

# KLINGE CORPORATION



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## CARGO LOADING

For best airflow and uniform temperatures throughout the refrigerated cargo bay, and for best thermal protection of the cargo, it is best to have the cargo bay floor fully covered when possible. But partial loads can also be accommodated, with special precautions. Regardless of whether the cargo bay is partially loaded or fully loaded, the correct cargo stacking arrangement and type of dunnage used (preferably none) is critical to proper system operation and cargo protection.

When planning how to stack the cargo onto pallets for efficient packing, and for safe and thermally-stable storage and transport in the container, the cargo bay arrangement and limitations are critical to understand; making the required loading arrangements in the field to the requirements will save a lot of problems and time later on.

### NOTE

The refrigeration unit must be OFF while loading cargo into the cargo bay. Moisture entering the cargo bay while the rear doors are open will degrade the refrigeration unit's efficiency and its ability to return the cargo bay to set-point temperature.

### DUNNAGE

### NOTE

DO NOT place any solid dunnage (airbags, pillows, solid boxes, blankets, etc.) between the cargo and the walls, rear doors, or front wall of the cargo bay, as airflow will be inhibited and thermal damage may occur to the cargo.

**DO NOT use solid dunnage anywhere in the cargo bay.**

Hollow dunnage (such as an open-frame pallet on edge) is acceptable only if properly placed so that air can easily pass through it from front to rear and top to bottom, without hindering proper air distribution and airflow patterns.

## CHIMNEYS

"Chimneys" are air spaces between boxes of cargo stacked on a pallet, or between pallets of pre-stacked cargo. Three types are described and shown below:

- Non-Chimneys (no air gaps) ----- PREFERRED
- Partial (Closed-Top) Chimneys ----- ACCEPTABLE
- Open (Open-Top) Chimneys ----- **PROHIBITED**

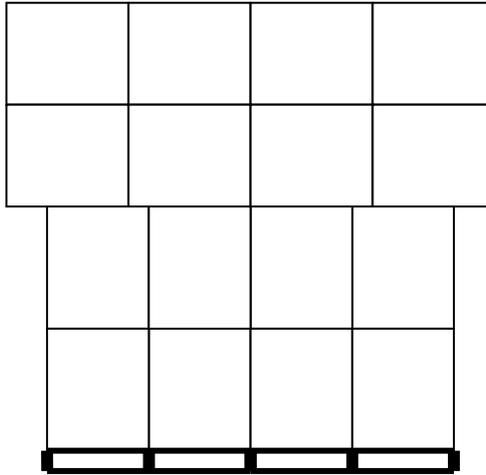
When loading boxes on pallets for loading into the cargo bay, it is critical that the boxes can be stacked correctly per the instructions herein to prevent open chimneys. It is also critical to arrange the loaded pallets in the cargo bay in the correct orientation, and to place the loaded pallets tightly together to prevent open chimneys.

### CAUTION

Improper loading and spacing of boxes and pallets can lead to air "short-cycling" within the cargo bay, leaving the rearward areas in the cargo bay vulnerable to higher temperatures and possible damaged cargo.

### Non-Chimneys: Preferred

“Non-chimney” packing and loading is allowed and preferred at any location in the cargo bay. Non-chimney pallet loadings have the cargo boxes placed tightly together on each pallet, and the pallets of boxes are then placed tightly together within the cargo bay, leaving no vertical air gaps anywhere within the cargo bay load. Since there are no vertical air gaps between boxes or pallets from the floor up to the maximum 2133 mm (84-inch) “Red-Line” loading height, circulating air is forced to travel along the floors, walls, and ceiling of the cargo bay as intended. The non-chimney packing scheme will provide the best thermal environment for cargo.



