MTS Hydraulix™ Monitoring Services

Remote monitoring of hydraulic system performance

be certain.
MTS HYDRAULIX MONITORING measures and trends hydraulic system performance through a secure internet connection. By combining onsite fluid sampling with sensor technology, this solution provides the high-value, actionable diagnostic information regarding the operation and maintenance of your servohydraulic test equipment that you need to efficiently manage your testing resources.
Remote monitoring over a secure internet connection helps ensure the maximum operating performance and service life of your entire hydraulic system. MTS Hydraulix Monitoring will help you to properly identify threats to hydraulic system health, and define corrective actions to keep your system in optimum condition.

MTS Hydraulix Monitoring offers expert fluid sampling tools and techniques combined with options for 24/7 logging of critical system parameters. Most importantly, it features critical analysis of the monitored and logged data-streams by highly experienced system engineers who have been trained in fluid analysis and the operation of servohydraulic test systems. This analysis includes and goes beyond in-depth particle and chemical evaluation of the hydraulic fluid used within the test system, and can be extended to monitor components and the hydraulic distribution system.

With immediate access to system performance measurements and analysis of trends over time, you can maintain your hydraulic systems in the most efficient manner. Condition-based monitoring allows for early detection of potential issues and prevents unnecessary downtime for unneeded maintenance. Convenient, secure online access to system condition will help you make the best decisions regarding system operation.

A haphazard approach to hydraulic maintenance can be detrimental to lab operations and dangerous to valuable testing equipment. Contaminated fluid has the potential to wreak havoc throughout the lab, damaging everything from components, such as servovalves, to entire systems. Early warning of potential component failure protects uptime and minimizes repair costs. A planned approach with MTS Hydraulix Monitoring allows you to mitigate risk and have more control over your lab operations.

Benefits of well-maintained hydraulic system

» **Test Schedule Predictability** – Proactively address potential problems and increase system uptime

» **System Lifecycle Extension** – Reduce wear and tear and extend overall operating life of the equipment

» **Data Integrity** – Create a better performing system that produces more accurate and repeatable data

» **Budget Management** – Minimize the risk of unpleasant budget surprises due to worn or damaged components or systems
## Fluid Health

### Fluid Condition
- ISO cleanliness code trending
- Contaminant ingestion event logging
- % water saturation
- Fluid chemistry health monitoring
- Nominal operation temperature trending
- Runtime hours per pump/motor group
- Duty cycle per 24-hour/30-day clock
- Utilization balancing across pump modules

### Filtration Effectiveness
- Rate of filter loading
- Filter effectiveness on output cleanliness
- Condition-based filter replacement

## HPU Health

### Fluid Power Generation
- Pressure output ripple/vibrations
- Audible noise suppression/detection
- Output fluid flow monitoring
- Pump/motor vibration monitoring
- Case drain flow & temperature trending
- Compensator setting/stability per module

### Heat Exchanger Efficiency
- Nominal output fluid temperature trending
- Water consumption trending
- Thermal heat transfer monitoring

## Distribution Health

### Hydraulic Distribution Performance
- Accumulator gas charge monitoring
- Ball valve fault detections

### Station Utilization
- Console temperature monitoring of station controller
- Station status - hydraulic-on & program-run utilizations

### Leak Detection
- Monitor trench cavities for oil or water flooding
- Monitor HPU deck and oil catch basins

## Energy Conservation

### Energy Usage
- Water consumption optimization/minimization
- AC current draw/motor-power/motor-performance in % trends
- Flow profiling/power manager analytics
MTS Hydraulix Fluid Condition Monitoring

Hydraulic Fluid Monitoring Techniques

MTS Hydraulix Monitoring starts with measuring Fluid Condition. The condition of the fluid is an indicator of overall system health, and is a base requirement of any hydraulic monitoring program.

**Sensory Inspections**

Sensory evaluation can quickly identify an inferior condition and thus save time and money on more expensive analytical procedures. If the condition of the fluid is observably bad as determined by both smell and appearance, there is something wrong with the fluid. However, the inverse is not necessarily true. If the condition of the fluid is observably good, it does not mean that the performance integrity of the fluid is good. More sophisticated methods of analysis must be employed after the fluid passes sensory inspection to determine whether the fluid is in satisfactory condition.

