Evans Cooling Systems Australasia

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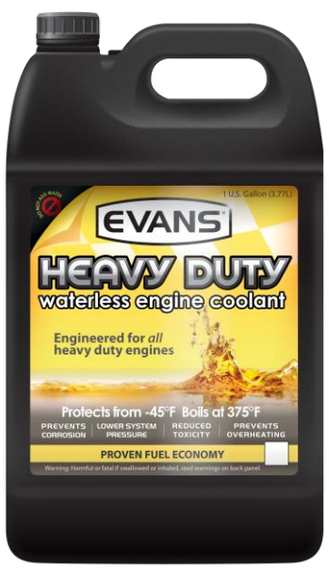
June 2013

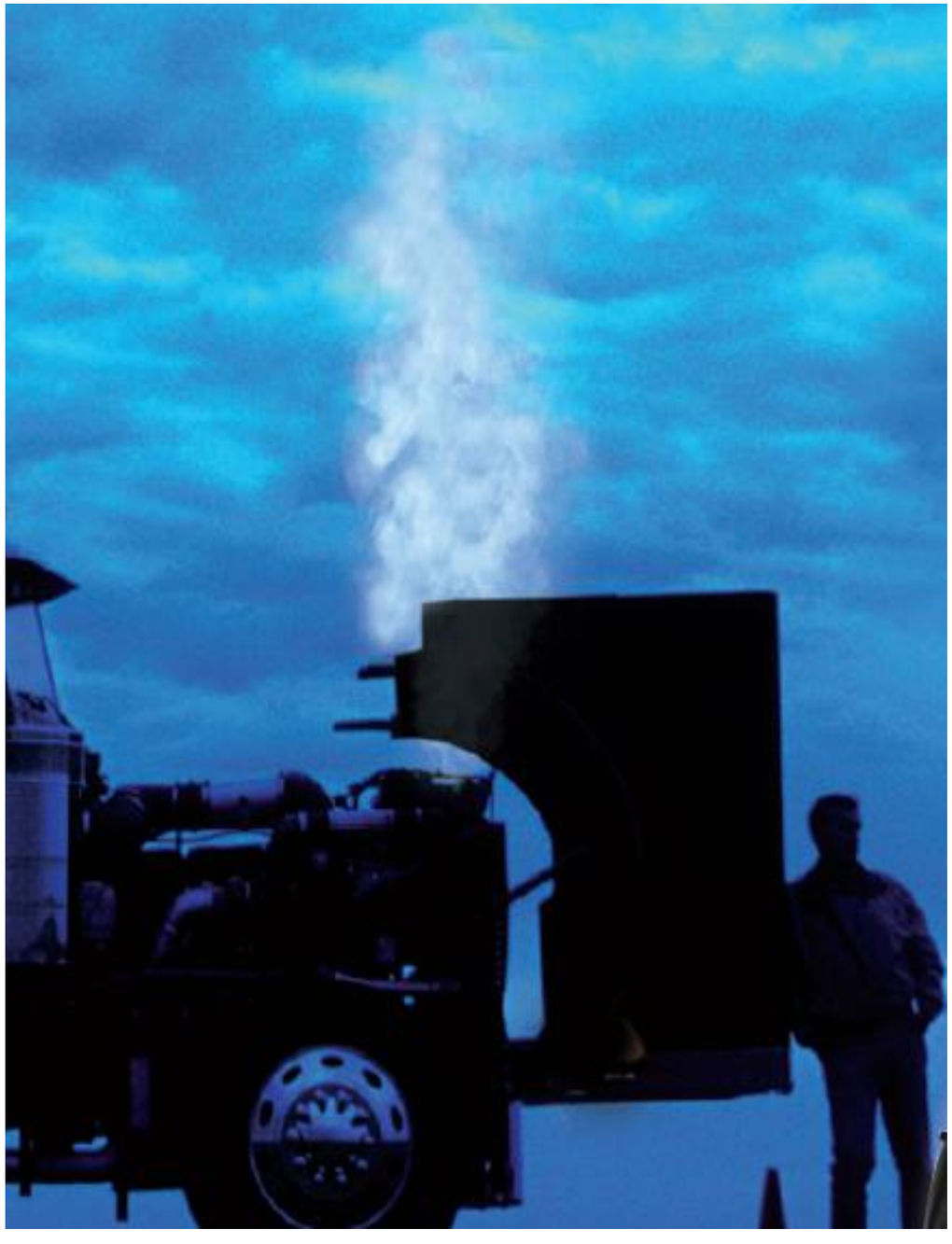
Evans Waterless Coolants

- A proprietary blend, soluble additives, and **no water**.
  - Additives **remain soluble** at all times **regardless of conditions**
- Boiling point: **190°C**, Pour point: **<-40°C**. (Atmospheric Pressure)
- Evans are **lifetime** coolants if they do not become contaminated with water.
  - Coolant can be re-used and transferred from old to new equipment
- Reduced toxicity



