ROOF-MOUNTED HVAC SYSTEM

Nova Bus offers roof-mounted HVAC systems to reduce weight on the rear axle, optimize weight distribution and ensure passenger comfort.

Key benefits

• Optimal weight distribution on both axles compared to rear-mount HVAC units

• Improved passenger comfort from stable temperature and easier temperature control throughout the bus

• Improved air flow throughout the vehicle from the HVAC central location

• Accessible main control switches and A/C climate controls located on the driver overhead control panel

• Sealed unit protecting internal components from water

• Installation possible on a rear window configuration

Technical Specifications

• Thermo King HVAC system is offered
Heating and air conditioning system

The heating, ventilation and air conditioning (HVAC) system is designed to optimize passenger comfort. The system regulates interior vehicle atmosphere, filters the return air and forces conditioned air to circulate throughout the vehicle’s interior.

Nova Bus has developed the Thermo King heating/air conditioning system Athenia model, with the horizontal scroll compressor Copeland for electric HVAC and the S616 for the other models, which is a roof-mounted units system.

The system regulates interior vehicle atmosphere, filters return air and force-circulates conditioned air throughout the vehicle interior.

One unit is used on our 40ft model

For the 40ft bus, the Thermo King AMII 1000 R407 S616 Compressor is included in our proposal.

These models are controlled by the Thermo King Climate Control system IntelligAir III version. The HVAC system is controlled by membrane type switches located on the overhead control panel.
THERMO KING CORPORATION
BUS AIR CONDITIONING SPECIFICATION

UNIT: Athenia 1000 R407C

APPLICATION: Roof Top

1. Performance

a. Cooling Capacity 113,000 Btu/hr (est) @3000 cfm Evap
   - Ambient: 95°F
   - Return Air: 80°F
   - Compressor Speed: 67°F wb (50% rh)

b. Evaporator Airflow:
   - @ 0" (0 mm) H₂O External Static: 3000 cfm
   - @.5" (12.7 mm) H₂O External Static: 2600 cfm

c. Condenser Airflow: 5500 cfm

d. Refrigerant: R407C

e. Power: 105 amps @27 VDC

f. Heating Capacity 100,000 Btu/hr (est) with 8 gpm
   160°F coolant - 60°F ambient

2. Physical Characteristics

a. Evaporator / Condenser Package:
   - Length: 90.6 in (2300 mm)
   - Width: 74.5 in (1892 mm)
   - Height: 8.5 in (215 mm)
   - Roof radius: 5.0 - 11.0 m

b. Weight:
   - Evaporator/Condenser Package: 450 lb (est)

3. General

a. One-piece rooftop unit with controls.
4. **Condenser Coil (2)**

   a. Manufacturer & Model  
      Thermo King

   b. Face Area (total)  
      10.35 ft² (0.96 m²)
      Coil finned dimensions (ea)  
      11.62” x 64.11” (295 x 1628 mm)

   c. Number of rows  
      5

   d. Number circuits per coil  
      5

   e. Number of fins/in  
      9 (3.175 mm spacing)

   f. Tubes - material  
      Copper
      - O.D.  
      .375 in (9.5 mm)
      - wall thickness  
      .016 in (0.4 mm)

   g. Fins - material  
      Aluminum
      - thickness  
      .008 (0.2 mm)

   h. Header plates - material  
      Aluminum
      - thickness  
      .080 in (2.0 mm)

   i. Corrosion Protection  
      .001-.002”
      Water Based
      Lacquer Coating

5. **Condenser Fan with Integral Motor**

   a. Number of Fans  
      5

   b. Manufacturer/Model  
      Brushed: Spal/ VA01-BP70VLL-36S (3spd)
      Brushless: EBM W3G300 ECDC

   c. Type  
      Cased Axial flow

   d. Diameter  
      12 in (305 mm)

   e. Number of Blades  
      5

   f. Blade and Case Material  
      Plastic

   g. Fan RPM  
      3300 RPM

   h. Motor Horsepower  
      .30 HP

   j. Current Draw  
      10.0 AMPS each

   k. Voltage  
      27 VDC
6. **Evaporator Coil (2)**

   a. Manufacturer & Model  
   Thermo King

   b. Face area (total)  
   6.45 ft² (0.599 m²)
   
   Coil finned dimensions (ea)  
   7.62” x 61.0” (194 x 1549 mm)

   c. Number of rows  
   5

   d. Number of circuits per coil  
   7

   e. Number of fins per in  
   9 (3.175 mm spacing)

   f. Tubes - material  
   Copper
   - O.D.  
   .375 in (9.5 mm)
   - wall thickness  
   .016 in (0.4 mm)

   g. Fins - material  
   Aluminum
   - thickness  
   .008 in (0.2 mm)

   h. Header plates - material  
   Aluminum
   - thickness  
   .080 in (2.0 mm)