**Drawn Samples**

Fluid analysis is used to provide advanced chemistry and particulate identification. It can determine levels of deterioration and contamination in the fluid.

**Deterioration**

Fluid deterioration starts as “additive deterioration.” Additives are most susceptible to chemical and physical change in mixing fluids, entrapped air and high temperatures leading to fluid breakdown.

**Contamination**

Hydraulic pumps and servovalves can be damaged by fluid contaminated with hard metallic particles that are larger than the clearance between lubricated surfaces. These hard particles create more wear contaminant by continually scraping off softer metals, like copper, to further accelerate component failures.

**In-line Monitoring**

24/7 FLUID CONTAMINATION SENSOR SYSTEM (PARTICULATE & WATER)

Sensors provide in-line monitoring of fluid cleanliness, water saturation levels, and fluid temperature during system operation. They capture what the system has experienced over time and in between the regularly drawn samples. These sensors can be used to identify improper maintenance (e.g., adding unfiltered replenishing fluids) or when an in-rush of contaminants enter due to the connecting and disconnecting of hoses and hydraulic components.

Sensors may be installed in multiple locations to provide wear trending of critical hydraulic components and early detection of issues to reduce the potential for unexpected downtime. They complement the power of fluid analysis for the long-term trending of fluid condition, and provide protection between drawn samples.

**Observable Characteristics of Hydraulic Fluid**

**Appearance** — Clean hydraulic fluid is amber in color. A milky, dark or otherwise abnormal color may indicate the presence of one or more contaminants.

**Smell** — A marked change in the smell of the hydraulic fluid can indicate a chemical breakdown. This type of breakdown is generally due to air that has become entrained in the fluid, which creates varnish-like nitrogen-oil compounds that contaminate the fluid.

**Viscosity** — Although the pour quality can be observed, chemical analysis is required to validate fluid condition. The pour should be more similar to 20W engine oil and much thicker than the thin pour of transmission or brake fluid.
Better Sampling

MTS field service engineers are experienced in proper sampling techniques:

- Know proper procedure for flushing a sample bottle
- Know when, where, and how to obtain the sample
- Know how to handle the sample once it’s been taken
- Use our state-of-the-art, patented sampling tool

Better Analysis

MTS partners with ExxonMobil Oil Corporation to customize the Signum oil analysis services to MTS’ more stringent requirements for analysis, alert thresholds, information notification and trending. This customization enables MTS to provide the most progressive and comprehensive fluid care program available. The MTS Hydraulix Fluid Condition Monitoring focuses on extending the lifecycle and maintaining optimum performance and fidelity of your mission-critical servohydraulic test equipment.

MTS combines the results from several measurements to achieve a comprehensive evaluation of the fluid condition. The results are presented within the following parameters and interpreted based upon the interaction of these parameters.

ISO CLEANLINESS TRENDS – ISO cleanliness measurement provides a summation of contaminant by size but not by composition or mass. The MTS control limits for ISO cleanliness are specific to servohydraulic test equipment that operates at much higher pressures, and in harsher environments than typical commercial-grade hydraulic systems. The information from our standard fluid analysis is combined with sensor particulate counting to produce a 5-minute granularity of sampling intervals and achieve the fastest diagnosis of contaminants.

CONTAMINANT & WEAR METAL MEASUREMENT – This parameter identifies existence of contaminant by mass and composition, but not by size. The rate and stability of shedding metals is diagnostic and predictive to the health of specific system sub-components and this measurement provides the data necessary to intervene in a purposeful and planned manner.

ADDITIVE DEPLETION LEVELS – Additives are protectors that inhibit undesirable changes in the precision hydraulic fluid and the test machine. High-pressure close-tolerance servovalves operating at higher frequencies can “slice” base oil and additive molecules apart during operation. When additives are depleted, your system has less protection against fluid breakdown and abrupt system failure.

WATER SATURATION & CONTENT PERCENTAGE – Water can cause emulsions to form and it can lead to corrosion. More than a trace of water may indicate early warning of a failing heat exchanger or ingestion of water through air breathers. The water volume measurement, when combined with the data gained from other tests, provides an indication of fluid condition. Sensor technology adds the saturation percentage measurement that confirms fluid condition and provides a clear diagnosis of risk.