Benefits of
Evans Waterless Coolant

- ***Enables Fuel Saving Strategies***
- ***Reduces Maintenance Costs***
- ***Eliminates Replacement/Disposal Expense***
- ***Eliminates Overheating***
- ***Offers Environmental Advantages***
- ***Increases Performance/Eliminates De-Rating***
- ***Provides Additional Cooling to EGR Engines***



How Evans Waterless HDC Achieves Fuel Savings

Evans HDC Allows Two Fuel Saving Techniques for Heavy Duty Engines

1. Reduce fan-on time by raising fan-on temperature
2. Increase thermostat temperature.

The fans of heavy duty diesel engines draw considerable horsepower. Minimizing fan operation leads directly to significant fuel savings.

Radiator fan-on time, which draws in the range of 25 horsepower, can be cut more than 50 percent. This saves about 5 litres of diesel per hour of fan run time.

Reduces Maintenance Costs

- Waterless formula eliminates corrosion and electrolysis.
- The absence of vapor reduces system pressure.
- Pump seals hoses, gaskets will not deteriorate and last longer.
- Lengthens engine life by preventing pump and cylinder liner cavitation erosion.
- No abrasive additive deposits.

Eliminates Replacement Expense

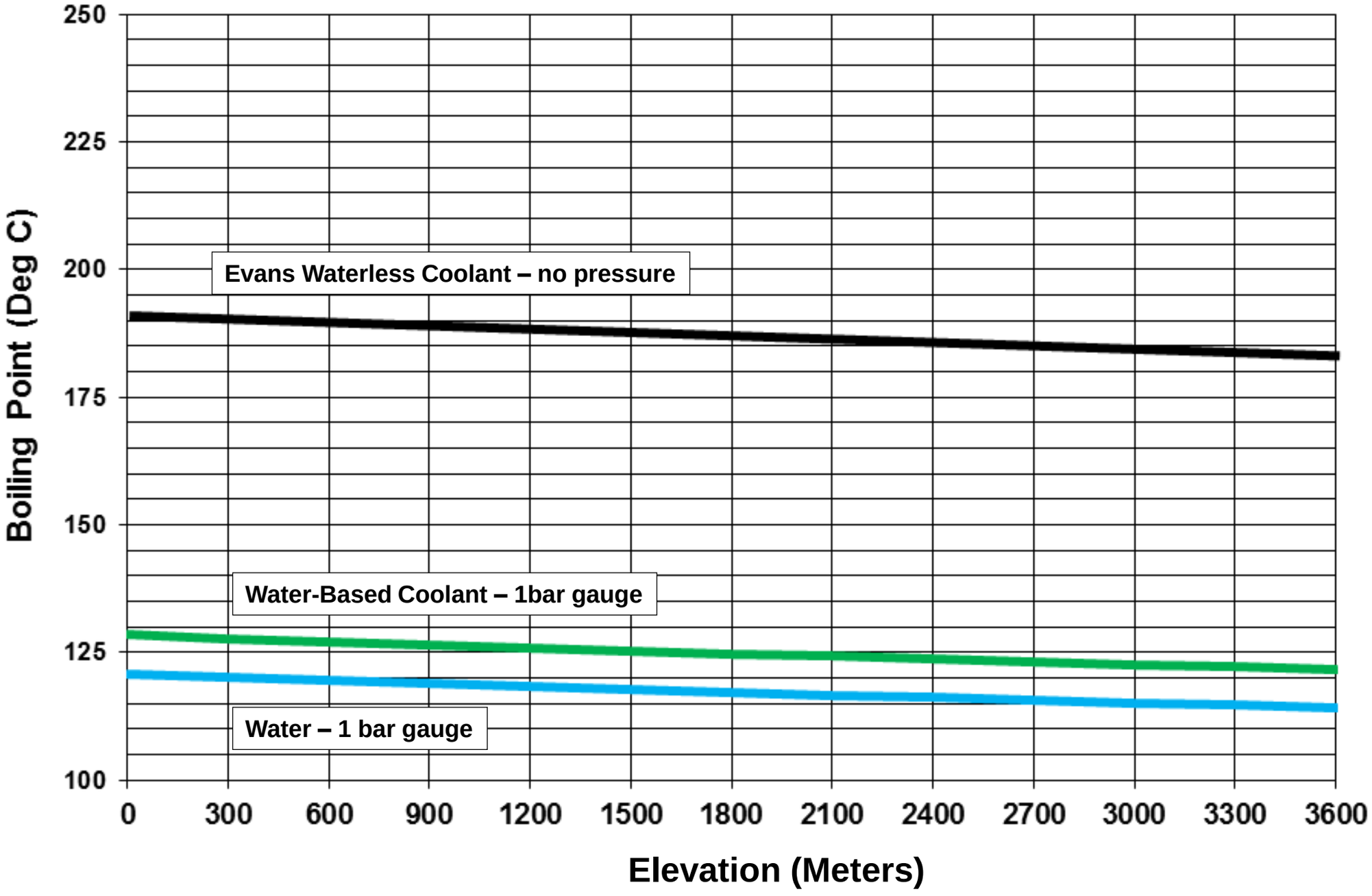
- Replacement costs are eliminated; Evans waterless coolants are lifetime coolants
- Additives not required; Evans additives remain stable and in solution during storage and use.
- Occasional “topping off” not required. Evans waterless coolants will not evaporate.

