Thermal Transfer Products

Fluid Power Conference and Expo
‘Fast & Efficient, Off-line Kidney Loop Fluid Conditioning’
When working with original equipment manufacturers, hydraulic system designers and plant maintenance engineers, one of the key factors for long system life and low down time is to provide isolated ‘Off Line Fluid Conditioning & Monitoring.’
Hydraulic system efficiency, eliminating break downs and predictive maintenance are all keys that play a significant role in clients being able to more efficiently manage their hydraulic applications and systems, while maintaining peak power and efficiency of those systems.
In the field of fluid contamination, ‘Cool Loop’ off line kidney circuits become a key component in the monitoring of hydraulic circuits where OEM’s/MRO’s are guarding against machine failure without disruption and system spikes, by isolating key system components such as; filtration and coolers.
As Brand leader in the manufacturer and design of oil coolers and related heat transfer components, Thermal Transfer Products is very enthusiastic about our new *Off Line Fluid conditioning System* named **COOL LOOP**. We are particularly proud that we have designed a full ‘turn-key’ system that can be added during front end system design or after the install for additional conditioning.
The key behind this system is the heat exchanger core design that promotes maximum BTU heat transfer, the design of the circulation screw pump to transfer nearly any fluid without worry, and the high beta filtration for bearing level applications. All to insure high efficiency and system cleanliness levels throughout.
Today’s hydraulic system capital expenditures and machine downtime misfortunes are too costly for anyone to miss this seminar.

Please join us to discuss ‘Fast & Efficient, Off-line Kidney Loop Fluid Conditioning.’
Topics Covered

- What is heat?
- Sources of heat
- Areas of concern
- Effects of heat on hydraulic system
- Methods to address Heat
- What is Offline Fluid Conditioning?
- Pro’s of Offline Fluid Conditioning
- Con’s of Offline Fluid Conditioning
- Installation
- TTP Cool Loop
- Applications
- Summary
- Development Activities
What is Heat?

Added energy that causes substances to rise in temperature, fuse, evaporate, expand, or undergo any of various other related changes, that flows to a body by contact with or radiation from bodies at higher temperatures, and that can be produced in a body (as by compression).

Whenever more energy than is required to do work is put into a system, the excess energy is converted to heat.

Heat is necessary to a degree as it lowers the Oil Viscosity which allows the Oil To flow into the Pump so it can be distributed throughout the system and also to lubricate the pump bearings and Cylinder bushings (bearings). If the Hydraulic System is based on a Water type of medium it could be exposed to freezing when operating outdoors and may require heat to achieve an operating temperature in order to start rotating the pump shaft.
Sources of Heat

Pressure drop across a component is unused energy and the primary cause of heat

- Pressure regulators
- Flow control valves
- Resistive pressure drops in pipes, orifices, and passageways in components
- Pump, motor, and valve leakage
- Friction between moving mechanical parts

Compression heat created in pumps due to entrained air in the fluid

Absorbed heat from external sources

- Furnaces
- Engines
- Hot equipment room
Areas of Concern

Inefficient Hydraulic Design

- Often hydraulic system designers do not have a true sense of machine requirements
- One system does not fit all applications
- Use of fixed displacement hydraulic pumps

High duty cycle applications

- Minimal dwell time increases chances for excessive heat.
- Not allowing fluid to spend much time in reservoir to naturally dissipate heat
Areas of Concern

Utilization of smaller hydraulic reservoirs in machine design

- Floor space is a premium and standard size reservoirs are not always realistic
- Ideal relationship is 3 to 1 based on system flow requirements
- 25 gallon of pump flow required would make 75 gallon reservoir the ideal choice

Geographic location

- Understanding of actual installation conditions
- Higher Ambient temperatures require additional thought and consideration
- Especially when comparing the Midwest to Southwest
- Entering Temperature Delta is tricky when trying to remove excessive heat (Maximum Ambient Temperature–Inlet Oil Temperature)
- The larger the delta the smaller the heat exchanger
Effects of heat on Hydraulic System

Excessive Heat will cause the transfer fluid to break down by either burning the and wear additives or in water based fluids causing the water to boil off and leaving Behind the suspended grease molecules.

- Excessive heat will break down the lubricating properties of the transfer fluid therefore increasing friction wear
- Excessive heat may cause valve spools to not shift due to close dimensional interference (tolerance)
- Thereby causing pump pistons and valve spools to stick and increasing wear due friction = reduction of component life
Effects of heat on Hydraulic System

Excessive heat will cause seals and gaskets to become brittle and result in fluid leakage

- Down time associated with changing of seals
- Manpower and service part costs
- Creation of environmental challenges = Clean up

Bottom line excessive heat will lead to down time and increased operational costs!
Methods to Address Heat

Oversize reservoir
- More surface area improves the time and effectiveness of this natural conductor
- Not always practical due to space limitation and cost

Reduce system speed and pressure
- HP consumption is a direct function of both of these elements of design
- Not always practical as your machine will not achieve performance goals
Methods to Address Heat

Conversion of hydraulic system from fixed displacement to variable displacement

- Logic is that you will only use necessary flow and pressure that is required at point of operation
- Many clever different control options available (Horsepower limiting/Unloading circuits) as well
- Very efficient method and recommended

Integration of Offline Fluid Conditioning package into system design

- Most ideal way to remove heat!
Offline Fluid Conditioning

COL 725 - 1600

FILTER OPTIONAL

COL 8 - 400

FILTER OPTIONAL
What is Offline Fluid Conditioning?