7. **Heater Coil (2)**

   a. Manufacturer & Model  
   Thermo King

   b. Face Area (total)  
   6.45 ft² (0.599 m²)
   
   Coil finned dimensions (ea)  
   7.62” x 61.0” (194 x 1549 mm)

   c. Number of rows  
   2

   d. Number of circuits per coil  
   7

   e. Number of fins per in  
   9 (3.175 mm spacing)

   f. Tubes - material  
   Copper
   - O.D.  
   .375 in (9.5 mm)
   - wall thickness  
   .016 in (0.4 mm)

   g. Fins - material  
   Aluminum
   - thickness  
   .008 in (0.2 mm)

   h. Heater Plates - material  
   Aluminum
   - thickness  
   .080 in (2.0 mm)
8. **Evaporator Blower with Integral Motor (6)**
   a. Manufacturer/Model
      Brushed: Spal 006-B40-22 (3spd)
      Brushless: EBM K3G097 ECDC
   b. Type
      Forward Curve, Double Inlet
   c. Diameter
      4.00 in (102 mm)
   d. Fan and Housing Material
      Plastic
   e. Fan RPM
      4400 RPM
   g. Motor Horsepower
      .30 HP
   h. Motor Type
      Permanent Magnet Brush
   i. Current Draw
      10.0 Amps each (60 total)
   j. Voltage
      27 VDC

9. **Expansion Valve (2)**
   a. Manufacturer and Model
      Sporlan BBINE-5-C
   b. Type
      Thermal,
      Externally Equalized,
      Non-adjustable Superheat
   c. Connections - inlet
      5/8” solder (15.9 mm)
   - outlet
      7/8” solder (15.9 mm)

10. **Filter/Dehydrator**
   a. Manufacturer & Model
      Various
   b. Type
      Disposable, in line
   c. Capacity
      490+ drops each
   d. Size
      41 in³ each
   e. Fittings
      1.25-12UNF-2A Rotolock
      .75” ID
   f. Isolation valves
      Both Inlet and Outlet
11. Receiver Tank
   a. Manufacturer & Model: Parker Horizontal-Type
   b. Capacity: 125 in$^3$

12. Protection Features
   a. High refrigerant pressure cut out (switch): 470 psig ± 7 (R407C)
      Cut in: 375 psig ± 38
   b. Low refrigerant pressure cut out (transducer):
      Cut out: 5 psig ± 3
      Cut in: 20 psig ± 5
   c. High refrigerant pressure:
      Relief valve: 500 psig +75/-15
   d. Control Fuses:
      Controller: 5 AMPS
      Boost Pump: 15 AMPS
      Driver’s Display: 3 AMPS
   e. Evaporator/Condenser Motor Fuses (9): 15 AMPS each

13. System/Temperature Controls (Remote)
   a. Controller
      - Manufacturer & Model: Thermo King
         IntelligAIRE™ III
         Smart Controller™
      - Type: Microprocessor
      - Input Power: 27VDC
   b. Relays
      - Manufacturer & Model: P&B/Bosch
         1189A42G05
      - Type: SPDT, 24VDC
   c. Transducers
      - Discharge: 0-500 psia +/-7.5
      - Suction: 0-200 psia +/-3
14. **Electrical Wire**

<table>
<thead>
<tr>
<th>Type</th>
<th>FLRY-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>PVC</td>
</tr>
<tr>
<td>Coding</td>
<td>Hot stamp numbered</td>
</tr>
<tr>
<td>Rating</td>
<td>105C, 80 VDC</td>
</tr>
</tbody>
</table>
### Compressor S391

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Helical Lobed Screw</td>
</tr>
<tr>
<td>Displacement</td>
<td>23.86 cu. in./rev. (391 cu. cm/rev.)</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>HFC (R-134a or R-407C)</td>
</tr>
<tr>
<td>Oil separator</td>
<td>Integrated</td>
</tr>
<tr>
<td>Oil sump</td>
<td>Integrated on discharge side</td>
</tr>
<tr>
<td>Oil charge</td>
<td>70 fl. oz./1.8 liter</td>
</tr>
<tr>
<td>Oil type</td>
<td>POE SOLEST 120</td>
</tr>
<tr>
<td>Oil filter</td>
<td>Integrated full-flow</td>
</tr>
<tr>
<td>Max. tilt</td>
<td>10 degrees any direction</td>
</tr>
<tr>
<td>Drive Method</td>
<td>Belt or direct</td>
</tr>
<tr>
<td>Max. belt side loading</td>
<td>300 lbs. (136 kg)</td>
</tr>
<tr>
<td>Weight (Approx.)</td>
<td>147 lbs. (66.8 kg) (including oil, service valves and clutch)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum BHP (R-407C)</th>
<th>35 hp at 450 psi discharge and 100 psi suction @ 3000 rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum BHP (R-134a)</td>
<td>24 hp at 350 psi discharge and 65 psi suction @ 3000 rpm</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>3000 rpm</td>
</tr>
<tr>
<td>Max. discharge temp.</td>
<td>300°F</td>
</tr>
<tr>
<td>Maximum operating pressure</td>
<td>350 psig (R-134a) 450 psig (R-407C)</td>
</tr>
</tbody>
</table>
Installation of TK on 40ft
Roof mounted HVAC System
Floor heating configuration

