

Post-fire Structural Integrity of Composite Gratings for Offshore Platforms

R. Holliday¹, J. Humphrey², P. Di Modica², S. Christke², G. Kotsikos², and A.G. Gibson²

1. MMI Engineering Ltd, AVC Business Centre, Wellington Circle, Altens, Aberdeen AB12 3JG UK.
2. School of Mechanical & Systems Engineering, Newcastle University, Stephenson Building, Newcastle upon Tyne, NE1 7RU UK

Abstract

In parallel to studies by the HSE resulting in the issuing of a Safety Alert warning to the offshore industry on possible failure of fire resistant composite gratings (Bulletin No: HID 2-2012), a study was made by MMI Engineering in conjunction with Newcastle University into the post-fire integrity of phenolic and polyester FRP gratings to determine whether such gratings can be safely used following exposure to fire.

Firstly the range of weights of offshore workers was established. The recommended residual strength required for post-fire use should exceed the load generated by a running person, at the upper 5-percentile of the weight spectrum, carrying fire fighting or rescue equipment. This load includes a dynamic amplification factor to allow for the effect of running, additionally a further safety factor is required to account for fatigue effects.

Samples of gratings were tested to determine the stresses resulting from running or walking by applying strain gauge instrumentation to individual beam elements of gratings to measure the strains produced. The strain gauge study was augmented by modelling to quantify the relationship between applied load and local strains. These strains were found to depend on the 'footprint' area over which the load was applied.

Fire exposure tests involved using a propane burner to expose individual beam elements to three heat fluxes of 12.5kW/m^2 , 37.5kW/m^2 and 100kW/m^2 as well as jet fire testing at $\sim 250\text{kW/m}^2$ representing the full range of fire types considered on oil and gas installations. The duration of the fires were increased in increments up to 16 minutes to establish the rate of deterioration.

This paper presents the results of the testing, provides information to operators on where these materials can be safely used as well as providing grating manufacturers with guidance on product testing and development to produce more fire resistant systems.

Keywords: *offshore composites, phenolic resin, pultruded grating, post-fire integrity.*