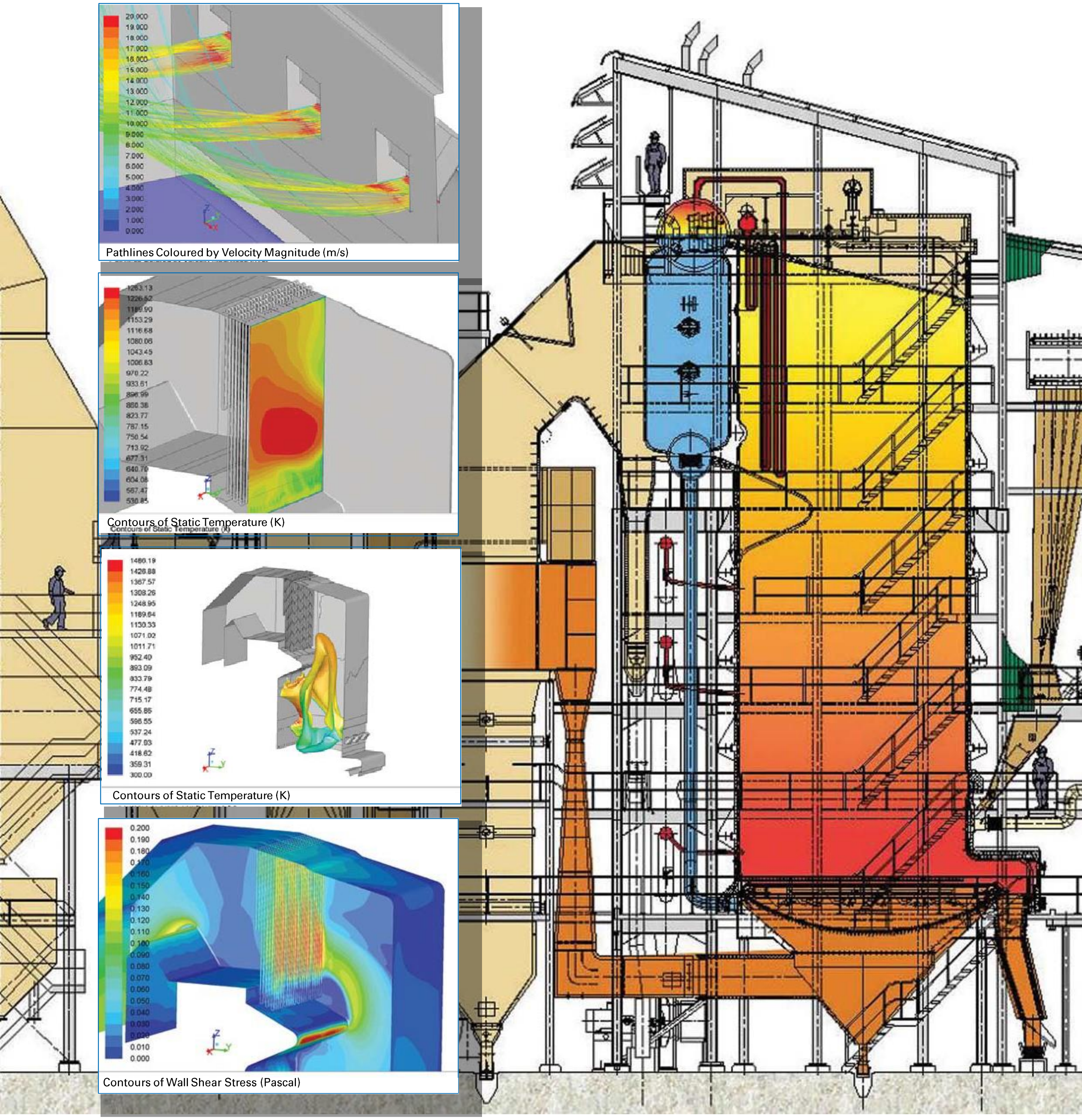


ENGINEERING CAPABILITY

Computational Fluid Dynamics (CFD)

john thompson

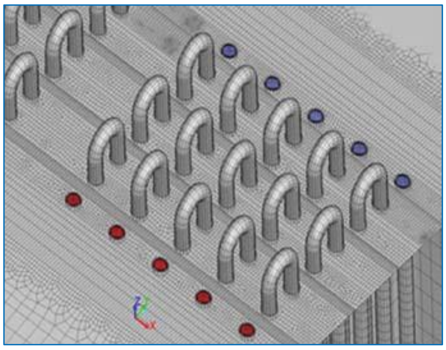
ACTOM

Typical sugar industry boiler

As a leader in the field of boiler technology John Thompson has always placed a strong emphasis on product development and thermal/combustion technology. To this end the company has maintained a policy of investing in the engineering resource to enable them to lead the field with modern boiler design and more efficient combustion methods.

