



HORSBURGH & SCOTT
GEAR UP™

'Sentry' Solutions

Problem/Solution Cost/Benefit 'Case' study:

√ Converter/Reactor: Fan Recoup "Surge/Stall" Events.

The 'Sentry' Concept

Predicts the future “health” of equipment to proactively ensure maximum Uptime, Prevent Downtime and Protect your investment.

Provides 24/7 “At a Glance” equipment condition (of vibration, strain, temperature) using intuitive Red/Yellow/Green “Traffic Light” system.

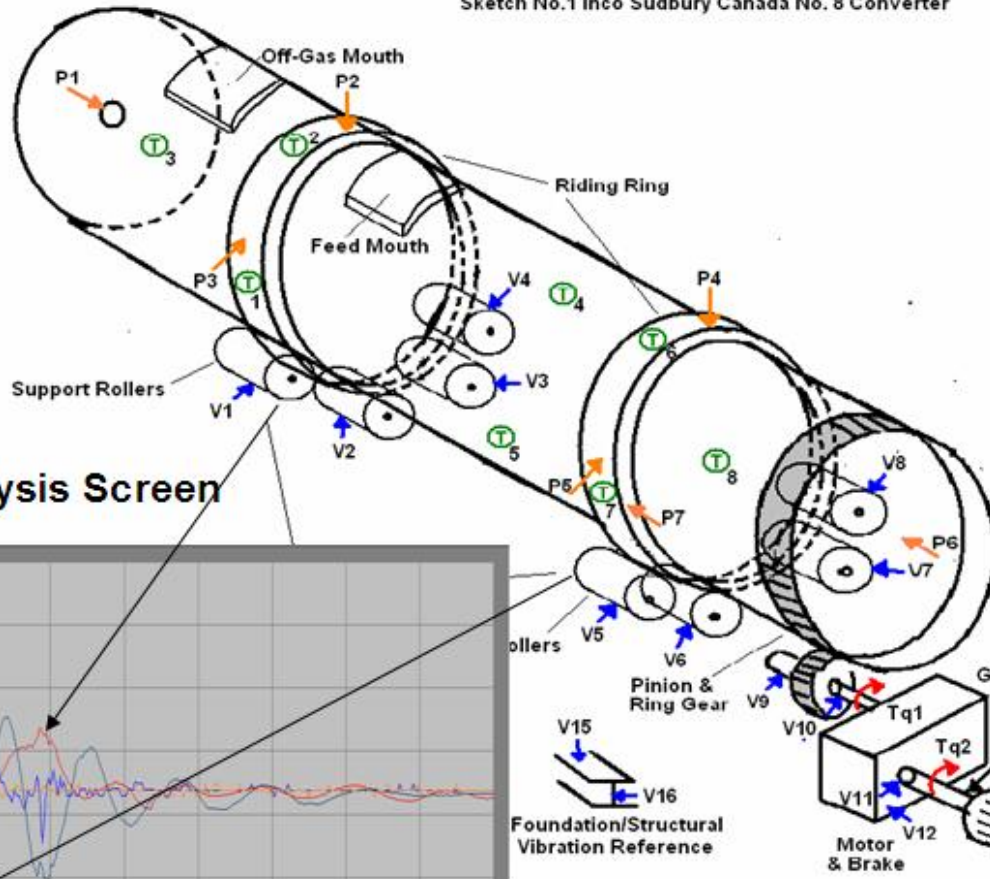
Creates 3-D “movies” to rapidly identify the TRUE Root Cause of equipment “hot spots”.

Enhances Predictive Maintenance (PdM) and Process optimization.

H&S takes full ownership for detailed Corrective Actions specific to the unique Needs of the Customer. (Extension of Customer Reliability Group)

Problem: Converters, Reactors Fan Recoup "Surge/Stall" Events.

