Webasto Thermo Comfort North America, Inc.

SAFETY.CAT.COM™

COLD WEATHER RECOMMENDATIONS FOR ALL CATERPILLAR MACHINES

Excerpted from Operation & Maintenance Manual (SEBU5898-11-01)

Category 3

−18 to −30 °C (0 to −22 °F)

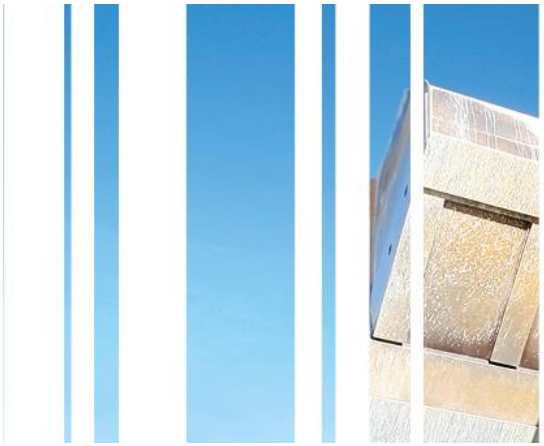
Table 4

Category 3 Starting Aids			
Altitude	**Engine Model**	**Recommended**	**Optional**
All Altitudes	All Models	Continuous Flow Ether	Oil Heater
		Coolant Heater	Fuel Heater
		Heavy Duty Battery and Starter(1)	Battery Warmer

(1) Contact your Caterpillar dealer for availability for your machine model.

Caterpillar Warm Up Recommendations

- **To avoid valve damage, always run the engine until the coolant temperature is at least 180°F.**
- **This will keep carbon deposits on the valve stems at a minimum.**
- **Thoroughly warming the engine will keep the other engine parts in better condition.**
- **This could also extend the service life of the engine.**
- **With less acid and less sludge in the oil, lubrication will be improved.**
- **This will give longer service life for engine bearings, piston rings, and other parts.**



Target Product Families

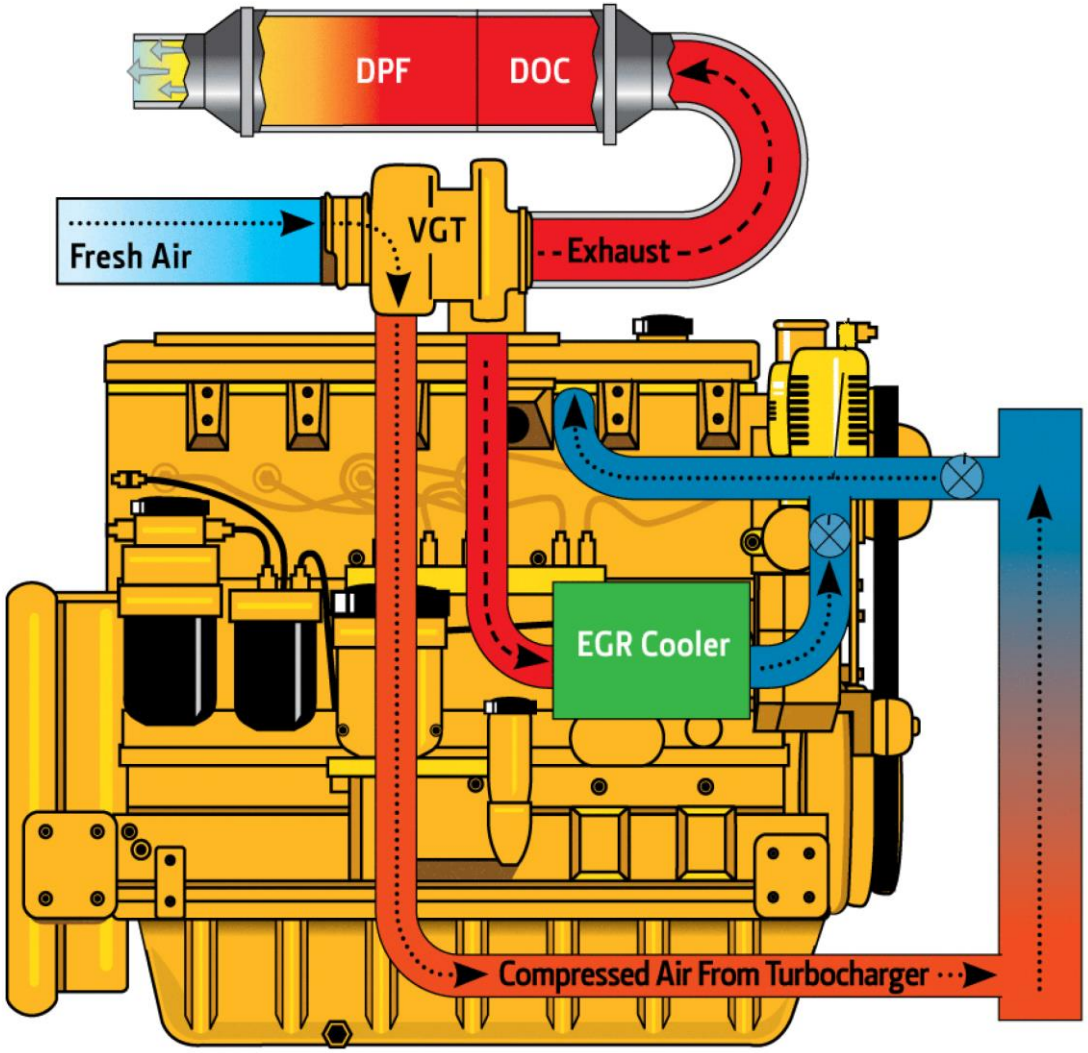
Target Products

Wheel Loaders

Articulated Dump Trucks

Off-Highway Trucks

DPF Regeneration Reduced with Pre-Heating



FOR IMMEDIATE RELEASE

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Wednesday, November 13, 2013

Webasto Releases Independent Test Results Showing Pre-heated Engines Reduce Emissions and Improve Performance of Diesel Particulate Filters (DPFs)

Fenton, MI – An Independent Emissions Testing Lab recently tested the effects of a Webasto coolant heater on the emissions performance of a diesel engine. To simulate different temperature conditions during the seasonal changes and the effect caused by the Webasto heater, boundary conditions to the test engine were set at 40 degrees Fahrenheit and 75 degrees Fahrenheit during separate test runs.

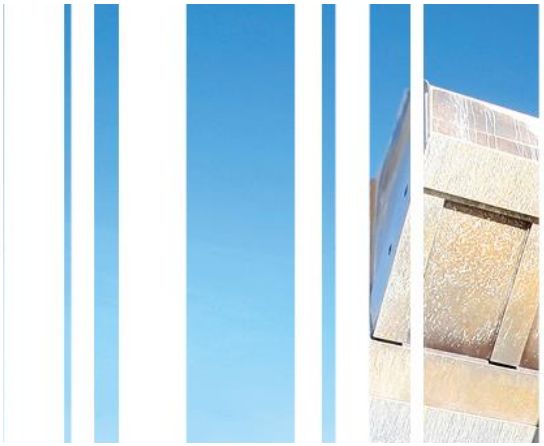
Emissions testing using an AC transient engine dynamometer, was performed to determine the effect of engine start-up temperature on PM, HC and CO emissions on a 2005 DT466 engine using an FTP Transient cycle with a Webasto Thermo Top C 5 Kw coolant heater (Part Number 923369). Emissions data shows that the start-up temperature has a significant effect on the engine emissions and overall performance of DPFs.

Results Summary

- Engine start-up temperature has a significant impact on the emissions levels emitted by the engine.*
- PM emissions were reduced by 66 percent by pre-heating the engine during the cold weather conditions. Pre-heating also provided a 27 percent reduction in PM emissions during normal ambient conditions. This will help in longevity of the DPF life and can avoid more frequent regenerations and cleaning intervals.*
- NOx emissions were reduced by around 40 percent by pre-heating the engine to 155 degrees Fahrenheit.*
- The test results shows a 29 percent reduction in CO during winter conditions, and a 62 percent reduction during normal ambient conditions.*
- Pre-heating the engine does not have a significant effect on the Hydrocarbon emissions.*

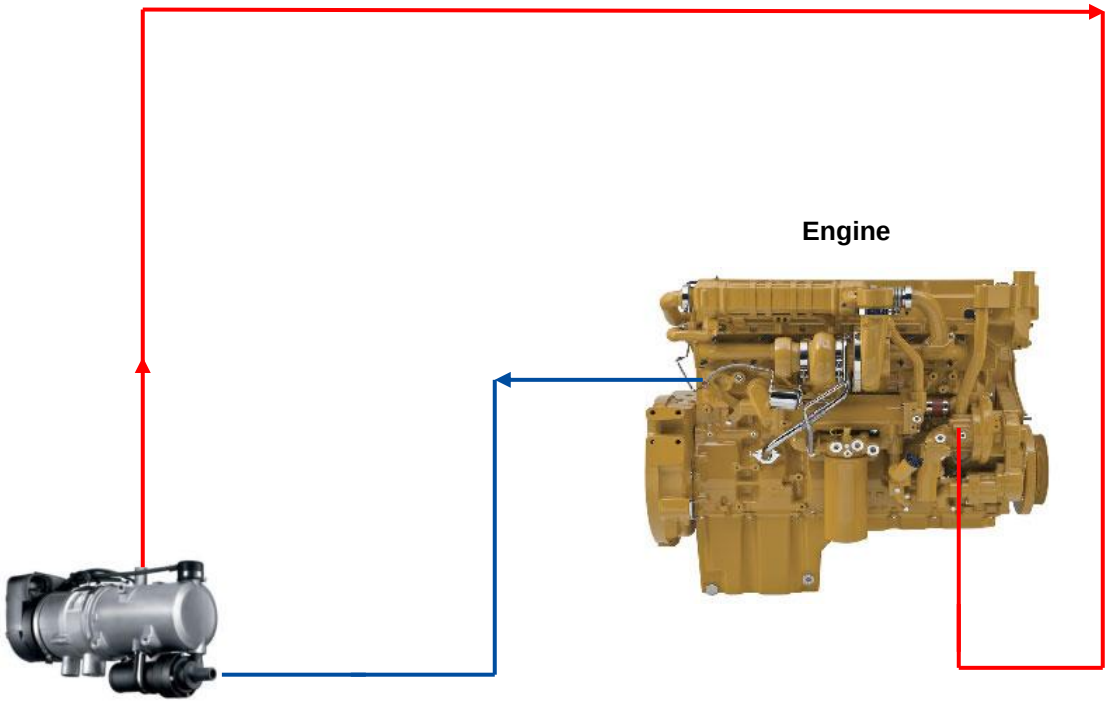
Engine Pre-Heating and Idle Reduction Improves DPF Performance

*Source: ESW America Inc. Results will vary based on engine size, duty cycle and overall maintenance. FTP Cycles ran did not follow all the CFR testing requirements as test cell conditions were controlled to represent cold conditions.

