WHY YOU NEED A BUCK-BOOST TRANSFORMER

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Voltage problems are silent. The damage is not.

Most equipment failures blamed on the unit, the install, or the brand are actually caused by the wrong voltage at the disconnect.

UNDERVOLTAGE: HVAC COOLING

At 208V vs 230V rated: **Capacity drops 10-15%. Efficiency drops 15-20%. Runtime increases 20-30%.**

Cascading thermal failure: Motor runs hotter, heats suction gas, reduces capacity, longer runtime, more heat, lubricant breaks down, compressor fails years early. Contractor replaces compressor. Same voltage. Cycle repeats.

Worst performance on the hottest days when load and ambient are highest.

UNDERVOLTAGE: HEAT PUMPS

Same compressor for heating and cooling. Undervoltage hits both sides of the cycle. In heating mode, system already working against cold outdoor temps with reduced capacity. At 208V the compressor produces less heat, runs longer, relies more on expensive backup strip heat.

Heat pumps are the dominant system across the South. Every heat pump on a 208V building has this problem year-round.

UNDERVOLTAGE: RESISTANCE HEATING

Power = V squared / R. A 12% voltage drop = 25% heat output loss.

Applies to heat strips in air handlers, ovens, fryers, steamers, warmers, booster heaters. Oven equilibrium drops 80-100F below set point. Cook times increase 50-100%. No error code. Equipment quietly underperforms.

WATER HEATERS

Commercial water heaters on 208V with 240V elements lose 25% capacity. Recovery between uses dramatically slower. Water never reaches sanitizing temperature. **Health department issue, not a comfort issue.**

WALK-INS & REACH-INS

Walk-in compressor on 208V runs continuously on a hot day. Product temp drifts above safe range. **Food safety risk and health code violation.** Different buyer than HVAC, same fix.

OVERVOLTAGE: HVAC EQUIPMENT (250V)

ANSI C84.1 allows up to 252V on 240V service. Equipment rated 230V at 250V+ runs at 109%+ of nameplate. **Inverter boards fail first.** ECM motors overheat. Capacitors blow. Compressors short-cycle.

Grid upgrades, distributed solar, lighter loads, and fixed tap settings are pushing delivered voltage higher. Utility is within spec. Equipment is within spec. The combination kills the equipment.

Inverter-driven heat pump compressors are the most vulnerable. Variable-speed boards are the most expensive component and most sensitive to overvoltage. Board replacement: $500-$1,500. Same voltage = new board burns out too.

Contractor makes three service calls before anyone checks voltage. A 6% step-down permanently corrects 250-252V to 235-237V.

MOTORS, FANS & BLOWERS

Torque proportional to voltage squared. At 208V vs 240V = 75% of rated torque. More current, more heat, speed drops under load.

Insulation 10-degree rule: Every 10C above rated cuts life in half. 20C hotter = 75% of insulation life gone.

Fans/blowers: Less voltage = less CFM. Reduced condenser airflow compounds cooling losses.

CNC, WELDERS & SHOP EQUIPMENT

Most shop equipment rated 230/240V. On 208V: 75% torque, finish degrades, fault codes on hard materials. Welders can't hold arc. Saws bog on hardwoods.

GARAGE DOORS / EV CHARGERS

Garage doors: Undervoltage = slower, may not lift heavy doors in cold weather. Overvoltage = faster than designed, board failures. Nobody checks voltage.

EV chargers: Undervoltage = 13% less power, 8-hr charge becomes 9+ hrs. Fleet: 50 vehicles on 208V = 6-7 vehicles lost per night. Overvoltage: Porsche/Jaguar fault at 250V+. Jaguar confirmed buck-boost as fix.

THE 208/230V NAMEPLATE REALITY

208/230V is a **230V motor the manufacturer will warrant at 208V.** 208V is the minimum floor, not the design point. Higher current, more heat, shorter life.

Operating outside rated voltage can void manufacturer warranties. That makes facility managers pay attention.

WHY VOLTAGE IS WRONG: UNDERVOLTAGE

US grid averages 50 years old. Most commercial buildings fed 208V three-phase. Majority of equipment rated 230/240V. **That gap exists on every commercial install.** Over-capacity circuits, voltage drop in wiring, long wire runs.

WHY VOLTAGE IS WRONG: OVERVOLTAGE

Utilities intentionally deliver high. ANSI C84.1 allows up to 252V on 240V service.

Getting worse: Lighter loads, rooftop solar, grid upgrades reducing impedance, regulators set for peak. Off-peak voltage runs even higher.

UNDERVOLTAGE: RESISTANCE vs MOTOR LOADS

	Resistance Heat	Motor/Compressor
Voltage loss	12%	12%
Output loss	25%	10-15%
Runtime increase	50-100%	20-30%
Failure mode	Silent, no codes	Compressor dies early
Heat pump	Strip heat at 75%	Both modes hit

COST OF THE PROBLEM vs COST OF THE FIX

Failure	Cost
Compressor replacement	$2,000 - $5,000
Inverter board	$500 - $1,500
Commercial oven	$15,000+
Service calls (x3)	$450 - $900
Buck-boost transformer*	**$300 - $1,000**

**Cost depends on % of voltage increase/decrease and amperage of circuit.*

The fix costs less than the first callback.

THE FIX

A voltage-specific buck-boost transformer corrects the mismatch permanently, at the point of use, without changing the building's electrical service. **30-minute install. One transformer per circuit. The technician already on the job adds it to the same ticket.** Cost goes on the same PO as the equipment install or service call. Building owner, tenant, or contractor can spec it. No separate project, no separate trade.