FLUID VISCOSITY & AGE TRENDING – Viscosity is the most important property of the lubricant itself. Changes in viscosity affect the ability to form the essential lubricating film for the test machine and indicate poor fluid condition due to aging. Fluid aging is accelerated by operating at higher temperatures, presence of even trace water, fluid contaminants and additive depletions.

VARNISH/SILT/SLUDGE/OXIDIZATION MEASUREMENT – Operating at persistent elevated temperatures and in the presence of trace water contributes to accelerated fluid breakdown reflected in high oxidation, nitrartion, and/or suspended silt particulate. MTS analysis measures all these elements. The nitration test, which predicts varnish deposit potential, is rarely found in other fluid analysis solutions. The UC (ultracentrifuge) test detects contaminants less than 0.5 microns that can cause premature filter plugging and erratic valve operation. These tests will alert you to the potential formation of sludge, silt, lacquers, and various other hard and soft gummy surface deposits.

Better Evaluation

- Fluid analysis and monitoring data evaluated by MTS engineers with in-depth knowledge of servohydraulic system operation and specialized training in fluid chemistry
- Comprehensive interpretation of the interaction of all the analysis parameters to form a sophisticated diagnosis of fluid condition
- Close monitoring alerts you to potential hazards before they become serious issues
- Trended results and corrective actions are communicated

MTS brings years of experience working with servohydraulic test equipment to the analysis process so you can rely on us to know how to intervene to keep your system in peak performance condition.
In addition to Fluid Condition Monitoring, the MTS Hydraulix Monitoring Services provide several other options for performance monitoring:

**Filtration Effectiveness**
- Rate of filter loading
- Filter effectiveness on output cleanliness
- Condition-based filter replacement

Filter performance is important because it protects contaminants from reaching and damaging the servovalve and actuator. Inadequate filtration can result in the actuator scoring and seal damage that leads to leaking and potential component failure. It is important to monitor filtration effectiveness because filters have bypass mechanisms to ensure that they do not collapse. A filter in an undetected bypass state provides false confidence that the hydraulic fluid is clean. Filtration monitoring is an easy way to make sure the filters are performing to expectations.

**Heat Exchanger Efficiency**
- Nominal output fluid temperature trending
- Water consumption trending
- Thermal heat transfer monitoring

Correlating thermal transfer with output flow is a great way to detect early problems in power generation or the cooling circuit. Maintaining a stable output temperature is critical because thermal temperature drift can impact servocontrol of the actuator and the performance of the test system. Heat exchangers operate under the principal of thermal transfer so the water flow and in and out temperature deltas provide the variables needed to calculate and track thermal transfer efficiencies. Changes in the thermal transfer over time often indicate a degraded heat exchanger that needs to be replaced. Many things can cause a heat exchanger to fail including highly contaminated water, or corrosive water that plugs or coats the heat exchanger. Trending the water consumption can identify failed water solenoids or indicate when someone has forgotten to turn on the water supply, giving the operator time to turn on and cool the hydraulic fluid to prevent an over temp shutdown.

**Fluid Power Generation**
- Pressure output ripple/vibrations
- Audible noise suppression/detection
- Output fluid flow monitoring
- Pump/motor vibration monitoring
- Case drain flow & temperature trending
- Compensator setting/stability per module

Several factors can negatively impact the efficiency of a hydraulic power unit, and measuring these parameters can guard against potential drops in performance. If a great percentage of your potential power is going to heat generation or if your output fluid is pouring over the safety relief valve and back into the tank, you are wasting potential energy. One of the ways we determine fluid power generation efficiency is to measure the pressure output ripple. This hydraulic noise can be an indicator of reduced performance and can be transferred to the testing systems adversely affecting testing results, especially for brittle or highly stiff specimen. An increase in audible noise is usually subtle over time, but may be attributed to failure within critical subcomponents or cavitation of the pump.

