

NGL-Recovery Expander-Compressor Commissioning (Case Study)

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QATAR
SUPPLYING  MILLION TONNES
OF LIQUEFIED NATURAL GAS PER ANNUM



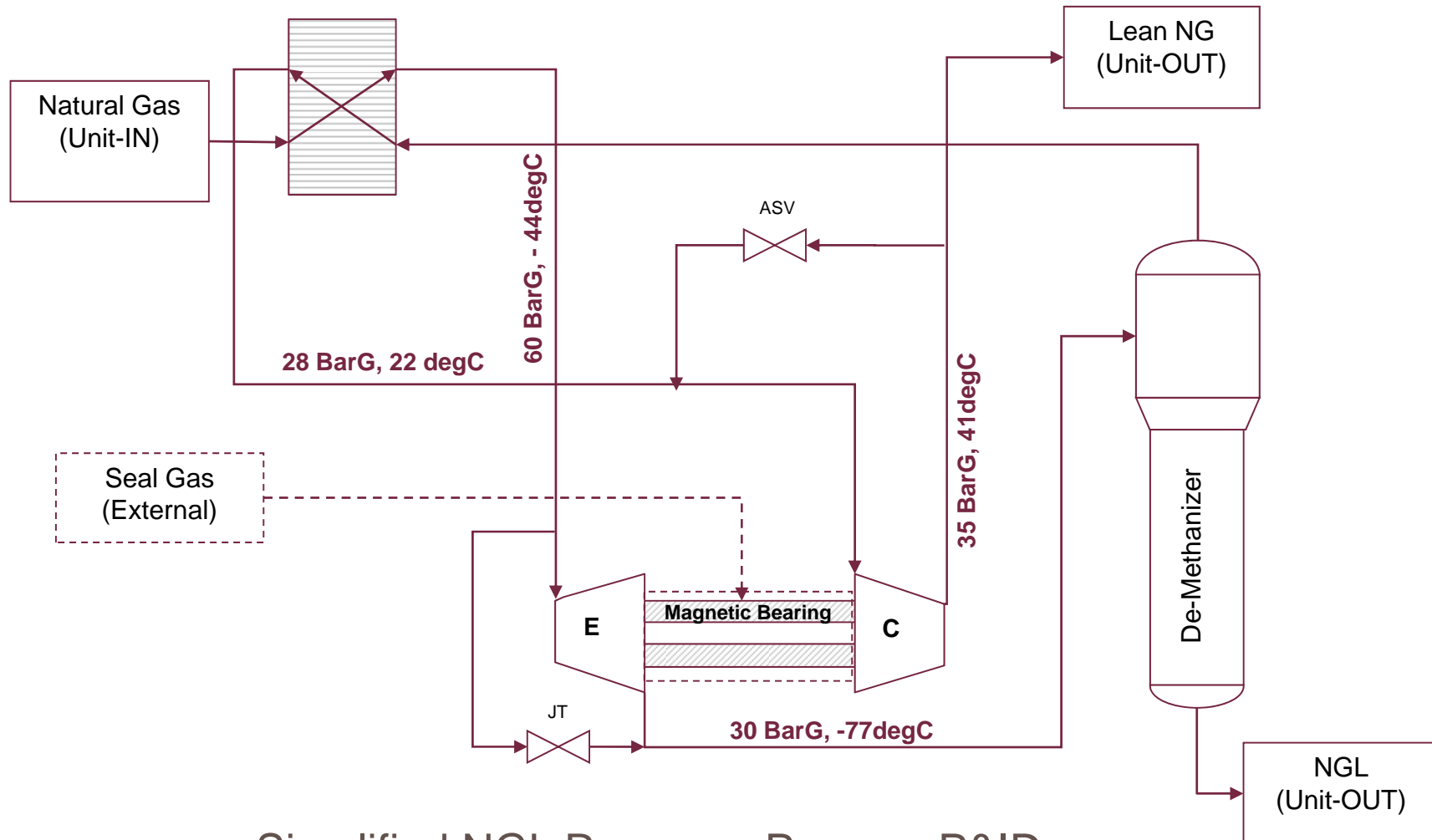
Outline

- Commissioning Background
- Description of the NGL Process.
- Description of the NGL expanders-compressors.
- Initial startup issues, troubleshooting and solutions:
 - 0% IGV speed overshoot.
 - Decrease of the Bearing housing temperature.
- Recommendations.

