Case Study

Golden Pass LNG, Sabin, Texas (USA)

Howden
A Chart Industries Company

> Golden Pass owned by Qatar Petroleum and ExxonMobil will have capacity to produce 16 million metric tonnes of LNG annually after completion.

Both McDermott (US) and Chiyoda (Japan) acted together as Engineering, Procurement and Construction (EPC) contractor, where Chiyoda has the larger technology base.

Environmental interests are important in the area; there is a strong pressure from the end user to keep noise from the site within stringent limits.

Introduction

In Spring 2019, Golden Pass LNG selected Chiyoda as EPC. DTS was awarded the contract for delivery of the coolers and set up early noise tests in Gunsan, Korea using Howden Cooling Fans.

Howden Netherlands Centre of Excellence and Howden Hua cooling fan specialists visited the test site, alongside Howden Korea colleagues to support the DTS engineers and Chiyoda's technical managers.

Challenge

The EPC, Chiyoda faced high environmental requirements, laid down for the plant. Leading to commercial pressure on the EPC, in order not to exceed the required noise levels.

The EPC will take no risk on this and demand proofing tests from the cooler builder, DTS to have the noise within limits. With over 600 pieces of air cooler heat exchangers, the DTS sees himself for a challenge. The engineers lay down the noise requirements for the coolers, knowing that the fan will be the dominant factor for the noise production. The deducted fan noise requirements lie between 77 and 80 dB(A) sound power level per fan.

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Solution

The SX series of Howden cooling fans have a profile, designed for low noise. Howden provided a test fan and technical support for DTS's trials in Gunsan.

The airflow capacity of the selected SX cooling fan performed better than data sheet predictions resulting is reduced engine speed and even less noise.

With all of these features in the SX series, the noise requirements were met. Imposing less on the environment of the LNG plant.

Turbulence

Essentially noise is induced by turbulence, so avoiding this is crucial.

Lowering the operating speed of the cooling fan will reduce the airspeed around the fan blades and is thereforea most dominant factor to reduce turbulence, hence noise.

Wide blades and an almost closed fan ring (high solidity) ensure maximum air goes through the fan ring at one rotation **(See figure 1),** indeed lowering the required rpm of the fan.

Another way of reducing the required speed is increasing the efficiency of the fans.

Therefore, the SX and SXT fan blades have an air foil profile, thus increasing the pressure drop between lower and upper part of the blade, increasing efficiency. The shape of the SX blades comes in play to reduce the sound even further.

An additional source of sound is the pressure wave that forms when blades pass the support of the fan. A straight blade has a large pulse (coherent noise waves). Compressed air pushed away from blade and fan, creates a high flow of turbulence. With the curved blade, the air is literally cut and a spread out of the “pulse” results (incoherent noise waves). The spread out comprises lower speed turbulence therefore lower noise. **(See figure 2)**

90° angles will induce turbulence as well.

The shape of the SX blades does not have any 90° construction angles **(See figure 3)** and therefore the noise is lower as a consequence.

Noise is exponentially proportional to local air velocity perpendicular to the trailing edge.

From the graphic below **(See figure 4)** one can see that compared to a straight-thin blade the projected vector of the local airflow is much smaller at the SX blade than it is for it straight comparison.

The last feature we would like to mention about the curved fan is the forward swept blade.

Although a backward swept blade has above characteristics as well. The forward swept blade releases the air at the trailing edge spread over the length edge.

A backward swept blade releases its air more or less concentrated at the tip, leading to a stronger tip vortex. This will result in more or less the same amount of air through a small surface, thus higher noise for the backward swept blade.

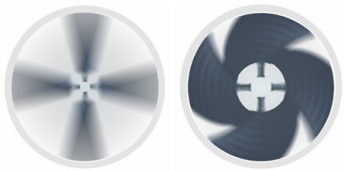

Figure 1

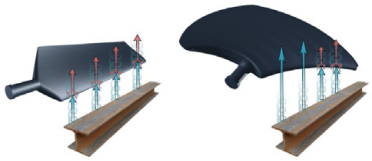

Figure 2

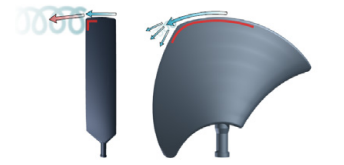

Figure 3

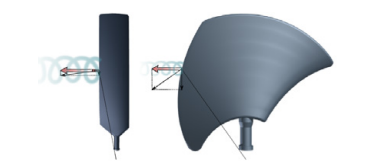

Figure 4

For further information get in touch with our team today:

cooling.fans@howden.com | **www.howden.cloud/coolingfans**

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