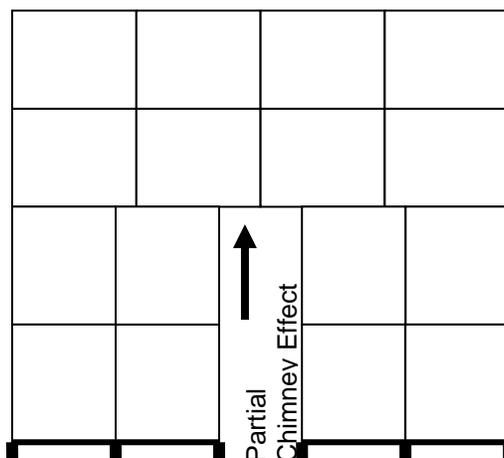
Preferred “**Non-Chimney**” Pallet Loading Arrangement  
(as viewed from rear of the container)

### Partial (Closed-Top) Chimneys: Acceptable

“Partial (closed-top) chimneys” are acceptable as long as they are properly constructed such that they prevent air from flowing upward from the floor and out to the ceiling. Partial chimneys are vertical air gaps between pallets or between boxes on a pallet that are capped or blocked to prevent air from flowing out the top-most layer in the stack.

### WARNING

Improperly created partial (closed-top) chimneys at any location in the cargo bay places all cargo at risk of non-uniform or uncontrolled temperature damage, and especially the cargo at the rear of the cargo bay.



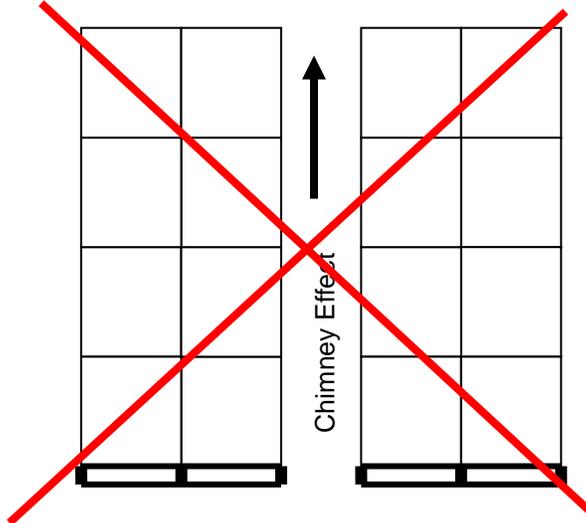
Acceptable “**Partial Chimney (Close-Topped)**” Pallet Loading Arrangement  
(as viewed from rear of the container)

### **Open (Open-Top) Chimneys: Prohibited**

“Open (open-top) chimneys” are NOT ALLOWED at any time or location in the cargo bay. Open chimneys are continuous vertical air gaps between pallets or between boxes on a pallet, from the floor towards the ceiling area.

### **WARNING**

An open chimney prevents complete circulation of the air to the rear of the cargo bay, increases refrigeration unit cycling, and decreases efficiency. Open (open-top) chimneys at any location in the cargo bay places all cargo at risk of non-uniform or uncontrolled temperatures, and especially the cargo at the rear of the cargo bay.



**Figure ZZ - Prohibited “Open Chimney (Open-Top)” Pallet Loading Arrangement**  
(as viewed from rear of the container)

## FIRST-ROW BULKHEAD LOADING

Due to specific air circulation requirements in the cargo bay, the proper loading and placement of the first row of cargo at the front bulkhead is extremely important.



**Toe-Kick Plate (at bottom of bulkhead wall)**

An angled “toe kick” aluminum plate is mounted to the bottom of the front cargo bay bulkhead and covers the first 100 mm (4 inches) of the t-slot floor to force supply air rearward along the floor. Do not alter or remove this angled toe-kick assembly for any reason, and be careful to not damage it while loading cargo. **Damage or alteration to the “toe-kick” plate will degrade the air circulation and cause temperature anomalies, leading to cargo damage.**



**Maximum Load Height**

- If you are loading the first-row cargo tight to the front bulkhead wall (which is allowed), DO NOT load the front row of cargo any higher than the 76-inch Max. Height Limit bar. Behind this first row of cargo (at 1930mm / 76-inch height limit), it is acceptable to stack the remaining cargo to as high as the Red-Line Height Limit of 84 inches.

## **PARTIAL LOAD**

Partial loads of cargo can be accommodated in the cargo bay, but special floor covering procedures must be followed to avoid cargo damage due to thermal “short-cycling” within the cargo bay.

