Affordable No-Idle Truck Sleeper Cooling

Peter Carr

Instatherm Company

PO Box 4390 Cary, NC 27519

919-418-2606 instathermpc@netscape.net

A Profound Need For Today

- A Billion Gallons of Fuel Wasted each year from Truck Idling for Sleeper HVAC. This is only the Tip of the Idling Iceberg!!
- Massive Inertia to Handling this Idling Issue -- Why??
  - Present Options Only Appeal to Niche Segments
  - Each is way too Expensive
    - First Cost
    - Installation Cost
    - Maintenance Cost
    - Operational Cost

Required Features

- Meet the Basic Cooling Needs
- Be Unequivocally LOW COST
- Be Unequivocally NEAR-TERM
- Be Environmentally Sound
- Minimum Maintenance / Installation
- Limited Sleeper Box Intrusion

Highly Desirable Additional Features

- Be Capable of Providing No-Idle Cooling at Times other than that for Sleeper Box Cooling
- Improve the Air Quality for the Resting Driver (Polluted Cab air is fast becoming an issue)
- Provide Maximum Overall Energy Efficiency

Our Approach -- Keep it Simple

- Use the Sensible Capacity of Water .
  - Non-Evaporative
  - No Ice Forming System Required
  - Inexpensive
  - Very Efficient Heat Transfer Fluid
  - Environmentally Sound
  - Universally Applicable

“Cool” Delivery

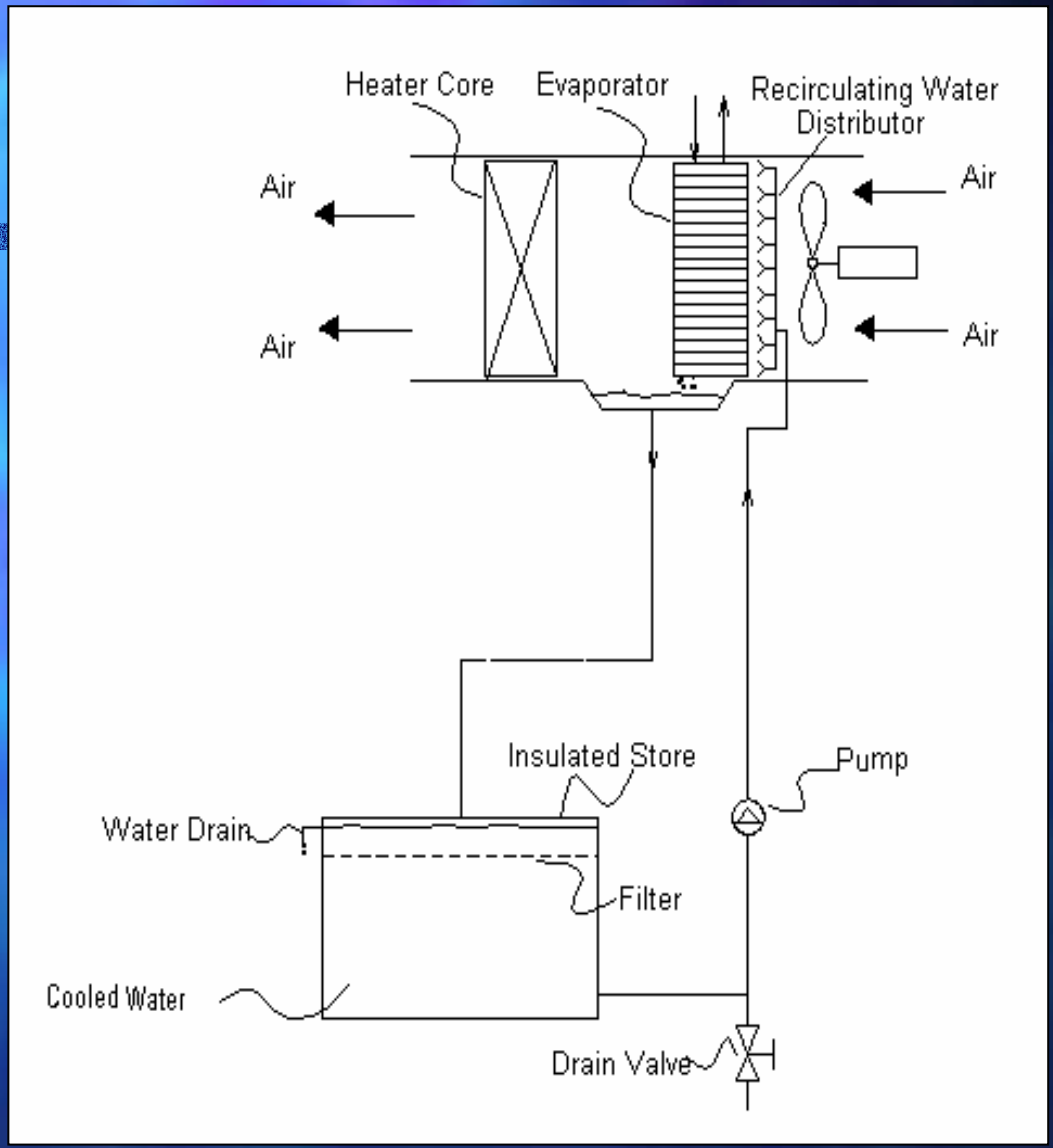
- Task Cooling Only – Resting Driver
- Minimal Extraneous Cooling
- Highly Focused 1500 Btu/hr typical, with 2400 Btu/hr max sustained

