



Engine & Compressor Diagnostic Services

Mechanical Condition & Performance Analysis - Work Scope

Visual Inspection

- Review the operational and maintenance history of the unit
- Visually identify instrumentation and accessory deficiencies
- Using infrared equipment, record important temperatures where instrumentation is not available
- Using Ultrasonic translator equipment, identify all compression leaks around spark plugs, head gaskets, fuel valves and pre-combustion cells; fuel leaks; air and process leaks including packing, valve caps, unloaders, recycle, bypass and blow-down valves

The analyst will listen and look for abnormalities in the normal operation of the unit and use these notes to help focus and direct the analysis process. If conditions indicate, the analyst will use the spectral vibration capability of the analysis equipment to check for excessive skid, frame and cylinder movement.

Ignition System Analysis

The analyst will gather statistical data on the secondary ignition system to determine accurate timing and ionization voltage information and measure the secondary arc duration, arc voltage, rise time, ring-down voltage, arc slope, no combustion and no arc events.

The analyst will observe and record the real time expanded secondary patterns to determine if there are problems with the spark plug wires, connections, transformers and primary wiring.

Compressor End Analysis

If an accurate TDC reference is available and indicator valves are installed, the analyst will measure the horsepower being consumed in each end of each cylinder, add the appropriate parasitic and accessory loads and provide the customer with a total BHP load and torque for the unit.

The suction and discharge volumetric efficiencies, flow rate, theoretical temperatures, clearances and horsepower will be measured or calculated as appropriate. The analyst will compare the measured data to these calculations and this comparison, along with measured valve cap temperatures, vibration and ultrasonic vs. crank-angle patterns, will allow the analyst to pinpoint performance deficiencies related to design or mechanical deficiencies.

If indicator valves are installed in the cylinder suction and discharge cavities, valve power losses can be measured.

Vibration and Ultrasonic vs. Crank Angle testing will be used to evaluate the frame components including crosshead components and bearings. Pressure, Vibration and Ultrasonic vs. Crank Angle will be used to evaluate rings, riders, valves and capacity control devices.

On those cylinders equipped with indicator valves in both ends, static rod loads will be measured. If detailed reciprocating weights are available, the dynamic rod loads will also be measured and graphed with a calculation of available rod reversal in degrees of crankshaft rotation.

Power End Analysis

Ultrasonic and Vibration vs. Crank-angle will be used to determine all event angles and identify deficiencies related to intake, exhaust and fuel valves; pistons, liners, rings, wrist pins, bushings and bearings. Deficiencies will be identified related to valve timing, cam and actuating components, valve lash, etc.

If indicator valves are installed, pressure will be measured at each degree of crankshaft rotation, developed horsepower will be measured and the unit balance will be measured. The pressure information is a valuable performance indicator and can add valuable information to the mechanical condition analysis process. Complete statistical information will be gathered.

Many high speed engines have no provisions for indicator valves. Little separation between cylinders and a high incidence of vibration cross-talk presents the opportunity to miss real problems and mistakenly identify a normal event as a deficiency. To reduce this problem, we utilize state of the art digital, real time analysis equipment allowing our analysts to visually see these cross-talk relationships. In addition, our Technical Services analysts have over 75 years of combined experience testing units in this category.

Questions? Contact us today:

Phone: (865) 539-5944

Web Site: www.windrock.com

E-mail: sales@windrock.com

Mechanical Condition & Performance Analysis - Work Scope (continued)

Reports

A complete report will be prepared and left on-site at the completion of the analysis visit. This report will include the following:

- Power Cylinder Performance Report (if indicator valves are present)

- Secondary Ignition Peak Voltage and Timing Report (unshielded ignition only)
- Secondary Ignition Critical Parameters Report (unshielded ignition only)
- Compressor Cylinder Performance Report (if indicator valves are present)
- Manual Panel/Temperature Report

- Priority coded Deficiency List with recommended corrective action
- Plots of all data will be maintained in our database for future comparison.

If requested, further evaluation and presentation of the data will be provided and invoiced at our normal on-site hourly rate.

Optional Analysis Services

Reciprocating Engine and Compressor Troubleshooting Analysis

All of the analyst's resources are brought to bear in a systematic approach to problem identification and rectification. The analyst's task is to gather as much factual data as possible about the problem and deal with those facts objectively. Our analysts are extremely capable reciprocating engine and compressor specialists and can provide the technical expertise necessary to get a unit up and running.

Vibration & Pulsation Analysis

This analysis is directed toward identifying the causes of unacceptable vibration levels in reciprocating engine and/or compressor packages. Our experienced analyst will determine if the unit has excessive engine or compressor imbalance, coupling misalignment, cylinder stretch, mechanical resonance, excessive pressure pulsations, mechanically

loose components or insufficient restraint and rigidity. The effect of the piping and non-reciprocating on and off-skid components will also be checked and specific recommendations for repair will be made.

Our standard analysis package includes a 4-channel spectrum analyzer capable of performing simultaneous vibration and pressure FFT calculations.

Our analysts possess years of reciprocating equipment experience, aiding them in separating the normal reciprocating vibrations from the abnormal vibrations. This is an attribute found in few rotational vibration analysts. An additional report charge is generally made for this type of testing.

Exhaust Emissions Testing Services

Windrock offers a full range of exhaust emissions-related services. These services are tailored specifically to the natural gas industry and its unique requirements for testing 2/4-stroke spark-ignited engines and gas turbine drives.

Services Include:

- EPA Title V Compliance testing (EPA Methods 3A, 10, 18, 19, 20, 25A, and 320)
- Pre-assessment Health Testing, Diagnostic/Troubleshooting Services
- Consulting Services
- Periodic Testing (NOx, CO, VOCs)
- Mapping and Development of Control Coefficients (only available for slow speed integral units)
- RATA Testing
- Catalyst Testing
- Ammonia Slippage Testing
- CEM Systems (Continuous Emissions Monitoring)
- Horsepower and Mechanical Condition Testing

Travel Considerations

Mileage and travel time charges will originate and end with either our Knoxville, TN; Tyler, TX; Morgantown, WV; or Indianapolis, IN Service Districts (depending on Analyst availability).

Cost

Let us provide you with a quote to solve your analysis needs. Our prices are very competitive and our analysts are among the most experienced in the industry.



Windrock, Inc.
431 Park Village Drive, Suite L
Knoxville, TN (USA) 37923
Phone: (865) 539-5944
FAX: (865) 531-6470
Web Site: www.windrock.com
E-mail: sales@windrock.com

Contact

Warren Laible
Technical Services Manager
Office: 865-539-5944 ext. 22
Cell: 865-806-8878
E-mail: wlaible@windrock.com