

PROVIDING REEFER OUTLET POWER

DESIGN CONSIDERATIONS



DISCLAIMER

- ESL is NOT a design engineering firm.
- ESL is NOT a licensed contractor.
- The information provided in this webinar is based on ESL's 30+ years of experience in providing reefer outlets worldwide.



WHAT IS A “REEFER”

“Reefer” is short for refrigerated container or refrigerated trailer. These special containers and trucks are used to transport temperature-sensitive, perishable cargo.

Refrigeration unit

Pigtail –
Electrical plug
with cable



SAFETY FIRST !!



- The User is handling and dealing with 480VAC power.
- ESL highly recommends the use of an outlet that prevents the user from connecting or disconnecting from the power source while energized, such as ESL's safety-interlocked module.
- Consider the routing of the reefer plug cables to prevent tripping hazards



THE CORRECT RECEPTACLE

- For compatibility purposes, the refrigerated containers (reefers) are designed based on IEC 60309-1 and 60309-2 standards. As such, this requires a 32A, 380/440V, (3-phase + ground) plug.
- Thus, the receptacle must be designed to accept and work with this plug.



GFCI PROTECTION ?

- For reefer yards this is difficult.
- Different methods are used to defrost the evaporator coils. All methods result in melting the frost, producing water that drips down over the coils.
- Water, because of the contaminants within it, is a conductor. It is typical to experience ground fault spikes during a defrost cycle.
- If personnel GFCI protection (5-6mA) is used, this most often results in nuisance tripping during the defrost cycle.
- If equipment GFCI (30mA) is employed, there is less likelihood of nuisance tripping.



REEFER LOADS



Alpha Stock | 1110393228

- Older reefers generally have an initial start-up current in the range of 24 – 28 amps with a running current of about 15-18 amps
- New reefers have an initial start-up current in the range of 18 – 20 amps, with a running current in the range of 9 – 12 amps.



DE-RATING FACTORS

- Must consider the external typical temperatures at the yard. Is it in northern Alaska, or southern Florida?
- What is the ratio of frozen loads versus refrigerated loads?
- Frozen loads are typically kept at a temperature between -20° F and 0° F
- What about refrigerated loads:
 - 32° – 36° F for greens, berries, apples, vegetables, grapes, stone fruits
 - 38° – 40° F for avocados, cranberries
 - 40° – 45° F potatoes, green beans, sweet potatoes

As you can see, determining a de-rating factor is based on a lot of assumptions.



DE-RATING FACTORS

When asked how much power is required per outlet, ESL's official response is a conservative number of 14kVA (~17A) per outlet.

Breaker sizing for a 10-Gang assembly

Example 1: 150Amp breaker (15A/outlet) → Risky, lower cost, smaller feed conductors

Experience shows that a 150 Amp breaker will trip when a bad reefer is plugged in with as little as 6 other reefers already online.

Example 2: 200Amp breaker (20A/outlet) → Less risky, more cost, larger feed conductors

Transformer sizing and de-rating factor... (Using Example 2)

How many outlets per substation? A typical number could be 250 outlets per substation.

The more outlets per substation, the lower de-rating factor. Range (0.8 to 0.65)

A port with over 1500 outlets might use a de-rating factor as low as 0.4 when considering total kVA



YARD LAYOUT/DESIGN

- The initial costs of installing more reefer outlet assemblies (ROAs) against the labor costs of managing cabling from fewer centralized ROAs should be investigated.
- Pay attention to reefer cable/plug length. Typically, these are between 30' and 50'.
- Use of extension cords is NOT recommended.
- The more receptacles that are installed in an enclosure, the higher the likelihood of tangled cables and inadvertently disconnecting the wrong reefer.



TO DAISY CHAIN OR NOT TO DAISY CHAIN?

PROS

- Reduces the number of feeder breakers needed.
- Reduces the number of conduit runs.
- Allows for higher de-rating factor.