Non-Evaporative Open Loop Heat Transfer

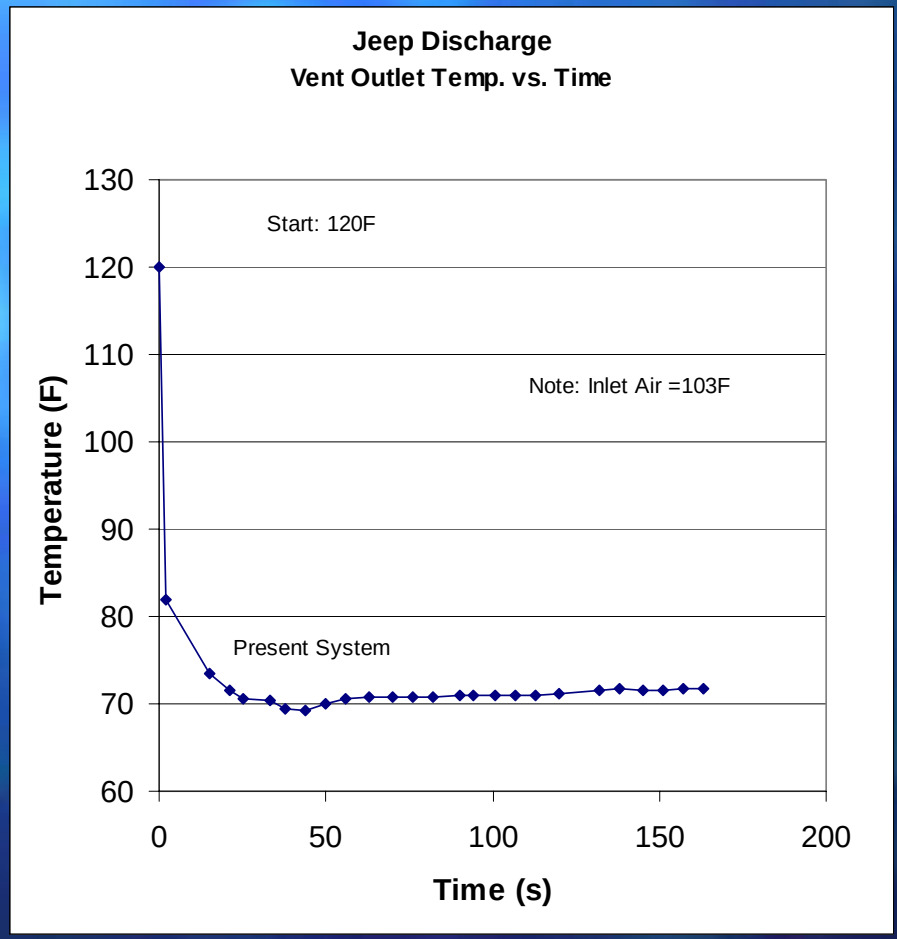
- US Patent #6,408,633
- Delivers All the “Required Characteristics”
- It also Provides all the “Desirable Additional Features” as a Bonus