These applications do not use return line oil flow.
- Creating a dedicated system circuit that is only responsible for pumping oil through filter and heat exchanger
- Pump/Filter/Cool the oil = Conditioning of Fluid

Dedicated Pump and Motor assembly
- Controlled flow velocity and pressure drop = Very ideal

Offline Filtration
- Oil is being constantly filtered
- Very Fine Filtration is possible-down to 3 micron
What is Offline Fluid Conditioning?

**Heat Exchanger**
- Will remove excess Heat generated due to friction, pressure drops over orifices, etc.

**Different from a return-line, we need to sub-cool the oil**
- That is, the oil out of the heat exchanger needs to be cooler than the desired reservoir temperature
- When hot return line oil mixes with cool oil from the conditioning loop the reservoir temperature will level out
Return Line vs. Offline Fluid Conditioning

**Return Line:** Installation of filtration and heat exchanger in the return allows for oil to be conditioned prior to returning to reservoir

- 300 Gallon reservoir
- 100 GPM Pump
- 60 HP electric Motor
- 40 F Entering Temperature Differential
- 20 HP desired heat rejection
- This system would require a large heat exchanger and return line filter to accommodate the flow
Return Line vs. Offline Fluid Conditioning

**BOL-950-2-3**
- 37” W x 28” H x 23” D
- $3,500

**LMP-400-4**
- 15” L x 7” W
- $1,000
**Offline**: Allows for constant filtration and heat removal independent of machine operation

- 300 Gallon reservoir
- 100 GPM Pump
- 60 HP electric Motor
- 40 F Entering Temperature Differential
- 20 HP desired heat rejection
- 20 GPM offline system

Not advocating removal of Return Line Filtration in all cases!
Return Line vs. Offline Fluid Conditioning
Offline Fluid Conditioning systems ensure controlled and constant oil flow and pressure through the filter and heat exchanger.

- **Eliminate surges of both oil flow and pressure**
  - Surges can have catastrophic effects on both filtration and heat exchangers
    - Filtration efficiency decreases over time as the element experiences consistent fluctuation
    - That fluctuation can impose a pulse on a particle that is captured by the media-displacing the captured particle downstream
    - Worst case leading to element collapse and release of all captured particles downstream
    - Most common heat exchanger failure mode is directly related to pressure spikes and flow surges!

- **Remove potential of spikes from actuators that could damage these system components**

  Creates much more efficient hydraulic system that will improve overall performance of your machine design
Collapsed Hydraulic Filter Element

Damaged Heat Exchanger

Did my 3000km oil change just now and found my Scott Stainless steel Oil Filter in this state. Anyone pls advise........
Offline Fluid Conditioning allows for constant filtration independent of machine operation

- Enables continuous, multi-pass filtration at a controlled flow velocity and pressure drop, which results in high filtration efficiency
- Low pressure application allows for selection of finer filtration
- Achieve target cleanliness at reasonable cost level
- The extent of contamination in the hydraulic system has a direct bearing on the performance and reliability of the system.
### Pro’s of Offline Fluid Conditioning

#### International Standards for Fluid Contamination Control

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Pro’s of Offline Fluid Conditioning

Real Time system monitoring

- Temperature/Pressure/Contamination sensors can be integrated into the system without much work
Pro’s of Offline Fluid Conditioning

Serviceability

- Since the system is off line, simple maintenance can be done without shutting the entire system
- Filtration is installed in the loop and easily accessible
- Element change can be performed with no down time
NEW
Offline Fluid Conditioning System
8 cooler sizes offered

- Small Flow: BOL-8,-16,-30,-400
- Large Flow: BOL-725,-950,-1200,-1600

- Small flow will utilize though shaft pump
- Large flow will use single shaft pump and have two electric motors
- Standard models will utilize most effective core offering on the market — TTP’s P-Bar
- Optional T-Bar Core with viscosities selected above ~ISO 320
8 cooler sizes offered
- Small Flow: BOL-8,-16,-30,-400
- Large Flow: BOL-725,-950,-1200,-1600
Screw Pump
4 pumps flows offered:

Small Flow
- 20cc-9.5 gpm @ 60hz, 1750 RPM
- 40cc-21 gpm @ 60hz, 1750 RPM

Large Flow
- 80cc-35 gpm @ 60 hz, 1750 RPM
- 100cc-45 gpm @ 60 hz, 1750 RPM
Screw Pump