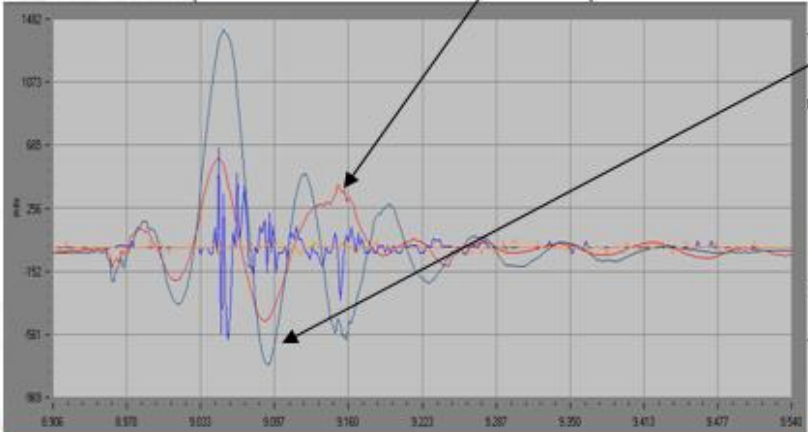
Sketch No.1 Inco Sudbury Canada No. 8 Converter



1. V1 - V16 ~ Single Plane Accelerometers w/ Magnetic mounts Vibration
2. T1 - T8 ~ Temperatures via thermal imager add'l temperatures can be assigned
3. P1 - P7 ~ Proximity (eddy current) sensors
4. Tq1 - Tq2 ~ Shaft Torques
5. Vm - Motor Voltage DC
6. Im - Motor Current DC
7. S1 Speed (rpm) Optical Sensor

Note: Sensor cables will utilize industrial braided shielded single pair 18 ga. stranded wires, with FEP Teflon jacket temp. range to 392 F

Phase Analysis Screen



3	4	6	7	0	0	0	0
mils	GBX IN S1	GBX OUT	GBX IN S2	GBX OUT	NA	NA	NA
Phase	-2.3	-21.1	-28.2	0	0	0	0

