# **Reciprocating Compressor Instrumentation and Condition Monitoring**

### **COMPONENTS AND NOMENCLATURE**





oricatina passage -

Crosshead pir

Recip Mulit-Event wheel kit (Part No. 146973-01) Custom Recip Multi-Event band (Part No. 105M5964-xx)

For more information visit bntechsupport.com or call +1 775 215 1818

Our machinery diagnostic engineers help you reach your safety and efficiency goals, increasing uptime, while reducing operatior and maintenance costs.

# **PISTON ROD BREAK**

Crosshead pin bushing

One revolution of rod position waveform in horizontal and vertical direction 700 µm pp 180 360 90 Trend of rod position peak to peak value in horizontal and vertical direction Rod break ~1900 µm pp ──► 1500 1000





# **ROD LOAD MONITORING**

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Combined (inertia and gas) rod loads calculated at the crosshead provide information about the lubrication condition of the crosshead pin. Insufficient reversal or excessive rod load can be identified and corrected before costly running gear damage occurs.

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5 min/div

4/14/2019

7:40:00 PM

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8:00:00 PM

#### Maximum allowable continuous combined rod load (MACCRL)

A value determined by the original equipment manufacturer (OEM) based on design limits of the various components in the compressor frame and the running gear (bearings, crankshaft, connecting rod, crosshead assembly, piston rod, piston assembly).

Maximum allowable continuous gas load (MACGL) A value determined by the OEM based on the design limits of the static components

#### (frame, distance piece, cylinder, and bolting). **Rod reversal**

The shortest distance, measured in degrees of crank revolution, between each change in sign of force in the combined rod-loading curve.

50.000 -50,000 -100,000

## **INSTRUMENTATION LAYOUT**







# LEAK

#### Leak to low pressure side (suction valves or pressure packing leak, if CE chamber)



#### Leak to high pressure side (discharge valves)



#### Inter-chamber leak (usually piston rings)



# **CAPACITY CONTROL STEPLESS UNLOADER**



# Bently Nevada a Baker Hughes business

## **CYLINDER PRESSURE INSTALLATION DETAILS**

#### Cylinder pressure transducer

Design features • Tested to over 2 billion cycles

- Evacuated transducer for absolute pressure reference
- Gold-plated diaphragm fo
- corrosion resistance Separate electronics module
- for high temperature resistance



olation valve (should no induce channel resonance reference GER-4273)

echanical bracing to otect cylinder pressure ransducei

linder pressure transducer (± 0.5% accuracy for 1+ billion cycles)

. . . . . . . . . . . . The single most effective way of determining the overall health of a reciprocating gas compressor is by examining the cylinder chamber pressure profile. Online access to the internal pressure for each compressor chamber enables continuous monitoring of chamber pressures, compression ratios, peak rod loads, and rod reversal. This provides valuable information on the condition of suctionvalves, discharge valves, piston rings, packing glands, and crosshead pin.



Typical pressure versus displaced volume A typical indicated cylinder pressure curve will have some pressure fluctuation when the suction and discharge valves are opened. The areas labelled "A" and indicated by braces show these pressure fluctuations. When the valves are closed, the pressure shows a smooth line.



Channel resonance on pressure versus displaced volume curve

A pressure transducer installation suffering from channel resonance will show pressure fluctuations when the suction and discharge valves are closed as well as whenthe valves are opened. The frequency of this resonanceremains nominally constant throughout the cycle.

#### **CYLINDER ACCELERATION OVERLAID WITH DYNAMIC PRESSURES**



### **CONDITION MONITORING**

Waveform types

Crosshead-mounted accelerometers can detect machinery problems due to mpact-type events such as loose running gear components, liquid ingestion into the cylinder, or excessive clearance in the wrist pin bushing.





Crosshead acceleration—band waterfall with 36 software bands

