Avoiding Shutdown of LNG Processing Facilities

Inlet Filtration Is the Key in Plants Using Turbines

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Avoiding Shutdown of LNG Processing Facilities

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Introduction

Gas turbines are widely used as mechanical drives when compressing refrigerants, which are used to help turn methane gas into liquefied natural gas (LNG).

The easy transport of LNG via specialized tankers without the need for vast, cross continental pipeline infrastructure has helped spur demand for LNG. If a gas turbine used in the liquefaction process has unscheduled downtime, this can cost the owner of a large LNG plant several million dollars per day in lost production. A single unscheduled turbine shutdown may result in the whole LNG train being taken offline with lengthy shutdown and start-up procedures leading to huge losses. In addition, this may also mean that all gas being processed needs to be flared instead of liquefied, with the extra associated cost and environmental impact. Fundamentally, the gas turbines used to help produce LNG need to provide extended, reliable operation with maximum uptime and maximum predictability of output. For this to happen, a carefully designed inlet filtration system is required.

Fig. 1. Photos of 8000hr borescope inspection on an aeroderivative GT used for LNG processing - no water washing (Parker designed air intake).

LNG Filtration Systems

Designed for Real World Conditions

Land-based refrigerant compressor stations for the liquefaction of methane are always located near coastlines to facilitate onward tanker transport of the LNG. This means gas turbines will be exposed to dust, moisture, salt and many other airborne contaminants, all of which will put gas turbine operations in jeopardy if not addressed. With the colossal volumes of air passing through a gas turbine air inlet, having the correct inlet filtration system in place is vital for ensuring ongoing reliable operations.

To handle these various, seasonally diverse contaminants, protect the turbines and avoid shutdown on the basis of either pressure loss (DP) increase or degradation in output, LNG filtration systems typically have multiple stages. Ensuring the right stages of filters are selected has a huge impact on the overall process availability, reliability and profitability. A filtration system that is correctly designed and engineered to meet the real-world conditions of the gas turbine installation can mean shutdowns are limited to scheduled maintenance periods only.

Choosing the wrong system, however, can have major financial repercussions. For LNG applications, the turbine needs to be protected from the corrosion, erosion and fouling which would be caused by salt and particulate getting downstream, with a primary focus on keeping the turbine operating reliably and predictably over long periods of time.

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Increasing Demand for LNG

Means Reliability is Crucial

Global LNG supply and demand is currently around 300 million tons per annum (MTPA). However, demand continues to increase and is predicted to outstrip supply within the next five to 10 years.

In-demand LNG translates as market prices hitting sweet spots, at which point suppliers can capitalize on the very best deals when selling. When these peaks occur, an unexpected turbine shutdown could be costlier than ever.

Fig. 2. An example of LNG refrigerant compressor GT air intake filter houses.

Keeping Problems out of the Gas Turbine

As onshore LNG installations are in close vicinity to seawater, the presence of a combination of sand, dust, salt and moisture all need to be factored into the turbine inlet house design. Where there are significant volumes of dust and sand, self-cleaning filters are often utilized. These use pulses of compressed air to periodically remove layers of dust from filters and reduce differential pressure across the system.

If there are also high levels of moisture in the air, coalescers can be added up-front to remove this prior to it reaching the filters. If there are also high levels of dust, in a desert region for example, care also needs to be taken that the coalescers do not get blocked, which may cause pressure spikes or force the coalescer out of place, rendering its protection useless.

To handle high levels of moisture and dust, modern coalescers such as the TS1000 from Parker, use a mesh which permits dust and sand to pass through while coalescing the water droplets from the air. By allowing the dust to pass through, the coalescer does not block. The relatively dry dust passes through the coalescer and can be much more effectively handled by the filters.

Fig. 3. Photo of sandstorm taken at an LNG facility in Western Australia. If there are high levels of dust, like those often found in desert regions, care also needs to be taken that the coalescers do not get blocked, which may cause pressure spikes or force the coalescer out of place, rendering its protection useless.

