

Forced Draft and Induced Draft Fan Examination



Fig. 1. Overall view of Induced Draft Fan.

As part of Thielsch Engineering's condition assessment and balance of plant inspection programs, we include the examination of the forced draft and induced draft fan components. These items are often overlooked as they are tucked away in the back of the station or external to the main powerhouse. However, these components represent a significant safety hazard, weighing as much as a ton with the ability to reach blade tip speeds of over 800 miles per hour at full operation, these components generate a tremendous amount of stress. Photographs of a typical power utility fan are provided in Fig. 1.

Thielsch Engineering has performed more than 150 fan inspections over the last fifteen years, 20 of which involved utility fan failure investigation, which resulted in catastrophic failure with significant collateral damage. The failure mechanisms have ranged from poor design considerations, improper welding techniques, bearing failures and normal operational deterioration.

The fan airfoils and shroud materials are typically produced from high strength, hardened alloy steels, made in accordance to ASTM A-517 covering "Pressure Vessel Plates, Alloy Steel, High Strength, Quenched and Tempered". Specific designs result in high stressed joint locations mainly at the airfoils to center plate welds. During operation, these fabricated components are subjected to varying load capacities, seasonally temperature fluctuations and particulate damage, these factors also contribute to fatigue damage mechanisms.

Our inspection program involves having the plant water wash the fan components prior to examination to remove heavy scale formation. Thielsch Engineering personnel will then prepare all welded joints by power hand grinding and wire brushing. This includes the outside shrouding, the center plate and both side of the air foil blading. Our qualified engineering and technical personnel will perform a detailed visual examination followed by a wet fluorescent magnetic particle examination. Indications of cracking are then evaluated to determine their cause and nature. Views of typical indications are shown in Fig. 2.

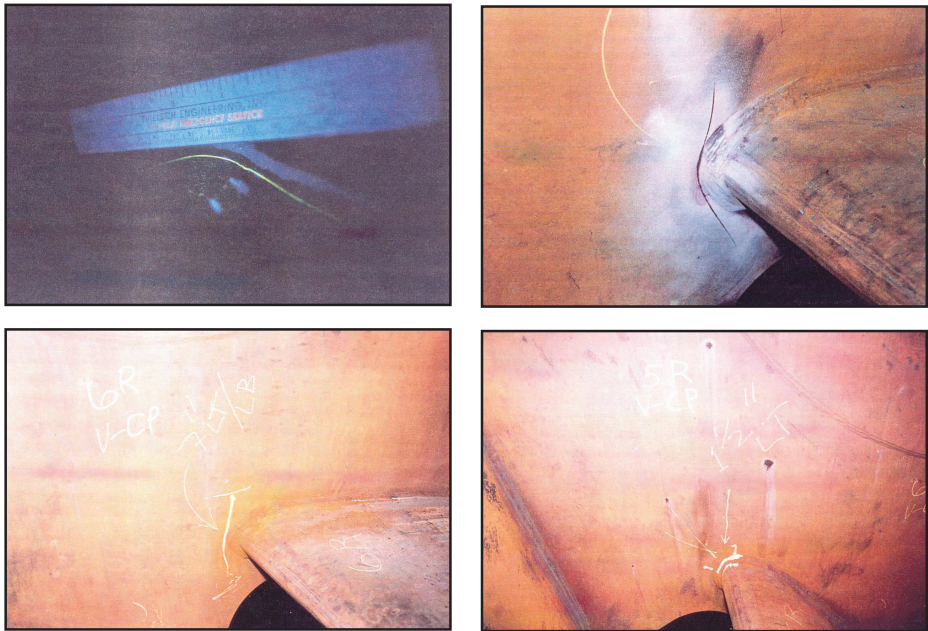


Fig. 2.
Location and orientation of
typical fan cracking.

(cont.)

Based upon evaluation discovering any indications, Thielsch Engineering personnel can develop and implement proven low stress weld procedures for these high-strength, hardened materials. These procedures involve elevated preheat temperatures, specific weld bead placement and balanced welding techniques. Photographs of typical weld repairs are shown in Fig. 3.



Fig. 3. Photographs of severe fan cracking and subsequent weld repair.

In those instances where the evaluation of the damage or cracking is determined to be related to a design issue, Thielsch Engineering has the ability to perform strain gage testing, Sonic Balancing and ANSYS Finite Element Analysis to design dampening rings or balancing devices to reduce operational fatigue stresses.