Evans Coolants Eliminates Overheating

- Evans HDC Separates the Boiling Point of the Coolant from its Operating Temperature
- The boiling point of Evans HDC is around **90C higher** than the typical operating temperature of a diesel engine
- Cooling system continues to function after shut down:
  - No after-boil.
  - Engine can be restarted at anytime.

With Evans HDC, the boiling point of water is no longer a limitation.

Boiling Point Comparison
(Coolant Failure Temperature)



The coolant failure temperature is the boiling point of the coolant at the system pressure

A ‘Greener’ way to run your fleet

- **TOXICITY**:
  Evans waterless coolants contain an inhibitor that lowers the toxicity of ethylene glycol – safe for animals.

- Considered essentially **non-toxic** by animal and in-vitro testing

- Contains **Evans DETOX**, toxicity inhibitor technology

- **DISPOSAL**:
  Eliminates future disposal of old coolant.

- **REDUCED EMISSIONS**:
  Less fuel burned means less carbon dioxide emissions

- **COMPLIMENTS EXISTING TECHNOLOGY:**
  Significantly reduces likelihood of EGR cooler failures

ASTM Standards

- Some current ASTM standards are not applicable to waterless coolants because the test method requires the addition of water as part of the procedure.

- A new ASTM task group established (D15.22 Non Aqueous Engine Coolants) was established in an effort to develop new standards specific to non aqueous coolants

- Evans Coolants currently meet most specifications under the current ASTM D6210 & D3306 standards, including:

  - D1384 Glassware Corrosion Test

  - D7583 John Deere Cavitation Test

- Target Completion: December 2013

* more information available upon request

ASTM D7583 Engine Cavitation Test

Cylinder Liner Protection

- John Deere Engine Cavitation Test is a real-world predictor of coolant performance
- Test performed by Southwest Research Institute
- Passing specification is 200 pits maximum,

and Evans Coolants showed only 21.

Results were ***70% better*** than <u>the best</u> water-based coolant tested

Why is “Waterless” so Important?

What is GOOD about water in coolant?

Water has been the choice for cooling engines for over 100 years for very good reasons:

- Water is cheap.
- Water is available.
- Water has **superior** thermal conductivity in its **liquid state**.

