Science.

Technology.

Innovation.

PNNL Develops Centrifugal Chiller Diagnostician

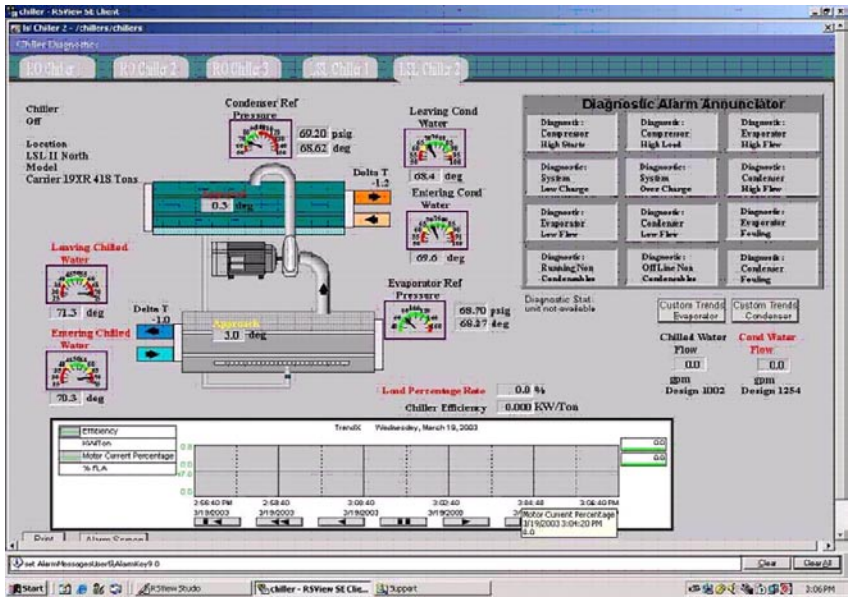
PNNL scientists and engineers have developed an automated, sophisticated, multi-level, real-time centrifugal chiller diagnostician with diagnostics available under partial load conditions. This diagnostician provides auto-analysis of system efficiency and diagnoses the most probable causes of centrifugal chiller operations caused by common failures. It provides a generic diagnostic tool applicable to most major brands of centrifugal chiller units.

Typical Centrifugal Chiller

Key Accomplishments

The diagnostician trend display also generates instrument and calculated values for extensive trending either as a single instrument or value, or the data can be combined for several instruments and values to be analyzed collectively. All instruments, calculated values, and problem identifications have a diagnostic screen that will provide alert and alarm notifications with the following information:

- Problem Identification - what the problem is.
- System Impact - the potential impact of the problem on the system operation.
- Likely Causes - the three most probable causes of the problem.
- Corrective Action - the three most probable steps the operator should take to mitigate the problem.
- Actual Condition - the current condition.
- Desired Condition - what the current condition should be.



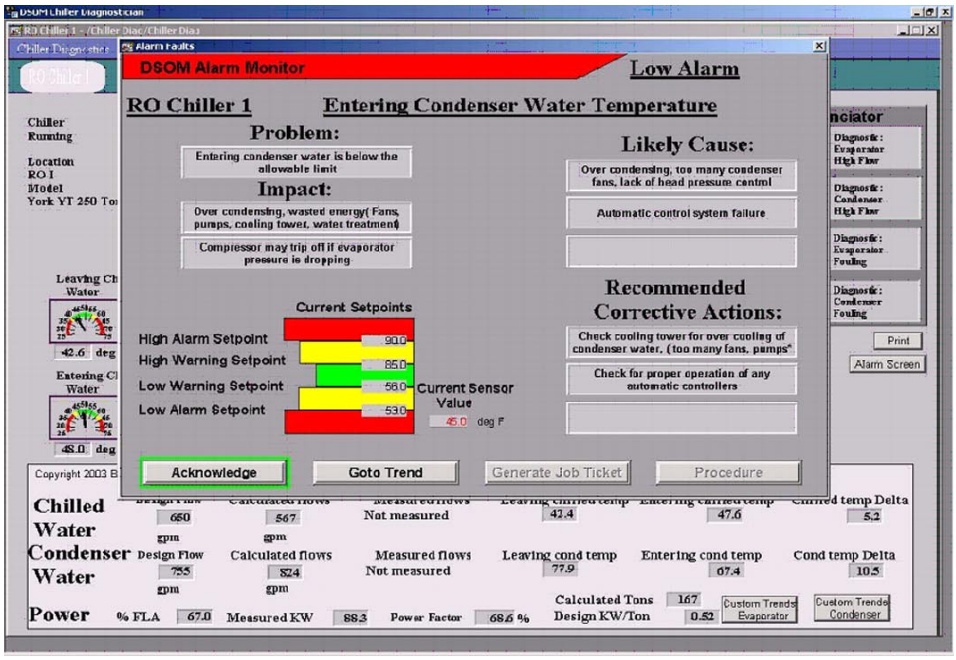
Centrifugal Chiller Display

Pacific Northwest National Laboratory

Operated by Battelle for the U.S. Department of Energy

Diagnostics have been developed for:

- Compressor high starts
- Compressor high load
- Evaporator high flow
- System low charge
- System over charge
- Condenser high flow
- Evaporator low flow
- Condenser low flow
- Evaporator fouling
- Running non-condensables
- Off-Line non-condensables
- Condenser fouling.



Typical Diagnostic Display

Additional information displayed:

- Diagnostic status
- Custom trends option button for the evaporator and condenser
- Chiller running/off status
- Chiller location
- Chiller model and design tons
- Alarm and alert summary screen
- Chiller and condenser water flow design rates

The following instruments and calculated values are monitored on the live screen display with associated diagnostics for high alarm, high warning, low warning, and low alarm conditions:

- Chilled water in and out
- Chilled water delta T
- Evaporator refrigerant pressure
- Evaporator refrigerant and approach temperature
- Condenser refrigerant pressure and temperature
- Condenser approach temperature
- Condenser water in and out
- Condenser water delta T
- Load percentage rate
- Chiller efficiency in KW/Ton
- Chilled water flow
- Condenser water flow.

The following unique capabilities have been developed into this software:

- Applied a polynomial function generator to support partial load diagnostics rather than just full load diagnostics (industry standard)
- Event analysis and counter
- Event based data logging
- Innovative TCP/IP data acquisition for string type data
- Improved OPC communications
- Advanced intuitive GUI
- Diagnostic factory-engineered curve fit algorithms for a centrifugal chiller
- Ability to interpret string data (text messages) for faults vice just numerical data

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