Commissioning Background

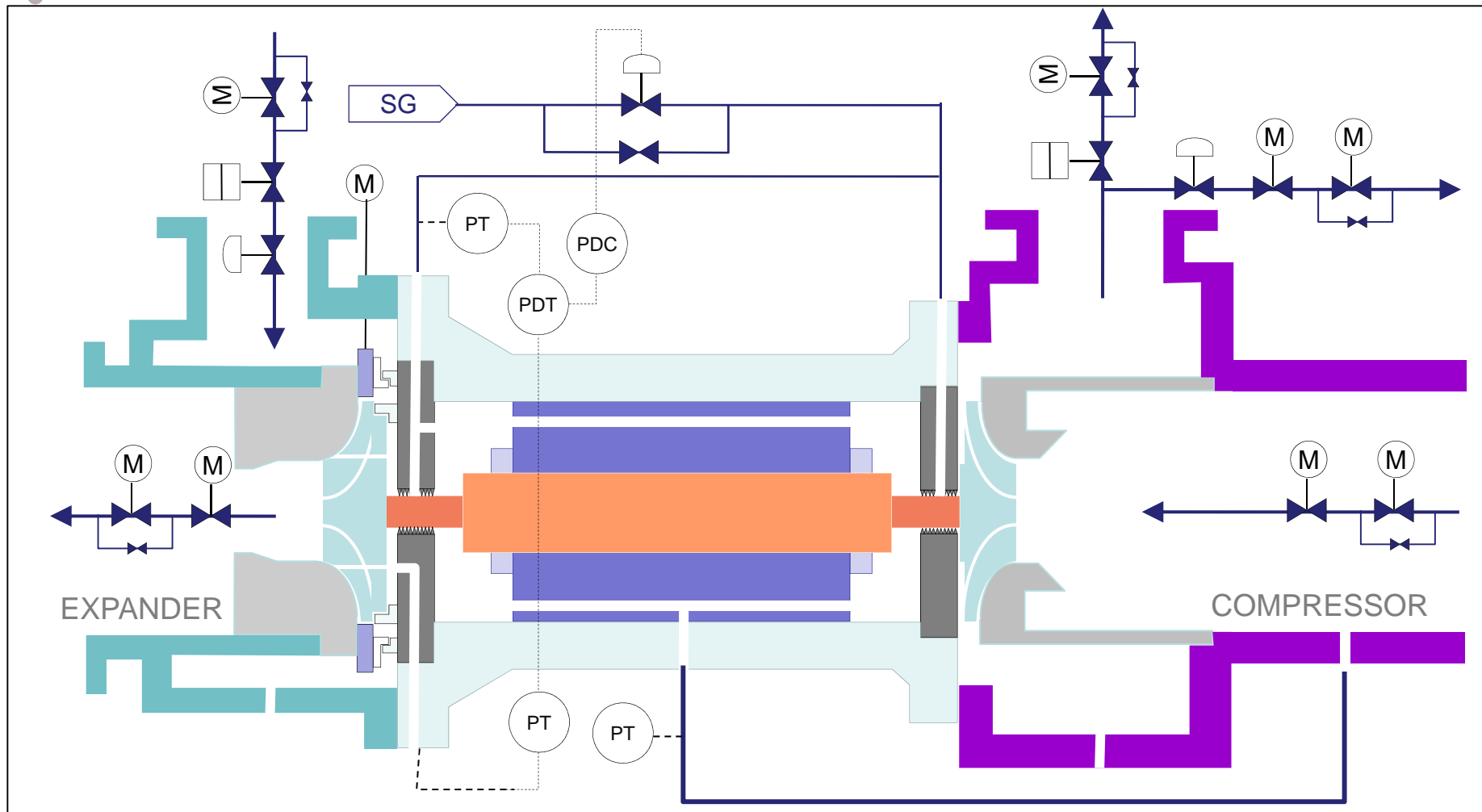
- Late 2008, 1st LNG Mega-Train (7.8 MT/Y) commissioning and start-up started at **Qatargas** Train-4 facilities.
- The majority of the Machinery commissioning was divided into three phases :
 - Driver solo run (Uncoupled run), except for expanders-compressors.
 - Coupled commissioning run (Air run and safe-fluid run), except for expanders-compressors.
 - Normal run (Startup for duty).
- January 2009, 1st NGL expander-compressor was started.

