Troubleshooting Hydraulic Systems (THS) ***New for 2018!***

Troubleshooting Guide – Introduction to Reading Graphical Motion Data

Note: Troubleshooting is a developed skill. All equipment problems and failures no matter how mystical always make complete sense after you find them. Troubleshooting is nothing more than knowing what normal operation is. If you don't know normal, you can't identify abnormal.

- Defining the problem – examples
  - Cylinder or motor does not move
  - Cylinders or motors are (often) failing
  - Cylinder or motor moves too slow
  - Cylinder or motor thrusts violently, harshly or with a 'lack of smoothness' and/or stops very abruptly with a 'lack of smoothness'
  - Repetitive cylinder rod seal failure/leak
  - 'burnt' fluid
- Define the problem original occurrence – when was the first time the problem occurred?
  - First time
  - Problem has occurred from time to time since equipment was installed/commissioned
  - Problem first occurrence can be tracked back to some past time
  - Was there any work performed on the hydraulic system around the first failure occurrence?
- Identify the problem
  - Speed related – answer the question, where did the flow go?
  - Pressure or actuator force related – answer the question, why is the pressure too high or too low?
  - Interaction between flow and pressure
    - ✓ Flow bypassing through another parallel circuit can limit pressure depending upon pump flow capacity
    - ✓ Low system pressure or pressure reducing valve setting will result in reduced flow (reduced ΔP reduces flow)
    - ✓ Use of Pascal's Law – pressure in a trapped volume…
    - ✓ Converse of Pascal's Law (above) if there is flow there must be a ΔP from point to point in a hydraulic circuit
- Is the speed or pressure/force problem an adjustment problem?
  - Improper adjustment of a relief valve or a pressure reducing valve
  - Improper adjustment of flow control valves
  - Can an improper adjusted flow control affect how hard a cylinder can push or affect the twisting force of a hydraulic motor
- Problems caused by mis-assembly of D03 valve stacks
- Problems caused by improperly reversing D03 from meter-in to meter-out and visa versa
- Problems caused by load control valves
- Problems caused by load holding valves and circuits
- Premature pump failures

- Fluid related – too hot, too cold, too dirty
- Poor suction conditions
  - ✓ cavitation problems
  - ✓ tank venting restrictions
  - ✓ suction filter
- case drain line inadequate size, too long
- pump-motor shaft alignment – mis-positioned on shafts
- reflected shock loads
- piston pump operating below a minimum pressure
- piston pump installed/commissioned without spike pressure relief
- poor tank conditions
  - ✓ fluid too low
  - ✓ high water content in mineral oil fluids
  - ✓ tank line (suction line too small
  - ✓ high air content
  - ✓ tank temperature poorly controlled
  - ✓ return lines into the tank improper depth
  - ✓ air cavitation – vortex

- fluid filters
  - pressure filter excessive pressure drop
  - return filter clogging (can cause catastrophic failure)
  - return filter excessive dirt or clogging can cause proportional pressure controls to stop functioning
  - return filter excessive dirt or clogging can cause elevated relief valve and reducing valve operating pressures to increase
  - can cause externally drained PO directional control's main spool to not open fully when commanded to do so
- Directional control valve failures or improper control of the actuator and its connected load
  - Direct operated
    - ✓ Wrong spool type
    - ✓ Occasionally fails to stop the actuator when deenergized
    - ✓ Load drifts when DCV deenergized
    - ✓ Motor and connected load catastrophic failures
    - ✓ Damaged, destroyed solenoids
    - ✓ 'stuck' spools (lacquering or varnished spools)
    - ✓ Excessive spool leakage
    - ✓ Causes actuator and its load to thrust violently or stop harshly
    - ✓ Spool orientation within the valve body
  - Pilot operated
    - ✓ Spool erratic movement when commanded to open
    - ✓ Causes actuator and its load to thrust violently or stop harshly
    - ✓ Actuator speed too slow
    - ✓ Deenergized pilot valve doesn't stop the actuator from continuing to move
    - ✓ Spool orientation within the valve body
- Logic cartridge valves – effects of control orifices
- Troubleshooting hydraulic system problems with the use of graphical motion data