INTRODUCING THE YORK CHEMICAL ANALYSIS OF WATER CHILLER OIL

This offer has been designed to allow Districts to capitalize on a traditional, but effective chiller diagnostic tool. Oil Analysis provides an inexpensive opportunity to gain access into customers' machines with an initial S & R approach to later develop Maintenance Agreements or generate additional S & R.

80 % of YORK's Oil Analysis business is included within Maintenance Agreements, while the remaining 20% is incremental revenue. The offer allows growth of each through a professional marketing of YORK's depth of analytical service and expertise.

District Service Office flexibility is the cornerstone of this offer. The OVERVIEW section of this package details the multi-variate approaches to oil analysis. The purpose of this offer is to optimize that flexibility in such a way so as to allow each District to select their own analytical methods, establish their own pricing schedule, and grow additional S & R or Maintenance Agreements in accordance with their greatest business advantage.

OBJECTIVES:

* Gain a foot-in-the-door to additional S & R or Maintenance Agreements with a low cost, diagnostic entree.
* Provide flexibility for District customizing.
* Demonstrate YORK depth of Service and Expertise to both existing and potential customers.

PROFILE:

Periodic Oil Analysis is a good "preventive maintenance" technique to assess the mechanical condition of a water chiller, when interpreted by refrigeration system experts. Most manufacturers of water chiller equipment recommend at least an annual check unless conditions warrant greater frequency. Oil Analysis can be performed by manufacturers, independent labs, and field service technicians.

SCOPE:

YORK will be responsible for collecting the oil and/or filter sample from the machine, submitting for appropriate analysis to a laboratory of the District's choice, interpreting the results, and reporting those results along with equipment recommendations to the customer.

FLEXIBILITY:

* "Cafeteria" offering of analytical services for each District Service Office to use.

* No formal, centralized YORK report format is provided. Some customers prefer "independent" analysis, while others prefer "Factory Service" analysis. Districts can choose their most effective method. In either case, the District can develop their Cover Letter most appropriate to the analysis method used.

* Oil Analysis costs vary greatly based on the types of analytical techniques desired. Pricing therefore is not established within this offer. The Oil Analysis can be Priced as:
    1). incremental S & R; i.e. profit
    2). a loss leader
    3). M/C discount contingency
    4). S & R discount contingency

* The Oil Analysis Sales piece is generic to adequately cover the different types of analysis practiced in the field. Each District can then market their specific analytical preferences, or select a particular method to suit the customer.

OIL ANALYSIS METHODS AND SOURCES:

The OVERVIEW presents the various Oil Analysis Methods available, and several of the testing sources who perform these services. The analytical methods and the particular laboratory chosen by each District will vary depending upon District requirements.

A CHILLER OIL ANALYSIS PRIMER

VISUAL ANALYSIS BEGINS AT THE JOBSITE

Oil analysis begins with the technician at the jobsite. Upon removing the oil filter and sampling, the trained eye can provide a rough assessment through color differences or sediment collected on the oil filter surface. Certain sediment characteristics may allow identification of the debris source. For instance, shiny aluminum could indicate bearing or impeller wear.

YORK International offers an Acid and Color test kit (P/N 026-20379-000) for Turbo compressor models at a cost to Districts of $375.44. Approximately 25 tests can be performed with one kit. Replacement kits are available through T.M.A. Testing (717-757-1165). Refer to Circular Letter S-59-86 by Steve Nusbaum for special instructions.

The Acid/Color Test kit provides a quick on-site determination of the Neutralization Number (Total Acid Number) and the conformity of the oil color to standard. The T.A.N. provides a value for oil acidity as the total amount of acidic product present in the oil sample. Dark or unusual color may indicate the existence of abnormal machine operating conditions.

The Acid/Color test kit allows the technician to make prompt but limited machine evaluation. It does not provide a complete chiller interpretation. Equally as important are Moisture Content and Oil Filter Sediment Analysis.

LABORATORY ANALYSIS TECHNIQUES

Moisture analysis measures the amount of water suspended in the Oil. Quantitative lab analysis techniques may determine if their is a leak within a refrigeration system. Sediment Analysis may require "wet chemical" analysis using chemical reagents, microscopic study, scanning electron microscopy, or spectroscopy to identify debris. Proper debris identification may specify the abnormal machine condition. These analytical methods require refrigeration lab expertise.

SPECTROGRAPHIC ANALYSIS IS INEXPENSIVE AND QUICK

The quick turnaround of the independent labs is achieved through reliance on spectrographic analysis. Microscopic metallic elements suspended in the oil are identified and measured in parts per million (PPM). This test is quick and quite inexpensive. Often labs can report same-day results if required.

Independent labs "feature" spectrographic data as a way to assess metal content within the sample. They can generally also provide the Neutralization Number, Moisture Analysis, and Viscosity at additional expense.

ANALYTICAL LIMITATIONS OF THE SPECTROGRAPHIC TECHNIQUE

Spectrographic analysis has significant limitations when used solely for metals analysis. Spectrographic analysis examines only those particles small enough to be suspended in the oil. Due to this selective particle size, the test may not "see" certain wear particles; it is more likely to measure corrosion products than metal wear.