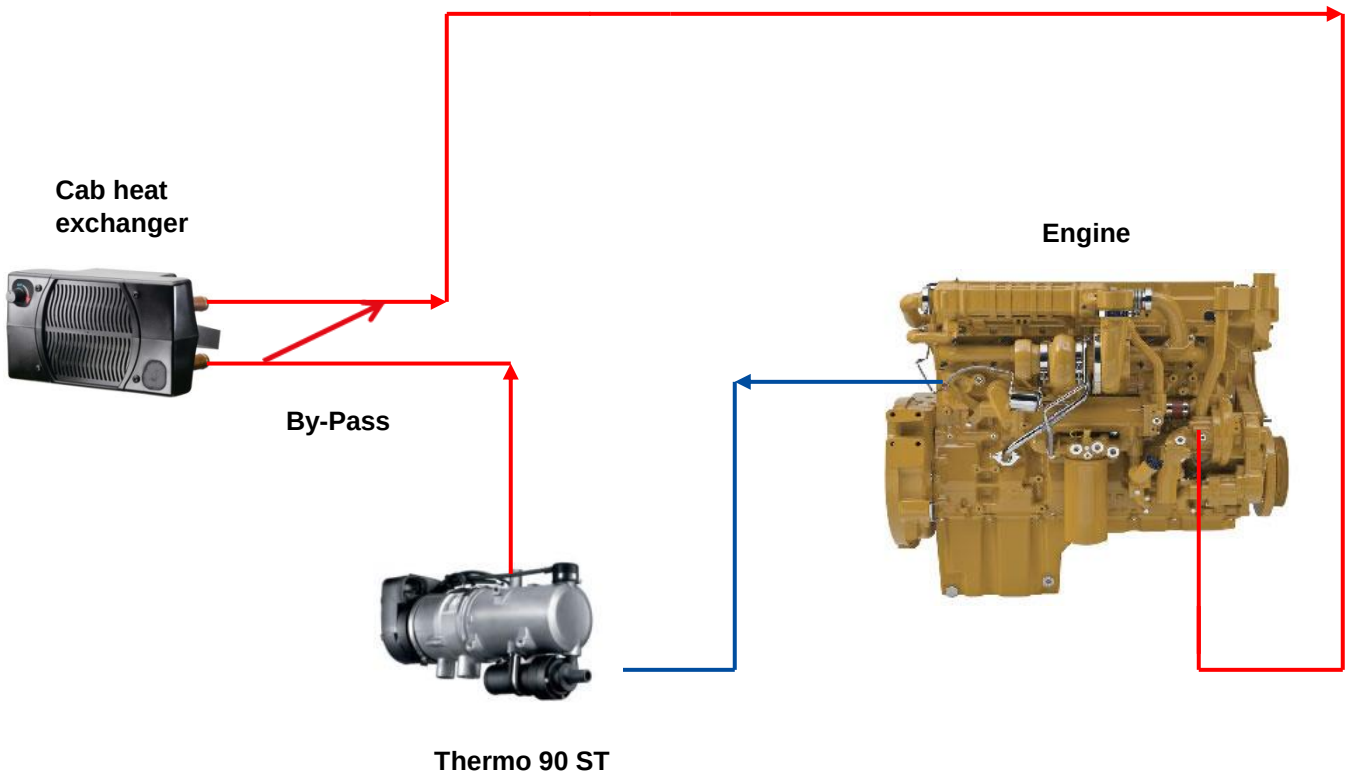


Systems overview

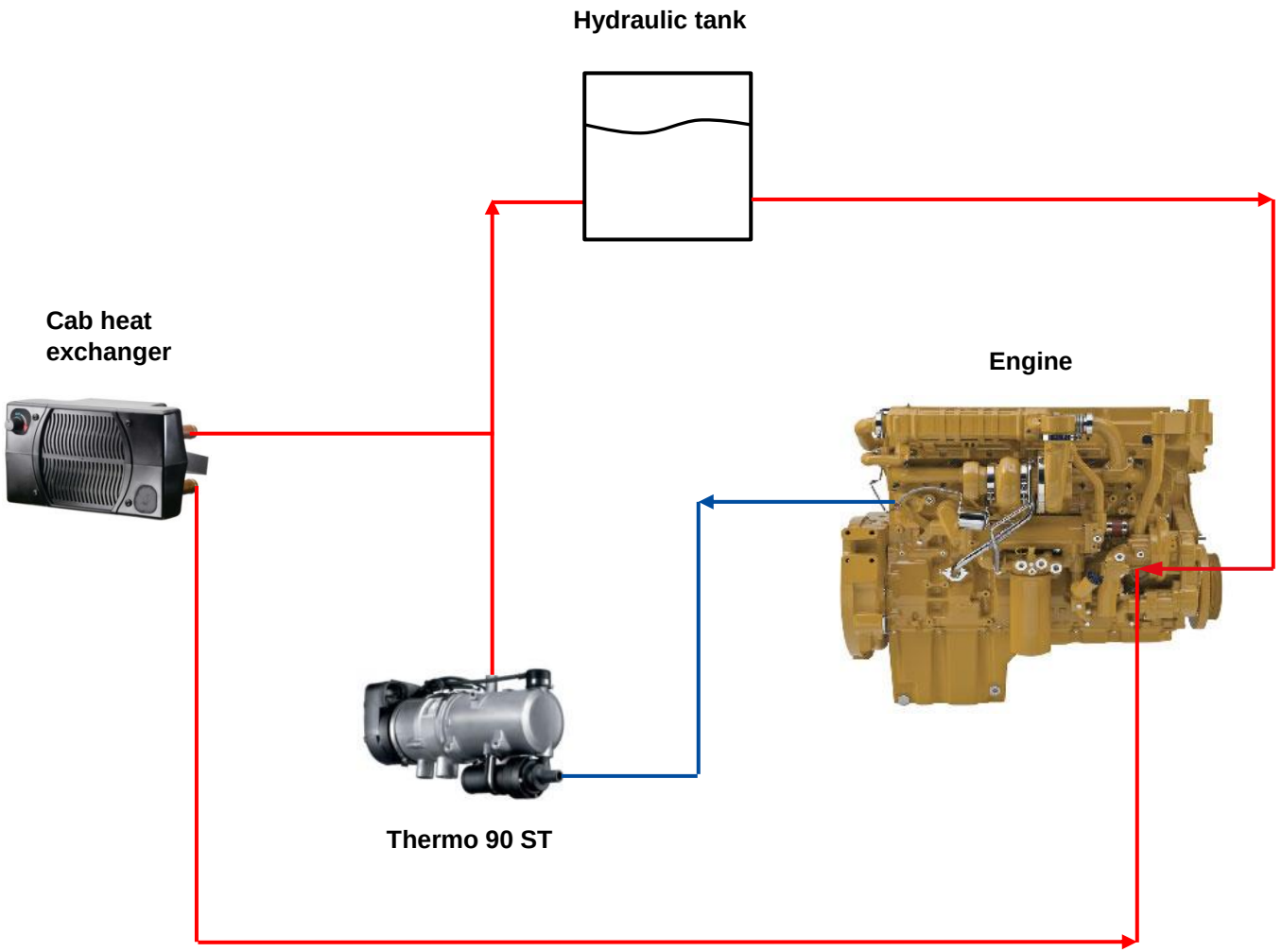
Engine Heating



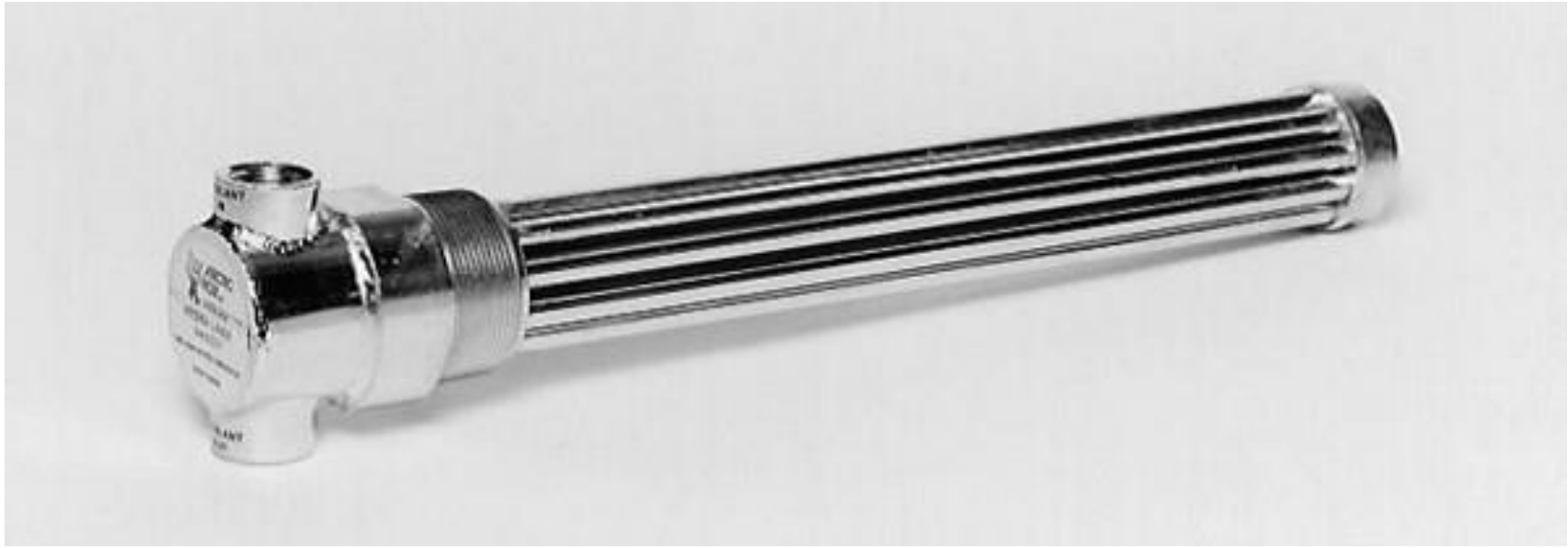
Engine and Cab Heating



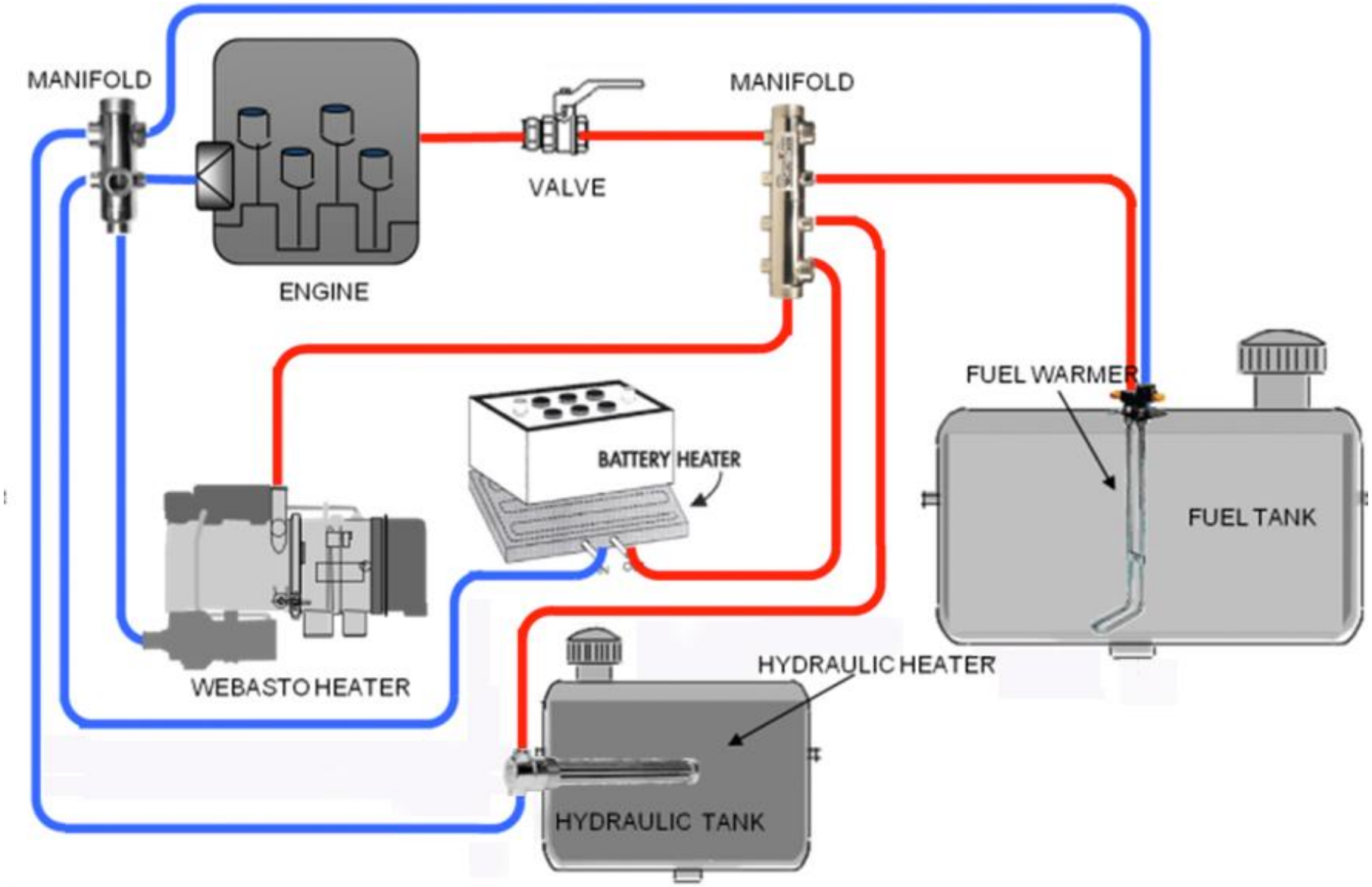
Engine, Hydraulics & Cab Heating

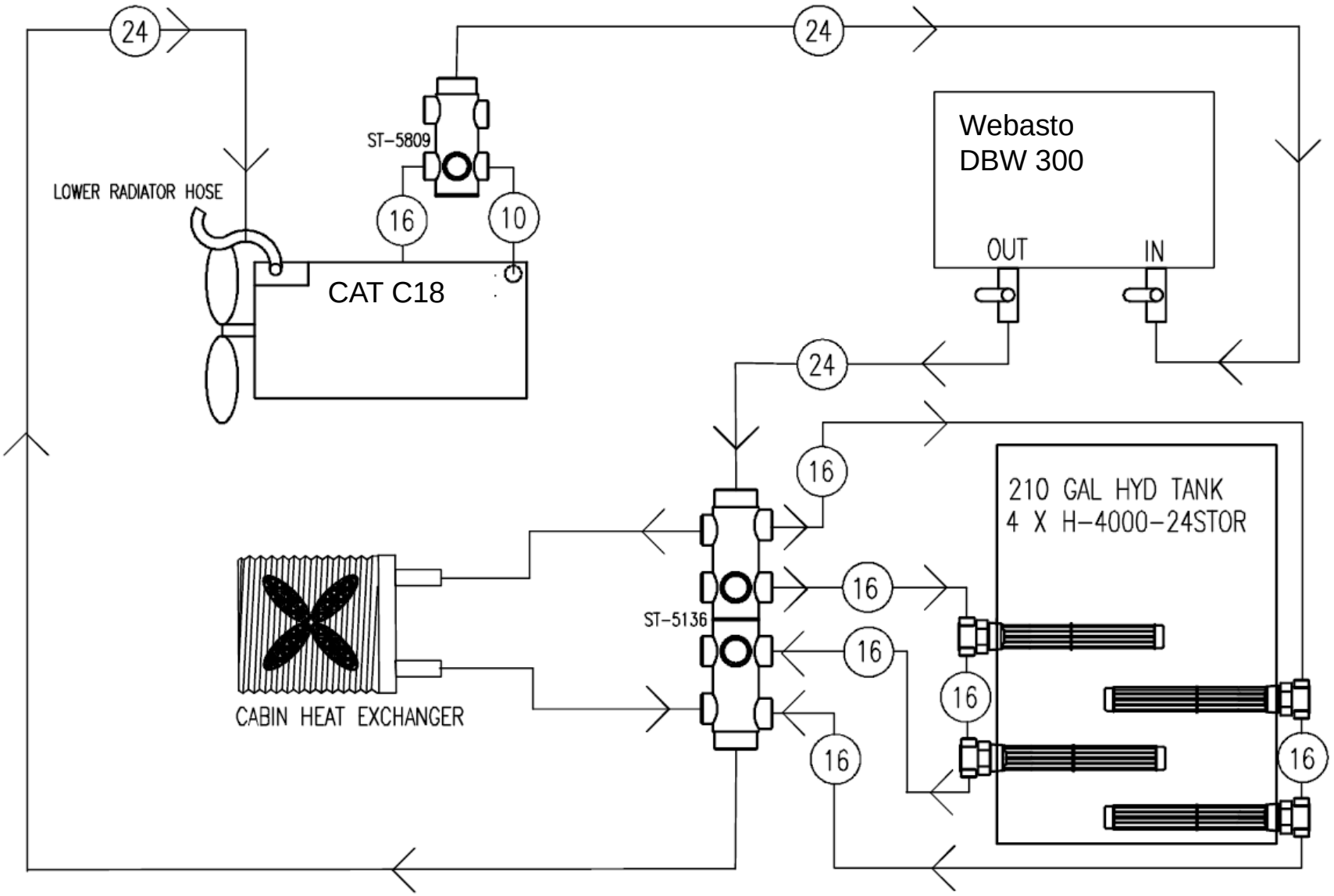


Arctic Fox Hydraulic Fluid Warmer



