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WHITE PAPER 04 · MIXED LOADS

USDA Groups 1–8: The Mixed-Load Playbook

The industry standard co-load chart from USDA Marketing Research Report 1070 (in Handbook 669). Groups, ice rules, odor pairing, and when multi-temp is non-negotiable.

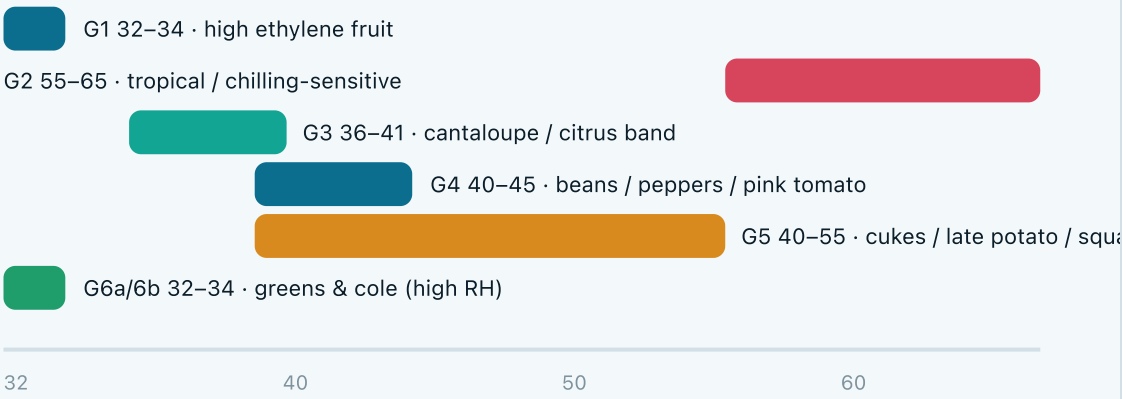
ProspectSentinel | ~13 min read | USDA AH-66 + HB 669 | For shippers & reefer desks

Transit Guide | Cold Chain Index

Executive brief

Appendix II of USDA Handbook 669 reprints the load compatibility groups from Marketing Research Report 1070 (Lipton & Harvey, 1977). They remain the industry's shared language for mixed produce: commodities in the **same group** share transit temperature, humidity, ethylene, and ice tolerance closely enough to ride together under normal practice.

USDA Load Compatibility Groups — transit temperature bands (°F)



Same group ≈ co-load candidates. Group 1 vs 6a/6b is the classic ethylene conflict (USDA MRR 1070 / HB 669 Appendix II).

Five factors before the chart

1. Required commodity temperature
2. Required relative humidity
3. Emission of physiologically active gases (ethylene)
4. Odor-absorbing characteristics
5. Modified-atmosphere requirements

HB 669: desired transit temperatures of co-loaded products should be within a reasonably close range — mature-green tomatoes at ~55°F do not share air with lettuce at 32°F.

Group cheat sheet

GROUP	TRANSIT °F	RH	CHARACTER
1	32–34	90–95%	Apples, stone fruit, berries*, pears… high ethylene; ice never in contact
2	55–65	85–95%	Avocados, bananas, mangoes, green tomatoes, many tropicals
3	36–41	90–95%	Cantaloupes, cranberries, many oranges/tangerines/lemons*
4	40–45	~95%	Snap beans, okra, peppers, summer squash, pink tomatoes*
5	40–55	85–90%	Cucumbers, eggplant*, late potatoes, winter squash; ginger ≥55°F
6a	32–34	95–100%	Leafy greens, lettuce, herbs, sweet corn, many roots
6b	32–34	95–100%	Cole crops; generally compatible with 6a (exceptions: figs/grapes/mushrooms)
7	55–65	85–90%	Early potatoes, sweetpotatoes, ginger
8	32–34	65–75%	Garlic & dry onions — dry + odor isolation

*See handbook footnotes: origin-specific citrus temps; grape SO_2 rules; multi-group commodities (watermelon, eggplant, pink tomato, etc.).

Non-negotiables

- **Group 1 ↔ 6a/6b:** no (ethylene).
- **Ice contact:** never for most fruit/berries/mushrooms; acceptable for many cole crops / some 6-class items per notes.
- **Grapes:** only with others if not SO_2-fumigated in the vehicle / no SO_2-releasing packs that conflict.
- **Group 8 onions/garlic:** odor taints nearly everything; keep isolated.

> **Tools:** Produce Shipper Transit Guide Mix load tab implements groups interactively; Cold Chain Index tags commodities with USDA groups and flags conflicts including odor.

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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

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

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01 The Reefer Is Not a Precooler

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05 Airflow, Load Patterns & Multi-Temp Zones

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