Partial Load Procedure:

1. Load cargo into the cargo bay following the details and precautions noted in the sections titled **First Row Bulkhead Loading, Chimneys, and Dunnage**.
2. Always fill the cargo bay from front bulkhead rearward towards the rear doors, filling the side-to-side space with cargo as completely and tightly as possible to prevent open chimneys and wasted space.

### **NOTE**

A gap of 35-50 mm (1.5-2 inches) must be maintained between the cargo bay side walls and the outer surface of all cargo boxes to allow for proper airflow and cooling.

### **NOTE**

Never place plywood under any cargo load or pallet.

3. Critical: If the container will travel with a partial load, it is critical that all plywood sheets on the floor be secured to prevent movement and shifting.

## **FULL LOAD**

Full Load Procedure:

1. Load cargo into the cargo bay following the details and precautions noted in the sections titled **First Row Bulkhead Loading, Chimneys, and Dunnage**.
2. Always fill the cargo bay from the front bulkhead rearward towards the rear doors, filling the side-to-side space with cargo as completely and tightly as possible to prevent open chimneys and wasted space.

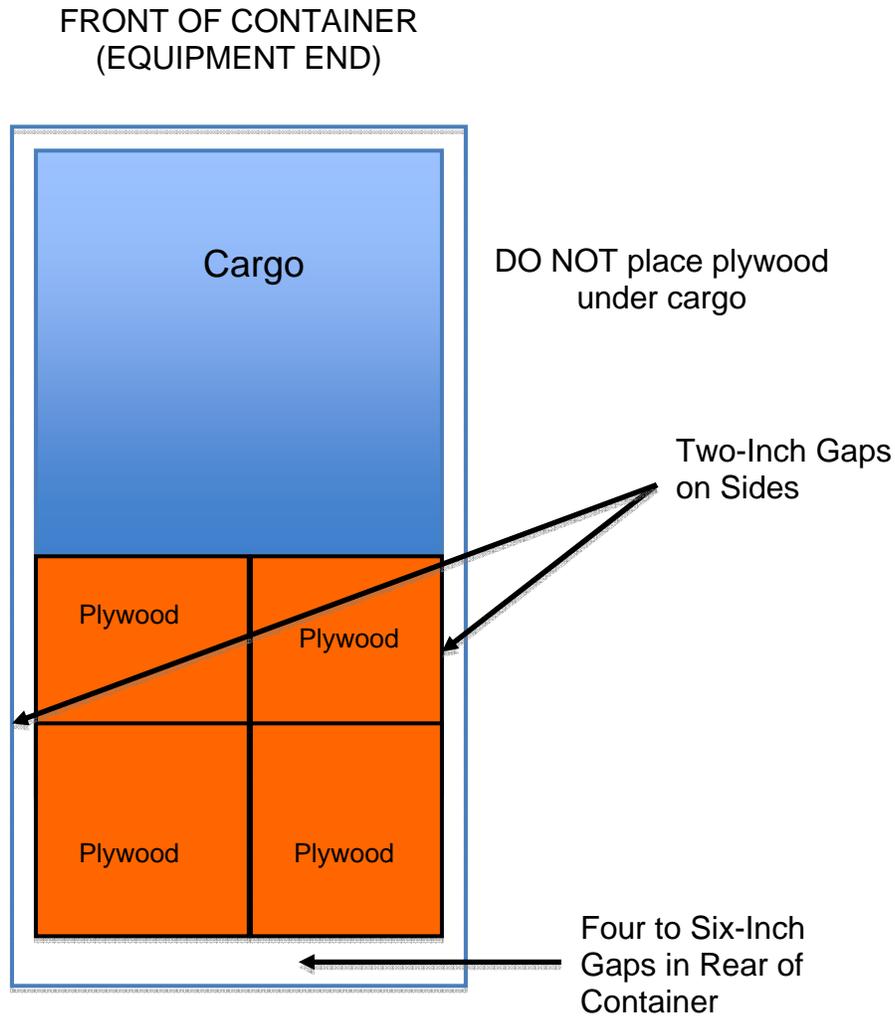
### **NOTE**

A gap of 35-50 mm (1.5-2 inches) must be maintained between the cargo bay side walls and the outer surface of all cargo boxes to allow for proper airflow and cooling.