NGL Unit Process Description



Simplified NGL Recovery Process P&ID

NGL Expander-Compressor Description

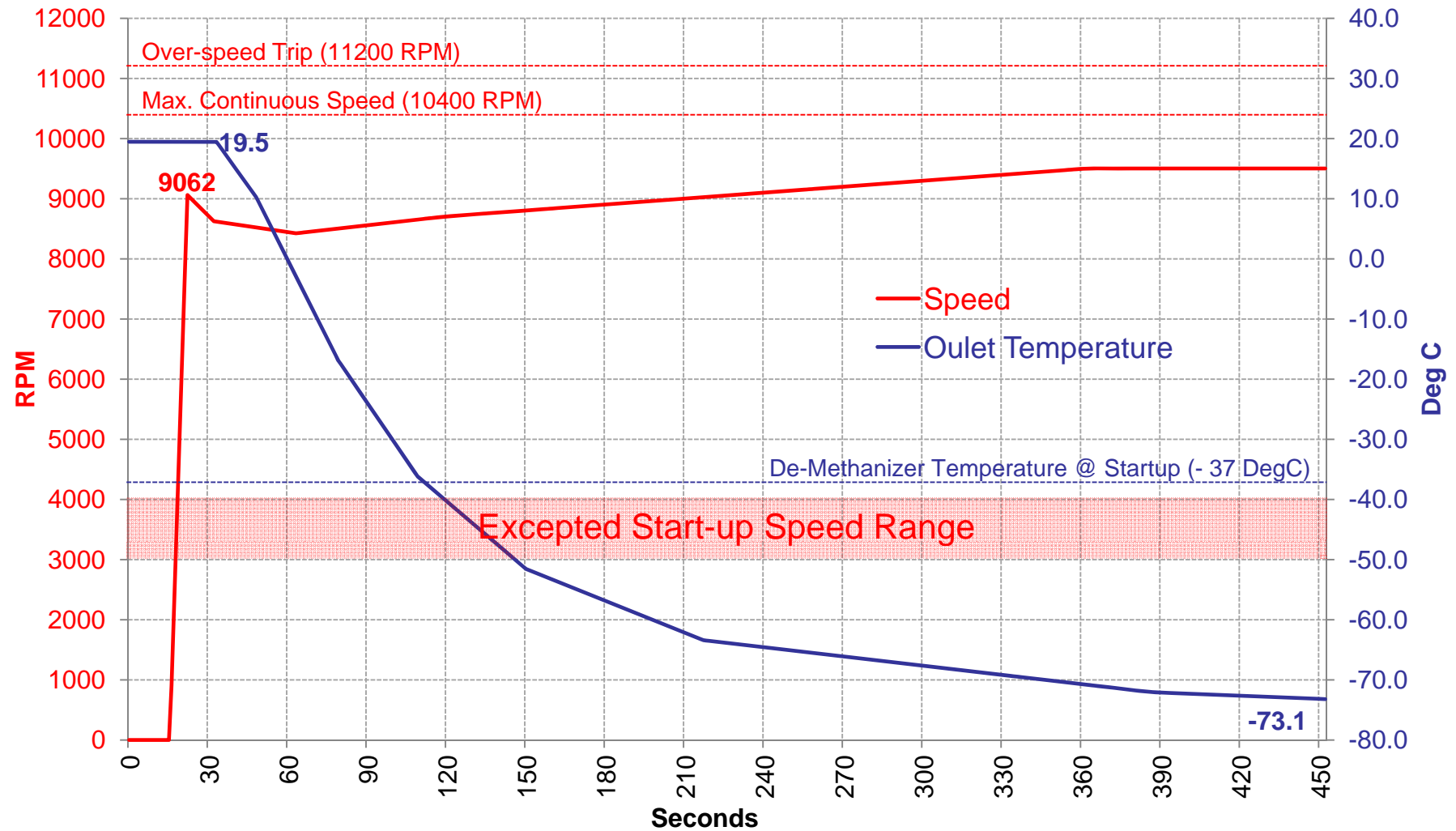


Simplified Expander-Compressor Cross Sectional Drawing

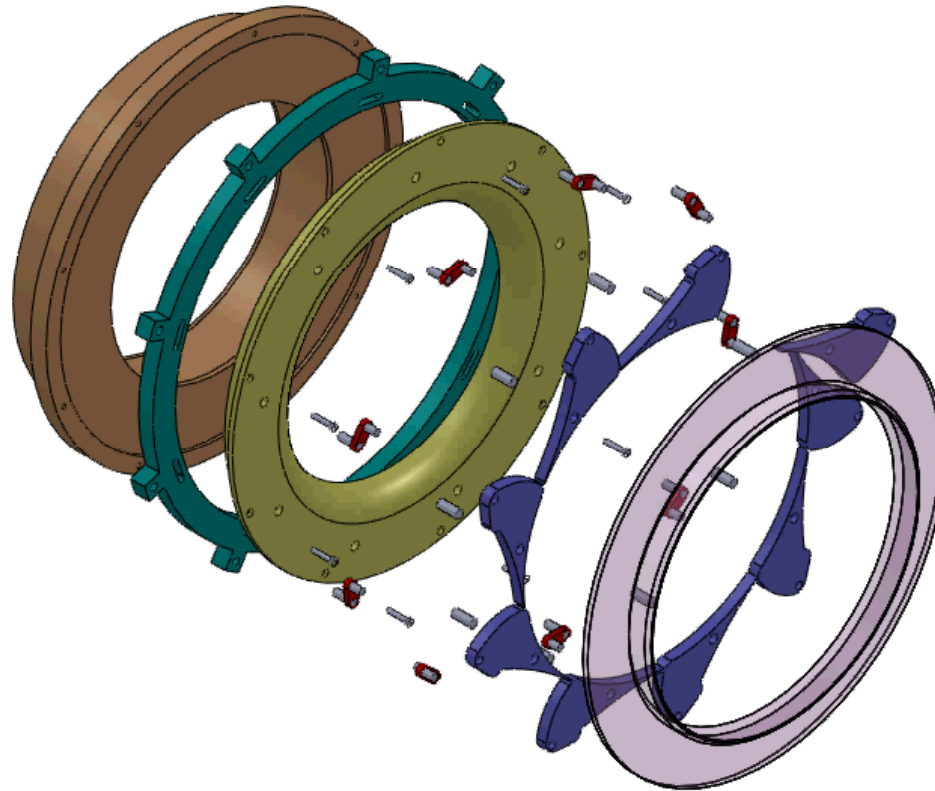
Pre-startup Checks

- NGL Expanders-Compressors were delivered with a dummy **Mechanical Center Section (MCS)**, the duty MCS was packaged inside a preservation container under N2.
- The following adjustments and clearances were set during the duty MCS installation:
 - Expander and Compressor wheels clearances.
 - **Inlet Guide Vanes Close** clearance (0% IGV) and **Open** clearance (100% IGV).
 - Actuator stoppers (Close/Open) and stroke adjustment.
- Controls tuning and final assembly checks.
- All the adjustments and clearances were recorded.

0% IGV Speed Overshoot

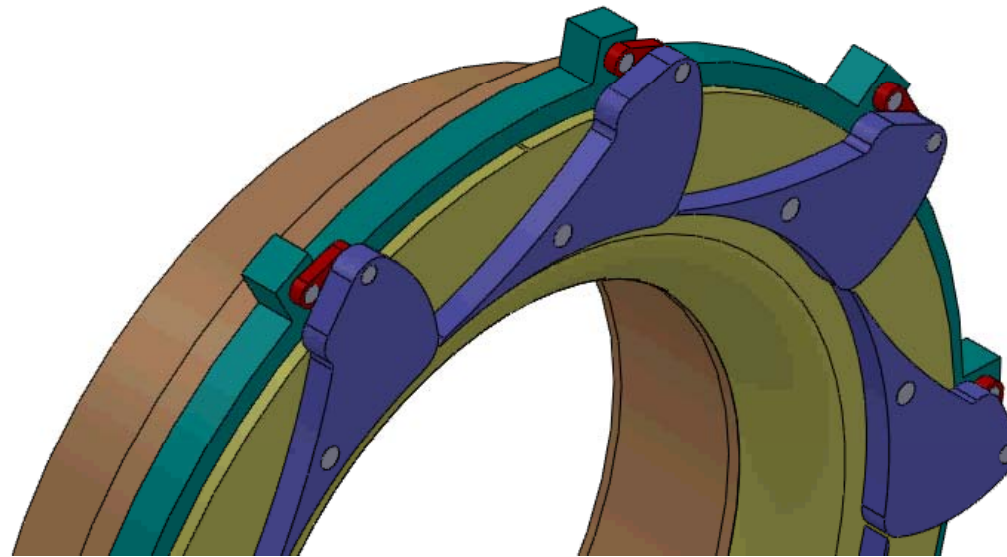


IGV Mechanism



IGV Mechanism (Illustration Video Only)

IGV Mechanism



Fixed Pivot Holder Shifting (Illustration Video Only)

