A60 - Rated Fire Door for Marine Applications

Overview
Fire doors are an integral part of naval ships as these doors contain any outbreak of a fire between the ship compartments. The A60 fire door design requires several layers of insulation that will allow the design to pass the ISO 11-82 test. The test requirements include the temperature of the unexposed face of the door do not rise more than 140 °C, no smoke leakage, and less than 50% mass loss.

Objectives
The main objective of the project is to design the first A60 rated fire door that is manufactured in the United States. To accomplish that the door has to provide an adequate amount of fire insulation in order to pass the ISO 11-82 test.

Approach
- An iterative design approach was employed through gathering customer needs and design specifications and testing
- The customer needs of the design were assigned through the requirements of the 1182 ISO test
- Three concepts were generated and the Honeycomb design was selected as the final concept
- The final design consists of three layers of insulation. 12 gauge steel, concrete, and a honeycomb mesh in the centre that alternates between air and Rockwool.
- The external supporting parts of the door were selected to include hinges, closers, door handle, and intumescent seals as a gasket
- CAD model was created to 3D print the alpha prototype for design show purposes.
- Transient Heat Conduction with Finite Temperature Difference was the method used to obtain the finite element analysis of the fire door.
- The analysis proved that the designed door has a safety actor of 1.2 with a temperature rise of 121°C
- For the design for manufacturing purposes, steel grating is selected as an alternative of the honeycomb mesh for the Beta prototype.

Outcomes
- The design is ready for the 11-82 test in San Antonio, TX
- An excellent alternative for the concrete are cement boards by Durock and Hardieboards.
- The inclusion of Vapour Barrier should be considered for refrigeration purposes modification
- The cost can be reduced by reducing the overall weight
- More detailed design of the door handle and hinges is recommended.