Sub Systems Heating




24
24
ST-5809
LOWER RADIATOR HOSE
16
10
CAT C18
Webasto
DBW 300
OUT
IN
24
16
210 GAL HYD TANK
4 X H-4000-24STOR
ST-5136
16
16
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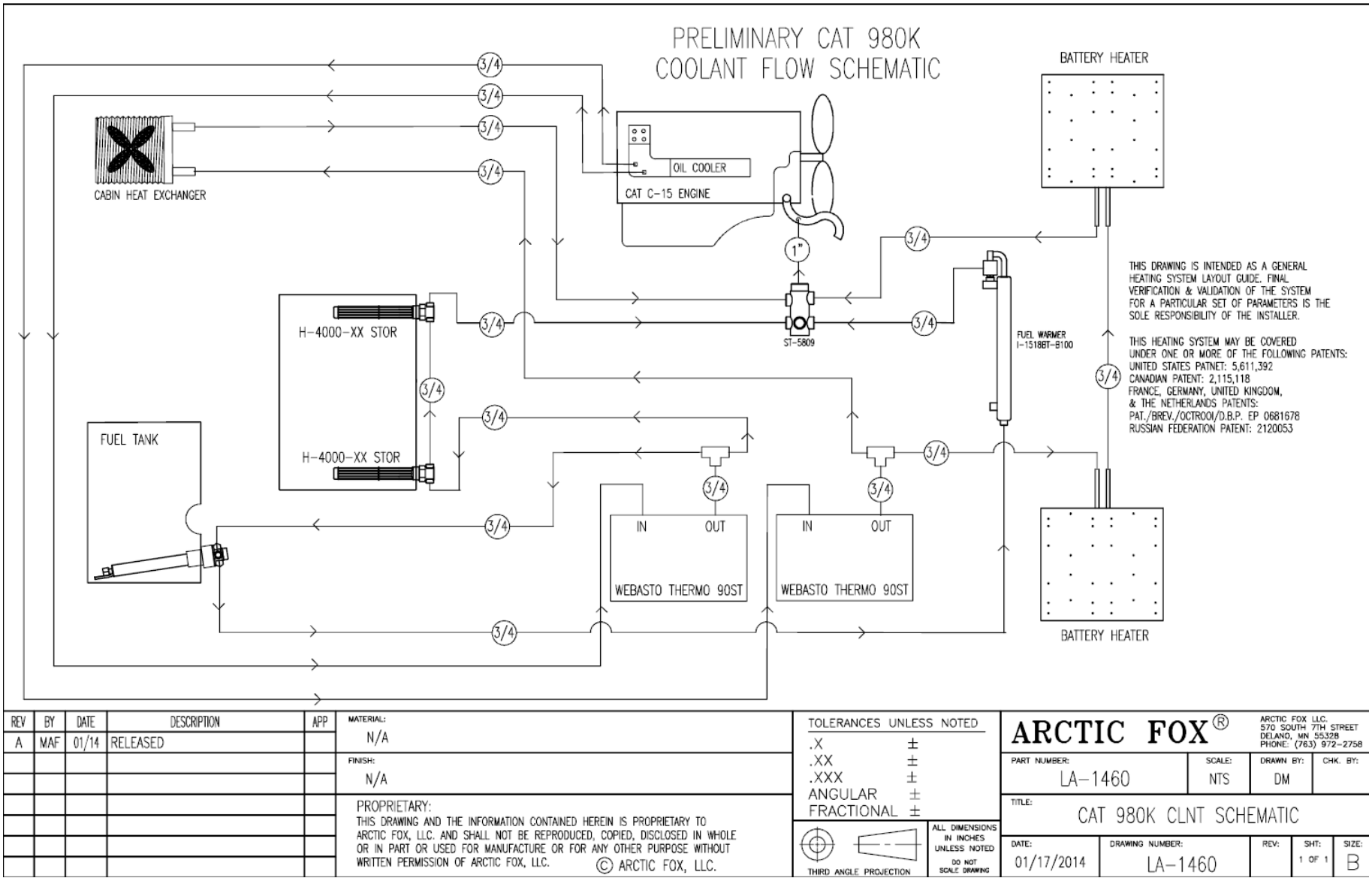
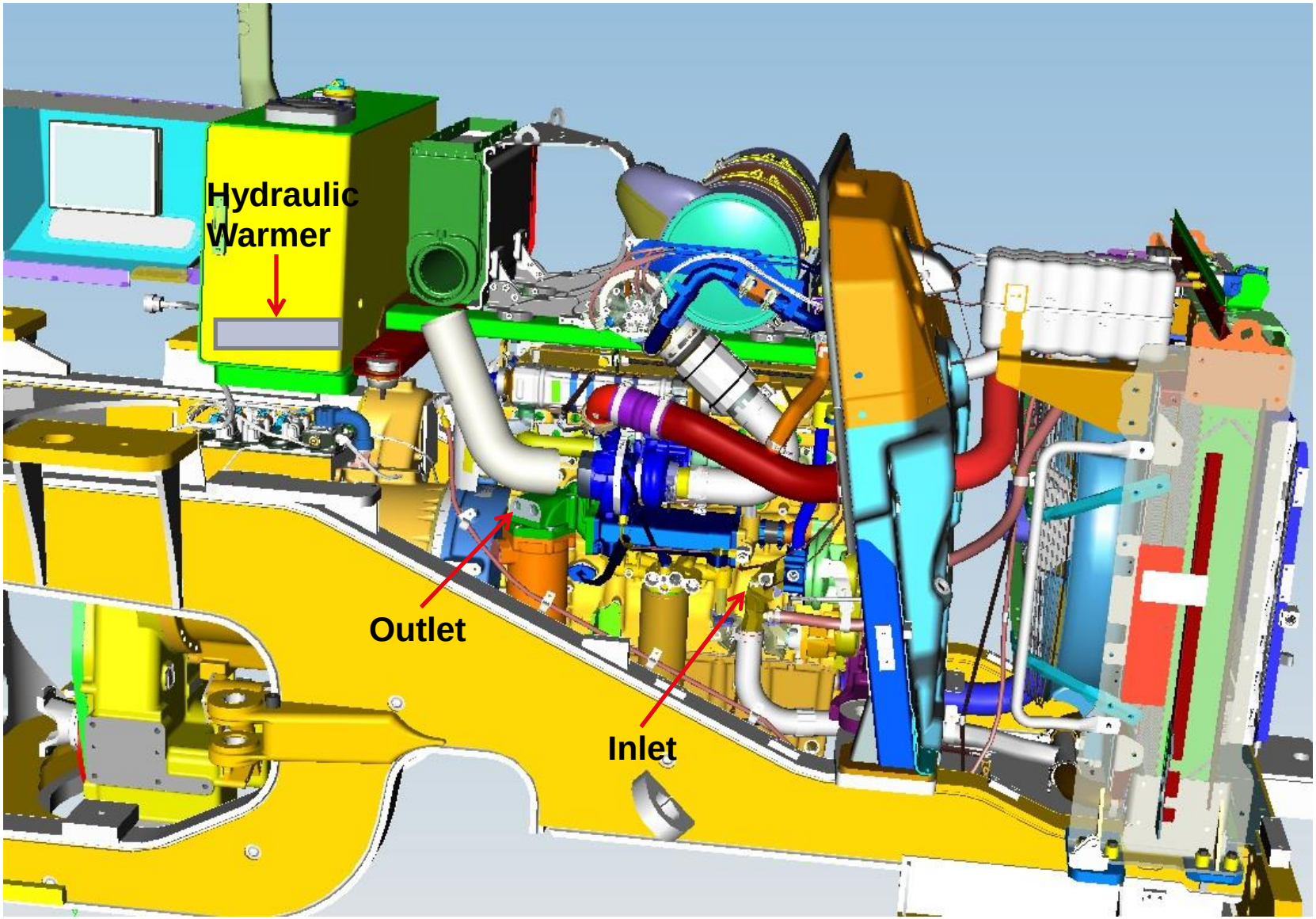
16
16
CABIN HEAT EXCHANGER