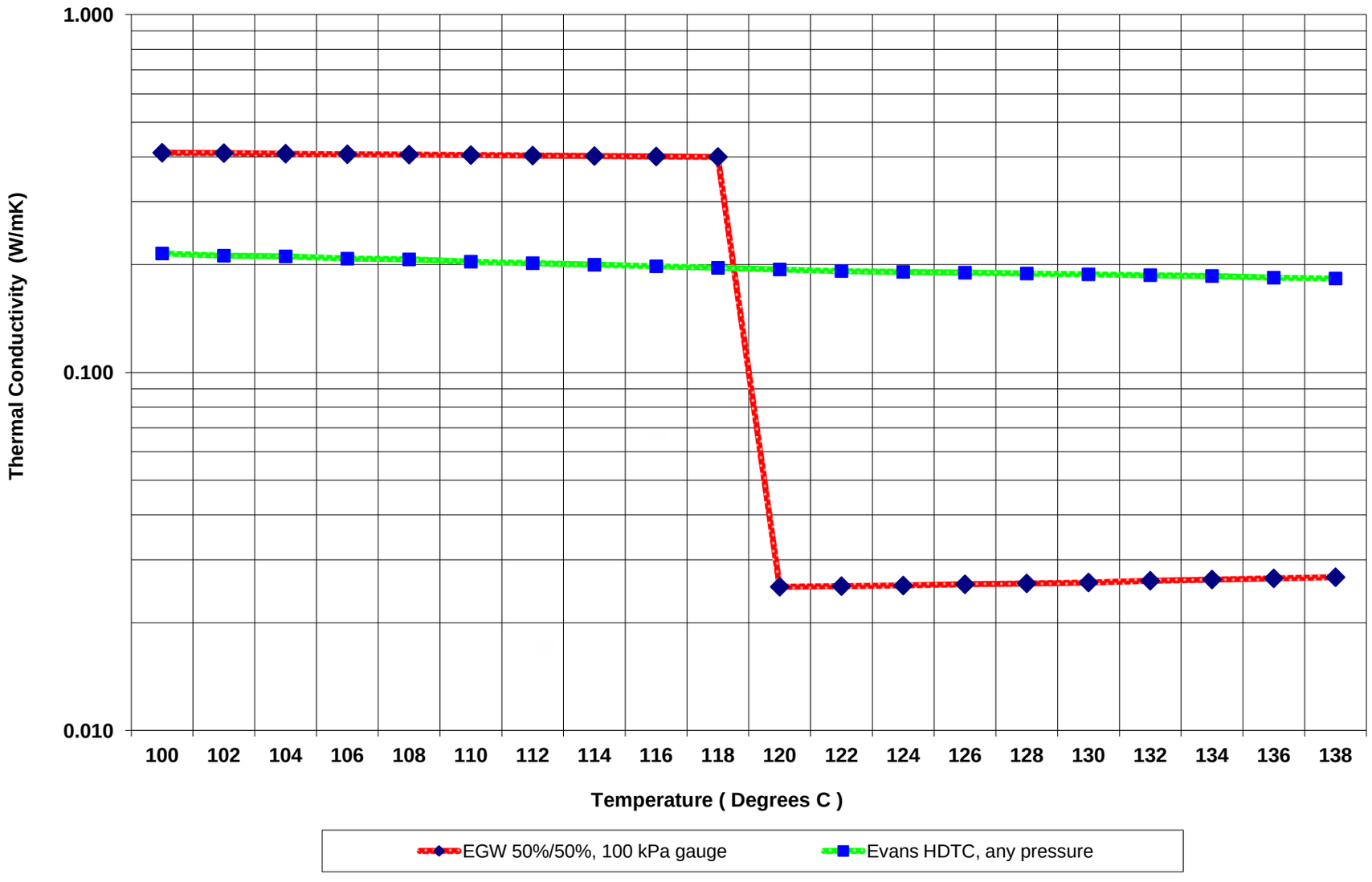
What is BAD about water in coolant?

- The low boiling point of water **(100°C to 104°C)** becomes the **failure temperature** of traditional cooling systems.
- Water is corrosive.
- Water quality is inconsistent
- Water retains just **4%** of it’s thermal conductivity when it changes to vapor.
- Water promotes electrolysis

The energy that it takes to maintain coolant temperatures below the boiling point of water is a huge waste of fuel.

