

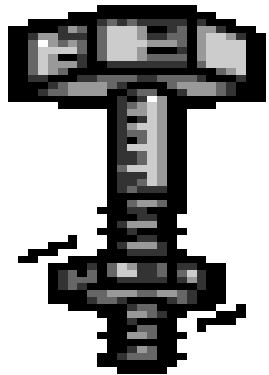
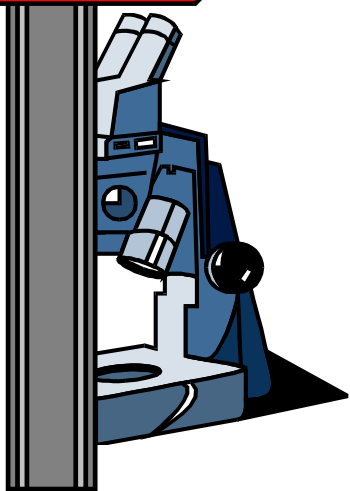
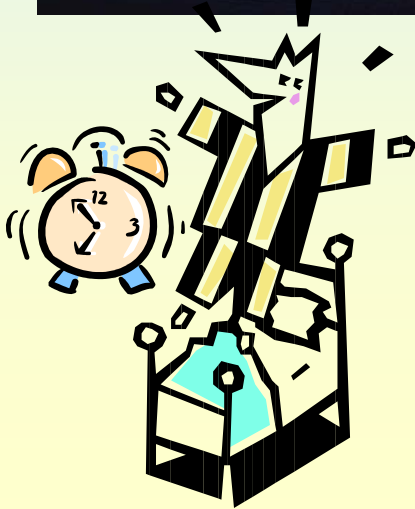
Induction Motor Vibration Experience

- ◆ 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

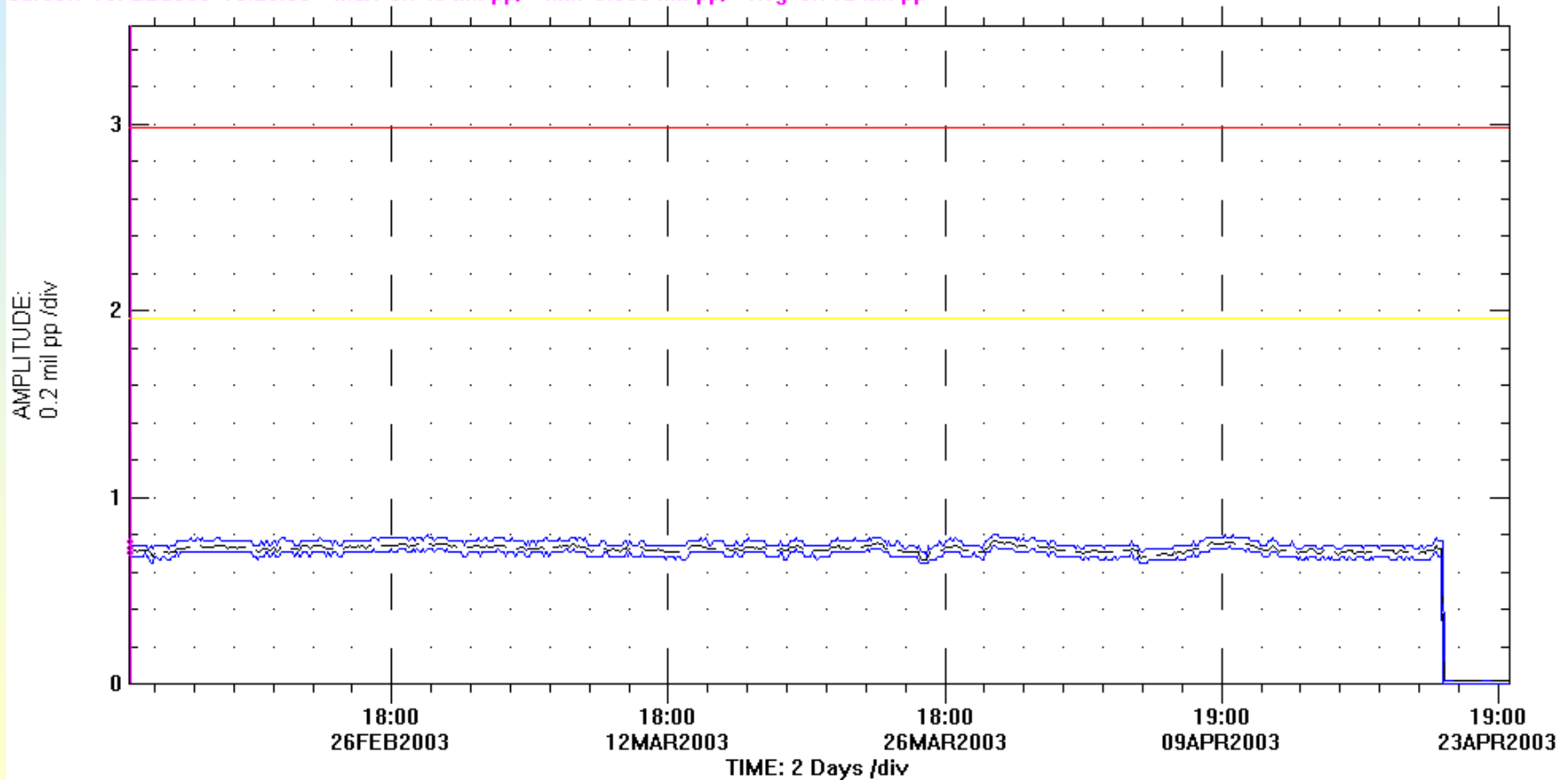
- *No indications* of problems with this motor/system
- Opportune time - Turn Around (Spring 2003) Preventative Maintenance

