Induction Motor Vibration Experience

- Lou Trahan
- DuPont at Sabine River Works, TX - Ethylene Unit
- Share our experience with rework of 5600 H.p. /1800 RPM motor during major TA
Background

• Purge Propylene Refrigeration Compressor, Elliott 38M-6 driven by a Westinghouse 5600 Hp/ 1800 RPM induction motor with speed increaser to 3600 RPM
$Before the Turn Around$
Background Review

• *No indications* of problems with this motor/system

• Opportune time - Turn Around (Spring 2003) Preventative Maintenance
Vibration Signature Before T/A

POINT: Motor NR 391 West /45° Right Direct

From 13FEB2003 10:54:34 To 24APR2003 08:55:46 Delta Time
Cursor: 13FEB2003 13:20:00 Max 0.745 mil pp, Min 0.686 mil pp, Avg 0.712 mil pp
Shop Work - Specifications

• Remove the rotor
• Clean the components
• Inspect the rotor and stator
• Inspect seals and bearings
• Reassemble
• Shop test
• Ship
Problem Statement

- Re-installed motor at end of the TA

- Vibration is now unacceptable
  - The frequency was from 1X to 7X
  - Over 2.5 mils peak to peak (prior to rework - 0.65)
Vibration After the Overhaul

POINT: Motor NR 391 West \(45^\circ\) Right Direct

From 15APR2003 02:51:00 To 14JUN2003 21:38:56 Delta Time
Cursor: 15APR2003 05:00:00 Max 0.745 mil pp, Min 0.667 mil pp, Avg 0.712 mil pp
Vibration vs. Ambient Temp

POINT: Motor NR 391 West /45° Right
POINT: Ambient Pressure

0.343 mil pp
87.0 deg F
29MAY2003
18:00:00

From 23MAY2003 02:07:01 To 13JUN2003 07:21:59 Delta Time
18:00:00

TIME: 1 Day /div

AMPLITUDE: 5% Scale /div
Troubleshooting

- Vendor/consultants performed field inspection of the installation
- Continued for a month until…
  - Unit S/D due to power outage
  - Pulled motor
  - Ran various shop tests for 1 week no conclusion
Shop Rework

- Couldn’t repeat the field results
- Pulled rotor out again
- Found hot spot with thermography in rotor, tightened loosened bar (not done in original rework)
- Balance checked on rotor - OK
- Stator core test - OK
- Performed bore sweep – OK
- Bearings - OK
Shop rework (cont.)

- Plastigaged the crush on the bearings, both were loose 0.001”-0.003”
- Installed the seals with zero clearance, vendor recommends they will “RUN-IN”
- Continued monitoring vibration with motor vendor equipment and third party consultants
Vibration vs. Temp After Rebore Seals

POINT: Motor NR 391 West 45° Right
POINT: Ambient Temp

From 01JUL2003 21:20:00 To 09OCT2003 13:40:00 Delta Time 01:00:00

AMPLITUDE: 5% Scale/div

TIME: 2 Days/div


DIRECT
0.258 mil pp
79.0 deg F
09SEP2003
01:00:00
Conclusion

• Good sound rotating equipment practices are critical to performance

• Detailed specifications are necessary

• Simple issues like these seals are critical

• Housing would shrink enough during ambient cooling to cause seal interference to worsen