Additionally, monitoring the output fluid flow, case drain flow and temperature over time will give early indication of potential pump failure and give ample time to correct before significant damage can occur. A malfunctioning or poorly adjusted compensator can cause the pump to run in idle mode, increasing wear and wasting electrical power.
Energy can be lost in heat conversion or through the overuse of electrical power, water or hydraulic fluid. If you don’t manage the power generation to meet the demand, the energy and resources are wasted. Monitoring the items in this category will help conserve energy, reduce costs and lower your carbon footprint. Measuring water consumption will help you use less and save more money. Tracking the actual current draws compared to the output flow provides a ratio of productivity to efficiency for hydraulic power unit motor performance. With flow profiling, we should be able to pattern the flow just in advance of the demand and modulate the power generation required to produce the desired forces and motions. Ideally we want to help you use the least amount of hydraulic power to produce the maximum results and performance.

Hydraulic Distribution Performance

- Accumulator gas charge monitoring
- Ball valve fault detections

Monitoring hydraulic distribution performance includes making sure that the accumulators, hardline and electronic controls are in the proper working condition to deliver hydraulic power to the test station. Accumulators are the shock absorbers for the hydraulic system that help regulate system pressure. Hardlines that bang and hoses that slap can create dangerous fatigue conditions that crack manifolds and abrade or blister high pressure hydraulic lines. Accumulators prevent these surges in pressure that create the unwanted motion and unwelcome noise in the lines. Yet, maintaining the correct charge in accumulators is an often overlooked, tedious and time-consuming job. Remote monitoring will indicate which accumulators need charging so the hydraulic distribution system can readily manage flow demand.

Station Utilization

- Console temperature monitoring of station controller
- Station status - hydraulic-on & program-run utilizations

Remote monitoring of the controller console temperature can alert you to spikes in temperature that could be damaging to controller performance. High temperature at the console is the number one cause of electronic board failure and is likely triggered by cooling fan failure or cooling vent blockage. Monitoring the temperature changes allows you to resolve the issue before more expensive board failure occurs. With station status information and utilization data, you can manage your hydraulic demand in an efficient manner and plan for your future needs.

Leak Detection

- Monitor trench cavities for oil or water flooding
- Monitor HPU deck and oil catch basins

Leak detection is important for economic and environmental reasons. Constantly leaking just a small amount of hydraulic fluid can be quite expensive over the course of a year. Additionally, environmental excursion is highly regulated and significant governmental penalties can be applied if large amounts of hydraulic fluid pass into sewer and water drain systems. Monitoring trench cavities is important because as the lowest gravity point, they are often the first indication of leaks. On older hydraulic power units, the leaks from the deck-mounted hydraulic pumps, are direct indicators of shaft seal failure, and a sign the pump is nearing failure mode.

Energy Usage

- Water consumption optimization/minimization
- AC current draw/motor-power/motor-performance in % trends
- Flow profiling/power manager analytics

Energy can be lost in heat conversion or through the overuse of electrical power, water or hydraulic fluid. If you don’t manage the power generation to meet the demand, the energy and resources are wasted. Monitoring the items in this category will help conserve energy, reduce costs and lower your carbon footprint. Measuring water consumption will help you use less and save more money. Tracking the actual current draws compared to the output flow provides a ratio of productivity to efficiency for hydraulic power unit motor performance. With flow profiling, we should be able to pattern the flow just in advance of the demand and modulate the power generation required to produce the desired forces and motions. Ideally we want to help you use the least amount of hydraulic power to produce the maximum results and performance.
Hydraulic Health Benefits

Test Schedule Predictability
MTS Hydraulix Monitoring offers the peace of mind that comes with knowing that you are decreasing the chances of unplanned downtime. When you monitor the hydraulic system, you are able to proactively address potential problems before unexpected damage occurs.

System Lifecycle Extension
Proper monitoring and care of your test system with MTS Hydraulix Monitoring will reduce wear and tear and extend overall operating life of the equipment. Get the most out of your test system investment by taking care of your hydraulic system.

Data Integrity
Keeping your system’s hydraulic health in peak condition creates better-performing test equipment. Test systems that are performing to specifications produce more accurate and repeatable data.

Budget Management
By investing in remote monitoring, you minimize the risk of unpleasant budget surprises due to worn or damaged components or systems. Enjoy the consistency and certainty that comes from knowing you are managing your test schedule and budget. Extend your equipment’s lifecycle and improve your test data integrity by adding MTS Hydraulix Monitoring as part of your test lab management plan.
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