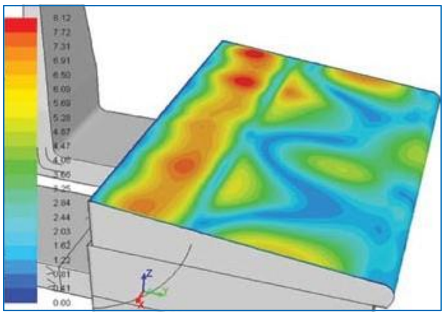
We also have extensive materials engineering facilities for both in-house facility and on-site investigations. These facilities enable detailed surveys to be conducted to establish the metallurgical condition of materials and failure analysis.

Market pressures on more cost effective and energy efficient boiler designs are increasing continuously. Additionally, the challenges faced in boiler design and combustion technology demand more detailed and more expensive engineering methods. To meet these demands our team of highly qualified and experienced engineers are armed with state of the art engineering tools through the investment in Computational Fluid Dynamics (CFD) technology thereby boosting the engineering capability on in-house boiler design. The software alone cannot solve all problems and a thorough understanding of the complex process is required. Our engineers are suitably qualified in this regard.



Numerical grid

The combustion process inside a modern water-tube boiler is a complex phenomenon. Traditionally these boilers are designed using lumped thermal models of the combustion reactions to determine fluid composition and properties.



CFD velocity contours

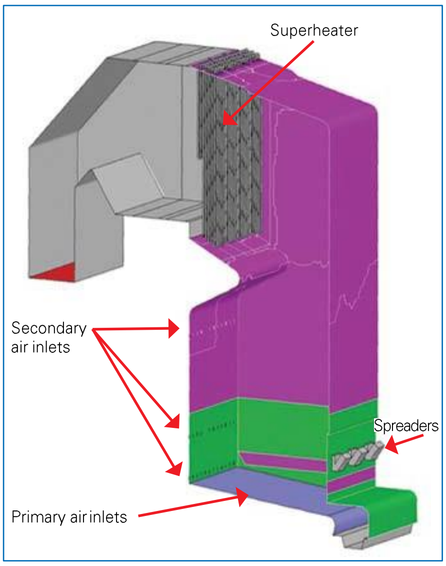
However, these methods require empirical correlation factors that may not be appropriate for all applications.

As the drive for more efficient and environmentally friendly boilers increases, engineers require a better understanding of the combustion process, heat transfer and flow patterns inside these boilers. A detailed and accurate understanding of these phenomena aids boiler design engineers in predicting any problems in the design and operation of the boiler before manufacturing and commissioning.

Computational Fluid Dynamics

CFD technology is a tool that can potentially provide this insight. By investing in a commercial CFD package our engineers can model the combustion process and related physics of various fossil- and biomass-fired water-tube boilers.

When doing these computations different physical models are implemented in the code to simulate the process. Physics included in the CFD model are: tracking of the fuel particles; evaporation and devolitisation of these particles; the combustion process in the gas; surface combustion on the fuel particles; radiation and NOx formation.

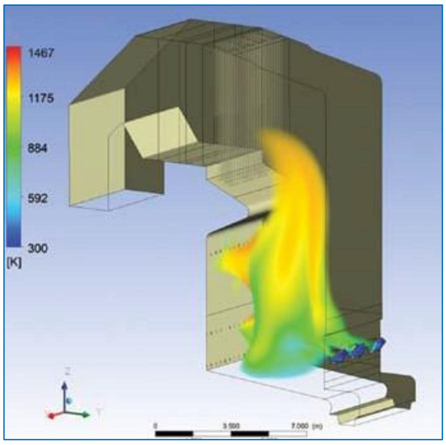


Geometric modeling of watertube boiler

Mono-drum watertube boiler

A high level of geometric detail is included in the model to capture certain key results. The geometries considered in detail are the spreaders that introduce the fuel into the boiler, the secondary air inlet, the superheater and the primary air inlet.

A numerical grid is then generated which can contain more than 14 million elements which consist of a combination of hexahedral, tetrahedral and prism elements. Higher grid densities are used in areas of expected high solution gradients.



Temperature volume rendering

The results from the CFD analysis show the resultant temperature contours, flow patterns, and gas composition throughout the boiler. Quantitative data from the model include critical design criteria such as superheater gas exit temperature, boiler outlet gas temperature and boiler outlet gas temperature distribution.

These accurate and more precise calculations and data enable the John Thompson engineers to keep improving on boiler designs providing the Industry with the quality product that makes the John Thompson boiler the benchmark in the Industry.

An additional much needed benefit of this technology to industry is that we can analyse problems in existing boilers so that scientifically derived solutions can be achieved. Such problems can include erosion, combustion profiles, output restrictions and superheater performance, etc.

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