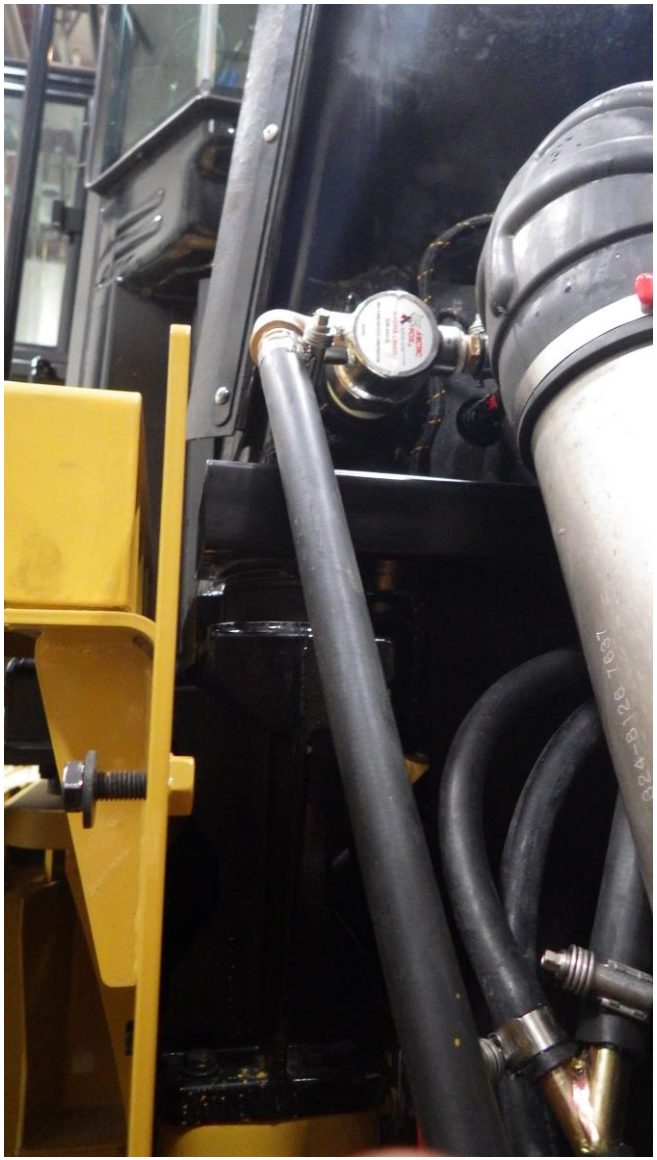
Full Arctic Package

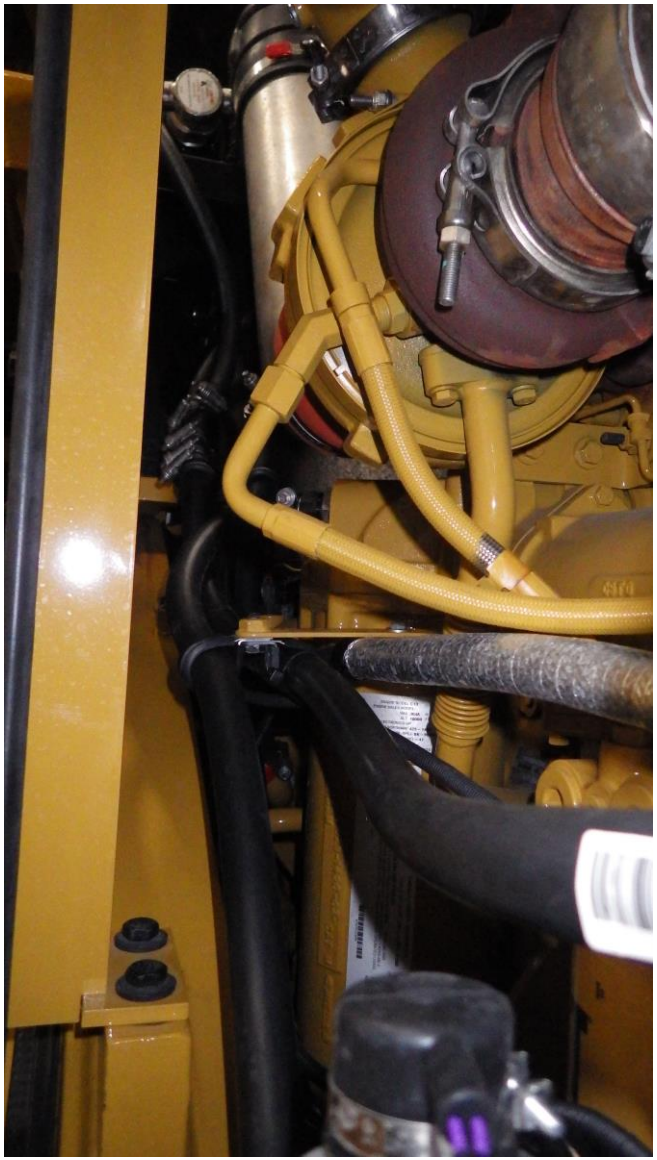


980K Left Side Rear Frame



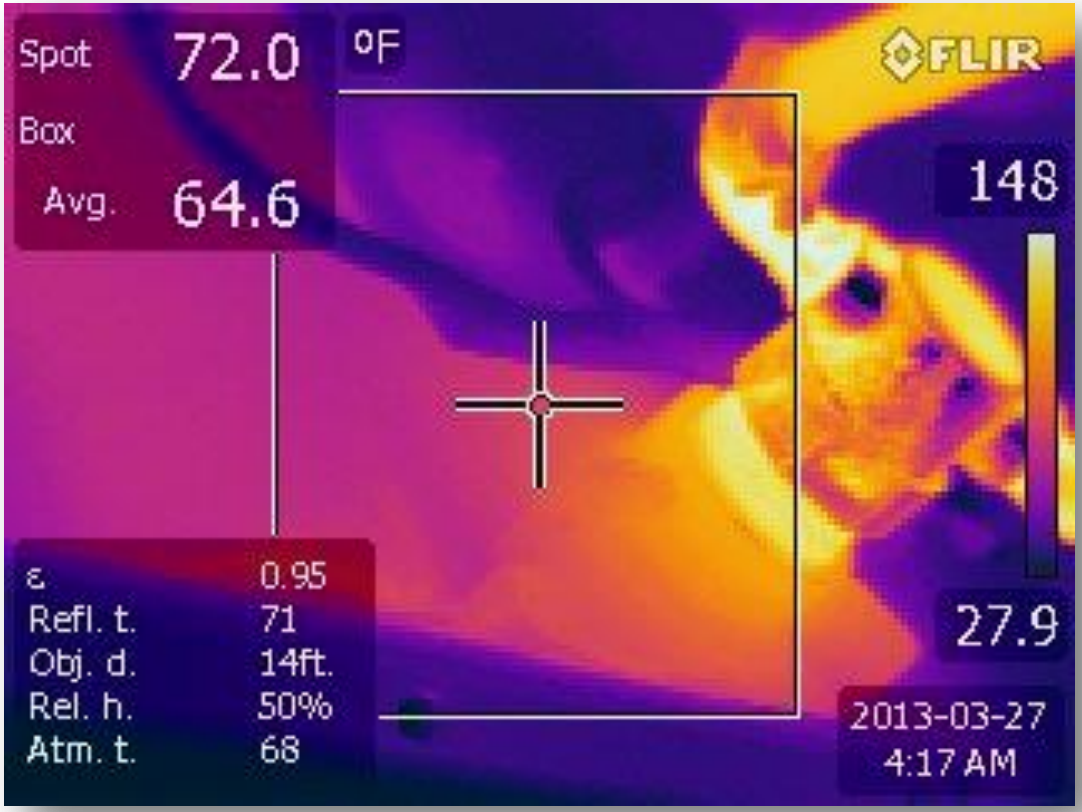
Inside Hydraulic Tank

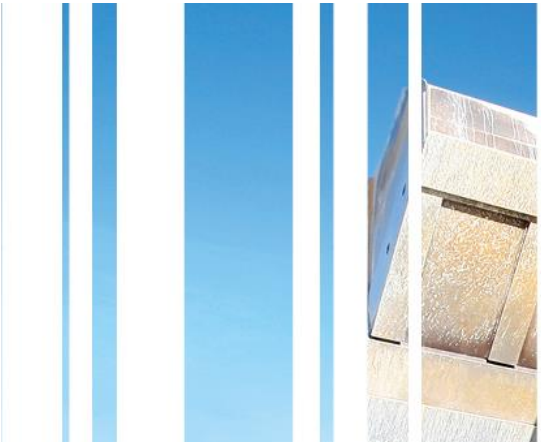




Hydraulic Warmer

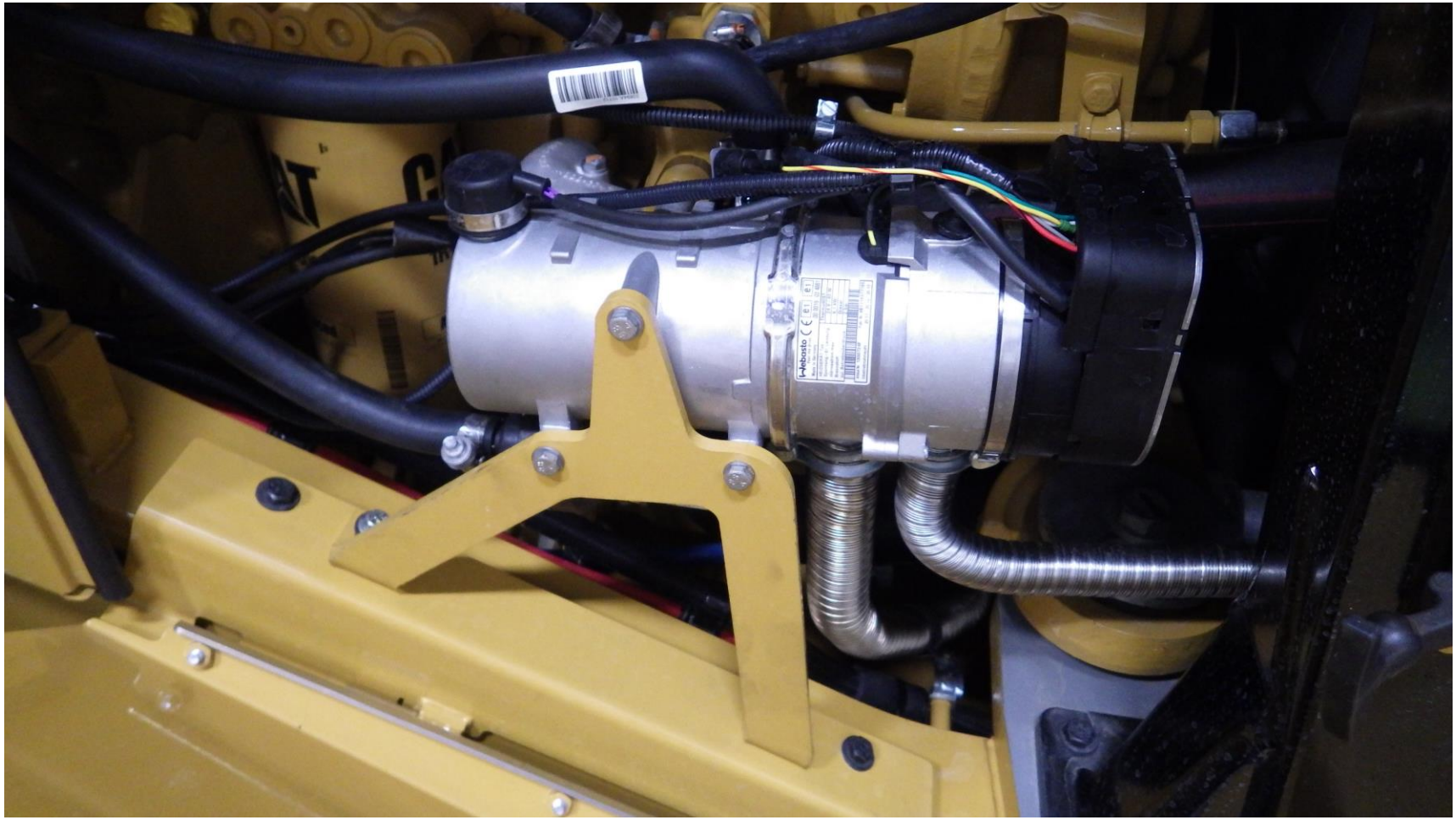
Hydraulic Warmer

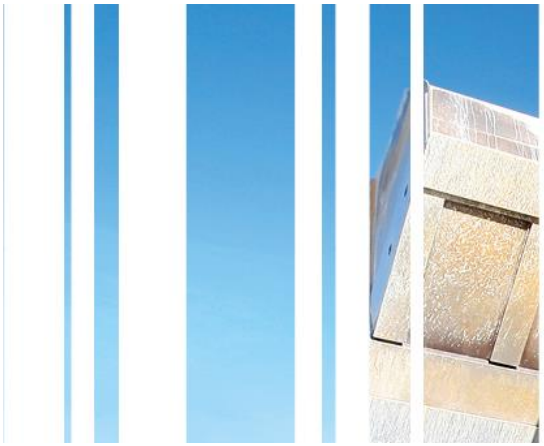




980K Pre-Heating

Thermo 90ST on 980K





Benefits

Benefit to Operator

- Extra hour of sleep each day
- Cab warmed to comfort prior to start
- No need to recalibrate scale system
- Reduced DPF regeneration frequency
- Increased productivity
- Normal cycle times sooner
- No need to scrape and clear windows