- One pump for all viscosities & up to 20,000 cst
- Handles a broad range of fluids
- Petroleum based to Skydrol
- No air emulsion restrictions
- Only three moving parts
- Rolling action eliminates noise and vibration
- Less than 55db (even with air emulsions)
- Unique pump design offers the characteristics of a gear pump with the silence of a screw pump
Filtration

- Utilize a modern in-line filter housing and cartridge element
- 10 micron fiberglass media
- 3, 6 and 25 micron fiberglass media
- Beta 1000 filtration efficiency
- Optional dirty filter indicators
- Low pressure system that allows for selection of finer media at reasonable cost
- Easier to achieve target cleanliness levels
- Extends life of pressure and return line filtration
Monitoring

Electronic Temperature Sensor
- Field Adjustable with 2 DC PNP output signals
- Temperature Range of 37F to 284F
- Outputs can be easily integrated into existing PLC logic
- Higher Cost but well worth the investment

Thermostat Temperature Sensor
- Immersion Thermostat with integral bulb well
- Field adjustable with SPDT switch output
- Temperature Range of 0F to 194F
- Low Cost but very simple design
Core Options
What is P-Bar?

Standard COL utilizes Thermal Transfer’s P-Bar Core

P-Bar is ‘Plate and Bar’ core construction

**Rugged, lightweight and compact**
- Highest performing oil cooler in the market place!
- Provides the best heat transfer per given envelope while minimizing pressure drop
- Air-side fin design minimizes fouling and static pressure
- Welded fitting/ports and manifolds ensure structural integrity
- 100% brazed aluminum construction
Plate & Bar Construction

Component parts allow rapid application design flexibility

- Top & Bottom Plate
- Cold/Air Side Spacer Bar
- Cold/Air Side Fin
- Hot/Fluid Side Spacer Bar
- Turbulator/Hot Side Fin
Designed for Performance

Higher performance with Plate & Bar

- Very aggressive ‘cheese grater style’ turbulator

Comparison to Round Tube

- Flat tubes provide maximum material to media contact
- Dense design; more tubes in a smaller space
- Single path flow
Installation

Hydraulic Schematic
Common Applications

Oil and Gas
- Oil Lubrication Transfer Services

Power
- Turbine and Compressor Lubrication
- Seal oil applications
- Filtration/Lube services

Wind Energy
- High Viscosity Lubrication and Filtration Systems

Gear Box
- High Viscosity lube
- Air Emulsions

Industrial
- Fluid Power-Hydraulic Power Units
- Injection Molding Machines
- Filtration Systems
- Pulp and Paper Machinery
Field Application
Problem:

Customer has experienced high amount of downtime and exceeded Maintenance budget due to issues with heat and contamination.

Pressure and Flow surges have caused the tube to header joint to crack and leak on this cooler.

Replaced Numerous servo valves due to contamination caused by collapsed elements.

Need way to battle water ingestion due to outdoor installation.
Amusement Park Ride

Hydraulic System Specifications:

- 15 GPM @ 3000 Psi
- Integration of Offline Fluid Conditioning Loop
- 9.5 GPM Loop
- 40 F Entering Temperature Differential
- 90 Gallon Reservoir
- 6 turns of reservoir per hour
Field Application

Solution:

Installation of Offline Fluid Conditioning System

COL-8-2-20-3-10-EV
Through integration of offline fluid conditioning system customer was able to improve machine uptime and reduce maintenance costs.

- Reduction of annual maintenance budget — No more costly repairs and overhauls
- Reduced down time associated with unplanned maintenance
- Contamination and water under control—significant reduction in element change interval
- Overall reduction of replaced components that were effected by heat and contamination
Con’s of Offline Fluid Conditioning

Space Claim
- Heat exchangers are typically larger as they must cool the fluid from the desired reservoir temperature to a lower temperature in order to offset the hot return line fluid
- If existing system, you may not have the room to install

Cost
- Higher initial cost
- Complete package is normally more expensive than installing heat exchanger and filter on the return line

Additional labor required to integrate into existing system
- Require wiring of additional motor starters
- Suction and discharge lines to reservoir
Summary

Pro’s
- Controlled flow and pressure through heat exchanger and filtration
- Ideal for high cycle machine applications
- Real time monitoring of temperature, pressure, contamination
- Constant Filtration-Able to achieve and maintain target cleanliness levels
- Independent system-can be serviced while machine is running
- Turn Key/Pre Engineered Solution

Con’s
- Space Claim
- Cost
- Additional Labor to integrate
- Another piece of equipment to maintain
Capitol equipment is too costly to cut corners

The Pro's or Benefits of investing upfront, far outweigh any Con’s

- Eliminate common down time problems
- Decrease annual maintenance
Thank you
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