3. Critical: The last row of cargo should not be tight against the doors. Minimum 100 mm (4 inches) for airflow between the cargo and the doors is preferable. This is where the rearward-traveling cold air will exit the floor channels and begin its required path back to the return air grill in the front bulkhead.
4. Critical: If the gap between the last cargo box/pallet and the closed rear door is more than 300 mm (12 inches), this is considered a partial load and plywood floor covering must be installed and secured per the “Partial Load” procedures above. The plywood must be spaced 2” from the cargo bay side walls to allow air to circulate up through the corrugation of the walls
5. To prevent a shifting load during travel from blocking the required 100 mm (4 inches) air space near the door, it is acceptable to install and secure open blocking or open-frame vertical pallets in the 125-150 mm(5-6 inch) air space behind the last load. **NEVER use solid blocking in this space, as it will block the required airflow out of the floor channels.**

## NOTE

If there is more than a 300 mm (12") gap between the rear-most cargo and the inside of the closed rear door, the open T-slot flooring behind that cargo must be covered with plywood and secured to the floor to prevent movement during travels. This will ensure that air travels under the floor all the way to the rear door.

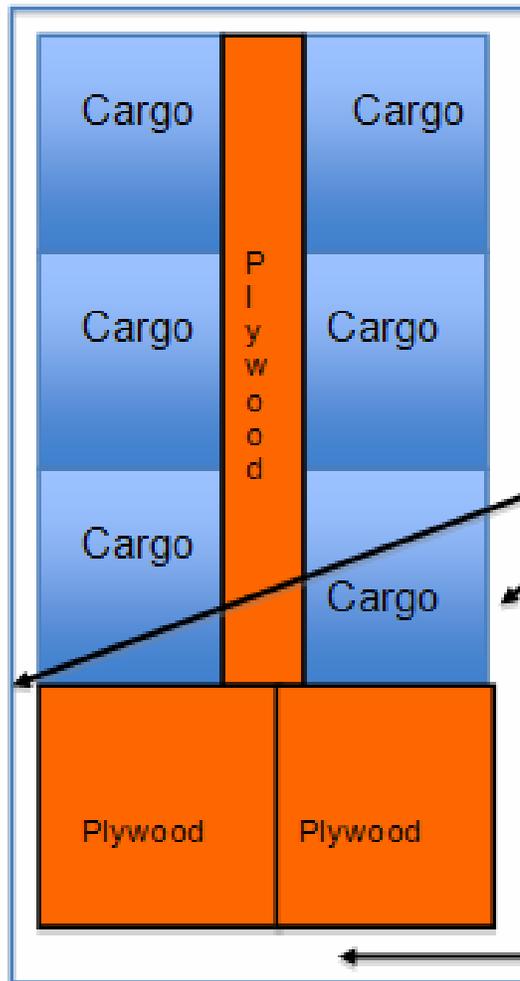


Partial Load with Plywood Covering Container Floor

## NOTE

When laying plywood on the floor behind cargo that is further than 6" from the rear doors, be certain to leave a 150 mm (6") gap between the rear edge of the plywood and the inside surface of the closed rear doors.