0% IGV Speed Overshoot

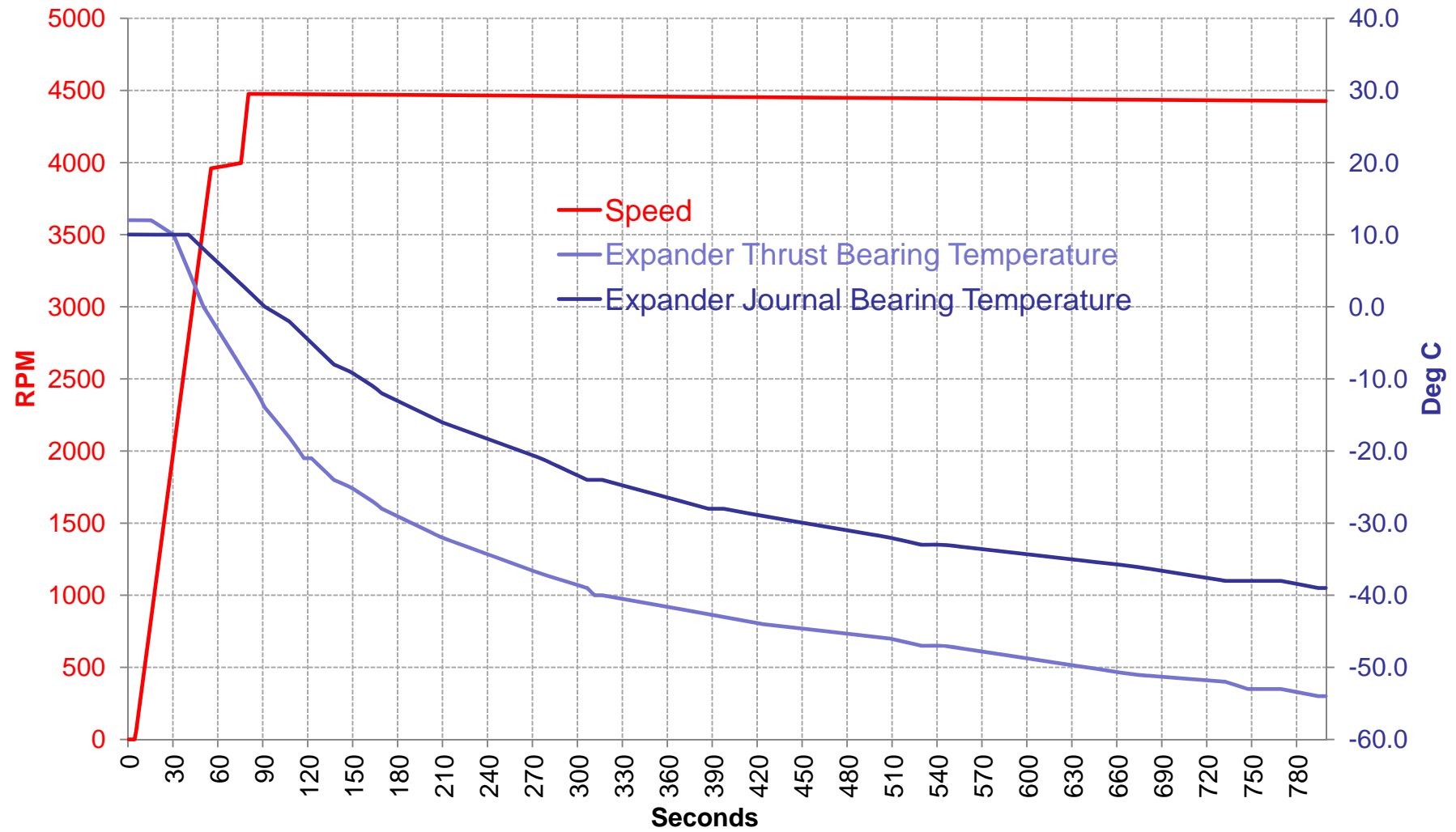
Solution:

- Addition of two dowel pins between the holder and the support preventing rotational movements.

Facts:

- Expander speed reached 87% of the total speed range at 0% IGV.
- Outlet temperature dropped from 19 to -73 deg C within 7 mn.
- There is no contractual limitation in either the speed or the outlet conditions when starting the machines with the IGV at 0%.
- API-617 Chapter 4 “Expanders Compressors” do not limit speed or the outlet conditions with the IGV at 0%.

Bearing Temperature Decrease



Bearing Temperature Decrease

Solution:

- Operating procedure and an Extra Delta Pressure transmitter were added to monitor the Delta pressure across the bearing housing during pressurization.

Facts:

- Operations Procedures developed during the construction phase (machine already manufactured) extracted from the Vendor instructions.
- Vendor instructions limited to the package boundaries .
- HAZOP performed for the NGL unit, not specific to expanders.

Recommendations

- Consider maximum speed or expander process outlet limitations at 0% IGV during the engineering phase.
- Operations involvement during the early stage of the machine engineering.
- Specific Operational review and start-up HAZOP for systems involving expanders.



Thank you ...