Benefit to Customer

- **Work Year is 300 Days**
- **980K Idle Fuel 1.5 Gallons Per Hour**
- **Operator Start Time 1 Hour Prior**
- **150 Less Operating Hours**
- **225 Less Gallons of Fuel**
- **150 Less Hourly Wages & Benefits**
- **1 Less Machine Service Per Year**

Operating Cost Value to Customer

- **225 Less Gallons of Fuel = $900**
- **150 Less Operator Wages & Benefits = $6,000**
- **1 Less Machine Services = $1,000**
- **Greater Production $????**

Estimated Annual Savings $7,900 Per Machine

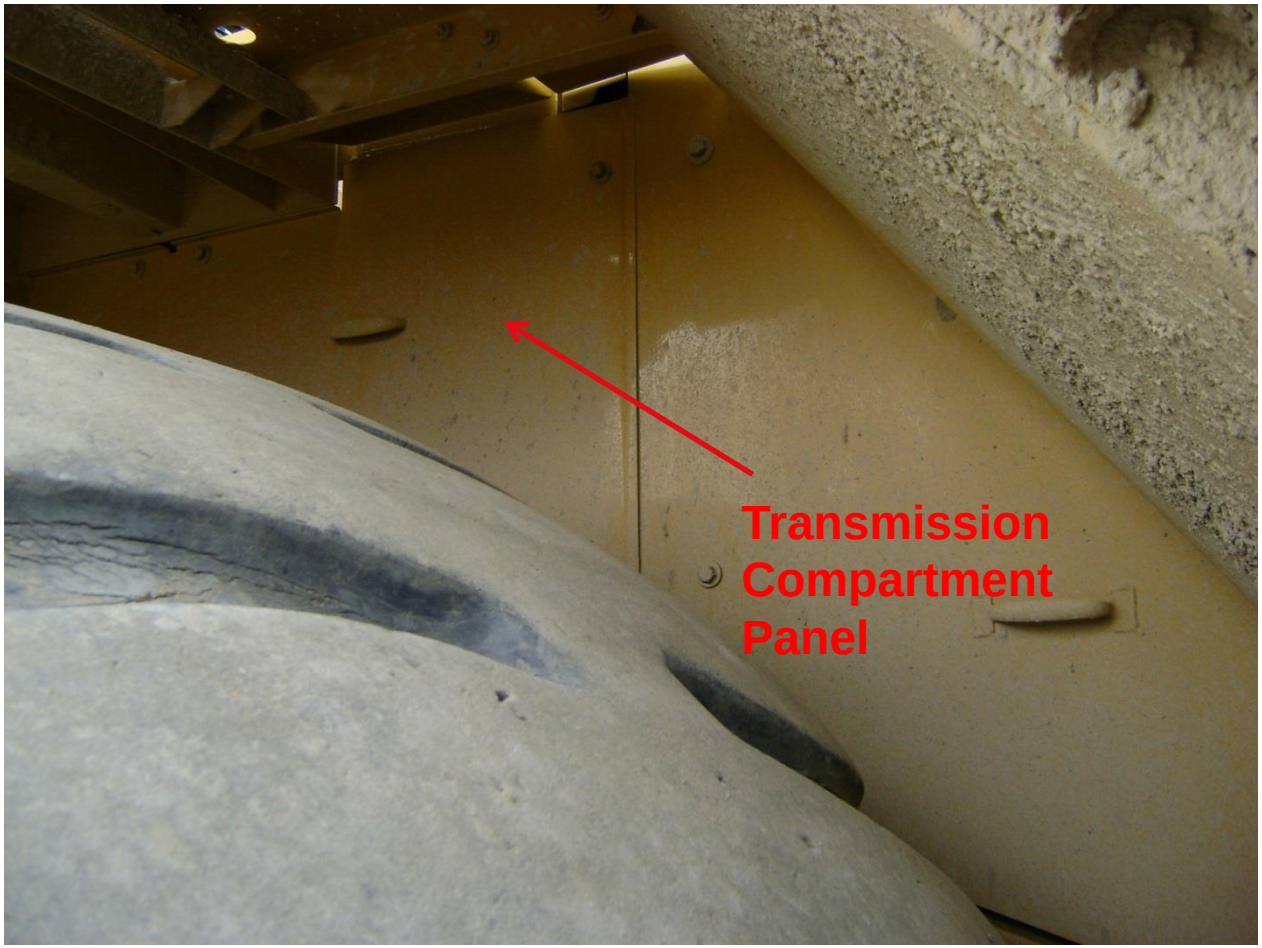
Owning Cost Value to Customer

- **Lower annual hours = Higher residual values**
- **Higher residual values = Lower monthly payments**
- **Pre-heated engine extends time before overhaul**
- **Pre-heated engine starts reduce DPF regeneration**
- **Warm hydraulics prolong component life**
- **Warm hydraulics allow for immediate operation**
- **Pre-heat and thaw Urea tank prior to starting**