Vibration Signature Before T/A

POINT: Motor NR 391 West $\angle 45^\circ$ 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

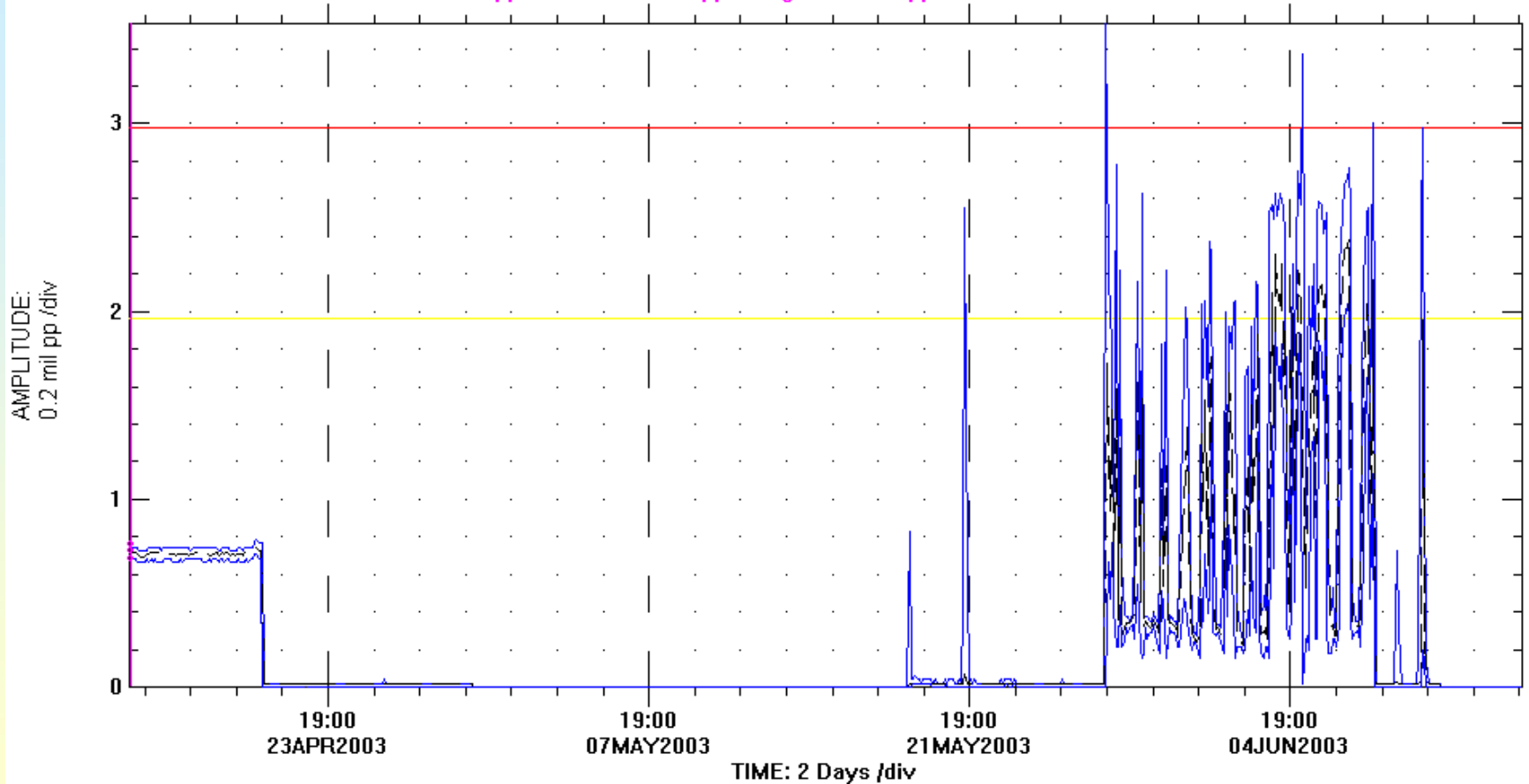
- Re-installed motor at end of the TA
- Vibration is now unacceptable
 - ◆ The frequency was from 1X to 7X
 - ◆ Over 2.5 mils peak to peak (prior to rework - 0.65)

