

Airflow, Load Patterns & Multi-Temp Zones

How air delivery, bracing, floor channels, and multi-temperature bulkheads decide whether setpoints on paper match pulp temps at delivery. From USDA Handbook 669 loading chapters.

ProspectSentinel

~12 min read

USDA AH-66 + HB 669

For shippers & reefer desks

Transit Guide

Cold Chain Index

Precool Estimator

Executive brief

A correct thermostat setting with a blocked airway is fiction. HB 669's loading chapters (top-air vs bottom-air delivery, unit loads, bracing, top-ice, vented loads) exist because air must actually contact surfaces and return to the evaporator. Multi-temperature vehicles add bulkhead and zone discipline on top of that physics.

Air delivery types

- **Top-air delivery:** discharge along ceiling; return typically at front bulkhead. Channels from bulkhead to rear and under/around the load matter. Hand-stacked and unitized patterns differ — but both fail if the rear header or top path is sealed shut.
- **Bottom-air delivery:** deep floor channels / T-rail logic; product and packaging must not smother the floor path.

HB 669 emphasizes raising loads off the floor when under-load airflow is required (especially freeze protection in cold weather) and bracing so vibration does not topple upper rear cartons into the air path.

Load pattern principles (desk language)

1. Leave designed air channels — do not “maximize cube” by murdering return air.
2. Centerline / offset / pinwheel pallet patterns exist to create paths; pick one appropriate to the equipment, not Instagram.
3. Secure top-rear positions first; they take road shock.
4. Top-ice only for ice-tolerant commodities; melt water is a feature or a failure mode depending on the crop.
5. Frozen cargo loads tight with perimeter air intercepting wall heat; fresh respiring cargo needs different air philosophy than hard-frozen freight.

Multi-temp: Zones only work if bulkheads seal and each zone's commodities match that zone's band. A paper “0 / 35 / 55” plan with a leaky bulkhead is a single-zone trailer in denial. Use [Produce Shipper Transit Guide](#) checklist items on airflow and multi-temp.

Pre-load / loading checklist (condensed from HB 669 themes)

- ☐ Equipment capable and clean; prior odor loads washed out (fish/onions before butter/dairy).
- ☐ Unit precooled or prewarmed to near setpoint.
- ☐ Pulp temps verified; product within band.
- ☐ Air paths planned for the actual delivery type.
- ☐ Bracing installed; vents configured; seals intact.
- ☐ Setpoint + continuous run / cycle policy agreed and written.

[Open dock checklist](#)

[Precool estimator](#)

PDF DOWNLOAD · OPTIONAL UPDATES

Save this guide as a PDF

Download immediately—no account required. Optionally leave a work email for occasional cold-chain field notes from ProspectSentinel. Built for produce shippers, receivers, and reefer operations teams.

Work email (optional for direct download)

PDF is also available without email. Submitting agrees to occasional series updates; unsubscribe anytime. Educational content only—not legal or claims advice.

[Download PDF now \(no email\) →](#)

FAQ

- ▶ Is this official USDA guidance?
- ▶ Can I share these with customers?
- ▶ Where are the interactive tools?

Sources & interactive tools

- [USDA AH-66 — The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks \(2016\)](#).
- [USDA AMS HB 669 — Protecting Perishable Foods During Transport by Truck](#)
- **Federal rules (eCFR):** [7 CFR Part 46 — PACA regulations](#) · [49 CFR Part 370 — Principles and practices for the investigation and voluntary disposition of loss and damage claims](#)
- [Cold Chain Index](#) — 200+ commodity storage/transit matrix + co-load checker
- [Produce Shipper Transit Guide](#) — dock setpoints, mix load, checklist
- [Reefer Precool Time Estimator](#) — half-cooling-time style estimator
- [Perishable Claim Analyzer](#) · [PACA Good Arrival Calculator](#) · [Produce Truck Rate Explorer](#)
- [Freight claim package checklist](#) · [Claim / Carmack deadline calculator](#)

IMPORTANT NOTICE

This publication modernizes and explains **public USDA guidance** and, where noted, points to **public federal regulations on eCFR.gov** for educational use by shippers, brokers, carriers, and operators. It is **not** an official USDA or DOT document, and it is **not** legal, insurance, PACA advocacy, food-safety certification, or professional claims advice. Always verify current commodity specifications, contracts, and the *current* eCFR text with the controlling authority and your counsel.

Primary sources: USDA-ARS Agriculture Handbook 66 (2016); USDA-AMS Handbook 669, *Protecting Perishable Foods During Transport by Truck* (1995, reprinted 2008), including Load Compatibility Groups from USDA Marketing Research Report 1070 (Lipton & Harvey, 1977). Selected federal regulation entry points: [7 CFR Part 46 \(PACA\)](#); [49 CFR Part 370 \(freight claims\)](#).

Full series

00 Cold Chain Operating System

01 The Reefer Is Not a Precooler

02 Colder Is Not Safer

03 Ethylene: The Invisible Load Killer

04 USDA Groups 1–8: The Mixed-Load Playbook

06 Commodity Setpoint Desk Guide

07 Protein, Dairy & Eggs on the Same Trailer

08 CA, MAP & When Gas Matters

09 From Temperature Log to Claim

10 Seasonal Produce Desk

Share with your team

Free to read, print, and forward. No account required. Bookmark the interactive tools or download the PDF for dock and desk use. Published by ProspectSentinel as an educational modernization of public USDA handbooks.

[Browse free tools](#)

[Download PDF](#)

Optional email updates are available in the form above. Content remains free either way.

Educational desk resources distilled from public USDA handbooks.
Free interactive tools and downloadable guides for professional use.