

AxionRay Task 2

Work Order Data

- **Invoice Date:** Converted from Excel serial format to readable date format.
- **Model Year:** Replaced invalid entries (0) with 'Unknown'.
- **Cause Column:** Dropped due to irrelevance.
- **Correction Column:** Translated from German to English for consistency.

Repair Data

- **Coverage Column:** Removed due to high percentage of missing values.
- **Qty & Revenue:** Converted all negative values to positive.
- **Cost:**
 - Renamed to Cost(\$).
 - Removed \$ symbol.
 - Converted to float, made positive, rounded to 2 decimals.
- **Segment Total:**
 - Renamed to Segment Total(\$).
 - Removed trailing \$, converted to float, and rounded to 2 decimals.
- **Invoice Date:** Converted from numeric format to date.
- **Revenue & Actual Hours:** Rounded to 2 decimal places for consistency.

1. Key Observations from Failure/Fix Conditions

A. Most Common Failure Conditions

Failure Condition	Frequency	Common Components Affected	Typical Fix
Leak	High	Hoses, Tanks, Couplers, O-Rings	Replace O-Rings, Retighten Fittings
Not Mentioned	High	N/A (Undocumented)	No Component Mentioned

Failure Condition	Frequency	Common Components Affected	Typical Fix
Oil Leak	Moderate	Gear Pump, Hydraulic System	Replace Seals, Retighten Fittings
Broken	Moderate	Harness, Boom, Plunger	Replace Damaged Parts
Error Code	Moderate	Sensor, Module, Engine	Replace/Reset Component

B. Most Common Fix Conditions

Fix Action	Frequency	Associated Failures
O-Ring Replaced	Very High	Leaks, Oil Leaks
No Component Mentioned	High	Undocumented Failures
Retightened	Moderate	Loose Fittings, Leaks
Replaced	Moderate	Broken/Damaged Parts
Installed	Moderate	Missing Components

2. Root Cause Analysis

A. Recurring Failure Patterns

1. Leak-Related Failures (Hoses, Tanks, Couplers)

- **Root Cause:** Poor sealing (O-ring degradation, loose fittings).
- **Evidence:** Frequent replacements of O-rings (e.g., O-Ring - Replaced appears in many fixes).
- **Recommendation:**
 - Use higher-grade sealing materials.
 - Implement preventive maintenance checks for hydraulic/oil systems.

2. Undocumented Failures ("Not Mentioned")

- **Root Cause:** Incomplete service records or unclear diagnostics.

- **Evidence:** Many entries have no specific failure component listed.
 - **Recommendation:**
 - Standardize failure reporting in service logs.
 - Train technicians on proper documentation.
3. **Electrical/System Errors (Error Codes, Sensor Failures)**
- **Root Cause:** Faulty sensors, wiring issues, or software glitches.
 - **Evidence:** Frequent Sensor - Replaced or Module - Reset fixes.
 - **Recommendation:**
 - Improve sensor durability.
 - Regular firmware updates for control modules.
4. **Mechanical Failures (Broken Harness, Boom Damage)**
- **Root Cause:** Wear and tear, improper handling, or material defects.
 - **Evidence:** High-cost repairs (e.g., REMAN ENGINE at \$41,540).
 - **Recommendation:**
 - Strengthen high-stress components.
 - Conduct fatigue testing on critical parts.
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3. Key Takeaways for Stakeholders

A. Operational Impact

- Leaks & Oil Losses are the most frequent issues, leading to downtime and fluid waste.
- Undocumented failures increase troubleshooting time and labor costs.
- High-cost repairs (e.g., engine replacements) suggest durability concerns in certain components.

B. Recommended Actions

✅ Preventive Maintenance:

- Regular O-ring and hose inspections.
- Scheduled hydraulic system checks.

✅ Process Improvements:

- Standardize failure reporting to reduce "Not Mentioned" cases.
- Implement better diagnostic tools for error codes.

✅ Design & Material Upgrades:

- Use higher-quality O-rings and seals.
- Reinforce high-stress mechanical parts (e.g., booms, harnesses).

4. Conclusion

The data reveals that leakage issues and poor documentation are the biggest pain points, while electrical/mechanical failures drive the highest repair costs. Addressing these root causes through better materials, maintenance protocols, and reporting standards can significantly reduce downtime and operational expenses.

Next Steps:

- **Short-term: Train technicians on proper failure documentation.**
- **Mid-term: Implement a preventive maintenance schedule for leak-prone systems.**
- **Long-term: Work with engineering to improve component durability.**