

Boreas Nitrogen Cooling System for refrigeration in the Transportation Industry is a safe alternative to conventional diesel systems. Our system offers improved performance, whisper-quiet operation, reduction in operating costs and is environmentally friendly.

As the transportation Industry moves to an increased safety awareness and reliable transportation of refrigerated fresh food, medical supplies and agricultural needs, Boreas Nitrogen Cooling Systems ensures compliance of the Food Safety Modernization Act (FSMA).



Boreas Cooling System vs Traditional Diesel System

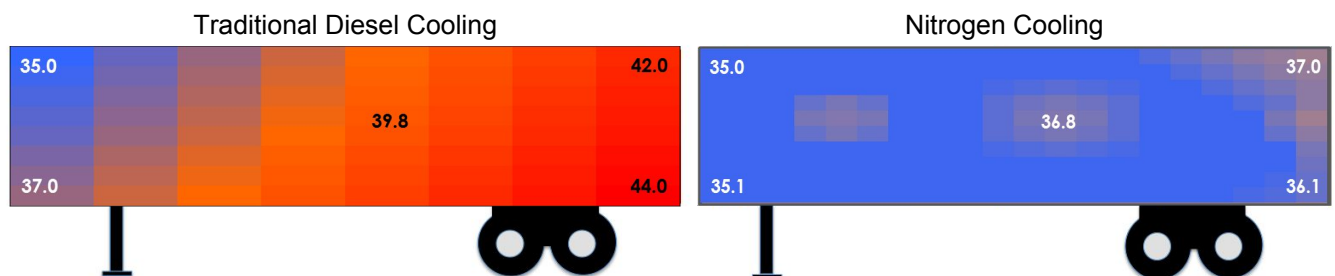
Attribute	BOREAS	Diesel
Safety	ISO-26262 Testing/Compliance ★	Standard ✖
Temperature Control	Up to 6.1F ★	Up to 12.6F ✖
Pre Cool Time	10 Minutes ★	2 Hours ✖
Pull Down Time	< 1 Hour ★	> 1+ Hour ✖
Steady State	2-5 Gal/Hr Avg. ★	0.8 Gal/Hr Avg. ✖
Operational Costs	\$0.35/Gal \$1.25 Ave Gal/Hr ★	\$2.50/Gal \$2.00 Ave Gal/Hr ✖
Maintenance Cost	< \$500/yr. ★	\$1,200 - \$3,000/yr. ✖
CO2 Emissions (Annual)	0 ★	up to 25 Tons ✖

KEY BENEFITS & COST SAVINGS

- ★ Safe operation
- ★ Tight temperature control
- ★ Whisper quiet
- ★ Reduction in maintenance costs
- ★ Emits zero emissions during operation
- ★ Assists requirements of no idle for trailer
- ★ System is supported with Solar Power
- ★ Competitively priced with conventional systems today
- ★ ROI less than 2 years
- ★ Telematic options available depending on customer requirements
- ★ Nitrogen infrastructure readily available
- ★ FSMA compliant

Consistent Cooling Temperatures

Increased Efficiency Over the Competitor



Nitrogen Cooling System Specifications

Description:

- Direct-Inject Liquid Nitrogen Cooling System, with 200 or 300 gallon Nitrogen Storage Tank under trailer
- Electrically Powered by Battery with Solar Assist Charging System
- Multiple Independent Sprayer Units for precise temperature control
- **Single zone:** Single temperature set point control with independent spray heads
- **Dual zone:** Dual temperature set point control with independent spray heads, Under development
- Designed to meet ISO-26262 Functional Safety Critical System (2011), SAE-J1113 EMC, ISO-16750 Environmental
- Multiple Microprocessor Control Modules connected by high speed, fault-tolerant CAN network

Features / Components:

Trailer Front	Trailer Top	Under Trailer	Trailer Rear	Inside Trailer
Boreas Control Unit & Venting System	Solar Charging System	Nitrogen Vessel w/Control Valves	Safety Gate System	Oxygen Sensing & Temperature Sensing
Operator Control & Driver Light Panels		Nitrogen Fill Box	Warn / Guard Indicators	Multiple Spray Units

Cooling Specs: (Assuming 100°F [38°C] Ambient and 35°F [2°C] Setpoint)

Operation	Start Stop			Continuous		
	Delta T	Time	LN2 Usage	Delta T	Time	LN2 Usage
Pre-Cool to 55°F (by Electric Power)	45 °F	<10 min	0 gal	45 °F	<10 min	0 gal
Pull-Down to 35°F	20 °F	<1 hr	~20 gal	20 °F	<20 min	~35 gal
Steady-State (configurable)	~ +8 °F	n/a	2.5 gal/hr	~ +2 °F	n/a	5 gal/hr

Electrical Current Consumption: (Parasitic Current from Tractor Aux 7 Way Pigtail)

Operation	During Daylight (Solar Assist)			Non-Daylight (No Solar Assist)			With Brakes Applied
	Peak	Normal max	Normal min	Peak	Normal max	Normal min	
On / No cooling	0 A.	0 A.	0 A.	15 A.	3 A.	0 A.	0 A.
Cooling	0 A.	0 A.	0 A.	15 A.	8 A.	3 A.	0 A.
Venting (< 10 minutes)	15 A.	15 A.	0 A.	15 A.	15 A.	15 A.	0 A.

Battery & Solar System: (2 High Efficiency PV Modules with MPPT Controller)

	Rating	Current	Voltage	Dimensions	Weight
Solar Panels (2)	280 W Total	16.27 A. @ Pmax	17.2 V. @ Pmax	59" x 26.5" [1500mm x 625mm] (each)	26.7lbs. [12.1kg] each
Batteries (2)	115 AH @ 20 HR ea.	760 CCA @ 0°C ea.	12V	Group 31	72.3lbs. [32.8kg] each

Dimensions:

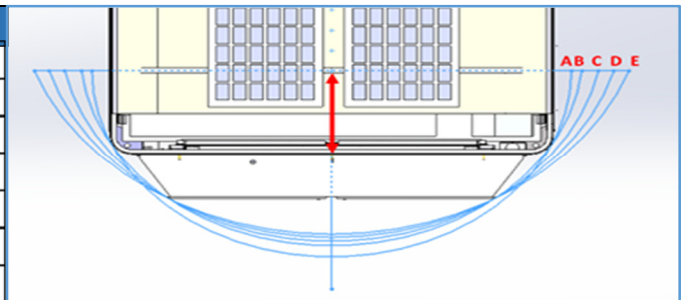
	Height		Width		Length / Depth	
AeroShell (Nose)	29"	737mm	75"	1,905mm	13"	330mm
LN2 Storage Tank	26"	660mm	26"	660mm	120"	3,048mm
Fan / Spray Control Box	7"	178mm	22"	559mm	20"	508mm
Sprayer Unit	3"	76mm	8.5"	216mm	75"	1,905mm

Noise:

Powered On / No cooling	Cooling (occasional valves clicking)	Venting (fans running inside)
Silent – No Sound	~20 dB (equivalent sound of rustling leaves)	~40 dB (equivalent sound of household fan)

Swing Radius:

Letter Designation	King Pin Location		Swing radius	
	Inch	mm	Inch	mm
A	24	610	55.2	1402
B	30	762	57.95	1471.9
C	36	914	62.63	1590.8
D	42	1067	67.51	1714.8
E	48	1219	72.59	1843.8



Weight: Single Zone (Fully Fueled) ~ 2000 lbs. (907 kg.), 75% on King Pin / 25% on Rear Axle