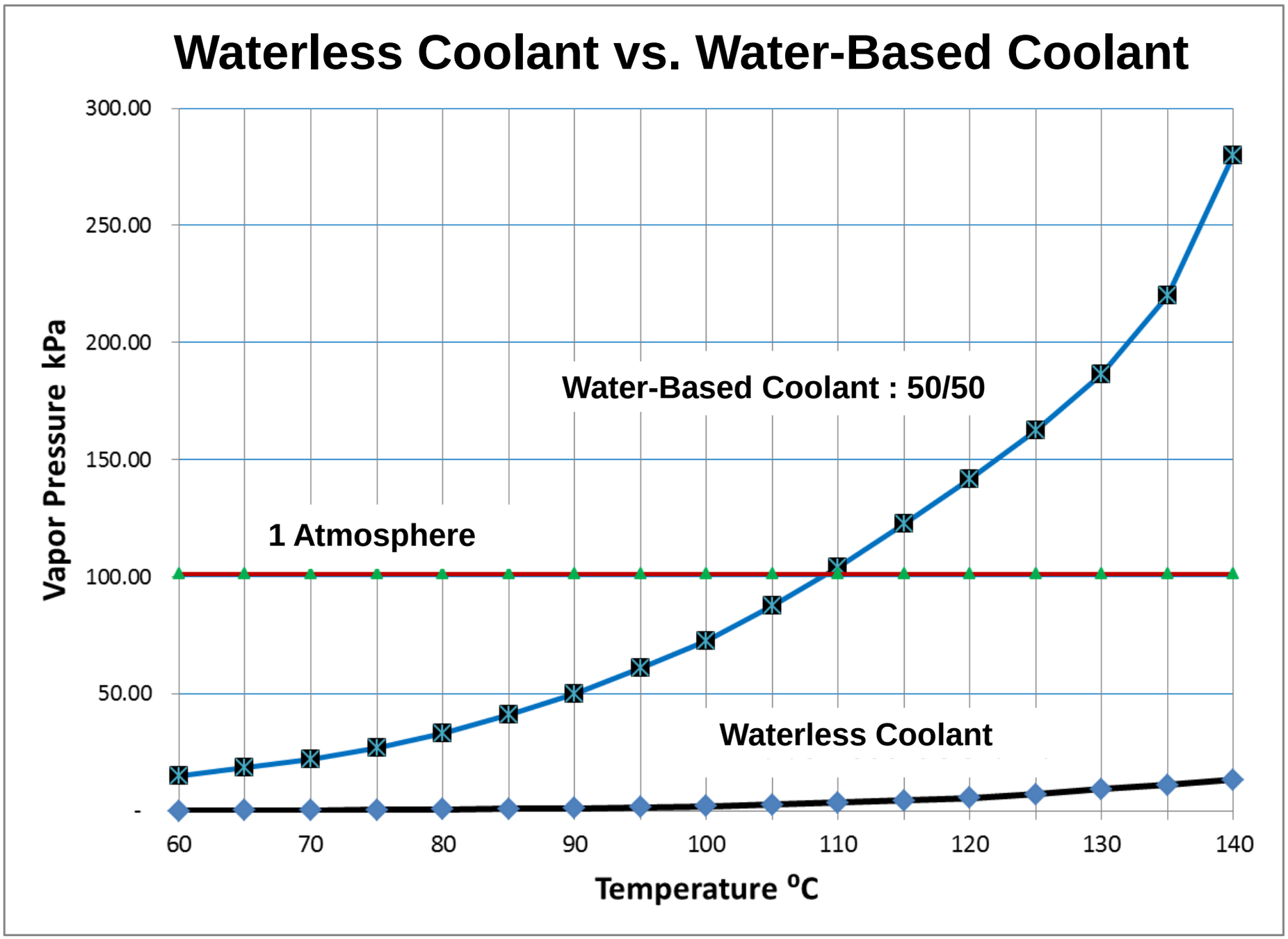
Thermal Conductivity Comparison

Thermal Conductivity of the Liquid and Vapor Phases of Water-Based Coolant vs Evans HDC (The vapor phase of water-based coolant has almost no thermal conductivity.)