Installation Examples

CAT 988G

Transmission Compartment Access Panel



Left Rear Transmission Compartment

Engine Outlet to Heater at Transmission Cooler

Manifold Mounted inside Transmission Compartment

Arctic Fox Insulated JIC Coolant Lines

16 inch Hydraliner with JIC Artic Fox Insulated Hose

Fuel Stand Pipe Adapters

Fuel Pump and Filter

CAT D9T Landfill Dozer

D9T Waste Arrangement Certified Rebuild

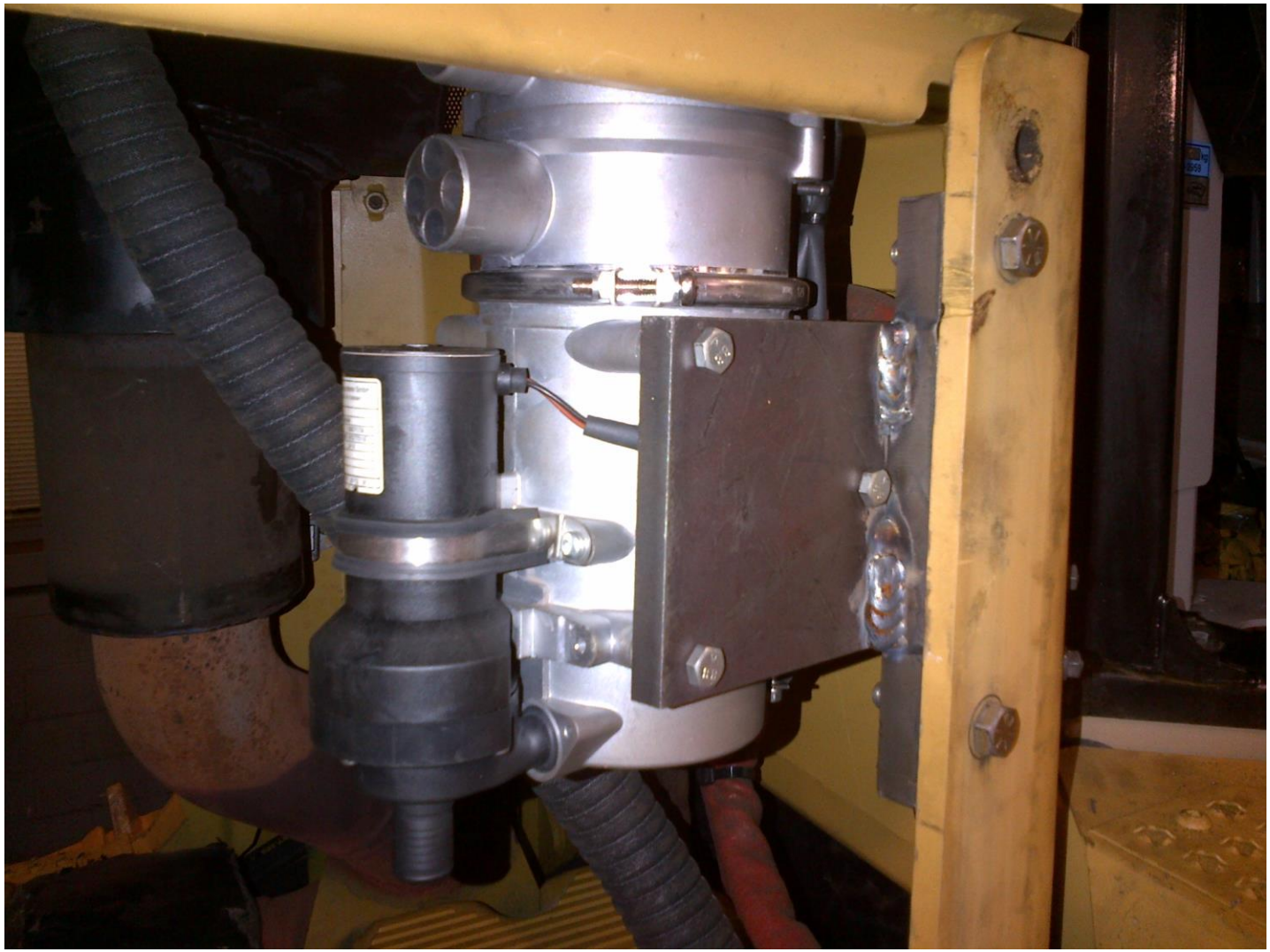
Fuel Access

Fuel Filter Compartment

Heater Fuel Pump Location

Left Side Engine Compartment

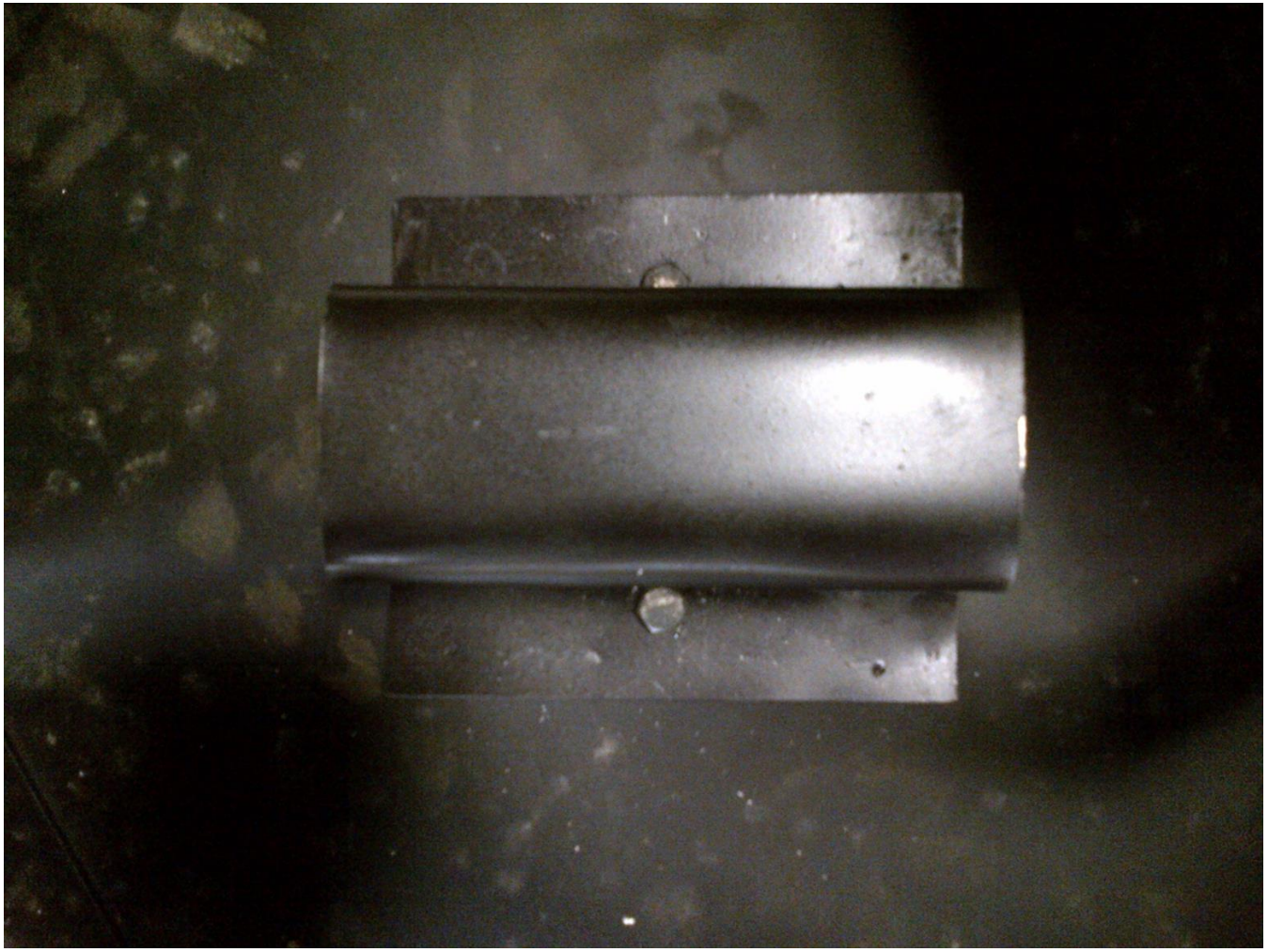
Bracket



Exhaust Wrap

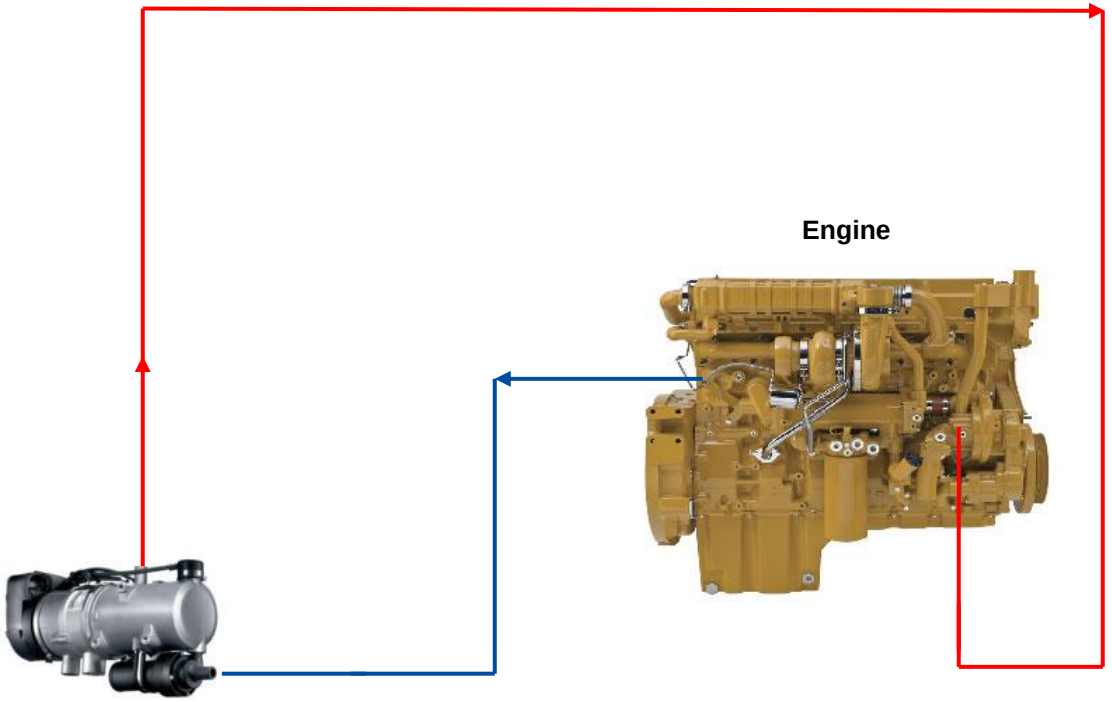