CONS

- Increases the amp rating of the feeder breaker.
- Increases the size the size of the feeder cable.
- Increases the size of the enclosure to accommodate larger PDB and associated wire bending space.
- If feeder breaker trips, all connected outlets loose power.



OTHER DESIGN CONSIDERATIONS

- kAIC rating required. To help reduce costs, a short circuit study should be performed.
- Enclosure penetration location. Penetrations are best through the bottom of the enclosures. Minimizes the potential for water intrusion.
- Installation location - avoid submersion, minimize cable entanglement.
- Voltage drop for long cable runs.



WHAT OTHER FEATURES MIGHT YOU CONSIDER?

- Pilot light to indicate power is “available” at the outlet.
- Pilot light to indicate that the receptacle is energized.
- Contacts to provide remote indication that the outlet breaker is ON.
- Contacts to provide remote indication that a plug is inserted into the receptacle.
- Enclosure material 304 or 316 stainless steel.



VARIETY OF OUTLET ASSEMBLIES

Pedestal / Pad Mount Assemblies

Bunker Mount Assemblies

Rack / Wall-Mount Assemblies

Single-Gang Modules

Rear Actuated Assemblies

Inserts for Power Pack Assemblies

Portable Distribution Trees

Reefer Sharing Units RSU's



PEDESTAL / PAD MOUNT ASSEMBLIES

Pedestal assemblies typically include 2-8 outlet modules.

However, designs can include more than 8 outlet modules.

Typically specified for “floor level” applications

Designers should consider how the reefer container pigtails will be routed.



Bunker Mount Assemblies

Bunker mount assemblies typically include 2 or 4 outlet modules.

Designers should consider how to protect the bunkers.

Typically specified to provide power to reefers on chassis.



Rack / Wall Mount Assemblies

- Rack / wall mount assemblies typically include 2 to 4 outlets modules.
- Ports and terminals often stack reefer containers, sometimes as high as 5 to 6 containers high. Reefer racks are designed and built to provide safe and convenient access to connecting and disconnecting the electrical connectors.
- Conduits typically run vertically in racks. ESL can provide assemblies with precut holes for conduits.
- ESL does not design and manufacture reefer racks.
- ESL's sales team can provide advice for clients considering reefer rack applications.



Single-Gang Modules

- Individual Outlets
- Better choice for Automated terminals
- Outlets are closer to the Reefers
- No confusion as to slot location
- More Feeder Cables/Conduits in the Reefer Rack
- Less cables on walkway as compared to Multi-Gang designs.



Rear Actuated Assemblies

- Rear actuated assemblies offer a higher level of safety.
- For these assemblies, the ON/OFF actuator rods are located on the opposite side of the receptacles.
- This ensures that the operator is away from the plug and receptacle connection when the unit is energized.



WHAT ABOUT OVERFLOW DEMAND ?

- The yard has been designed for the expected demand, however, due to unforeseen conditions, the yard must now provide power to more reefers than designed for.
- ESL has a few options available



INSERTS FOR POWER PACK ASSEMBLIES

- Inserts are typically integrated with generators in a containerized portable “Power Pack.”
- A “Power Pack” is generally a container, that has a generator installed within it.
- The container has an opening cut in the side for installing a multi-gang reefer outlet “insert”
- The output from the generator is wired to this multi-gang reefer outlet “insert”.
- This provides for a transportable, stand-alone, multi-gang reefer power outlet.



PORTABLE DISTRIBUTION ASSEMBLIES

- Portable units are typically furnished in 10-Gang, 20-Gang, and 30-Gang designs.
- Furnished with single pole cams for temporary connection to a generator.
- Enclosures are furnished with forklift pockets for easy mobility.
- Mounting holes in the pockets are provided to secure the unit in place.



REEFER SHARING UNITS (RSU's)

- The typical RSU configuration involves using a timer to alternate power between two **frozen load** reefer containers.
- The most common configuration alternates power every 4 hours.



**Thank you for your time.
Questions ?**

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