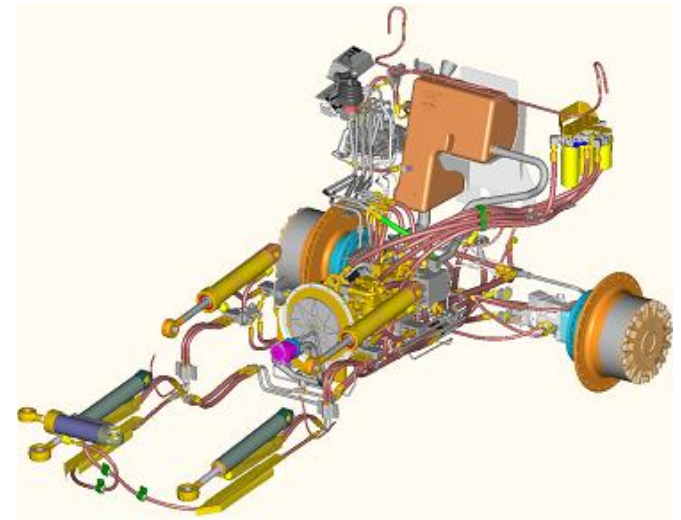




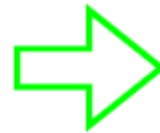
# Caterpillar's Focus on Fluid Lines

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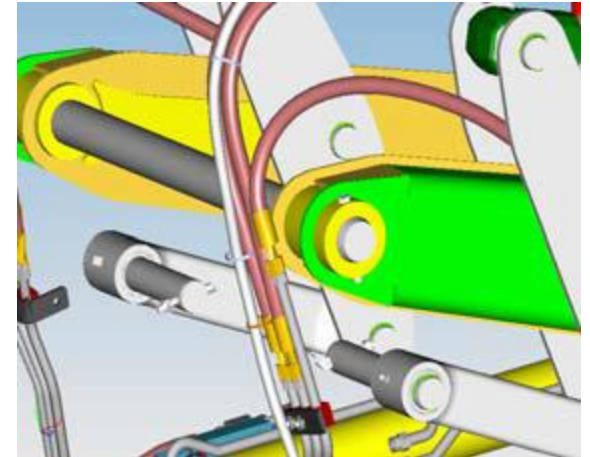
- Developed own software for hose routing called Fluid Lines
- Design guides and training classes for hose and tube designers
- Hose audit process to maximize reliability and durability
- Dealer network enabled to support fluid lines for all products



# Hose Audit Process



Virtual Review



On-Machine Review



# Cat has Success on Underground Equipment

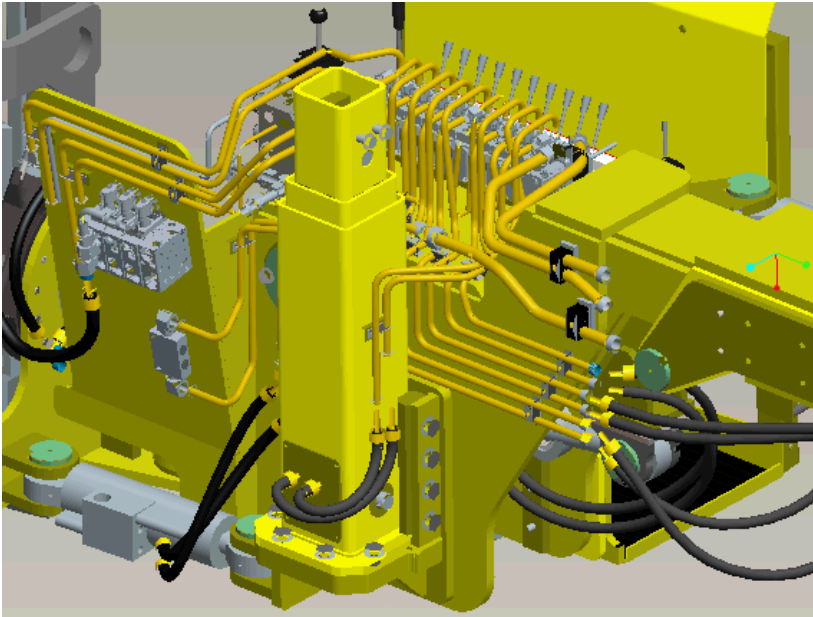
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All new hard rock vehicle development uses ORFS

# Increasing Reliability on Roof Bolters

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- Initiated fluid line audit process on roof bolter
- Using Fluid Lines to design hose and tube routings
- ORFS is preferred connector
- Using combination of hoses and hard lines

# Summary

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- Case studies show poor reliability of fluid lines in underground mines
- To increase fluid line reliability we must change the underground standard
- Using the proper line type and connector are critical to success

Wherever there's mining, you'll find Caterpillar. Cat products are hard at work around the world — drilling and digging, loading and hauling, grading and dozing. And our people are there, too — supporting our products, training operators, helping customers mine safely and more profitably, and actively participating in the global mining industry.

**WHEREVER THERE'S MINING, WE'RE THERE.**