Initial Testing

System


Heater Core
Evaporator
Recirculating Water Distributor
Air
Air
Air
Air
Insulated Store
Pump
Water Drain
Filter
Cooled Water
Drain Valve

Hot Soak Performance

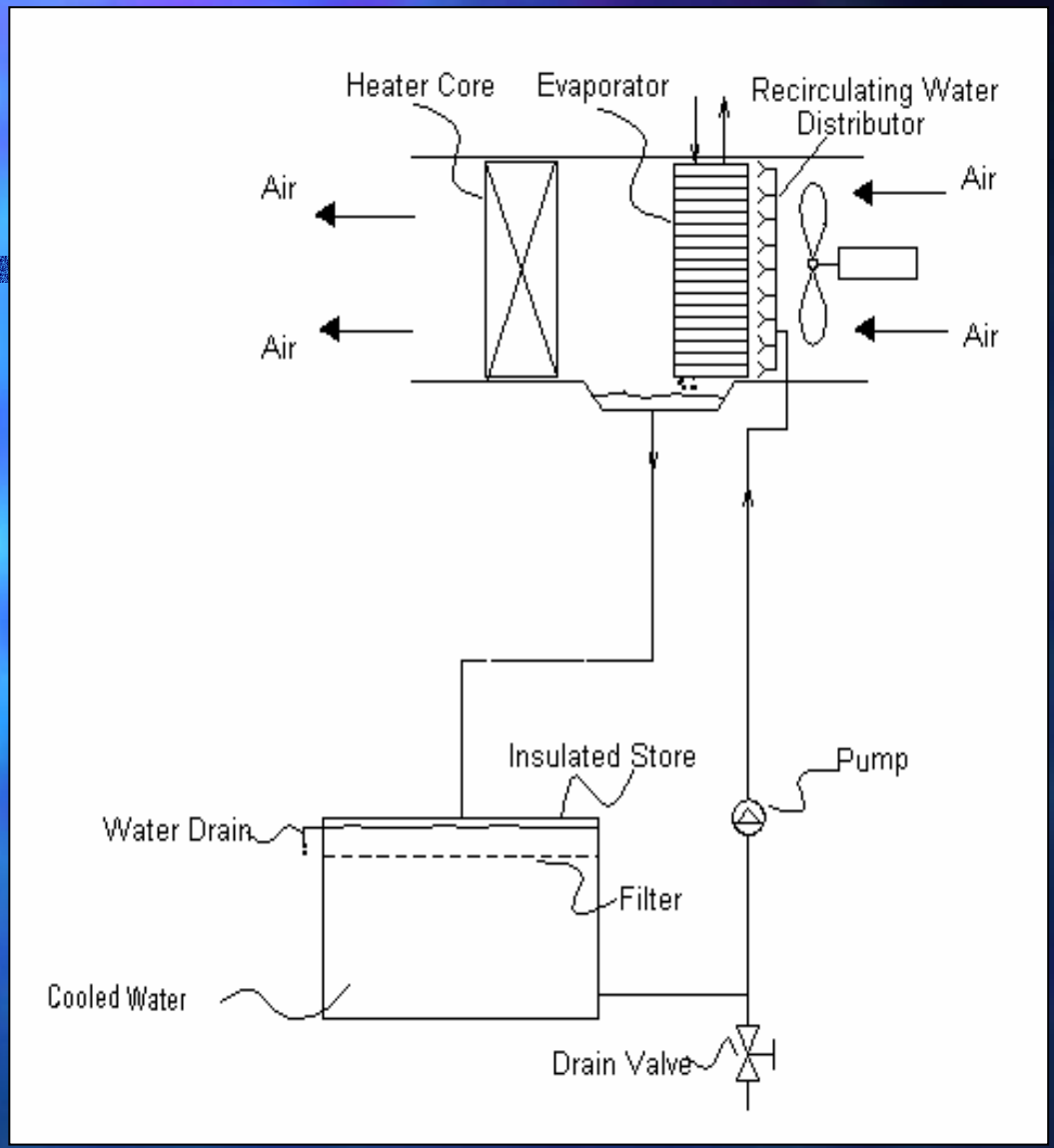


Truck Sleeper Derivatives

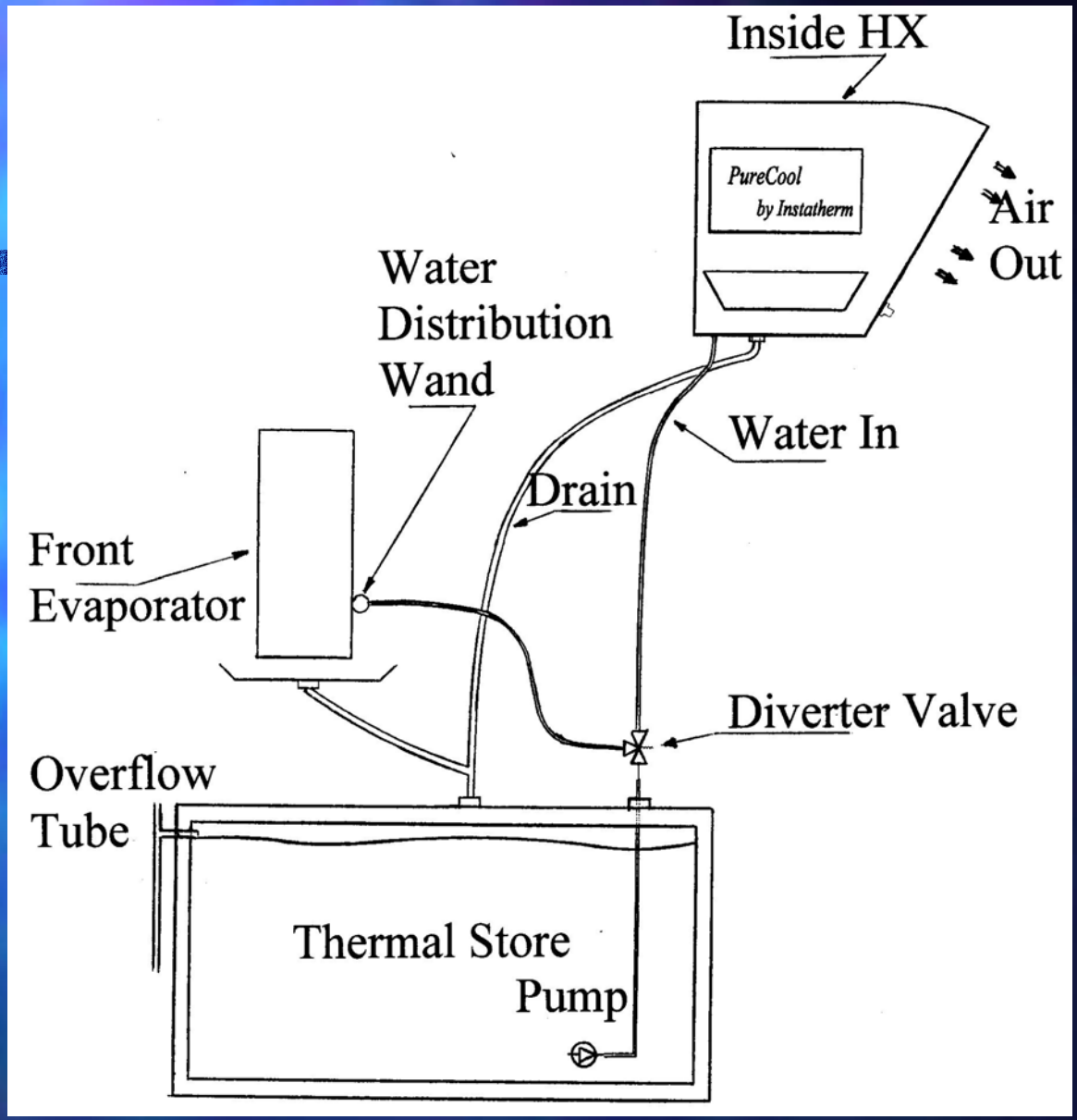
Options

1) Similar to Auto System but uses Rear Evaporator for Charge & for Discharge
2) Use Rear Evaporator for Charge and a Dedicated, Corrugated Aluminum Foil (0.003”) Counter Flow HX for Discharge
3) Same as 2) but uses the Front Evaporator for Charge

