REGULAR INSPECTION IS A MUST – EVEN ON FANS

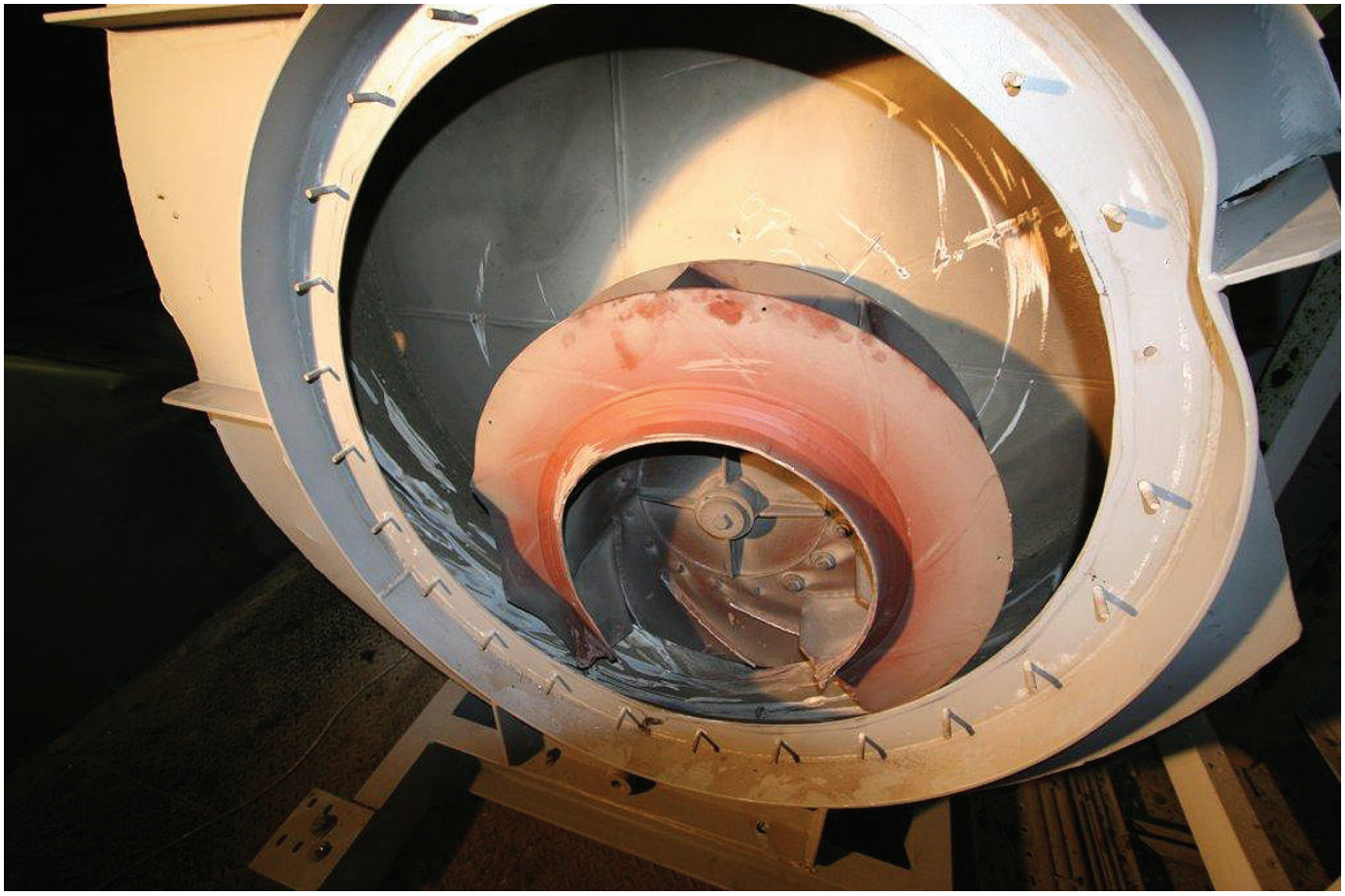
Repeated, rapid speed cycling over a period of years imposes severe stresses on the vanes of centrifugal fans, eventually leading to failure at values below their ultimate tensile strength. This can cause catastrophic failure and total destruction of the fan and the fan casing, which is not designed to withstand such failure, shutting down production until the fan is replaced.

Oakland Glass, based in Dewsbury, is one of the UK's leading independent glass processors and produces a range of energy saving and toughened sheet glass. It produces over 10,000 m2 of Oaktough® toughened glass per week, much of which is used in-house to produce sealed glazing units such as are used in conservatories. Because of its internal stress characteristics, toughened glass shatters into small fragments and cannot be reworked after tempering so sheets are cut to size before processing. Toughened or tempered glass is produced by heating the glass sheet up to 700oC, then cooling it rapidly using high pressure air from a chiller fan. The chiller fan, driven at up to 2970 rpm by a 250kW motor, is accelerated to full speed to cool the glass sheet within a few seconds then equally rapidly decelerated again. This demanding repetitive cycle, by its very nature, imposes a cyclic stress loading onto the impeller. Eventually failure will occur at stress values that are lower than the UTS of the material. In effect the impeller work hardens and

suffers "brittle fractures".

Jim Curley, Oakland's engineering manager, had to find a new fan quickly to get the plant back into production but enquiries to the original fan's European supplier, and others, seemed to indicate a minimum 10 week delay in providing a new fan at great cost, until Mr Curley was recommended to try Halifax Fan in nearby Brighouse. "Fans aren't something we buy every day and I'm not that conversant with the fan market so I didn't really know Halifax Fan" said Jim "Their service was exceptional. They were here on site within hours of my phone call, discussed the application, measured up what was left of the old fan and provided a competitive quotation."

"They built a bespoke fan to my exact specifications, with a matching impeller to maintain the correct glass tempering characteristics, and it was installed and operational within two weeks, saving a huge amount of production."



Halifax effectively reverse engineered the original fan to ensure the replacement met Oakland's production characteristics precisely. The 950mm impeller was built of Weldox® 700 steel. This high strength steel was used to enable the high running speed of the fan to be achieved whilst maintaining a good degree of toughness to withstand the cyclic loading. The whole design was subject to detailed finite element analysis (FEA) before manufacture. The extreme cyclic stress will however demand regular inspection and maintenance in future. Other users of high-cyclic action chiller fans have been recommended to inspect fans that have been in production for a few years and as a consequence, Halifax Fan has supplied at least one other similar replacement for a glass chiller fan on the point of failure.

Halifax Fan Technical Director Charles Halstead commented that, given a "clean sheet" of paper, designing for extreme fatigue life (essentially predicting the cycles to failure), is possible. By designing a careful selection of fan size, speed and materials, working stresses can be limited and this, combined with information of the cyclic duty, allows a prediction of safe working life to be made. In this case where the parameters were fixed, we were able to produce a safe working fan, albeit with a finite, safe working life.

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