Specifying Reefer Outlets for Container Port Terminals

In the design of tomorrow's port terminals that are destined to handle intermodal container cargo, it is important to consider the needs and impacts of the refrigerated containers (aka Reefers) that will pass through the terminal. David Hellmers, Vice President Engineering for ESL Power Systems, Inc explains…

Even though container volumes have dropped in some ports in recent years and will continue to fluctuate at unpredictable rates for terminals throughout the world, Reefer cargo has experienced a more stable rate than that of dry cargo during the global economic down turn. The challenge for planners and developers of new terminals with regards to Reefers continues to be in anticipating the volumes and utilisation of limited backland areas. This means allowing for adequate Reefer capacity and ensuring Reefer cargo is moved/stored/loaded efficiently. Once the planning has progressed to the point of knowing the overall TEU throughput, and how many Reefers versus Dry Containers will be in the terminal at a given time, the critical work regarding yard layout can begin. The layout must take into account many factors that are beyond the scope of this article, but the Reefer area or areas must be defined. At this point, the number of Reefer spots, the space available, the means of moving (RTG, Reach Stacker/Top Pick, STS Crane, AGV, etc.) and the landside method of transit (chassis, train, etc.) all need to be considered. The end result should be a Reefer area layout that best utilises the space and ensures efficiency. The Reefer area plan may include multi-level stacking or grounding of Reefers, or wheeled areas for Reefers on chassis. These various methods of Reefer storage directly impact the power distribution system that is required to keep the Reefers running while they wait for vessel loading or landside transit. Note that each Reefer container will require a dedicated Reefer Outlet (or Reefer Socket as they are often called) which typically provides 380-480VAC to the Reefer via a 60-foot power cord which is an integral component with ISO refrigerated containers. While the Reefer Outlets might seem to be an insignificant piece of the overall Port Terminal design, these Outlets will play a crucial role in long-term efficiency, safety, maintenance and cost of terminal operations. This is why many terminal operators and shipping lines insist upon the use of only name brand Outlets that have proven to be safe, durable and easy to operate & maintain. Reefer Outlets are available in a variety of materials and configurations. The most common female receptacle is the 32A 480VAC type that complies with IEC 60309-1 and 60309-2, but some closed-loop shipping lines have standardised on other receptacle configurations that have differing voltage and ampacities. The receptacles are often plastic of various types, some more durable than others, while the most durable Outlets are housed in Stainless Steel enclosures. It is extremely important that the receptacle be safety-interlocked to ensure that it cannot be energised unless the correct mating plug is properly inserted and mated – this is to protect the operator from making or breaking the electrical connection under load. While the safety-interlock is not typically required by code, it is a global industry standard and good common sense. The Reefer Outlet should also provide overload and short circuit protection to coordinate with the site's power distribution system. This is typically accomplished by the use of a high-quality molded case circuit breaker located behind the receptacle. The circuit breaker and the safety-interlock system must be enclosed in a heavy-duty sealed housing or enclosure suitable for a harsh marine environment, with the receptacle on the exterior. Finally, the housing must be oriented and mounted in a way to maximise access and simplify operation, maintenance and installation but also protect the Reefer Outlet from damage. Reefer Outlets that provide power to multi-level stacked Reefers are often mounted on steel rack structures. The racks consist of stairways and walkways to enable operators to access all of the Reefers that are above ground level. In rack systems such as these, the positioning of Reefer Outlets is critical to ensure adequate access to plug in the Reefers, minimise the distance the operator must pull the power cord, reduce the amount of conduit/wiring to the Reefer Outlets, and not block the walkways. The Reefer Outlets in these cases are typically mounted individually (single-gang) or in groups of multiple outlets to reduce the distance from the Reefer to the Outlet. In those locations where Reefers are stored single

level or on chassis, the Reefer Outlets are usually ground-mounted and therefore must be well protected from various types of vehicle traffic. Reefer Outlets in this case are mounted in low concrete bunkers, 2 to 4

outlets per bunker, or possibly on upright pedestals which provide easier access to the receptacles but are also more susceptible to damage by trucks and other yard vehicles. Pedestal designs sometimes incorporate protective bollard systems; these are expensive but provide a much safer and more resilient system. Yard layout for both bunker and bollard-protected pedestals is very important as it can be costly to reconfigure the bunkers or pedestals and all of the underground conduits if the eventual terminal needs change in the future and the container yard layout is reconfigured. In specifying the enclosure housing for the Reefer Outlets, consideration must be given to the number of Outlets in each enclosure. This can vary from (1) to (15) Outlets or more. The orientation of the enclosure, the mounting method, the receptacle orientation, location/size/protection of the incoming conduits and upstream switchgear, and the environment all must be weighed in choosing the proper Reefer Outlet configuration. The enclosures are typically fabricated from Stainless Steel and can be powder-coated any colour. In addition, each Outlet can be outfitted with options such as indicating lights, plug sensing, breaker trip alarm, power factor correction, and rear-actuation which insures the operator is not in front of the plug when the outlet is energised. The long term benefits of each of these options needs to be weighed against the initial installed product cost. The designer/engineer must keep in mind the most important aspect of the Reefer Outlet system; all of the Outlets need to be safe and operational all of the time to ensure that no cargo is spoiled or lost due to the absence of power to the Reefer. The cargo value of a single Reefer can be worth more than the installed cost of a hundred Reefer Outlets, and yet the terminal operator will expect that outlet to provide power to thousands of Reefers over its lifetime. Poor planning, taking short cuts in the design phase or skimping on the quality of the Reefer Outlets can be a recipe for disaster down the road.

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About the company:

Founded in 1991, ESL Power Systems, Inc is a global leader in the manufacturing of safety-interlocked reefer outlets.

With over 160,000 reefer outlets furnished worldwide, ESL works with engineers to create custom assemblies tailored to individual container port terminal requirements.

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