Truck Evaporator Charge/Discharge

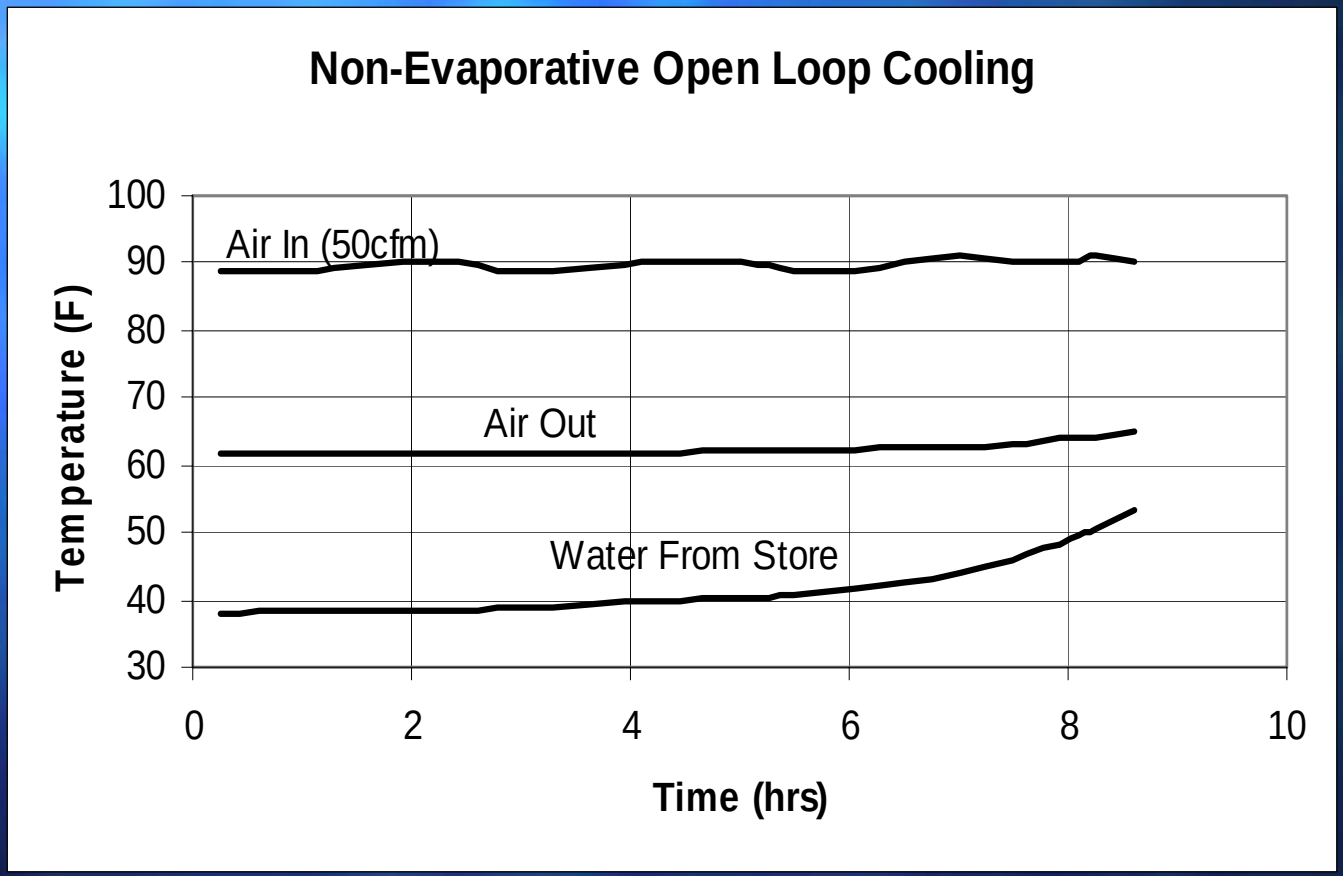


Evaporator Charge
Inside HX Discharge



Inside Sleeper HX Unit

The Result


Non-Evaporative Open Loop Cooling
Temperature (F)
100
90
80
70
60
50
40
30
Air In (50cfm)
Air Out
Water From Store
0
2
4
6
8
10
Time (hrs)

Performance

- The Stratified Water Store (300#) Functioned as Specified for 12,000 Btu of Highly Targeted Cooling. Drop in PCM for Higher Capacities
- The Counter Flow Corrugated Aluminum Foil HX Delivered 40 Btu of Sensible Cooling/lb of Water Throughput.

Physical Sizes

- Store 4.8 cu. Ft. Internal Volume (20”cube) for 12,000 Btu, Plus 1” of Foam Insulation. Mounts Outside Sleeper Box , Shape is Very Flexible

- Sleeper HX Module:- 0.3 cu. Ft. and only 4” Deep for Unobtrusive Sleeper Wall Mounting over the Bunk

Energy Requirements

- **Electrical**
- 24W While Providing Engine-Off Cooling
- <24W While Charging

- **Fuel to Charge Unit**
- 0.05 gallon to Charge for each Hour of Subsequent No-Idle Cooling

Relative Energy Use for No-Idle Technologies

Truck Idling	1.00
Fuel Fired Heater + Summer idling	0.60
Truck Stop Electrification	0.32
Auxiliary Power Unit	0.18
Fuel Fired heater + Storage Cooling	0.09

Derived from Argonne Report - ANL/ESD-43

Non-Evaporative Open Loop Characteristics

- Combine with fuel fired air heater -- most efficient all season performance available
