"Question: Why do (should) I want my truck to run warmer?"

[Begin. For your review: *The following is unsolicited feedback about the 203 degree PowerStroke thermostat by DieselSite.] While reading your Q&A, your answer touched on some complex interactive relationships familiar to engine designers that can't be reduced to easily understood statements. I offer this differently focused explanation for your consideration.*

"Question: Why do (should) I want my truck to run warmer?"

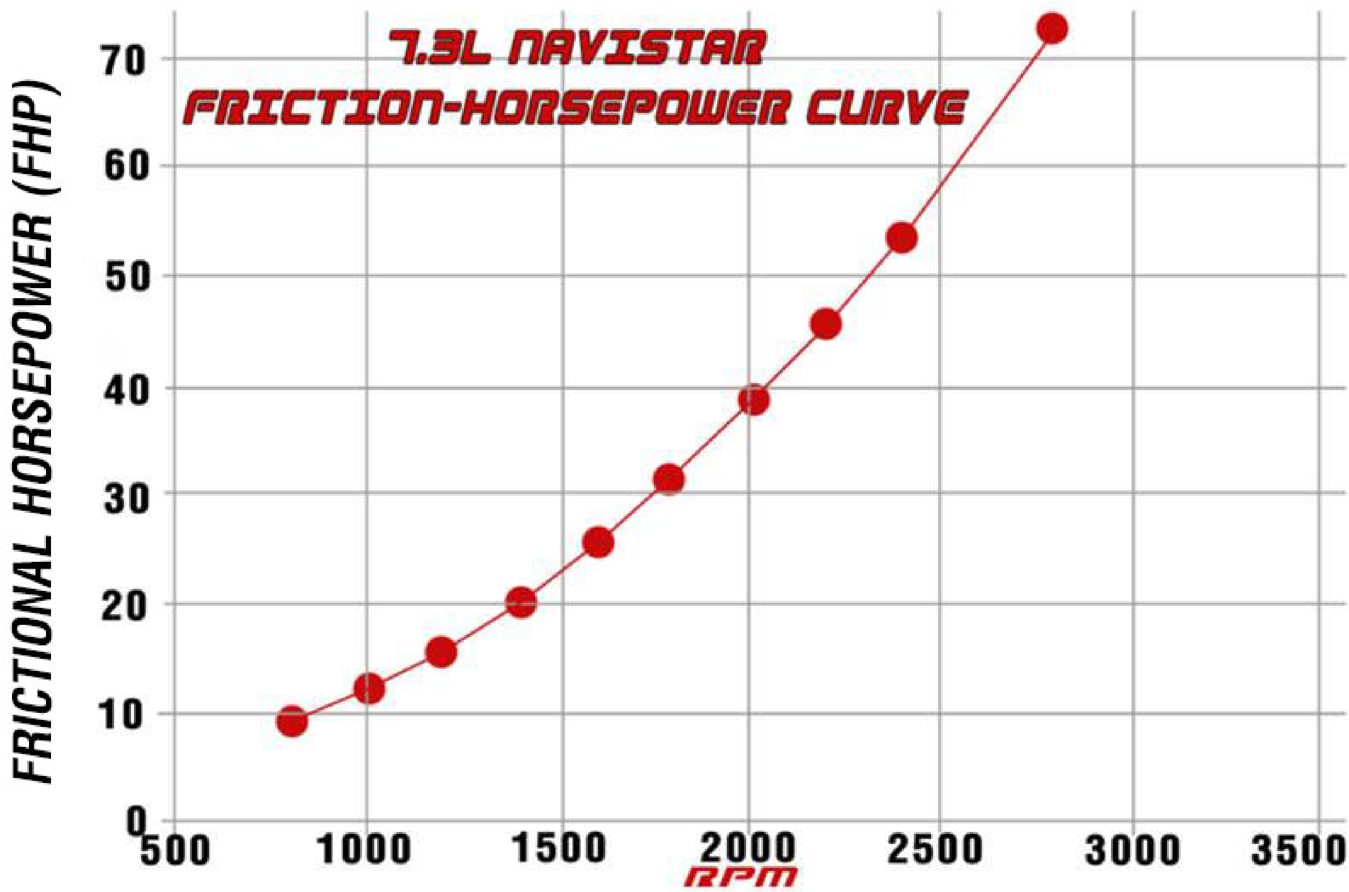
Answer: You should want your engine's oil & water temperatures warmer to
1) reduce piston/ring sliding friction,
2) to complete combustion before the crankshaft has rotated so many degrees which translates into more "area under the curve" of piston pressure pushing the connecting rod down to rotate the crankshaft, and
3) to better purge volatile oil-borne combustion byproducts from its oil supply.