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Offshore LNG Processing

Removes the Need for Lengthy, Subsea Pipelines

The use of Floating LNG (FLNG) vessels is also increasing. These have LNG processing facilities onboard, enabling LNG to be produced close to offshore gas fields. This has obvious benefits in terms of not requiring subsea piping systems, which can be hundreds of kilometers long, to transfer the methane to onshore processing plants. As opposed to the compressors used in onshore LNG trains, FLNG vessels (where space is extremely limited). require compact, high velocity GT air intake systems.

The offshore environment is brutal for any piece of equipment, let alone one that needs to continuously run in the face of harsh storms, sea spray, mist, fog and almost any other type of water challenge. PARKER Gas Turbine Filtration knows how to handle your marine challenges. It's where our history began. For nearly 50 years, we've designed high velocity compact filter systems for offshore oil and gas platforms, Navy ships, cruise liners and more, with ongoing technological developments to ensure water issues become secondary concerns.

Fig. 4. Offshore Air Intake Systems.

Inlet Filtration Recommendations

For an LNG Process Turbine

The inlet filtration system for an LNG process turbine can have three, four or even five unique stages, providing an ability to change filters online without the need to shut down the turbine.

The first few (prefilter) stages are designed to remove larger particles and extend the life of the later (high efficiency) stages. As prefilters can typically be changed out without taking the turbine offline, designs that facilitate quick change out need to be incorporated.

The final filtration stage should use high efficiency hydrophobic media, typically rated F9 (EN779) to E12 (EN1822) to achieve optimum results. Options to use an extended 24-in. deep final filter (compared with traditional 12-in. to 17-in. vCell filter depths), provides for extended filter service life if required.

Another area for consideration in correct filter selection is the type of high efficiency media used. Levels of moisture are obviously going to be high in offshore and coastal environments, and small moisture droplets can quickly block thin ePTFE membranes. Sudden blockages equate to sudden and unpredictable pressure spikes (the 'hockey stick' effect), which can result in complete turbine (and therefore plant) shutdown.

Micro fiber glass media, however, offers the same efficiency but is around 10 times thicker, making it more resistant to blockage and more predictable in its performance, with slow, gradual, pressure increases as contaminant is captured.

To avoid unplanned maintenance activities, filters should be designed for long life. Prefilters should require changing no more than around once per year. Second stage filters once every two years, and third or fourth stage filters around just once every three to four years. If a filtration system requires more regular maintenance, a review of its design and the choice of filter grades used is recommended.

Conclusion

It is widely accepted that an inlet filtration system is a crucial part of keeping turbines operating reliably. The design of this system, however, requires an understanding of real-world installation conditions and the effect they can have. Systems need to use optimum media types and filter efficiencies for the prevailing conditions, offer robust mechanical performance, help operators maximize production efficiency, minimize maintenance overheads and, for offshore installations, be compact. One filter type does not suit all applications or all operational goals.

For LNG processing, keeping the turbine running for extended periods is of huge importance. This means unplanned shutdowns for blocked filters must be avoided.

Filter system designers are continually developing and improving technology to enhance performance in challenging offshore and onshore installations.

It is always worth a conversation with filter experts to ensure the best, most advanced technology is being utilized. When considering the result of an unexpected shutdown, investment in the right filtration solution offers operators lightening quick return on investment.

For more information on Parker's gas turbine inlet filtration systems, please visit our website **www.parker.com/gtf** or call **(800) 821-2222**.

About Parker Gas Turbine Filtration

With more than 50 years of experience delivering innovative solutions for gas turbine inlet filtration and monitoring fleet-wide performance data, our industry and applications experts will select the appropriate filter for your site designed to meet your specific operating goals.

Parker Gas Turbine Filtration supplies a full range of inlet systems and filters engineered to meet your operating goals, including:

- Higher power output
- Lower operating costs
- Proven performance utilizing advanced filter technology
- Extended gas turbine availability
- Maximum protection against corrosion and fouling
- Easy maintenance and change out

Through our brands, altair® and clearcurrent®, we are the choice for advanced filtration for new units and replacement filters. Our inlet system designs include self-cleaning (pulse) and static inlet systems for all gas turbine OEMs. We supply a full range of filter types at all efficiency levels. The predictable and reliable performance of our air filters significantly reduces compressor contamination and the need for unplanned maintenance.

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