THERMONIX™ – HTx

Next-Gen Thermal Transfer Solutions

NANOMATRIX® MATERIALS

Advanced Nano-Coating for High-Performance Heat Dissipation on Air Conditioning Condenser Coils

Outdoor condenser coils reject heat from the air-conditioning system to the surrounding ambient air. At high outdoor temperatures, heat rejection becomes more challenging, increasing condensing temperature and compressor energy consumption. Conventional aluminum fins have limitations in how effectively heat is transferred and dissipated from the coil surface, while improvements in heat rejection typically require larger coils, increased airflow, or additional fan power, resulting in higher energy consumption.

Thermonix™ HTx is a patented, advanced, transparent, sub-10 micron nanocoating applied directly to aluminum outdoor condenser coils. It targets the sensible-heat side of the system by substantially improving heat transfer and heat dissipation at the condenser, **with no change to the substrate, fin geometry, refrigerant circuit, or airflow path, and with no additional power draw.** This ultimately reduces energy consumption while increasing sensible heat capacity.

Independent field and laboratory validation demonstrated:

20–25%	+2.6–9.4%	+5–43%
Energy savings (measured in field testing)	Cooling capacity increase (OEM unit tests)	Indoor airflow increase (OEM unit tests)

The Condenser Heat-Rejection Challenge

- **High Ambient Heat Load**
  High outdoor temperatures reduce the temperature difference available for heat rejection, making it more difficult for the condenser to dissipate heat to the ambient air.
- **Limited Heat Dissipation**
  Conventional aluminum fins provide a large surface area for heat rejection, but the rate at which heat is transferred and dissipated from the coil surface can limit overall condenser performance.
- **Higher Energy Consumption**
  As condensing temperature increases, the compressor must work harder to maintain the required cooling conditions, increasing overall system energy consumption.
- **Coastal Corrosion Exposure**
  Thermonix™ HTx can be integrated with suitable anti-corrosion coating systems, enabling enhanced heat-dissipation performance while supporting condenser coils designed for demanding coastal and high-corrosion environments.

How Thermonix™ – HTx Works

- **Functionalized Graphene-Nanoceramic Layer**
  A functionalized graphene–ceramic nanocomposite forms an ultra-thin layer bonded to the aluminum coil surface. The ceramic component strengthens interlayer phonon coupling, improving heat transfer through the coating.
- **Improved Through-Thickness (Z-direction) Heat Transfer**
  The nanocomposite enhances thermal transport perpendicular to the coil surface, supporting faster and more uniform transfer of heat toward the air-facing surface.
- **Better Heat Dissipation, Lower Energy Use**
  Enhanced heat transfer at the condenser supports more effective heat rejection to ambient air. Field testing measured 20–25% energy savings, while OEM unit testing demonstrated cooling-capacity improvements of 2.6–9.4% after application of Thermonix™ HTx.

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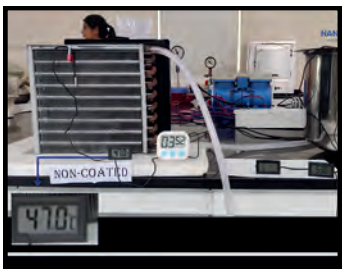
OEM Unit Performance Testing

(18K 3-Star Split AC, R-32) Before Coating vs After Thermonix™ HTx Coating

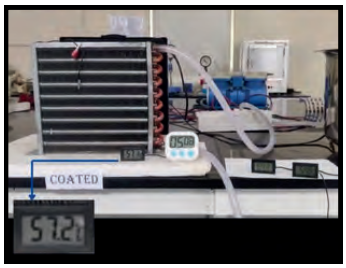
Operating Conditions	Sensible Heat Capacity		Sensible Heat Ratio		Sensible Heat Ratio	
	Before Coating	After Coating	Before Coating	After Coating	Before Coating	After Coating
Fixed speed	3,857	4,057 W (+5.2%)	84.2%	86.4%	4,579	4,698 W (+2.6%)
Inverter – half load	1,757	1,992 W (+13.4%)	87.3%	90.5%	2,013	2,202 W (+9.4%)

Source: OEM laboratory test data, before vs. after coating, same unit.

Thermonix™ HTx increased sensible heat capacity under both operating conditions, with the strongest improvement observed at inverter half-load operation.



Non-Coated Coil
Exhaust Temperature: 47 ° C



Thermonix™ Coated Coil
Exhaust Temperature: 57 ° C

Improved Airflow Performance

Thermonix™ HTx demonstrated improved airflow performance across different tests, including a measured reduction in air-side pressure drop during independent field testing and an increase in indoor airflow of 5–43% during OEM unit testing.

Independent Validation

Thermonix™ HTx has been evaluated through field performance testing and independent laboratory thermal characterization, validating both system-level performance and the thermal properties of the underlying graphene–nanoceramic coating technology.

Field performance – outdoor condenser coil on installedoutdoor units, independent field testing.

Parameter	Result (Field Testing)
Energy savings	20-25% measured
Air-side pressure drop	Measured reduction
Z-direction thermal conductivity	**157.86 W/m·K** Laser Flash Analysis (ASTM E1461), CMC Laboratories, USA
Thermal diffusivity, coated vs. non-coated Al	**19.25 mm²/s coated vs. 13.46 mm²/s non-coated** Approx. **43% higher**, Hot Disk TPS method, MNIT Jaipur
Specific Heat (Cp)	DSC cross-check by K.R. Mangalam University, New Delhi – consistent with CMC Labs data

Source: Independent laboratory and field test data compiled by Nanomatrix Materials (CMC Laboratories USA; K.R. Mangalam University; MNIT Jaipur).

Better Heat Rejection ⟶ Lower Energy Consumption

*Thermonix™ HTx is a **patented graphene–nanoceramic coating technology** engineered to enhance heat transfer and dissipation at the condenser, delivering measurable improvements in energy efficiency, sensible heat capacity and overall cooling performance—without changing the coil geometry, refrigerant circuit or airflow path, and without additional power draw.*

Same coil. Same circuit. Better heat dissipation

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