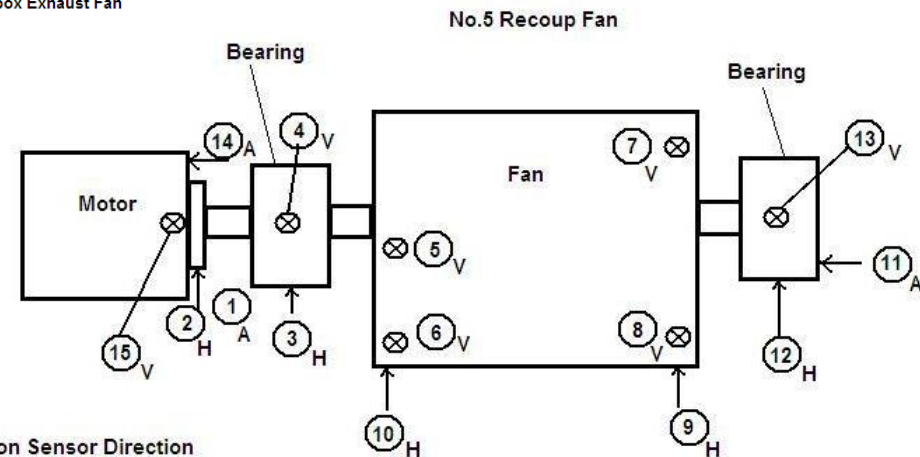
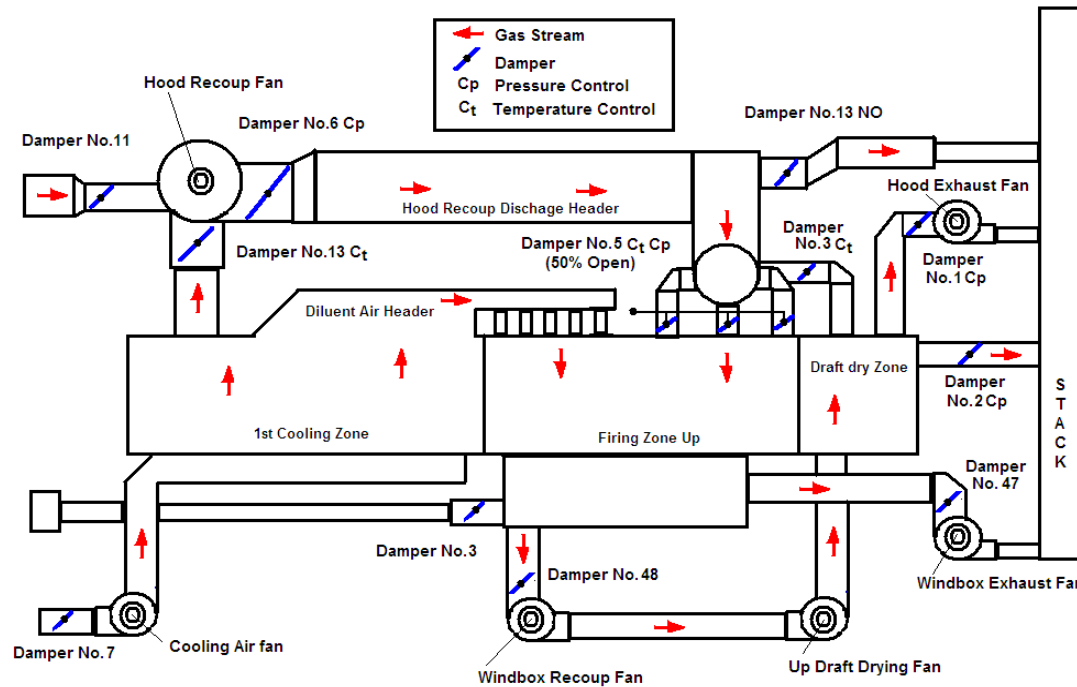
Freq. type Calculated 3.34

Scale: None
 Vale Inco Mine Sudbury, Canada
 No.8 Converter Dynamic
 Modelling / ODS
 Horsburgh & Scott Proposal
 No. _____
 Drawn By: WSS Date: 6/11/08

Phase Analysis Screen of Sentry VSA, note response of system is out of phase after initial excitation, due to different $F(n)$

Performed Condition Assessment of Recoup Fan.

Note: This Diagram is an Approximation of the IOC Indurating machine focusing on the location & control of the gas stream dampers.

