

Red Line Diesel WaterWetter® is designed to provide improved metal wetting when added to plain water or a glycol coolant. The most poorly maintained system in a vehicle is usually the cooling system. Maintenance is quite simple and only required once each year, but most vehicle owners never routinely change the coolant or replenish the corrosion inhibitors which are required for trouble-free operation.

Most commercial vehicles have a cooling system designed to reject sufficient heat under normal operating conditions using a 50/50 glycol solution in water, but with elevated summer temperatures or climbing steep grades, the cooling system may be inadequate and require the help of Red Line WaterWetter®.

BENEFIT SUMMARY

- Doubles the wetting ability of water
- Improves heat transfer
- Reduces cylinder head temperatures
- Cleans and lubricates water pump seals
- Prevents foaming
- Reduces cavitation corrosion
- Complexes with hard water to reduce scale

COOLING SYSTEM REQUIREMENTS

The internal combustion engine is not a very efficient powerplant. A considerable amount of the available fuel energy must be rejected from the metal combustion chamber parts by the coolant and dispersed to the atmosphere through the radiator. This heat rejection is necessary in order to prevent thermal fatigue of the pistons, cylinder walls, and the cylinder head. Elevated temperatures also reduce the lubricant film and expand engine parts creating unwanted stress, friction, and wear. Higher inlet temperatures also reduce the density of the air, reducing available torque. For these reasons reducing the flow of heat to the coolant usual-

ly reduces the power output of the engine. Figure 1 shows a typical heat balance diagram for an internal combustion engine. This diagram demonstrates that the coolant in an internal combustion engine must absorb and reject through the radiator 2 to 3 times the amount of energy which is converted to brake power.

THERMAL PROPERTIES

Water has amazingly superior heat transfer properties compared to virtually any other liquid cooling medium - far superior to glycol-based coolants. As shown in Table 1, water has almost 2.5 times greater thermal conductivity compared to glycol coolants. Mixtures of glycol and water have nearly proportional improvement due to the addition of water. Most heat is transferred in a cooling system by convection from hot metal to a cooler liq-

**Table 1
Thermal Properties of Cooling System Materials**

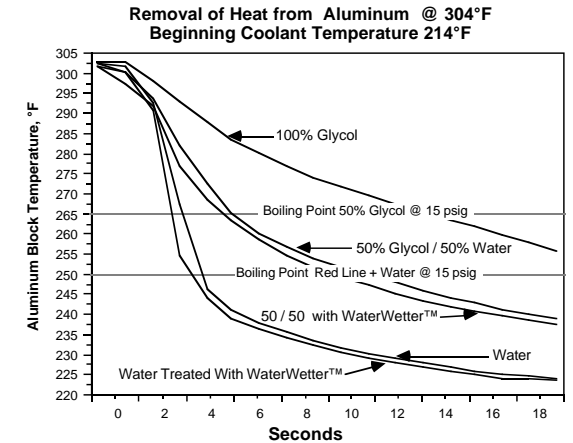
Material	Density g/cm ³	Thermal Conductivity Watt/m ² °C	Thermal Convection Watt/m ² °C	Heat Capacity cal/g°C	Heat of Vaporization cal/g
Water	1.000	0.60	1829	1.000	539
Glycol	1.114	0.25	-----	0.573	226
50/50	1.059	0.41	897	0.836	374
Aluminum	2.70	155		0.225	
Cast Iron	7.25	58		0.119	
Copper	8.93	384		0.093	
Brass	8.40	113		0.091	
Ceramics		1-10			
Air	.0013	.026		0.240	

uid as in the engine block or from a hot liquid to cooler metal surfaces, as in the radiator. The convection coefficient of liquids in a tube is a complicated relationship between the thermal conductivity, viscosity of the liquid, and the tube diameter which determines the amount of turbulent flow. Since 50/50 glycol solution has about 4 times the viscosity and only 70% of the thermal conductivity of water, the thermal convection coefficient for a 50/50 glycol solution is approximately 50% of the coefficient for water. Water in the cooling system is capable of transferring twice as much heat out of the same system as compared to a 50/50 glycol coolant and water solution. In order for a 50/50 glycol mixture to reject as much heat as water (amount of heat rejected is independent of the coolant), the temperature differentials at the heat transfer surface must be twice as great, which means higher cylinder head temperatures.

HEAT TRANSFER

Red Line WaterWetter® can reduce cooling system temperatures compared to glycol solutions and even plain water. Water has excellent heat transfer properties in its liquid state, but very high surface tension makes it difficult to release water vapor from the metal surface. Under heavy load conditions, much of the heat in the cylinder head is transferred by localized boiling at hot

spots, even though the bulk of the cooling solution is below the boiling point. Red Line's unique WaterWetter® reduces the surface tension of water by a factor of two, which means that much smaller vapor bubbles will be formed. Vapor bubbles on the metal surface create an insulating layer which impedes heat transfer. Releasing these vapor bubbles from the metal surface can improve the heat transfer properties in this localized boiling region by as much as 15% as shown in Figure 2. This figure demonstrates the



removal of heat from an aluminum bar at 304°F by quenching the bar in different coolants at 214°F under 15 psi pressure. Compare the time required to reduce the temperature of the aluminum to 250°F, or the boiling point of water at 15 psi. Red Line with WaterWetter® required 3.2 seconds, water alone 3.7 sec, 50/50 glycol in water required 10.2 sec, and 100% glycol required 21 sec. Water alone required 15% longer, 50/50 glycol 220% longer, and 100% glycol required 550% longer.