Up Exhaust Outlet

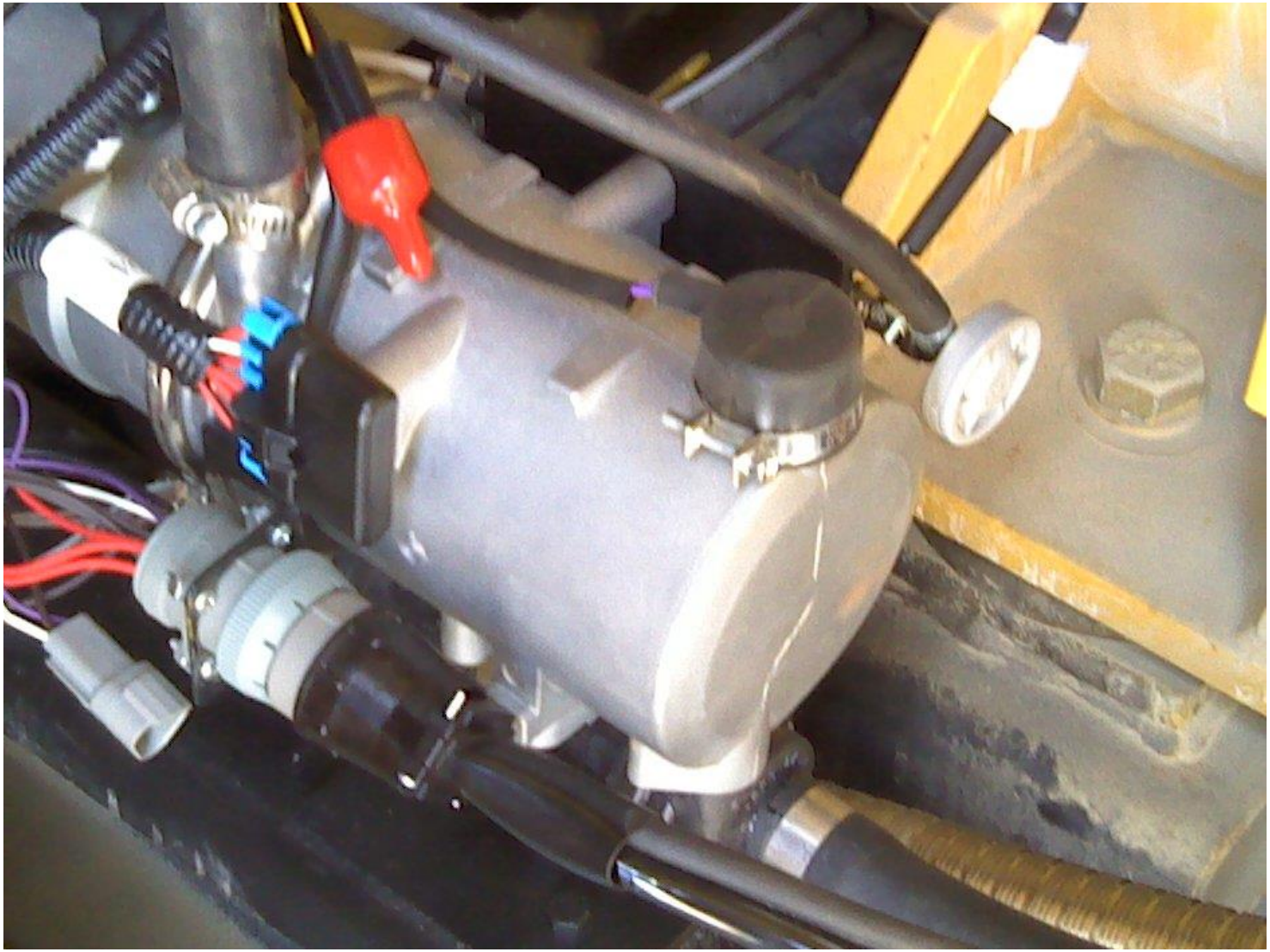
Erxhaust Outlet Rain Cap



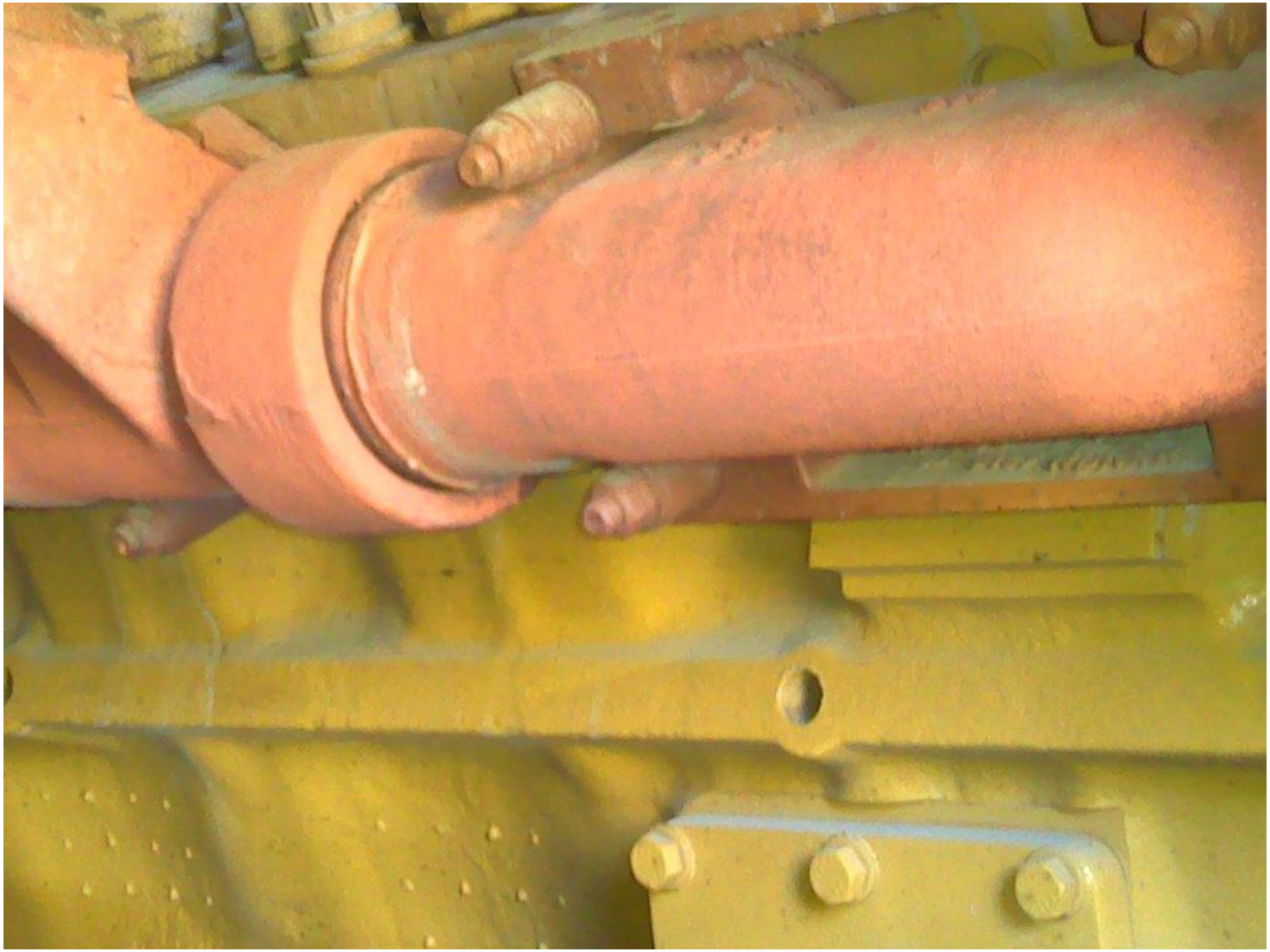
CAT 3512 GENSET

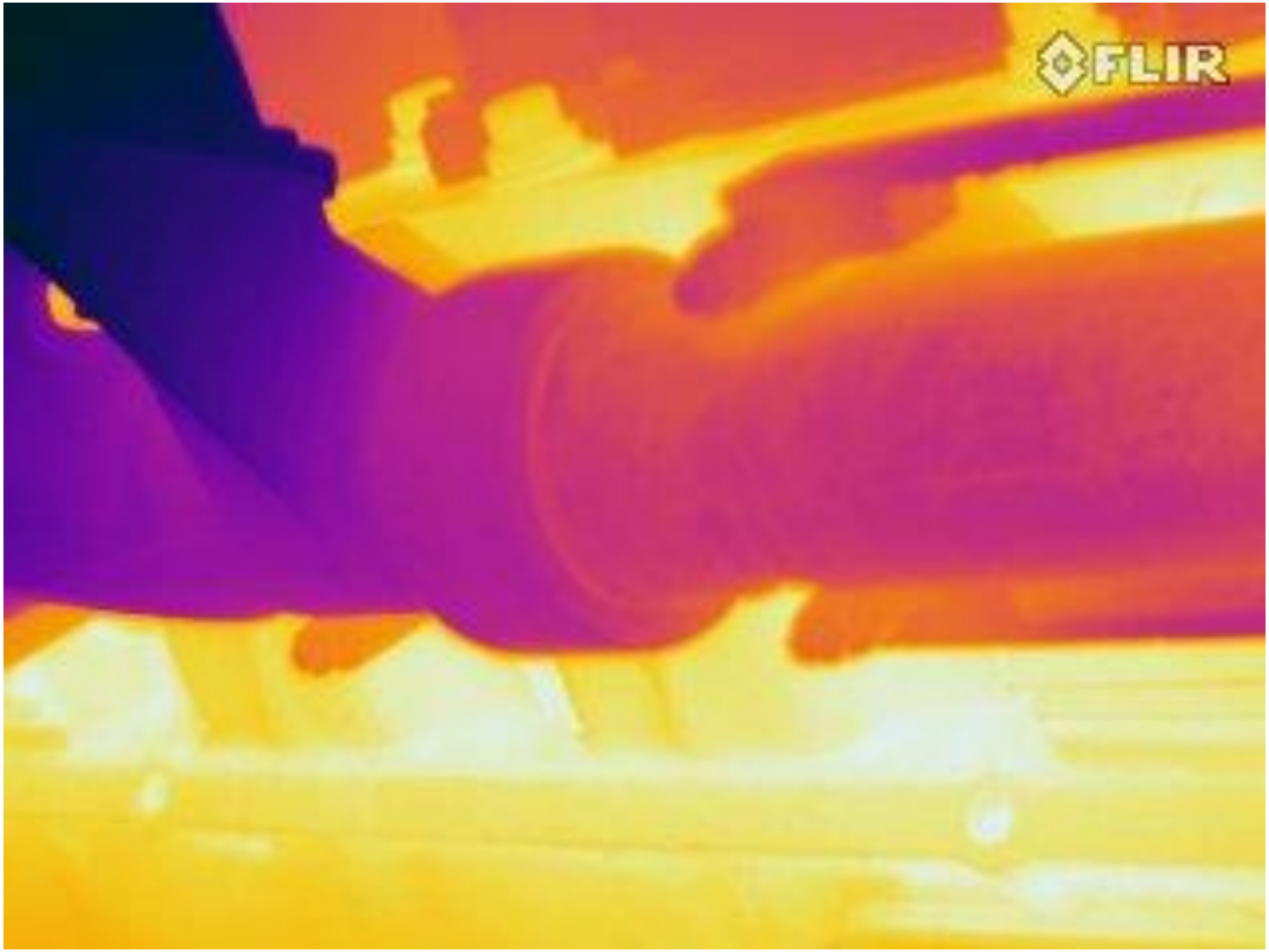
Engine Heating

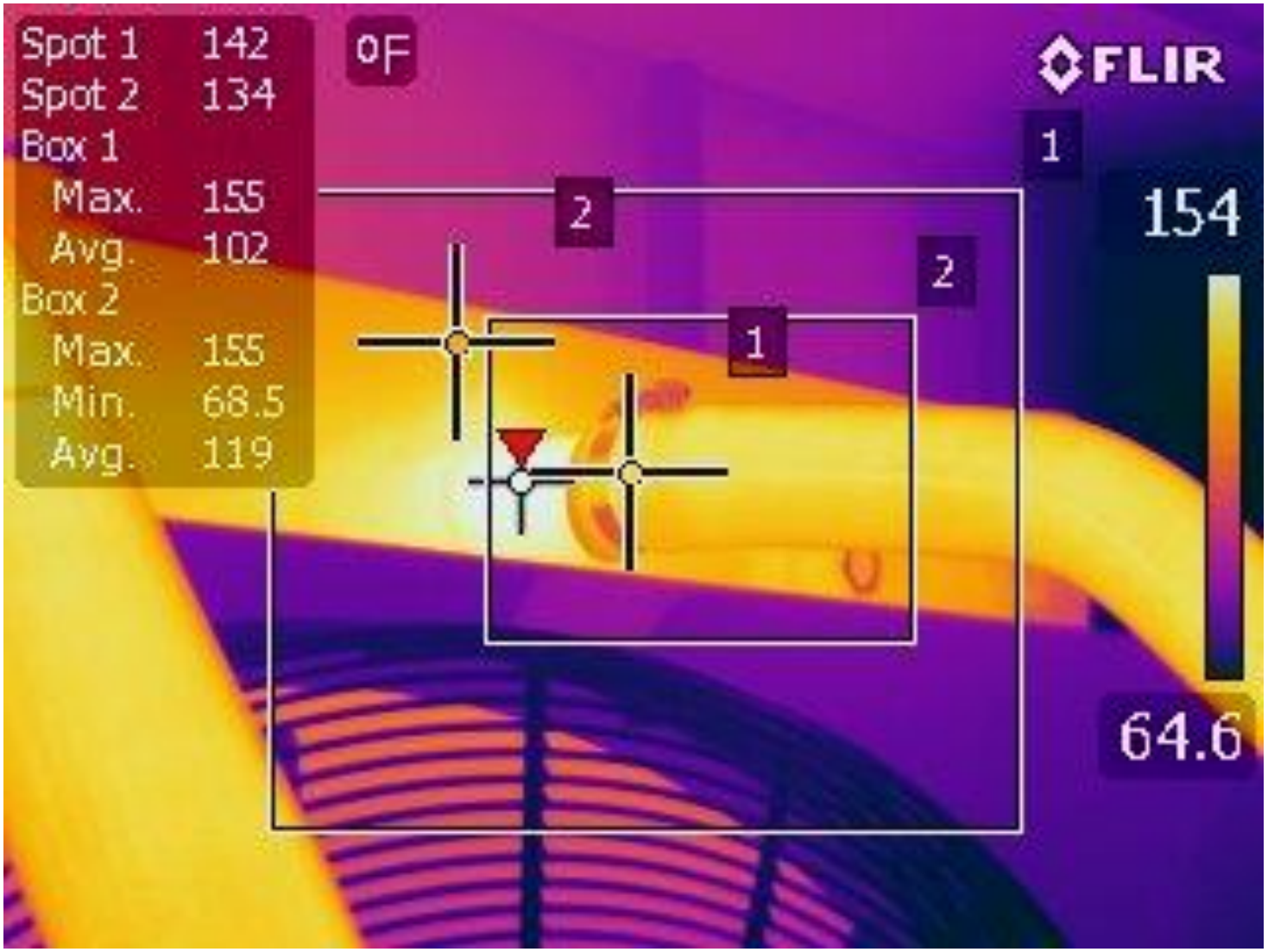





FLIR




FLIR


Spot 1 142
Spot 2 134
Box 1
Max. 155
Avg. 102
Box 2
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Min. 68.5
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FLIR
1
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154
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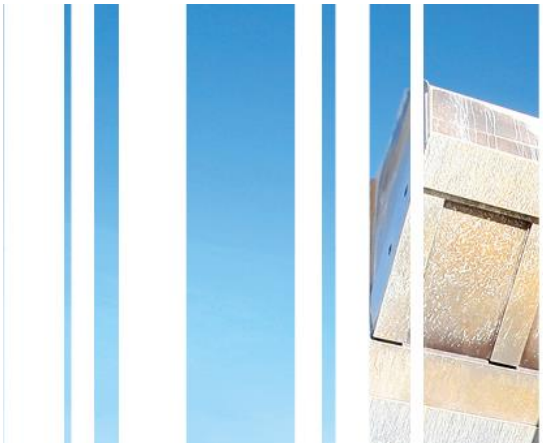
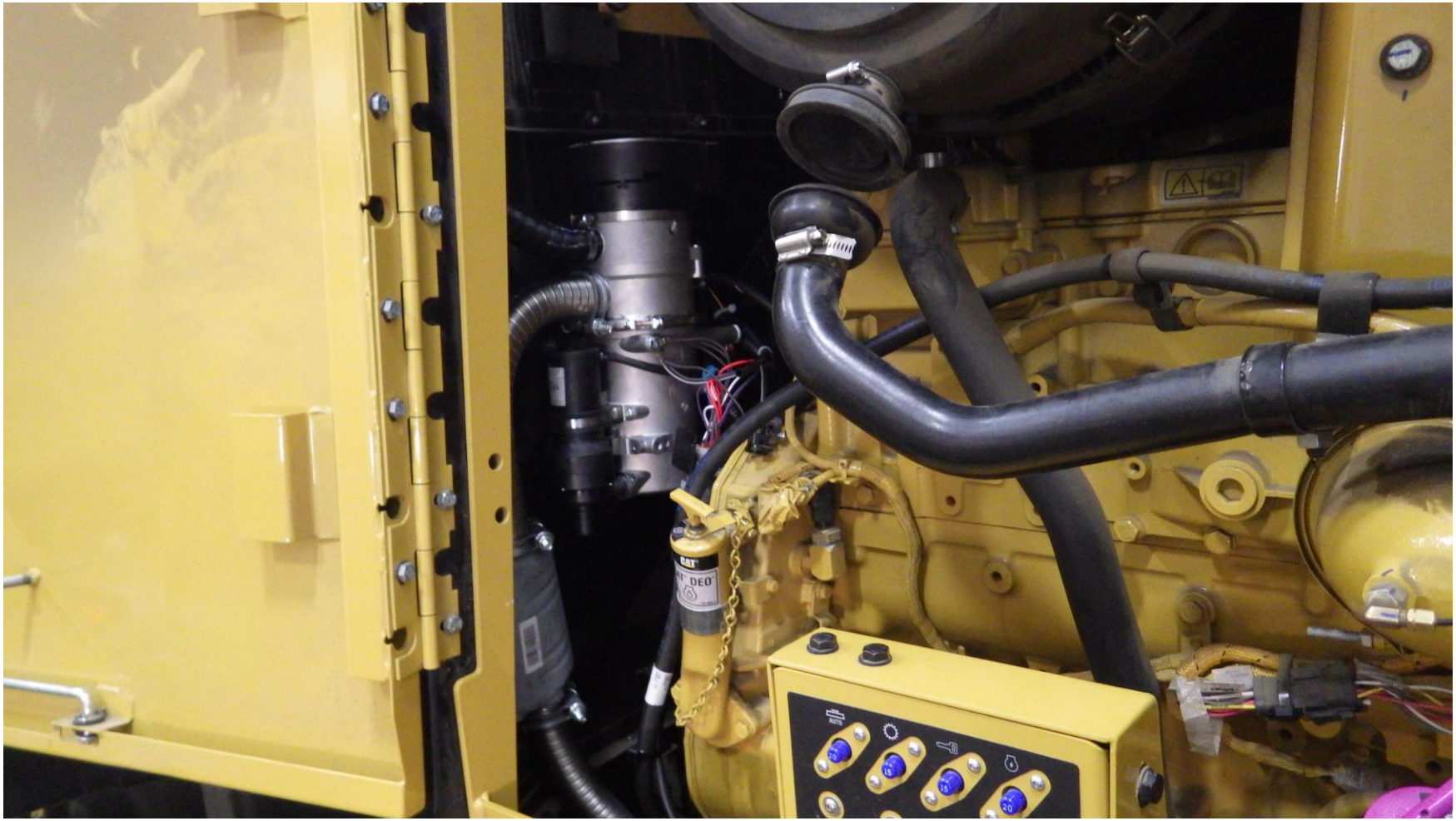