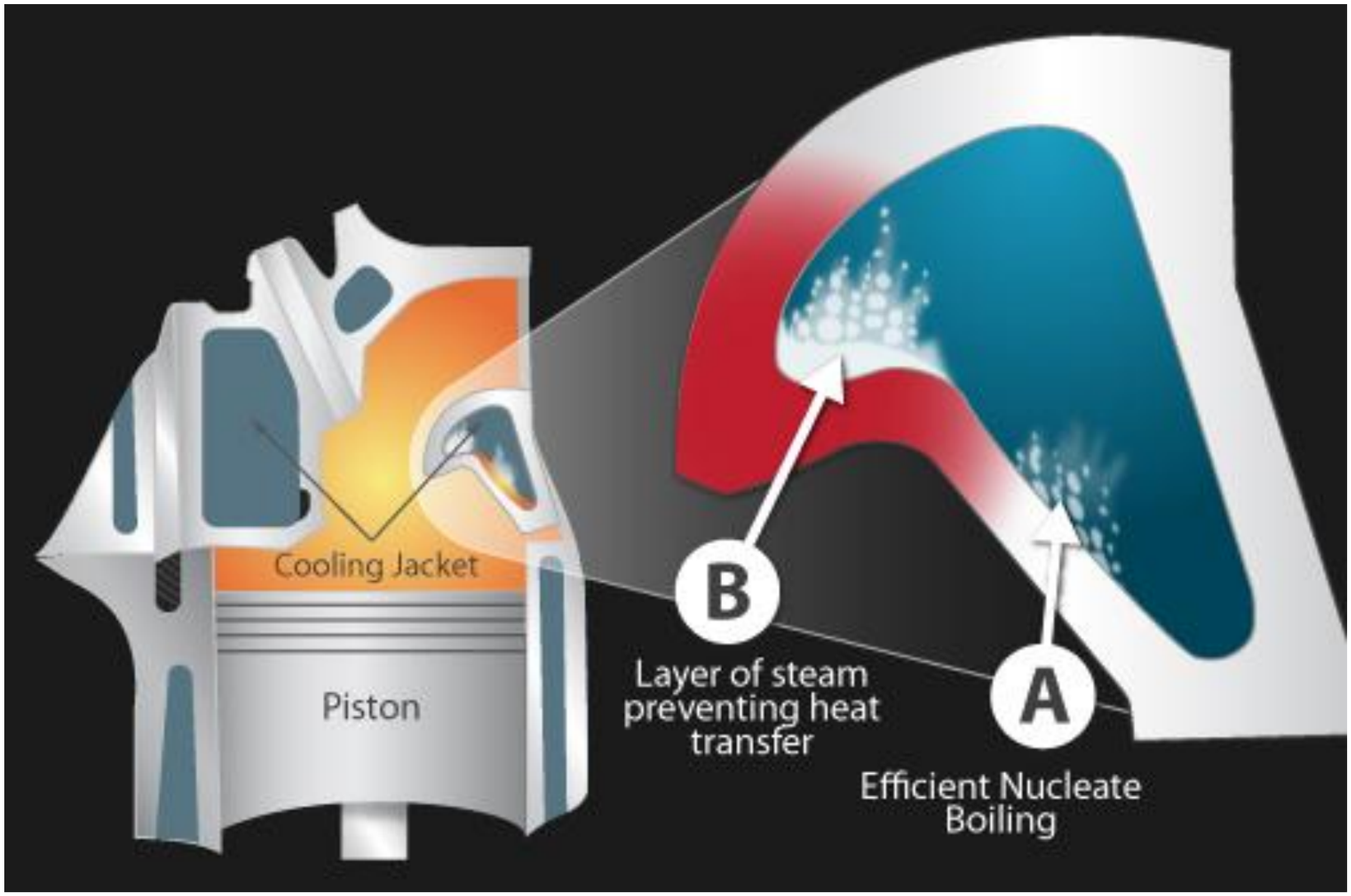
EVANS™ WATERLESS ENGINE COOLANT

System Pressure Comparison



With Waterless Coolant, System is Not Pressurized

Thermal Conductivity – No Vapour



A Waterless Coolant

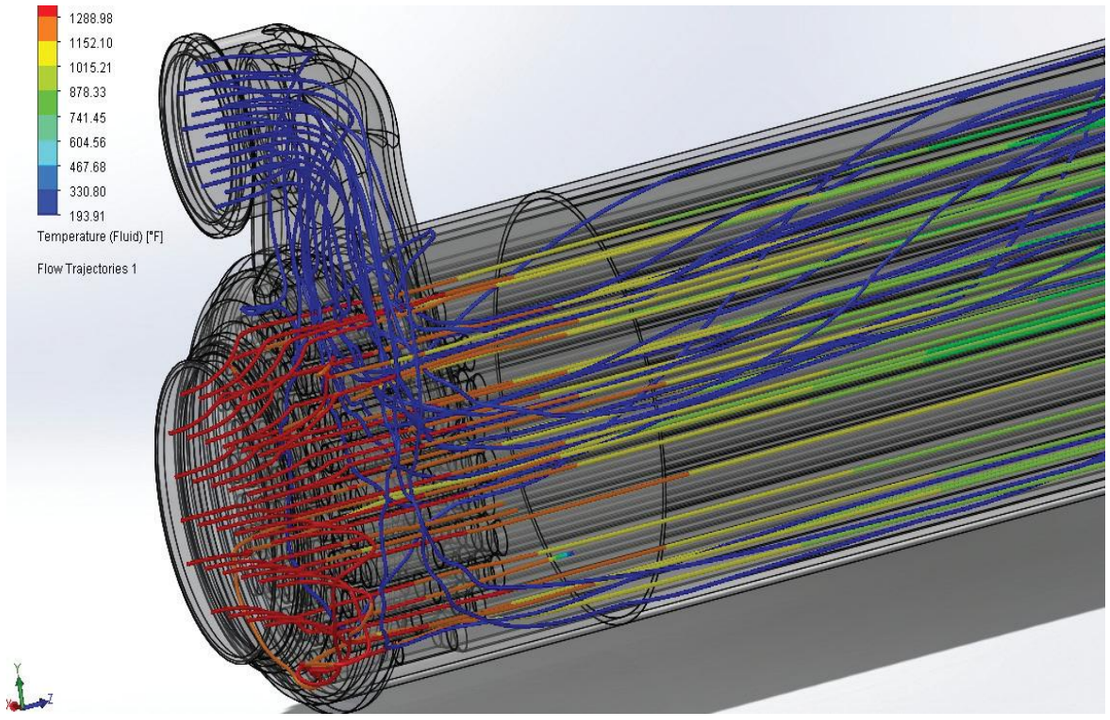
B Water-Based Coolant

Using conventional coolant localised boiling and vapour pockets form within cooling jackets even before boiling point is reached. Temperatures in these areas are typically higher than the engines usual operating temperature.

Evans Coolants eliminate ‘hotspots’ and ‘vapour pockets’ allowing constant heat transfer.