The capacity of THERMOKING convectors: 39,900 BTU/HR
Convector Technical Specification

Thermo King Model TK V800

Forced Air Convector
High Capacity Wall Heater in Convector Design

Top Features:
- Brushless Blower Motors
- 2-Speed Motor
- Low Noise
- Stand-Alone Wallheater or in combination with the Two-Pipe Convector Solution
- Water connection on both sides possible

Heating Capacity:

\[
\begin{align*}
Q_{H,80} &= 3.1 \text{ [kW]} \\
Q_{H,100} &= 3.9 \text{ [kW]}
\end{align*}
\]

Coolant Flow Rate: 750 l/h
Coolant Inlet Temp.: 80°C
Air Inlet Temp.: 0°C (-20°C)

Electric Power Consumption:
- High Speed: 0.6A
- Low Speed: 0.4A

Weight: 3.97 kg
50% Glycol / 50% Water
Athenia AM Series
Second Generation Platform
Introducing The Athenia AMII Series

The Updated Design Brings Significant Improvements In Quality And Reliability And New Value Added Features At No Additional Cost.
Athenia AMII Enhancements

- Similar size and bus interface as compared to current units.
- 10% weight reduction (estimated)
- Sheet metal welded frame replaces riveted extrusions.
- Number of potential leak points significantly reduced.
- Eliminated the use of sealants in the design.
- Stiffer design for improved unit/bus sealing.

New Unit Frame
Athenia AMII Enhancements

- Harness interface points use water-tight sealed fittings.
- No water ingress due to high/low pressure differentials
Athenia AMII Enhancements

New single piece evaporator/blower drain pan

- Increased distance from evaporator coil to blowers for improved air flow.
- Reduces risk of condensate carryover.
- Improved drainage under varying conditions by increasing the drain pan slope to drainage points.
Athenia AMII Enhancements

Tubing consolidated to one end of the unit.

- Better access to serviceable items.
- More flexibility for unit placement on roofs with CNG, Hybrid and other roof enclosures.
Athenia AMII Enhancements

New side access covers
  • Now secured using standard hardware.
  • Improves latching, sealing, access and aesthetics.
Athenia AMII Enhancements

Unit controls relocated to conditioned air space.
• Improved environmental protection.
• Improved access and serviceability.
Athenia AMII Enhancements

New, Electronic Capacity Control
- Capacity can be reduced when not needed - allows for fuel savings on cooler days.
- Improved temperature balance on Artic buses – capacity can be shifted from unit to unit as required.
New Motorized Water Valve

- Improved temperature control in re-heat and heating modes.
- Eliminates water hammer.
Athenia AMII Enhancements

• Condenser Coil – updated layout and circuitry to improve high ambient performance.

• Evaporator coil – updated layout and circuitry to improve airflow and performance.

• Micro-Channel (brazed aluminum) condenser coils will be added as standard in 2014 – results in weight reduction, refrigerant reduction & improved performance.
Athenia AMII Enhancements

• Sight glasses are now viewable from the return air section inside the bus – roof access is no longer required.

• New, optional, damper controlled Fresh Air vents will be available.
Information provided by Thermo King Corporation

Attached is a list of major components Life expectancy

The information is to be provided in appropriate terms, i.e.; hours, miles, cycles etc.

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC compressor X430/X426</td>
<td>Thermo King</td>
<td>15,000 Hours</td>
</tr>
<tr>
<td>AC compressor Screw</td>
<td>Thermo King</td>
<td>40,000 Hours</td>
</tr>
<tr>
<td>AC condenser</td>
<td>Thermo King</td>
<td>12 Years</td>
</tr>
<tr>
<td>AC evaporator</td>
<td>Thermo King</td>
<td>12 Years</td>
</tr>
<tr>
<td>AC fan controllers (EC motor controller)</td>
<td>N/A (No longer offered. Controllers are now integral to the motor)</td>
<td>N/A</td>
</tr>
<tr>
<td>AC motors</td>
<td>Thermo King/EBM</td>
<td>36,000 Hours</td>
</tr>
<tr>
<td>Defroster motor</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>