Refrigeration Unit and  
Generator Set End

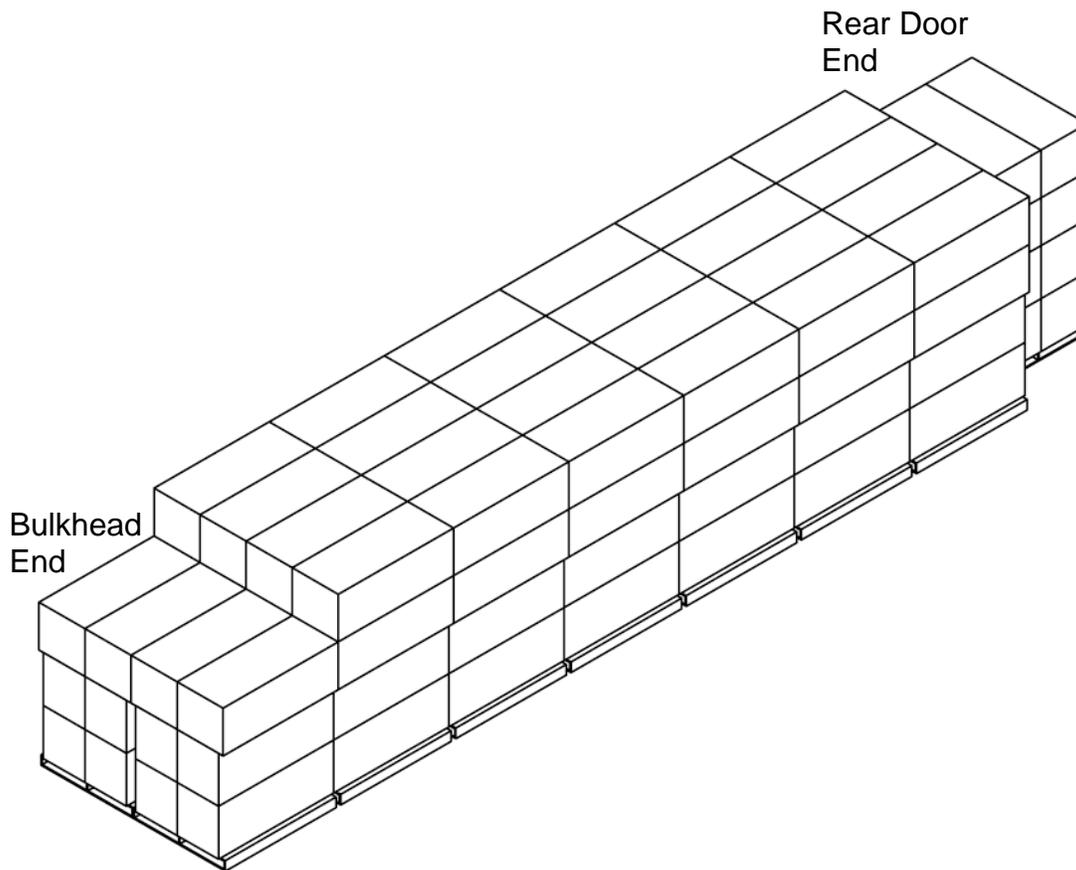


DO NOT place plywood  
under cargo

40mm Gaps on  
Sides

100mm Gap to  
Rear doors

Container Doors End



### **Fully Loaded Container (Optimum Airflow)**

The above illustration shows one of two suggested configurations of a fully loaded container. The absence of a top row of boxes at the bulkhead end allows for best airflow back to the refrigeration system.

Note the gap between the lower two levels of boxes at the left (bulkhead/refrigeration/front) end of the container. This gap causes a “partial chimney” effect, and is acceptable as long as the chimney is blocked above that level. To accomplish the required upper-level blocking of the chimney, the upper two tiers of boxes are stacked tight together, closing the chimney effect and preventing circulating air from escaping (short-cycling) upwards through the loaded skids of cargo.