EGR Cooler Failures

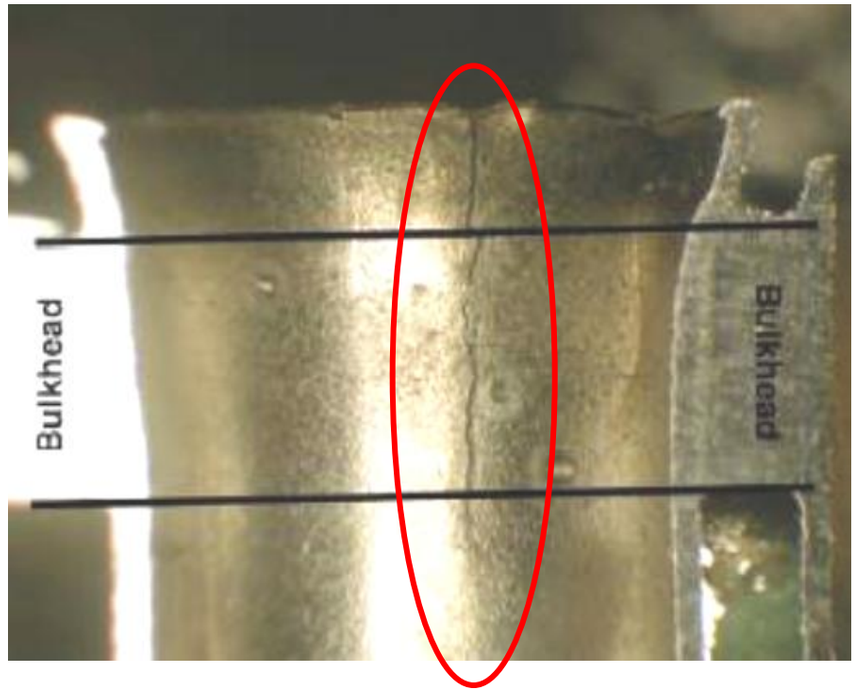
- **Significant Issue in the Industry**
- **Coolers see gas inlet temperature of 593C - 649C**
- **Heat load: Must Drop >400 degrees in ~60cm**
- **More Severe With Natural Gas**
  - Gas is 100C hotter
  - Causes 18% higher stress
  - Failures can happen 2x faster than with diesel

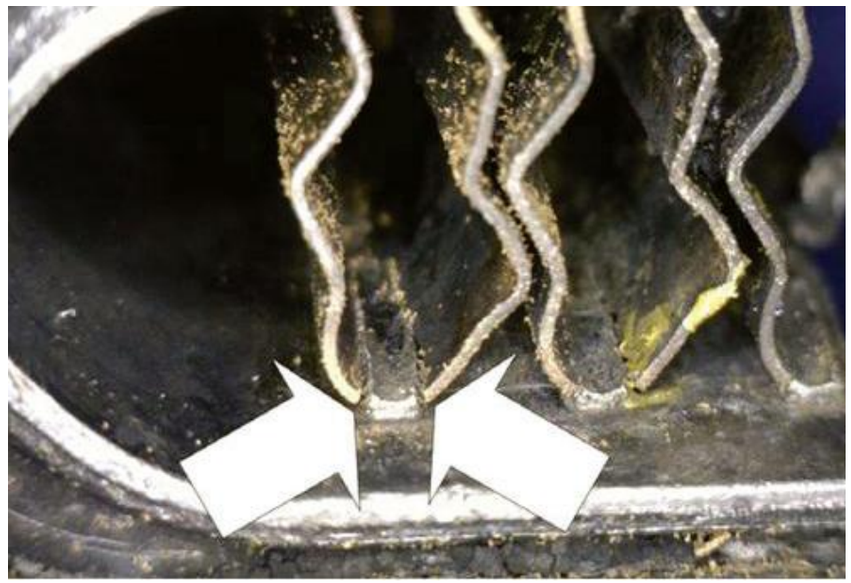


EGR Cooler Failures

- **Failure mode is tube cracking due to:**
  - Thermal cycling/stress
  - Vibration
  - Corrosive condensate (gas side)

- **Thermal stress likely exacerbated by vapor film on coolant side**
  - Analogous to cylinder head





Fatigue Break Points

EGR Cooler Failures

- **Metro California bus fleet**
  - 2800 buses, all natural gas
  - Chronic EGR cooler failures
  - Typical rate is every 8000 -11000kms
  - Coolant top up needed 4 – 6 litres a month

- **Waterless coolant installed in a problematic bus**
  - No failures out to 30500kms
  - No coolant top up needed

- **10 additional buses converted and being monitored**

Our Maiden Truck Conversion Still Going Strong!!

1. An Evans prototype coolant (predecessor of HDC) was installed into this Detroit Diesel Series 60 when it was new (1990).

2. In 2012 the truck is still in daily use. For its entire history, it has had 102°C thermostats and a 110°C fan switch.

3. The truck is going strong with nearly 1,600,000 kms. Joe reports getting better than 33 L/100kms consistently during the entire period.

4. Head, cylinder liners, pistons and valves are original.

5. Joe takes satisfaction in driving past trucks that have triggered de-rating or shut-down at 107°C while his fan doesn't even turn on until 110°C.