14M Motorgrader

State of Alaska 14M Motograder

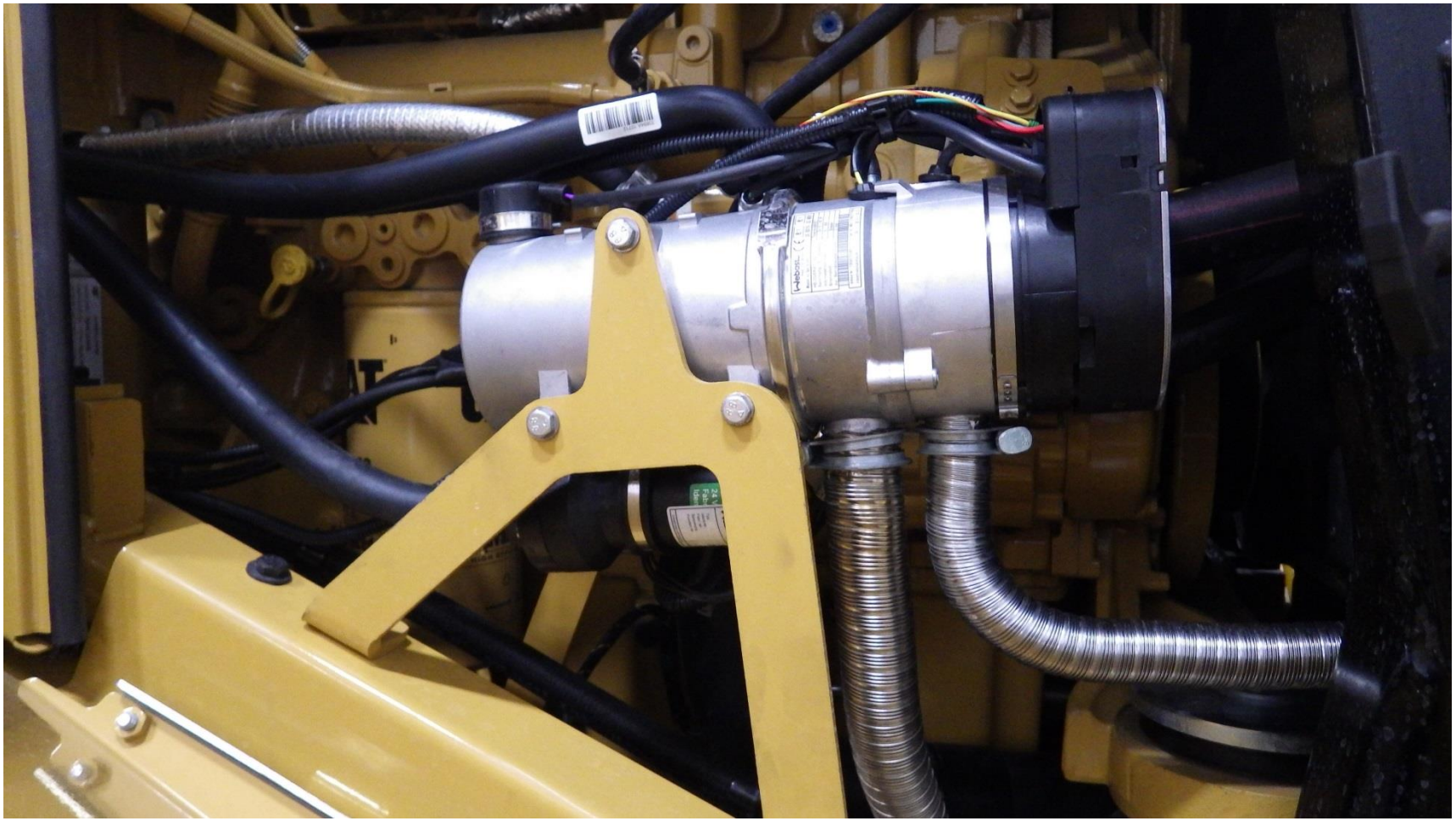
Thermo 90ST – Left Side of Machine



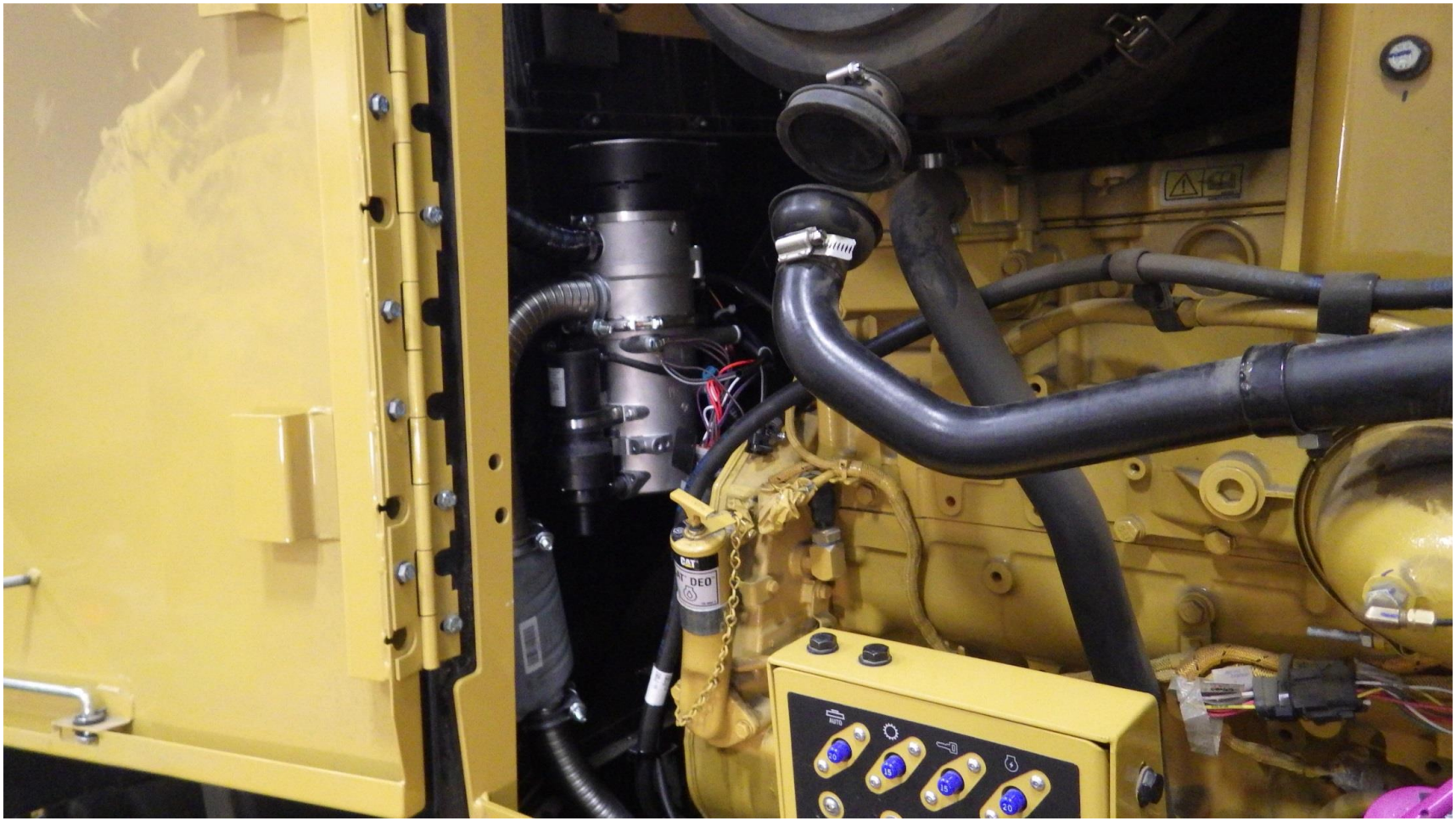
Thermo 90ST on Firewall

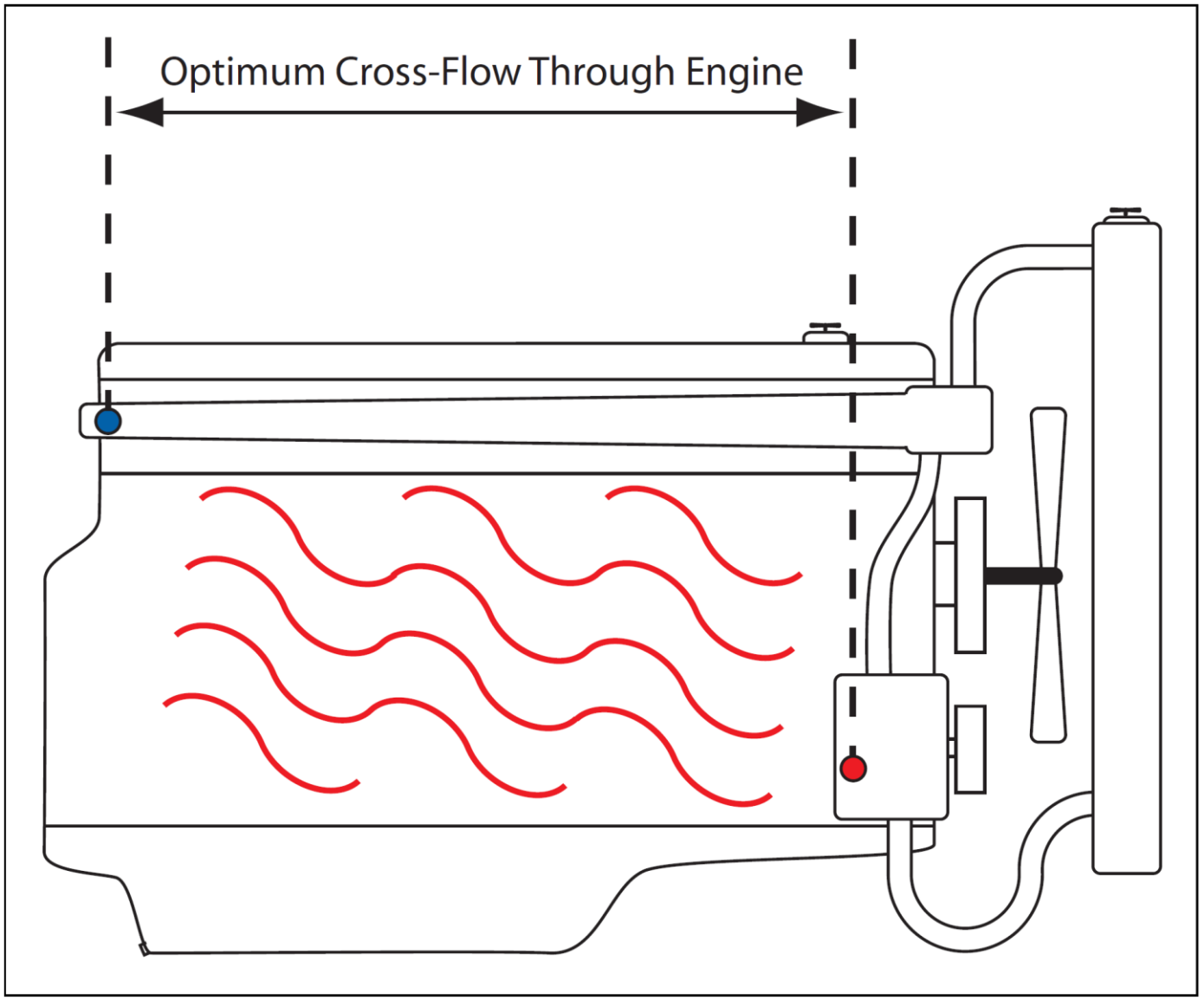
Plastic Hydraulic Tank

980K



14M




Optimum Cross-Flow Through Engine

Purging Air

- **The cooling system must be bled carefully before using the heater for the first time or after replacing coolant.**
- **Proper venting of trapped air can be identified by the circulating pump operating almost silently.**
- **Poor bleeding may cause the resetting temperature limiter to trip while the heater is in operation.**

Operate Engine at Medium – High Idle for Several Minutes

7.2 Various Plumbing Configurations

1. Coolant supply connection
2. Vehicle heat exchanger
3. Coolant pump
4. Thermo 90 S / ST heater
5. Coolant return connection
6. Engine coolant pump
7. Thermostat