- Could actually idle the truck 20% of a/c rest period and still consume less fuel than the next best performer – The APU
- Cleans air by water washing
- Continually Flushed with Condensed Water
- Add UV light for further air/water purification

Characteristics Continued

- Does not Yield High Humidity
- Uses Quiescent Water Flow Rates Over The Evaporator - No Spitting Into the Air Stream and Well Within the Capacity of a Standard Drain Pan
- Freeze Protected. However, Why Carry the Water Around in Winter? Drain It!

Summary

- Basic Development/Engineering Done and Patented
- System Works and is Very Near-Term
- Has by far the lowest cost potential of any alternative
- Requires No Modification to Existing A/C Refrigerant, Duct or Blower System –Simple Retrofit For the Total Heavy Truck Fleet

Summary Continued

- A Proactive Approach to scrubbing in-cab pollution. Positive Driver/OSHA Implications
- Is a Universal Energy Saving Approach for, Home, Business and Transportation A/C Applications. Any Evaporator will do.

Final Perspective

- A Billion Gallons/Year Fuel Presently Wasted Idling for Resting Drivers
- From Where We are Today a Win, Win, Win Open Loop System Could Be in Series Production in 18 Months For The equivalent of 1 Day of DOE Development Expenditures on Fuel Cells for Transportation.