

Designing for coatings could make ships safer

Conventionally, structural design of ships has sought an appropriate balance of requirements with respect to strength, weight, operation, ease of construction and cost while complying with classification society rules. Naval architects have long been accustomed to designing vessels to meet these requirements, but a novel approach, designing for coatings, could improve the performance of coatings and make ships safer, it is claimed.

While applauding the intent of amendments to SOLAS mandating compliance with the IMO's Performance Standard for Protective Coatings (PSPC) for dedicated seawater ballast tanks, industry experts argue that the effectiveness of coatings could be significantly improved – and ships made safer – if changes were made to the design of ships to make them more 'coatings-friendly'.

If the breakdown of the cost building a new vessel is considered, it is apparent that coatings represent only a very small part of the total price. This has led to the perception that coatings and their application are a 'low value' process, and little development has taken place to improve practices and technology, even though coating chemistry technology has advanced significantly over the last 40 years.

According to Raouf Kattan, managing director at UK marine coatings consultancy Safinah, this has been compounded by a lack of development of management systems used in the coating process, so that the coating process has become, as he puts it, "unstable and unpredictable without suitable controls."

"The lack of pre-production planning and integration of the coating process has led to the creation of a bottleneck in the painting of finished steelwork blocks," Kattan told *Solutions*.

"Scheduling of painting activities is often determined by the steelwork department, in order to maximise steel

throughput, rather than prioritising coating activity, and the coating process is often used as a buffer to compensate for steelwork and other production delays," he said.

"If the new PSPC requirements are to be met, there needs to be a greater emphasis on the coating process as a value-adding activity," he explained, "and it must be afforded equal importance to other production activities. Only then can the problems associated with the reliability of coating application be addressed."

The areas of a vessel with the greatest complexity and with restricted access tend to be the fore and aft peak areas, the double-bottom structure and any double-hull structure. Ballast water is often carried in these areas but, prior to the PSPC, they were often overlooked in terms of maintenance, despite the corrosive nature of the environment in such tanks.

Kattan highlighted that the problem of access to ballast tanks is compounded by their range of sizes and overall dimension – some require multiple staging to gain access to the entire tank while others are very small and confined. Many have complex shapes due to the presence of primary and secondary longitudinal and transverse stiffening, leading to a large amount of 'shadowing' of the surface to be coated within a given space.

"Another consequence of the complexity of water ballast tanks is the amount of weld and edge length; it is often almost impossible to gain visual access to many surfaces, let alone shot blast or paint them," Kattan pointed out.

"A further consideration is that the edges require rounding to allow better edge retention of the paint; a radius of a minimum of 2mm, or three passes of a hand-held grinder are defined in the PSPC. The effect of all of these factors is that even skilled operatives struggle to deliver a consistently high quality of finish, and thus the probability of an in-service failure is considerably increased," he added.

As Kattan noted in a presentation to a recent conference, the majority of coating failures are attributed to problems during surface preparation and paint application. "Given this, why did the process fail to provide the quality of finish required? Is it that the operators could not gain the required access to the surfaces? Did the area contain an excessive amount of edges and welds?"

In many cases, Kattan believes, it is the design of the structure that has a detrimental effect on the coating process, ultimately resulting in premature coating failures. "If some of the structures that have to be prepared and coated are examined in detail, credit should be given to applicators and paint chemists that there are not more coating failures once a vessel is in service," he said.

"If the design of water ballast tank structures could be simplified, while still meeting structural and other operational requirements, it might be possible to provide significant benefits, such as a reduction in the cost of

