

Powering reefers safely – with a twist

The lack of a uniform standard for the power-plugs ashore, on trailers and on-board ships calls for an exchange of about a million plugs globally and annually. Besides the costs there is also a safety hazard as plugs with the safety lug broken off can cause burns and shocks. Now HF and Maersk has developed a 3H/6H-plug that solves this problem – once the operators learn that the required standard can be achieved with a twist – literally!

By: Rolf Sylvester-Hvid, MScEE, EiC

Standards are great as long as they are just that: Standards. If there is, however, any doubt about the use or the specifications of any given standard, they may prove themselves to show some rather severe flaws. This is indeed what can be said about the plug that supply reefer containers with power on-board the ships, in terminals or on trailers that take the reefers to and from their end destinations.

Now, no one would dispute that the CEE-plug is actually a very good idea. It's a widespread standard that powers literally everything from building sites to caravans and – of course – reefers on any land-based location. However the situation changes, when the reefer goes on-board a container vessel for the long-haul sea-transportation. In this case – and for reasons that are somewhat lost down the line of history – the plug that powers the reefer container is keyed differently to the land-based CEE-plug. This position of the earth-pin on the plug for marine is set to 3H and land is set to 6H (as in three- or six o'clock on a clock-face) which means that the otherwise similar power plugs runs on two different standards depending on the placement of the reefer, thus minimizing the value of the so called "standard plug".

Reefers are essentially made for maritime transportation; hence their power plugs follow the maritime position of three phases and ground/earth for the energy-supply. The plugs are keyed, so there's no need to worry about plugging the reefer to a ship's power-supply in any wrong way. Now, for example; once a driver of an articulated lorry is faced with plugging the reefers into the supply of their vehicle, the keying of the plug to a ship-based standard may prevent the driver from connecting the reefer to the lorry's not so corresponding female socket.

So, what should a driver/operator do then? Well to get the container on the road, they could break off the lug off the container's plug with a pair of pliers – which in Maersk's Line's case unfortunately happens some 250.000 times a year. So, problem solved on a short-term basis. However, once the reefer goes back on a ship, the keying no longer exists. This is now a problem, as the lug also is used for activating the interlock on the receptacles, so the power can be energised plugging takes place.

Safety comes with a twist

- The health and safety of the crews and operators working with Maersk Line's equipment is a major company concern. Basically it's a human right to go home from work each day safe and sound, and even the smallest step Maersk can take to make this happen will be of great importance to the company. We are of course not oblivious to the fact that we must exchange around 250.000 plugs globally and annually on Maersk Line's reefers, says Paul Clarke, Global Reefer Technical Manager with Maersk Line.

He estimates that around a million reefers from various companies suffer from problems with broken plugs and lugs/keys which equals annual costs of many million USD in basically unnecessary

repair and maintenance of reefers worldwide. This amount doesn't even take into consideration the potential loss of freight if the reefers are not plugged in within a given time-slot if a plug has failed and needs to be exchanged. There is of course also an annoying time-factor that's however somewhat difficult to quantify.

- Years of frustration has led to the development of a plug that is essentially a "two-standard" connector that allows plugging in reefers into both land-based and maritime power-supplies. Discussing the problem with Hans Følsgaard A/S, the idea developed over an array of sketches on a napkin, we concluded that it would be a brilliant move to put a so called 3H/6H-plug into production thus saving a lot of money, time-consuming repairs, waste of materials and perhaps even lives, Paul Clarke explains.

Getting the design right and robust enough for handling on ships, in ports and on trucks was indeed no easy feat, and the development and prototyping of the 3H/6H-plug took well over two years to perfect. Paul Clarke is none the less impressed with the courage Hans Følsgaard A/S has, as it is neither cheap and not without risks, to manufacture and market a completely new plug.

The brain child of Maersk's expert and Hans Følsgaard A/S is an IP67-certified CEE-plug. The beauty of the design is the possibility of switching the positions of the ground- and one of the phase-pins with a twist of a screw-driver, hence making the plug a dual-standard solution, that easily – and with full safety – will supply reefers from both ship-based and land-based power supplies.

Fool-proof and user-friendly

Old habits are hard to change, and according to Paul Clarke the biggest effort isn't the on-going exchange of the old plugs to the new dual-standard 3H/6H-types as much as it is relaying the information about the technology to operators, ship-crews and lorry-drivers all over the world:

- This is very much a question of the shipping-agents in various regions all over the world showing the lorry-drivers and ship-crews how to use this new device. The people handling the reefers may not read information about new technology on a regular basis, so it takes a while to implement any new idea to the far corners of the world. The sooner the word is spread, time and money will be saved, and more importantly, the handlers' health & safety will not be compromised, states Paul Clarke.

The 3H/6H-plug is labelled with an instruction showing the drivers and the crews how to insert a screwdriver pushing down a latch and rotating two of the four pins of the plug 180 degrees clockwise or counter-clockwise thus changing the pin-out of the plug. A latch gives a well-defined click to indicate the twist has done a full half-circle.

Hans Følsgaard A/S has designed-in a few other safety-features that adds to the new dual-standard 3H/6H-plug. An outward facing latch prevents the plug to plugged-in, if the plug isn't correctly assembled after installing the wiring/cable. If the assembly latch isn't fully closed, the bayonet-ring plugging the reefer in can't be turned. This adds to the fool-proof design of the 3H/6H-plug.

- We introduced the new 3H/6H-plug all over the company in 2016, and though it's a quick and somewhat intuitive learning-curve, at Maersk Line we estimate that it will still take another couple of years, before the technology is fully implemented, and the handlers will take out the screwdriver rather than the pliers. We can only recommend the everyone takes notice of this new twisting, dual-standard 3H/6H-plug. This is not a proprietary system to be used with Maersk Line equipment alone. This is such a good concept that we would like to see these plugs used with any company's reefers units all over the world, concludes Paul Clarke.



Paul Clarke has developed the concept of the dual-standard 3H/6H with Hans Følsgaard A/S. The twistable design took more than two years to perfect, and Paul Clarke is impressed that Hans Følsgaard had the courage to take a whole new component into full-scale production.

The yellow label should tell lorry-drivers not to break off the key on the red plastic part of the plug (upper right corner of the picture) but instead inserting a screwdriver and reversing the ground- and phase-pins of the plug.



The white insert is the twistable part of the dual-standard 3H/6H-plug. It rotates 180 degrees clockwise or counter-clockwise with the twist of a screwdriver after pushing down the small grey latch.