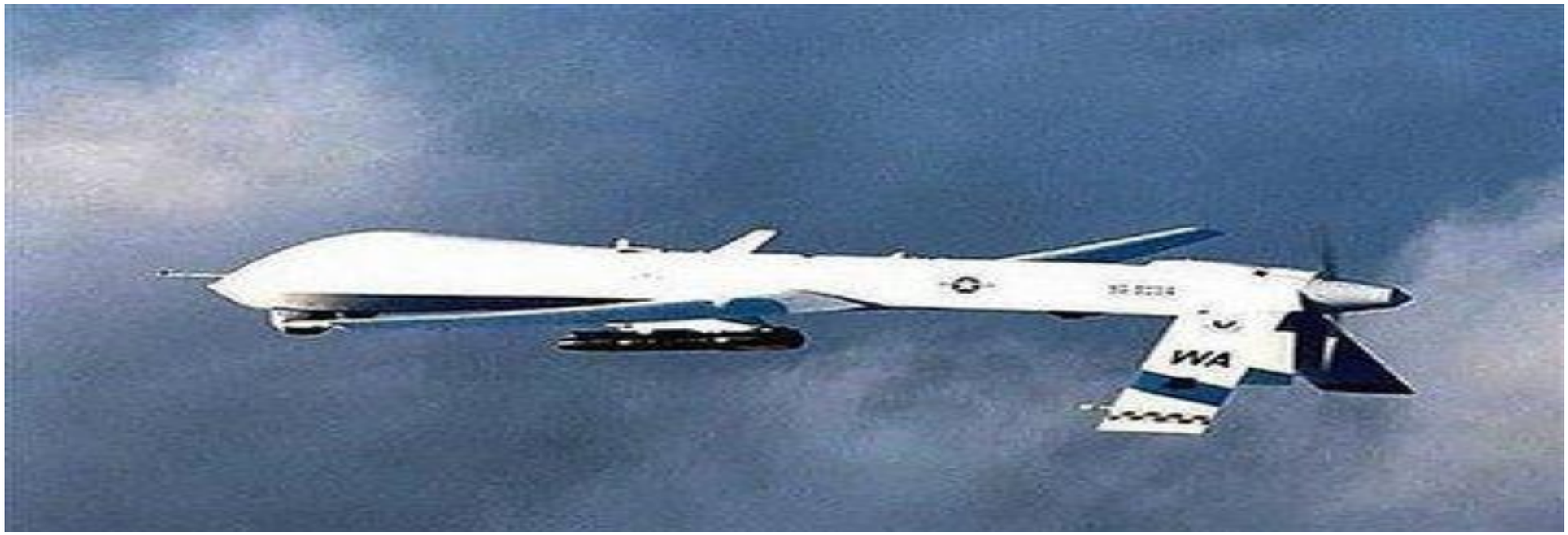
Veolia Fuel Savings

In a two year fuel economy study with Veolia Environmental Services, Evans Waterless Coolant has improved fuel economy of Mack MP7 Engines by over 5%.

Reserve capacity at 16,000 ft.

- New railroad project high in the Kunlun Mountains, China
- Elevation of 16,000 ft
- Trucks could not carry full loads and required periodic shut-downs for cooling off.
- Evans Conversion eliminated boil-over despite full loads and no cool-off downtime.

Rotax small aircraft engines.



- Rotax had a problem with take-offs in high ambient temperature regions.
- The coolant would boil over before reaching cooler temperatures aloft.
- Evans Waterless Coolant eliminated overheating
- Rotax recommends the use of Evans Coolants

Generators in Iraq more reliable

- Balad Airbase near Baghdad requested help from Evans to keep the electricity running.

- John Deere generators would automatically shut down at 107^{o}C.

- They would not restart without a 20 minute cool-down.

- Evans coolant was installed and the 107^{o}C shut-down thermostats were replaced with 120's.

- The problems stopped – the electricity became reliable.

- Oil analysis showed no issues.

Land, Sea, and Air

Hundreds of thousands of successful conversions worldwide in applications ranging from cars to aircraft to generators and heavy duty vehicles.

Most of these installations answer acute engine cooling problems that have defied solution by conventional coolant means.

Evans waterless coolants offer permanent solutions that save money *and* enhance performance.

Proven Economic, Environmental and Performance Advantages!!

Summary

Evans Heavy Duty Waterless Coolant:

- Eliminates Overheating
- Eliminates Corrosion/Cavitation
- Eliminates Evaporation/Top-Up
- Eliminates Replacement/Disposal Costs
- Improves Fuel Economy
- Provides a ‘Greener’ Alternative
- Reduces Downtime/Parts Replacement
- **Prolongs Engine Life**