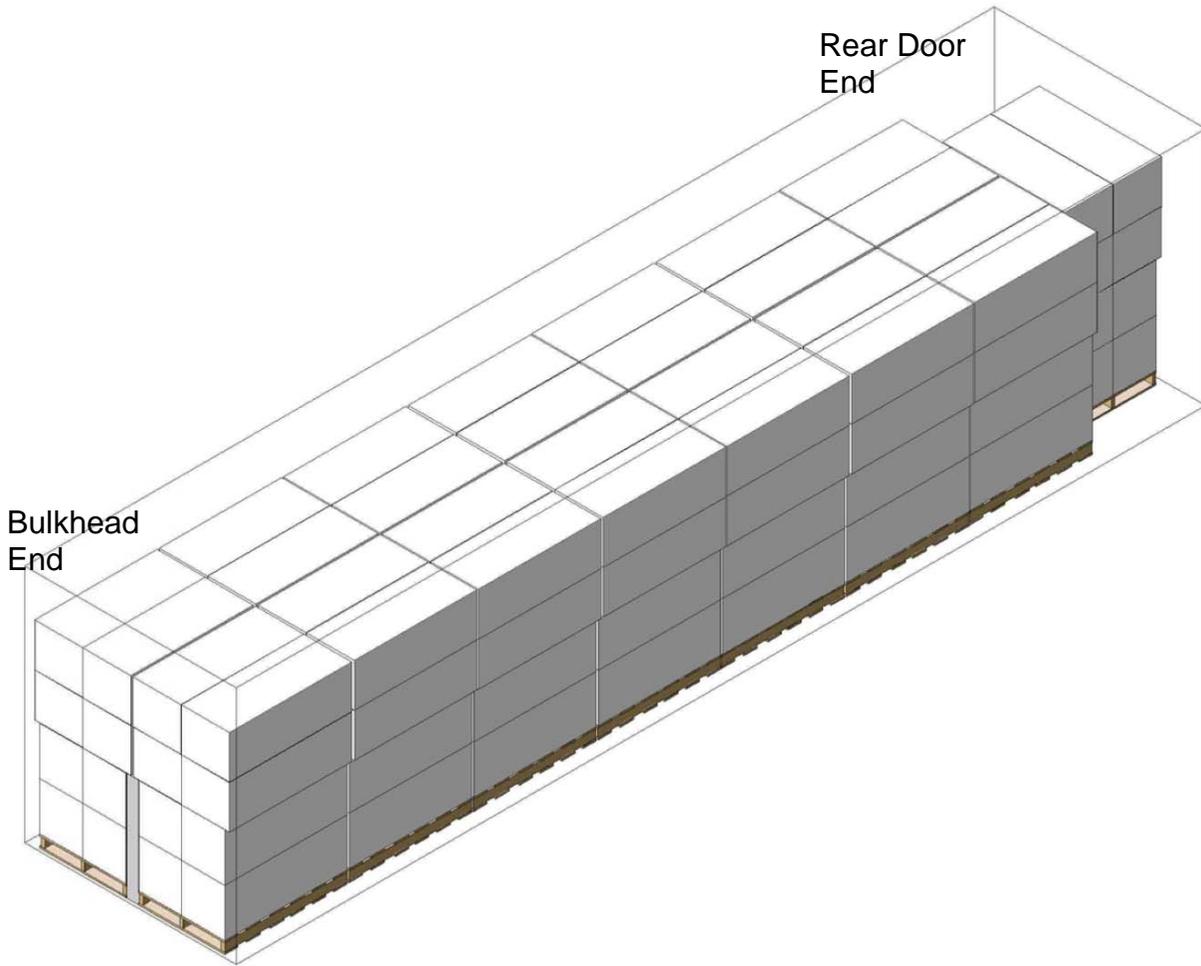
#### **NOTE**

Container loads must be packed as closely as possible to eliminate an “open chimney” effect of circulated air passing upward from the floor to the ceiling between the loads. An open chimney effect prevents complete circulation of the air to the rear of the cargo bay, increases refrigeration unit cycling, and decreases efficiency.

#### **NOTE**

Open chimneys are prohibited as they pose a large risk of causing cargo damage due to the cargo bay air temperature being less uniform and controlled in those “short-cycled” regions. Never allow the creation of open chimneys. Always be sure that any lower-level chimney is blocked above by using a solid load over the lower chimney gap. See CHIMNEY section for more details.

The partial chimney allows air to flow up between pallets throughout the cargo bay. Keeping pallets or boxed loads 35-50 mm (1.5-2”) from cargo bay side walls and not loaded beyond the red rear load line, as described previously in this manual, allows the refrigeration unit to discharge cold air into the cargo bay and flow in the best manner per system design.



**Fully Loaded Container (Reduced Airflow)**

The above illustration shows the second configuration of a fully loaded container. Pallets including the top row of boxes at the bulkhead end will cause a slight reduction in airflow.

Similar to the previously described fully loaded container configuration, a “partial chimney” effect is acceptable.