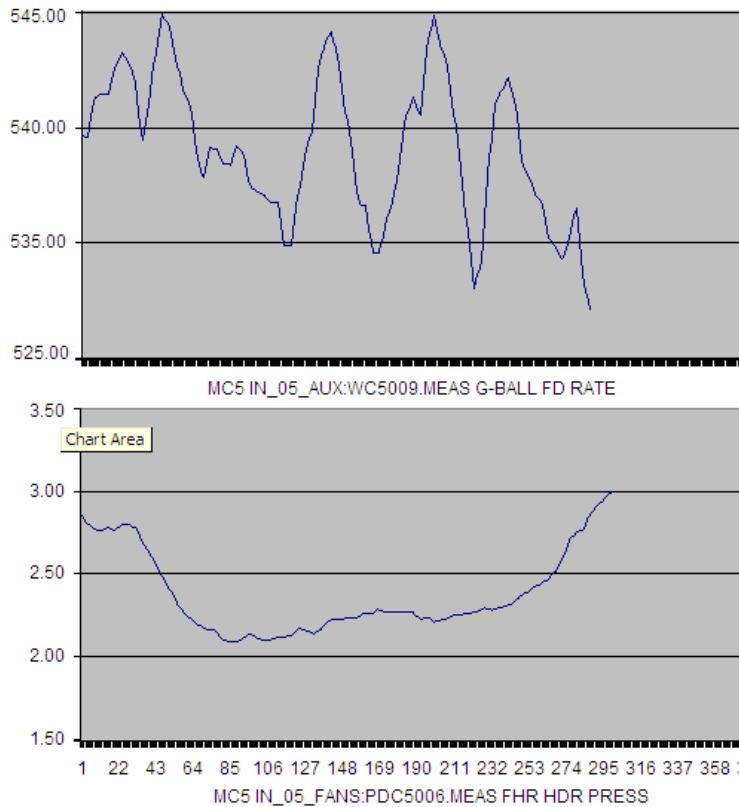


Vibration Sensor Direction

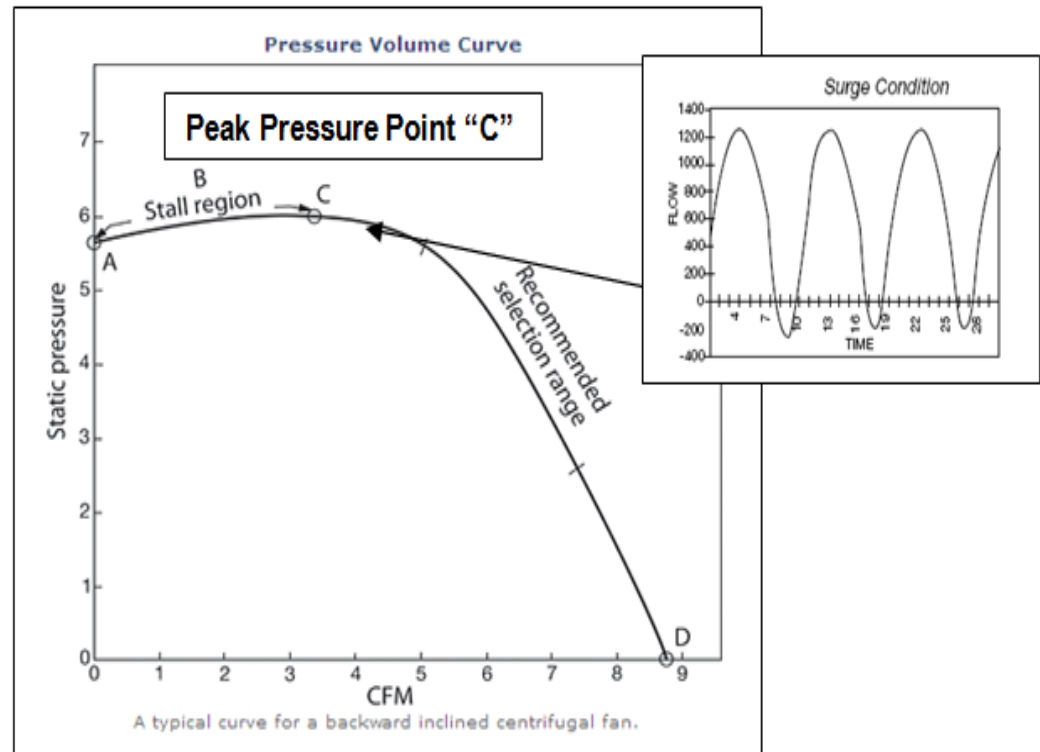
- A Axial
- H Horizontal
- V Vertical

Solution Conclusion. 'Root' Causes of Fan Surge/Stall Event.

Note the Integrated PI data (via OPC link) with Sentry data.



PI Data: Flow Oscillating with rising static pressure. Classic “surge/stall” Event.



Fan Curve for Centrifugal Fans w/ surge graphic

Solution: Adding Structural support to make more 'Stiff' reduced 'V' levels.

Investments, Cost/Benefit analysis

- \$150K investment: Condition Assessment (material and Engineering Services Labor), new/re-mfg. components and labor.
- ROI: Much higher reliability \$150K/Day of increased Uptime (initial \$1 invested = \$1 of Return in the first Day)