The analysis is limited only to identification of chemical elements. The spectrograph cannot distinguish elements from compounds. This limitation becomes significant since the analysis cannot specify whether the element is present as a metal (indicating a degree of wear), or as a metal oxide or chloride, which may be a typical product of corrosion within a refrigeration system.

Spectrographic analysis does not differentiate between wear particles, corrosion products, or other inorganic contaminants, such as oil breakdown products, waxes, and plastics.

The annual spectrographic analysis tells very little. Reliable conclusions and recommendations are not possible on such an infrequent basis. Reliability can be somewhat improved by establishing a trend analysis with multiple sampling, i.e., MONTHLY, with new curves drawn whenever the oil and/or filter is changed. The greater frequency of analysis to obtain reliable results can be a cost consideration.

WET CHEMICAL TECHNIQUES ADD RELIABILITY TO ANALYSIS

A few labs, including the YORK International Chem Lab, conduct "wet chemical tests," microscopy, and scanning electron microscopy in addition to spectroscopy to distinguish elements from compounds. While the cost and turnaround is greater, these techniques can provide a more accurate interpretation of the chiller's mechanical condition.

IDENTIFICATION OF OIL FILTER SEDIMENT

The oil filter is an important source of information. Just as the technician can spot debris trapped on the filter material, the lab can identify these sediments to further evaluate system condition. This evaluation can be just as important as the testing of the liquid oil sample.

The filter is designed to trap debris. A good filter, doing its job, traps particles of debris to keep them from damaging components of the lubricating circuit. Those particles often have an important story to tell.

Laboratory analysis of chiller oil is a relatively low cost method of analyzing mechanical condition and pinpointing whether a tear-down and visual inspection is needed. With complete and accurate laboratory oil analysis testing, recommendations for appropriate action become more reliable.

OIL ANALYSIS TECHNIQUE COMPARISONS

The following table outlines the methods and benefits associated with each type of analysis technique.

CHARACTERISTIC	ACID/COLOR TEST KIT	SPECTROGRAPHIC ANALYSIS	COMPLETE WET CHEMICAL ANALYSIS
COST	APPROX. $15 EA.	$13 PLUS	$50 - $150
TURNAROUND	DONE AT JOBSITE	1 - 10 DAYS	5 - 10 DAYS
MOISTURE ANALYSIS	NO	ADDITIONAL COST	YES
ACID NUMBER	YES	ADDITIONAL COST	YES
FILTER SEDIMENT ANALYSIS	NO	NO	YES
OIL COLOR	YES	ADDITIONAL COST	YES
ELEMENT IDENT.	NO	YES	YES
IDENTIFY COMPOUNDS	NO	NO	YES
IDENTIFY DRIVELINE WEAR	NO	NOT RELIABLE	YES
IDENTIFY CORROSION PRODUCTS	NO	NOT RELIABLE	YES
RECOMMENDED TEST FREQUENCY	?	MONTHLY *	ANNUAL *
REPORT EMPHASIS	LIMITED	ELEMENT PPM PRINTOUT	COMPREHENSIVE
SAMPLE KIT CONTAINERS	YES	OFTEN PROVIDED	NO
GEOGRAPHICAL PROXIMITY	ON-SITE	LOCAL/REGIONAL	LIMITED
SAMPLE SIZE	TEST-TUBE	SMALL (2-5 OZ.)	8 OZ. AND FILTER
PRE-PURCHASE SAMPLE BLOCKS	N/A	USUALLY YES	NO
EMERGENCY SERVICE (LESS THAN 1 DAY)	YES	YES	VARIES

* OR MORE FREQUENTLY IF PROBLEMS EXIST

OIL ANALYSIS LABORATORIES

There are many laboratories currently providing oil analysis services for YORK's thirty-three District Service Offices. The following list includes larger scale labs more capable of handling national coverage, lower cost, volume discounts, and quick turnaround.

The first three rely heavily on the spectrographic technique as explained earlier in the OVERVIEW. Only the YORK Chem Lab provides sediment analysis from the sample and oil filter element for compound identification and other as-needed tests at no extra cost. Contact the labs directly, or the lab you do business with now for price scheduling on other services they may provide.

ANALYSTS, INC. (213) 212-7001
Corporate Offices, Suite 120 TELEX: 258078
2377 Crenshaw Blvd.
Torrance California 90509-2955
- 4 -Test Complement: Spectrographic, Viscosity, Moisture by KF, and Neutralization Number (TAN)
- Other tests at extra cost
- Volume Discounts
- National Coverage with Multiple Locations

CLEVELAND TECHNICAL CENTER (201) 862-6790
2650 Marshes Rock Rd.
P.O.Box 671
Linden, New Jersey 07036-0671
- 4-Test Complement: Spectrographic, Viscosity, Moisture by KF, and TAN
- Other tests at extra cost
- Volume Discounts
- National coverage, not yet West Coast, multiple locations

T.A.I., INC. (404) 448-5235
P.O. Box 1182 1-800 241-6315
Atlanta, Georgia 30301
- 4-Test Complement: Spectrographic, Viscosity, Moisture by KF, and TAN
- Other tests at extra cost
- Limited to Denver and East

YORK INTERNATIONAL CHEM LAB (717) 771-7890
P.O.Box 1592-231 D
York, Penna. 17405-1592
- Gardner Color, Moisture by KF, TAN, Oil sample and Oil filter sediment analysis; Viscosity and other tests as required for complete evaluation