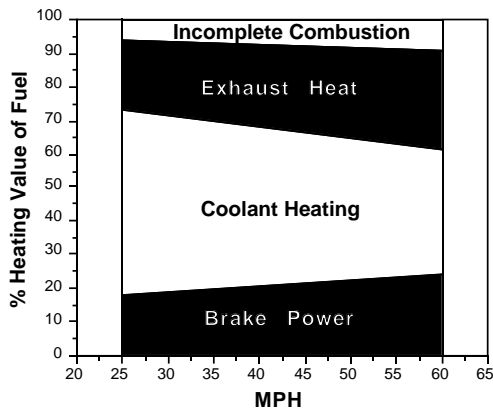
DYNO TEST RESULTS

Dynamometer tests showed significant improvements in coolant temperatures using WaterWetter®. These tests were performed with a Chevrolet 350 V-8 with a cast iron block and aluminum cylinder heads. The thermostat temperature was 160°F. The engine operated at 7200 rpm for three hours and the stabilized cooling system temperature was recorded and tabulated below:

Cooling System Fluid	Stabilized Temperature
50% Glycol/ 50% Water	228°F
50/50 with WaterWetter®	220°F
Water	220°F
Water with WaterWetter®	202°F

These numbers are similar to the temperatures recorded in track use and heavy-duty street use.

Combustion Heat Distribution



COOLANT EFFECTS ON PERFORMANCE

Under moderate load conditions, each percent glycol raises cylinder head temperatures by 1°F. 50% glycol raises head temperatures by 45°F compared to water alone.

BOILING POINT ELEVATION

Red Line WaterWetter® does not significantly increase the boiling point of water; however, increasing pressure will raise the boiling point. The boiling point of water treated with Red Line using a 15 psi cap is 250°F compared to 265°F at 15 psi for 50% glycol. Increasing the pressure by 50% to 23 psi will increase the boiling point of water to 265°F. Sudden shutdown after very hard driving may cause boilover.

FREEZING POINT DEPRESSION

Red Line WaterWetter® does not significantly reduce the freezing point of water.

CORROSION PROTECTION

Red Line also provides excellent protection from cavitation erosion in the water pump and cylinder head when used with an adequately inhibited coolant. Localized boiling in the cylinder head forms vapor bubbles which collapse when they come in contact with cooler liquids. This collapse creates tremendous shock waves which removes the inhibitor film from the aluminum surface and can cause catastrophic erosion of the aluminum if the inhibitor does not reform the film quickly. Another problem created by cavitation erosion is the deposition of the removed aluminum as a salt with poor heat transfer properties in the lower temperature radiator tubes. Red Line prevents this corrosion through effective film formation and smaller vapor bubble formation, which has a less violent collapse. Foam control is equally important since entrained air will cause cavitation erosion due to the collapse of foam bubbles. Red Line provides excellent control of foam with water alone and glycol solutions. Red Line Diesel WaterWetter® does not provide the general rust and corrosion protection available in a heavy-duty coolant. A minimum of 33% coolant is required for adequate protection of cast iron and copper alloys.

WET CYLINDER LINER CAVITATION EROSION

Although the reduction in surface tension created by the Red Line WaterWetter® should reduce the rate of cavitation erosion in wet liners, a long term evaluation of this potential has not been conducted, so continue to use the recommended supplemental corrosion inhibitor. Supplemental corrosion inhibitors are compatible with Red Line Diesel WaterWetter®. Avoid the milky soluble oil types which can actually impede heat transfer by wetting the metal surface with oil and this oil can swell and soften rubber coolant hoses.

USE DIRECTIONS

Use Red Line Diesel WaterWetter® at the rate of 1% in an ethylene glycol or propylene glycol antifreeze solution. One 15 ounce bottle treats 10 - 15 gallons of coolant. Add directly through the cooling system fill cap into the radiator or into the overflow tank. Do not open a cooling system while hot. For best results, replenish or replace every year. The anti-scaling ingredients in Red Line WaterWetter® allow its use with ordinary tap water. For maximum temperature reductions, use the most water and the least antifreeze possible, down to 33%, to prevent freezing in your climate. All antifreeze solutions are evaluated for their corrosion protection under the ASTM protocol at a 33% concentration, not 50%, so more water and less antifreeze, along with WaterWetter® will reduce coolant temperatures even more. Red Line WaterWetter® is available in 15 ounce containers which treat 10 - 15 gallons and 5 gallon pails which treat 500 gallons.

DESIGNED FOR PERFORMANCE

Red Line Synthetic Oil Corporation is the leader in lubricant and fuel system chemistry. Red Line manufactures a full line of automotive products which are designed to provide noticeable improvements in performance. Other Red Line products are:

Diesel Fuel Catalyst - with Fuel Lubricant
RL-2 Diesel Combustion Improver - with Fuel Lubricant
Diesel Fuel Biostat - Antimicrobial Agent
SI-1 Fuel Injector & Intake Valve Cleaner
Lead Substitute
Motor Oils - 5W30, 10W30, 10W40, 15W50, 20W50
Diesel Engine Oil - 15W40
Race Oils - SAE 5, 10, 20, 30, 40, 50, 60, 70
High-Performance Two-cycle Lubricants
Gear Oils - Lightweight, 75W90, 75W90NS, 80W140
ShockProof™ Gear Oils
MTL- Manual Transmission/Manual Transaxle Lube
ATF - Synthetic Dexron II, High-Temp ATF,
D4 ATF, and Racing ATF
CV-2 CV-Joint and Wheel Bearing Grease
Assembly Lubricant
Synthetic Compressor Lubricants
Synthetic Suspension Fluids
For further information please contact:



RED LINE®

DIESEL WATERWETTER® SUPERCoolant

TECHNICAL INFORMATION

Red Line Synthetic Oil
6100 Egret Court, Benicia, CA 94510
(707) 745-6100
www.redlineoil.com