Vibration After the Overhaul

POINT: Motor NR 391 West $\angle 45^\circ$ Right Direct

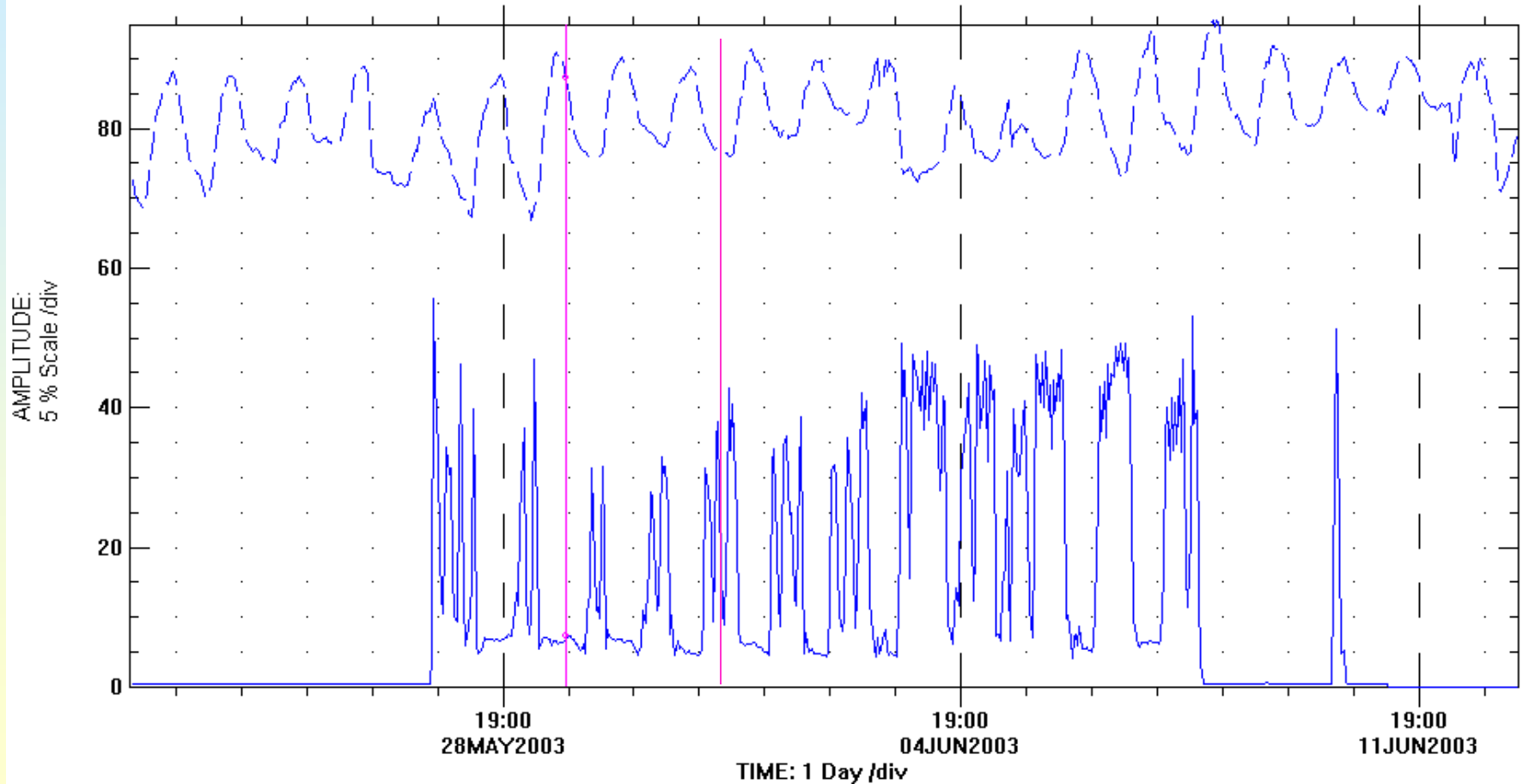
From 15APR2003 02:51:00 To 14JUN2003 21:38:56 Delta Time

