Indiana Heat Transfer Corp.
Cooling System Design Specification Sheet

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Date

Application:		**Customer:**	
	(Loader, Fork Lift, Lawn Mower…)	**Engineer:**	
Environment:		**Telephone:**	
	(Clean, Dirty, Clogging Possibility)		

Envelope Size:	Side to Side:		Top to Bottom:		Front to Back:	
Allowable Deviations in Size:	"+/-"		"+/-"		"+/-"	

Describe Radiator Mounting

Cooling System Components (Provide a resistance v.s. airflow graph for each component if available)	Component Position in Air Flow	BTU/min Heat Rejection to Coolant	Internal Flow Rate or Mass Flow Rate	Max. Internal Pressure Drop	Maximum External Pressure Drop	Maximum Coolant Temperature
Fan						
Radiator						
Charge Air Cooler(After Cooler)						
Transmission Cooler(Air to Oil)						
Hydraulic Oil Cooler(Air to Oil)						
Engine Oil Cooler(Air to Oil)						
Air Conditioning Condenser						
Transmission Oil Cooler In-Tank						

**Please Supply A Fan Curve **	Diameter	Fan (Suction or Blower)	Manufacturer	Part Number	Engine to Fan Drive Ratio	Core Face to Fan Distance
Fan						

	Type	Shroud Fan Hole Dia.	Fan Centered on Core	Off Center Dist. (side)	Off Center Distance (Top)	
Fan Shroud						
	(Type = Venturi, Ring, or Sharp Edge Box)					

Charge Air Cooler	Inlet Outlet Diameter	Max. Internal Delta P	Compress Out Temperature	IMTD Temperature	Compressor Out Pressure	Target Manifold Temp

Engine Data	Manufacturer	Model No.	Horse Power	Application RPM	Maximum Top Tank Temp.	Deaeration Required
	Engine Coolant Capacity	Coolant Recovery Sy.	Heat Rej. To Ambient	Max. Coolant Press. Drop	Heat Rise Over Engine	Recirculation Heat Rises

Application Design Parameters	Maximum Ambient Air Temperature	Target Air to Boil Temperature	Elevation	Engine Size to Engine Compartment Ratio est.	Additional Resistance Factors	Radiator Operating Pressure

Any Additional Application Information, Describe Any Air Flow Obstructions or Restrictions.

File:c:\mydocuments\cooling system Spec. Sheet.xls

Cooling System Design Specifications and Notes

Environment: Consider what kind of debris might get drawn into the cooling system by the fan during operation. Such as grass clippings on a lawn mower, or textile products on a fork lift that's working in a mill. The cleaner the environment the more economical the radiator core.

If it's a real dirty environment, and the piece of equipment has screens to prevent debris from entering the cooling system, note this fact so that we can allow for some additional air resistance when calculating the air flow.

Envelope Size: These are the maximum outside dimensions for the cooling system. The dimensions are taken from the driver's point of view.

Allowable Deviations in Size: Specify any possible deviations in the envelope size, because this allows us to match up a system to any existing tooling; in effect reducing the system price. This is quite possibly the most cost-effective parameter that you can provide.

Describe Radiator Mounting: Describe the type of mounting that the radiator will be subjected to. Does it have vibration isolation? Will it be hard mounted to a frame structure that might twist? Is there a saddle required? Will the radiator be mounted with wings on the channels?

Cooling System Components: For every component in the airflow path that IHTC is not providing, please include a graph of its resistance vs. air flow.

Component Position in Airflow: Consider the direction that the air will be flowing, and then number the individual components starting with the one closest to the ambient air, or the coolest air. Example: Pusher Fan pulling ambient air over the engine before pushing it into the cooling system. If two or more components are side by side, enter a duplicate number for each component.

Example:

No. 1 Fan
No. 2 Radiator
No. 3 Transmission Cooler

Designed Heat Rejection: If there are components in the cooling system that IHTC will not be providing, it is important that we know the amount of heat rejection that component is designed to radiate; usually in BTU/min or kW.

Component Max. Press. Drop. : If IHTC is going to design this component, we will need to know the maximum pressure drop allowed.