Just as injector nozzle pressures over 30,000 psi have enabled diesel designers to generate higher torque from identical total fuel flows of better atomized fuel presenting more surface area to oxygen which induces earlier combustion completion, so too do higher combustion chamber temperatures also cause slightly earlier combustion completion during the power stroke. Earlier combustion completion results in higher gas pressures earlier in the power stroke which are converted into higher average crankshaft rotating pressure. Gas pressure converted earlier into crankshaft rotating work is not later available as waste heat at the bottom of the power stroke. That contrasts with later combustion completion which fails to convert as much gas pressure into crankshaft rotating energy so more gas energy is still available at the bottom of the stroke as waste heat. **That complex relationship is why earlier combustion completion, whether caused by better fuel atomization or by higher combustion chamber temperatures, lowers exhaust gas temperatures while simultaneously increasing crankshaft power output.**

Most internal combustion engineering texts estimate roughly 80% of internal engine friction originates from piston & ring sliding friction within cylinder bores. That power absorption curve is directly reduced by increasing oil film temperatures. Reducing internal engine friction reduces fuel consumption required to overcome total internal engine friction at every point along the rpm curve. Therefore it also improves specific output power value along that curve and slightly extends that curve higher at its top due reducing that sliding friction component.This is apparent in slightly lower BSFC (Brake Specific Fuel Consumption) curves caused by higher oil and combustion chamber temperatures. Ford gas racers engine designers tend to target about 210 degrees.

Volatile combustion byproducts which bypass oil and compression rings can condense into crankcase oil. Higher oil temperatures reduce that condensation effect. That translates by higher temperatures oil supplies stabilizing at lower combustion byproduct condensate contamination levels. Crankcase ventilation into incoming air charge stream designs work are better able to reduce combustion blowby condensate oil fouling when engine oils are warmer.

Together these effects produce higher power from earlier combustion completion as compared to later combustion completion, even when excess oxygen insures 100% combustion as is normally true. Higher oil temperatures also reduce fuel consumption due to both this "area under the curve" effect and from lower internal friction at all throttle settings. Finally, warmer engines show slight total net maximum power gains due to these combined separate mechanism's effects because they extend that curve's peak value by simultaneously increasing fuel efficiency and lowering internal friction. Oil self-cleaning does not improve engine efficiency over short periods, but over extended periods lower oil fowling is another clear benefit.



Notice that the attached Navistar 7.3 internal friction curve is NOT linear. Read some of its values to realize how disastrous continuous high rpm operation is for efficiency in this engine series. At 2,800 rpm, it requires fueling 72 horsepower of internal friction before you can obtain the first net horsepower of output! An explanation of it's trade-offs compared to other diesels like the 5.9 Cummins would considerably extend this already long note. Higher nitrous oxide emissions argue against higher temperature thermostats. [But as shown here…]Your higher temperature thermostats directly improve that very expensive internal friction curve.

End

MANY THANKS TO THE ENGINEER THAT SUPPLIED US WITH THIS TECHNICAL INFORMATION ON HIGHER TEMPERATURE EFFECTS ON THE NAVISTAR 7.3L DIESEL ENGINE. HIS SUBMISSION WAS COMPLETELY UNSOLICITED AND WE APPRECIATE THAT HE TOOK THE TIME TO SHARE HIS FINDINGS ON OUR PRODUCT WITH US. WITHOUT HIS TECHNICAL EXPERTISE ON ENGINE DESIGN, THE BENEFITS OF RUNNING A HIGHER TEMPERATURE THERMOSTAT IN OUR 7.3L ENGINES WOULD NOT HAVE BEEN EXPLAINED TO THIS SIGNIFICANT DEGREE. - *Bob Riley*