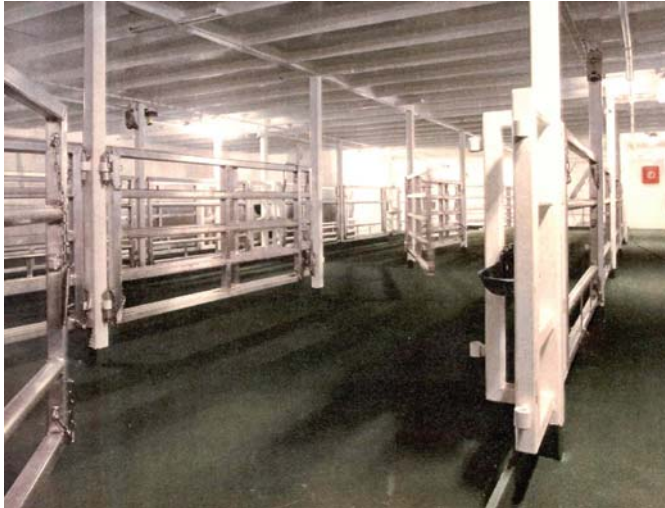


Flooring for livestock carriers



Whether they carry dry cargo, automobiles, or livestock, cargo holds of ships need to be protected against wear and corrosion. An inappropriate coating system on the decks of these holds can decrease cargo-carrying potential, increase survey frequency, and reduce the asset value of the vessel, all of which will affect the service of the vessel and penalize the ship owner financially.

This article will briefly consider the coating systems used on the decks of cargo holds of livestock carriers to overcome the problems associated with exposure to extreme chemical and mechanical stresses.

Livestock Carriers

Livestock carriers are specially designed to comply with the usual international standards and the rules of the Australian Maritime Safety Authority (AMSA) and the Irish Department of Agriculture (IDA) for the transport of live animals, most commonly cattle and sheep. For their own safety and comfort, the "passengers" are put into pens just like stables onshore.

The newest livestock carriers are constructed with structural steel decks and galvanized steel pillars, which steel hinges are welded to support the aluminum gates that form the pens. All steel parts are usually coat-ed with an epoxy system to provide good corrosion protection and a polyurethane topcoat to provide a smooth finish for easy cleaning after

cargo discharging.

The structural decks are one of the most important parts of this type of ship. The surfaces are subjected to a very aggressive environment, due to the dung and urine produced by the animals during the voyage, abrasion from the hoofs of the animals, and continuous washing with seawater to remove the accumulation of dung. If the steel decks are not suitably protected, a fast corrosion process causes steel degradation and severe pitting that could affect the structural integrity of the deck and the vessel. Furthermore, the decks must have a suitable anti-skid property to prevent the animals, mainly the cattle, from slipping during loading and discharging operations as well as during the voyage. According to the AMSA rule, "A pen floor or stall floor must have a surface that provides a satisfactory non-slip foothold for the cattle."

Many different floorings can be applied on the decks of cattle carriers, from simple epoxies or reinforced epoxies and polyurethanes to synthetic systems up to 5-6 mm (200-240 mils) in thickness.

The flooring must have the following properties.

- Excellent anticorrosive characteristics
- Excellent resistance to ammonia and chemicals (dung, urine, detergent)
- Good abrasion and impact resistance
- Good flexibility
- Good leveling characteristics
- Excellent anti-skid characteristics

The state-of-the-art systems are based on solvent-free, thermo-hardening (heat-accelerated, chemical-curing) synthetic resin systems. These are typically two-pack products that cure to form a seamless, impermeable wearing course. When it is necessary to level any steel deck deformation, a filler is added during the mixing of the two components to build up the thickness and obtain a uniform layer. These coatings have high mechanical strength; excellent adhesion to steel; good elasticity to allow for movement of the

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substrate (during sea voyage); and resistance to faeces, many organic acids, bases, and salts (Table 1). The broadcast aggregate material, usually calcined bauxite or quartz, determines the ultimate wearing and non-slip properties. The size of the aggregate material, which in the majority of the cases is spherical quartz, must be carefully evaluated and selected. A mistake in the selection could have catastrophic consequences during vessel service. If the size of the anti-skid material is too small, the cattle, which each weigh between 600 to 800 kg (1,320 to 1,760 lbs), will slip on the flooring and can die. If the size of the anti-skid is too big, it will cause injuries to the legs of the cattle, which again can die from the infection of the wound.

Table 1: Typical Properties

Shore hardness (Shore D)	60
Tensile strength	7.5 Mpa
Adhesion (steel)	>5 Mpa
Ultimate elongation	7%
E-modulus	220 Mpa
Water absorption (DIN 53495)	1.50%

Application

Steel decks must be abrasive blasted according to ISO 8501-1 Sa 2.5 or SSPC-SP 10 and have a minimum profile of 75 µm (3 mils). Before the surface can rust back, an epoxy or polyurethane primer, depending on the flooring selected, should be applied at 40-50 µm (1.6-2 mils) dry film thickness (DFT). Following the recommended overcoating time (minimum 16 hours at 20 C [68 F]), the flooring system can be applied by trowel, palette knife, or squeegee, at a minimum temperature of 10 C (50 F), to a minimum DFT of 3 mm (120 mils) or more typically 5-6 mm (200-240 mils). To improve the mechanical resistance of the system, spherical quartz (0.5-1 mm [20-40 mils] size) can be added to the mixture instead of filler. Immediately after the application, the coating is saturated with an excess layer of anti-skid material. When the flooring is fully

cured, the surplus anti-skid material is brushed off and collected. The floor can be used after the coating has cured for 24 hours at 15 C (59 F). The cost of the state-of-the-art deck coating is approximately 80 Euro/m² for a minimum of 1,000 m²; therefore, it is essential that it be properly maintained. In service, if correctly applied, the flooring can be expected to give 12-15 years' protection to the underlying steel. However, the floors must be cleaned after every cargo has been discharged, not only for the health and safety of the cattle, but also for the proper examination of the floor for wear or damage. Localised minor damage or defects can be easily repaired and touched up by the ship's crew using 10-litre (2.6-gallon) kits of the same product as applied originally. The defective areas have to be carefully washed with fresh water and then cleaned by power tooling, using needle guns and wire brushing in accordance with ISO 8501-1 St 3 or SSPC-SP 3. The primer is then applied by brush, followed by the application of the flooring and anti-skid material.



Conclusion

The use of high-performance, solvent-free synthetic flooring, with the correct particle size of aggregate to provide non-slip surface, can protect the steel decks of [livestock carriers](#) against aggressive chemical attack and abrasion for more than ten years, while allowing for the safe transport of cattle.

Source: JPCL April 2003