PROGNOST® for LNG applications
Machine Protection and Online Condition Monitoring
Content

LNG applications .........................................................................................................................................................4
LNG Carrier fuel gas compressors ..............................................................................................................................5
Monitoring Rotating Equipment ...............................................................................................................................6
BOG compressors ...........................................................................................................................................................6
Booster compressors ..........................................................................................................................................................6
Pumps ................................................................................................................................................................................7
References .........................................................................................................................................................................7
SIL 3 certified Machine Protection ...............................................................................................................................8
Online Condition Monitoring ..........................................................................................................................................9
PROGNOST Systems Customer Support ......................................................................................................................10
PROGNOST Systems has earned the distinction of being the recognized leader in the field of Asset Performance Management for critical rotating machines. The company and the product are focused to meet the specialized requirements of reciprocating machines and their users since 25 years and monitors centrifugal machinery since more than 10 years.

Offering SIL 3 certified machinery protection along with fully automated machinery diagnostics PROGNOST®-NT is the benchmark against which all other monitoring systems are compared. Following a steady increase in awards of system projects, we expertly gather and analyze machine information from approx. 6 million machine operating hours per year.

**LNG applications**

Specific analyses cover monitoring requirements for different type of rotating equipment for all essential LNG services such as:

- BOG re-compression (BOG = Boil Off Gas)
- N2 compression
- Gas liquification
- LNG pumping
- Gas boosting
- LNGC (BOG) fuel gas compression
Burckhardt Compression Laby-GI Fuel gas compressor solutions that are used on board of LNG Carriers are operating up to 24,000 hours in between the docking cycles of the vessel.

A high quality standard robust compressor design as the Burckhardt Compression Laby-GI fuel gas compression solution can fulfill this demanding requirement on reliability and availability. The PROGNOST® condition monitoring system helps to understand the conditions of the installed critical compressor components.

The PROGNOST® condition monitoring system supports the LNG Carrier crew to identify malfunctions of components and enables them to trigger planned preventive maintenance tasks in order to achieve 100% compressor availability.

Consequently there is no need for redundant fuel gas compressor solutions.
Monitoring Rotating Equipment

**Boil off gas compression (BOG)**
(Vertical and horizontal compressors)

**LNG storage**
(Centrifugal in-tank pumps)

**Vapourization**
(Centrifugal seawater pumps)

**Sending**
(Horizontal compressors)

**BOG compressors**

For BOG applications vertical compressors such as Labyrinth type compressors are widely used in the LNG process and allow oil-free and contact-free compression. These machines are designed to handle the compression of boil-off gas (BOG) at suction temperatures down to minus 170 °C (minus 250 °F). While the labyrinth type compressor is a proven solution for BOG compressor applications the use of an effective condition monitoring system has shown immediate payback during start up and operations due to challenging operational frame conditions.

**Typical sensor installation**

- Indicated pressure for automated p-V diagram
- Cylinder vibration
- Crosshead slide vibration

**Send out compressors (Booster)**

For LNG import terminals booster compressors are required to compress gasified natural gas up to local pipeline pressure. For these applications horizontal reciprocating compressors are specified.

**Typical sensor installation**

- Crosshead slide vibration
- Rod position
- Cylinder vibration
- Indicated pressure for automated p-V diagram
Pumps

- High Pressure pump
- In Tank pump
- Vaporizer Seawater pump

Sensor types and uses

Accelerometer
Most commonly used sensor to detect rolling element bearing defects, gear defects, electrical anomalies, belt defects etc.. The signal has a high frequency range, easily integrated into Velocity.

Proximity / Eddy Current Probe
The first choice to detect impending failures on sleeve bearings. It is desired to have x and y for radial shaft monitoring at minimum, this allows Orbit analysis and identifies alignment issues as well. The z-axis measurement monitors the proper condition of the thrust bearing.

Analyses

Vibration
- RMS, Peak value vibration, FFT, Peak-to-Peak

Position / Displacement
- Average value, Peak value, Peak-to-Peak per revolution or time, Peak-to-Peak by time

Orbit
- Maximum Amplitude Orbit, Angle of Maximum Amplitude Orbit, Orbit Peak-to-peak, Centerline

References
PROGNOST®-SILver

PROGNOST®-SILver is a certified SIL 3 hardware that provides operators with machine protection analyses that are recognized and proven worldwide. It processes sensor data from up to 32 machines, with a maximum of 68 sensors in one PROGNOST®-SILver rack. With its innovative design, users can install IEC 61508:2010 certified data acquisition and protection hardware directly in the field.

The benefits are obvious: proven and effective protection analyses and shutdown parameters with SIL certification as well as the lowest possible wiring costs through the use of certified bus technology and local installations.
Diagnostic capabilities
Detecting an anomaly is one thing. Defining and pinpointing it is another. PROGNOST®-NT does not solely indicate problems but also provides an accurate diagnosis with specific component identification, location and indication of the extent of damage. Equipped with this information, you can make well-founded decisions about the maintenance procedures you need to take and the time you need to take them.

Signal Plausibility Check
PROGNOST® uses specialized signal processing to avoid false alarms caused by electrical or hardware failures such as broken or loose wires, short circuits or broken terminals.

Ring buffer
Transient data recording allows maintenance technicians to replay a safety shutdown, alert, or machine start-up by examining a gapless recording of all signals in an uncompressed format – revolution by revolution. The ring buffer offers the possibility of subsequent analyses; the time frame of seven minutes before and three minutes after the ALERT, SHUTDOWN or UNSAFE alarm can be closely evaluated using all recorded time signals from all dynamic sensors and process values in the PROGNOST®-NT system.
Remote Access and Customer Support

The Customer Support provides 24 hr. / 7 day hotline support for its users through remote access to more than 90% of all systems installed. Our customer service support provides expert solutions and answers to diagnostic questions, periodical machinery health reports and recip diagnostic trainings.

With remote system access PROGNOST Systems stays in a close contact with its users taking care that their experience is continuously integrated into new developments.