Component Max. Coolant Temp. : If IHTC is designing this component, we will need to know what the maximum coolant temperature can be. This equivalent to the maximum top tank temperature on a radiator, or maximum inlet temperature. Radiators are usually 210^{O}F to 233^{O}F. Transmissions range from 240 ^{O}F to 260 ^{O}F. Hydraulic coolers typically are 180 ^{O}F.

Cooling System Design Specifications and Notes

Fan Curve: We must have a fan curve, or be able to acquire a fan curve from the manufacturer, in order to design a system.

Engine to Drive Ratio: This is the ratio of the fan RPM to the engine RPM. Larger fans typically run slower than the engine, (speed reduction), and small fans usually run faster, (speed multiplier.) This is because the fan tip speed limit is between 16,000 and 20,000 ft/min. Most applications will try to reach this limit for optimum performance, unless there are noise or horsepower issues.

Core Face to Fan Distance: This is the distance from the fan blade face and the next cooling component inline; typically the radiator core. This distance is critical to proper airflow and to the durability of the fan. If the distance is too close the air flow will focus on only that portion of the core that is covered by the fan blades, rendering the core section covered by the center hub section of the fan useless. If the fan is too close there will also be a constant flexing of the fan blades due to the proximity of the core face. Pressure gradient problems.

Fan Shroud:

Fan Centered On the Core: Yes or No. If the fan is not centered, use the next two boxes to describe how far off the core centerline the fan is located.

Engine Data:

Deaeration Required: This question has three answers:

1. N0. There isn't a baffle required in the top tank..
2. Partial baffle. There is a flow-diverting baffle in the top tank but it isn't sealed.
3. Full deaeration baffle. There is a fully sealed top tank baffle with a by-pass tube.

Cummins engines generally require a full deaeration top tank. Many John Deere engines only require a partial baffle that extends to within 1" of the tank end.

Engine Coolant Qt.'s: The engine coolant capacity in quarts.

Coolant Recovery System: Is there a coolant recovery system?

Heat Rejection to Air: The engine manufacturer will usually specify a heat rejection to coolant, a heat rejection to exhaust, and a heat rejection to air. The heat rejection to air is used to help determine the temperature rise from ambient, to the cooling system, when a blower fan is used, and the air is being drawn over the engine before entering the cooling system.

Max. Coolant Press. Drop: What is the maximum pressure drop across the radiator?

Heat Rise Over Engine: Specify the anticipated temperature rise from ambient, when pulling air through the engine compartment before entering the cooling system.

Re-circulation Heat Rises: Please specify any additional temperature rise from ambient, that will be associated with a re-circulation problem.

Cooling System Design Specifications and Notes

Application Design Parameters:

Maximum Ambient Air Temp. : What is the maximum design ambient temperature of the air? This is the air temperature at a distance of 6 feet from the test vehicle. Generally it is 110^{O}F, but can go as high as 125^{O}F. This temperature does not take into consideration re-circulation temperature rises.

Air to Boil Temperature: Some equipment manufactures specify an air to boil temperature for the radiator part of the cooling system which is based on ambient air, heat rises from other sources, and the top tank temperature to arrive at an air to boil out temperature. (Max. Top Tank Temp. – ITD – any additional heat rises = ATB). ITD = (BTU/min engine) / (BTU/min/F Radiator.)

Elevation: Is the equipment designed to operate at a high elevation? What is the designed elevation? This effects the air flow and fan curve.

Engine Size to Engine Compartment Ratio: How easy is it to draw air into the system and exhaust it? If this is a suction fan application pulling air through the cooling system, and exhausting it out over the engine, how easy will it be to get rid of the air? Generally, look at the engine sitting in the engine compartment, and specify a percentage of openings around the engine as compared to the engine size. Typically the open area is between 45% and 75% of the engine.

Additional Resistance Factors: Sound damping louvers as used on stationary generators.
Small areas for air to exhaust from.
Tight grill structures.
Debris screens.

Any Additional Application Design Considerations: Heavy-duty construction. (Bolted Tanks.)…

Describe any Air Flow Obstructions or Restrictions: **The air out orifice area is only 60% of the radiator frontal area and there is a muffler in the air path.**