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 — DIRECT 0.343 mil pp
POINT: Ambient Pressure — DIRECT 87.0 deg F
From 23MAY2003 02:07:01 To 13JUN2003 07:21:59 Delta Time 18:00:00



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

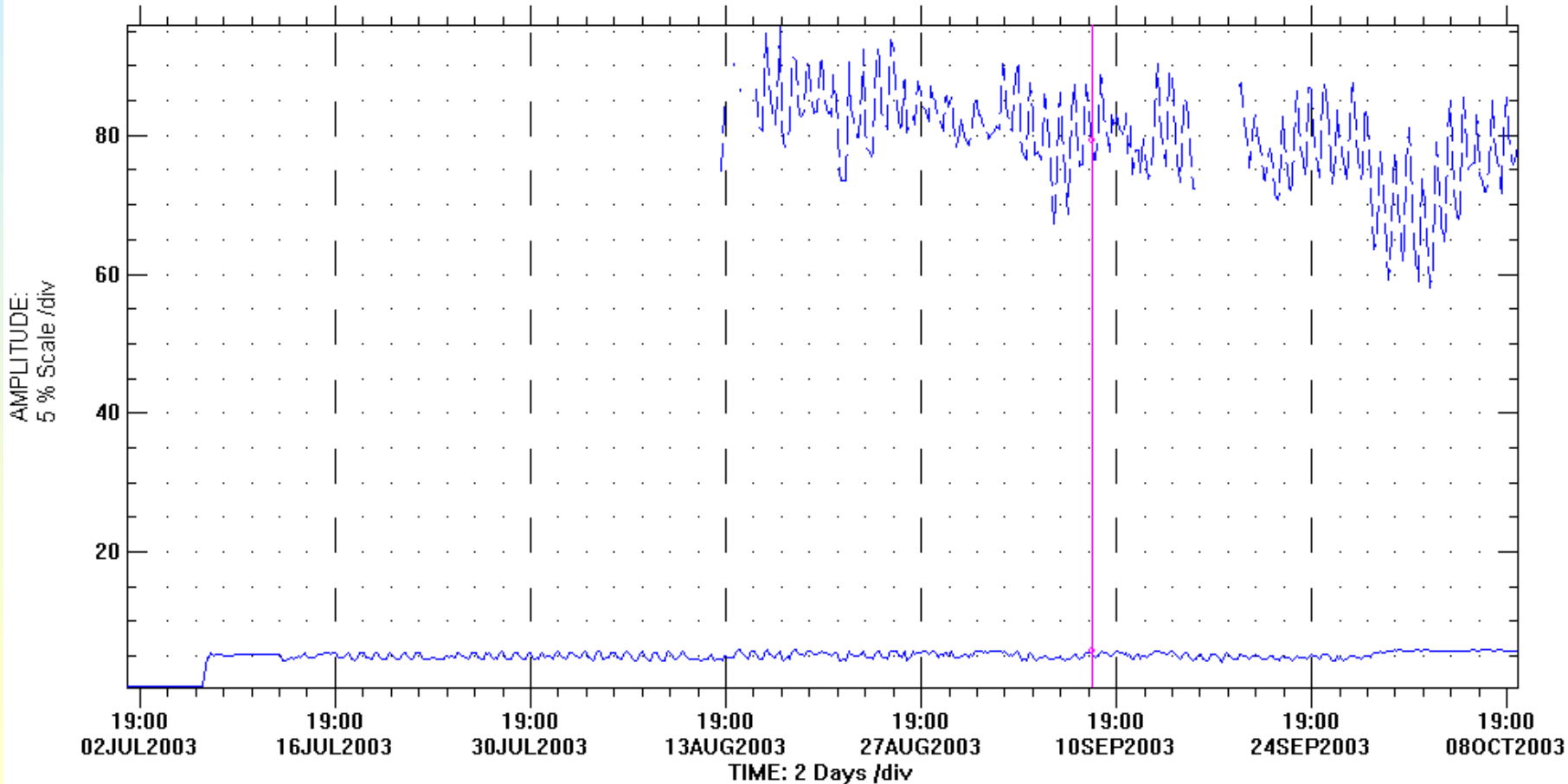
Shop rework (cont.)

- 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 $\angle 45^\circ$ Right — DIRECT 0.258 mil pp
POINT: Ambient Temp — DIRECT 79.0 deg F
09SEP2003
01:00:00

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



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

