Willard Says……

KEEL COOLERS

are a poor man's dredge engine cooling system. As with most such ideas they are attended by serious and expensive limitations.

What is a Keel Cooler?

It usually consists of several large channel irons welded to the underside of a dredge hull. The legs of the channels are welded to the bottom of the hull plate and the channels are connected so as to form one, leak-free conduit for the passage of engine coolant. Two pipefittings are welded into holes cut in the hull floor plate, one at each end of the channel conduit. The engine's coolant system piping is connected to the fittings so engine coolant can be circulated through the keel cooler conduit in the same manner as if it were the more familiar fan-cooled radiator. The goal is to transfer the coolant's heat into the water underlying the hull.

The Keel Cooler is the Villain

Recently, I visited a swishing-ladder dredge and learned that the owner was contemplating the installation of a huge fan in the engine room to solve engine overheating. The new fan would join two large fans already in use. Overheating has plagued this dredge during periods of hot weather for seven years—since it was new. The dredge manufacturer had no solutions to offer except to advise them to get more cool air into the engine room. Solving an engine overheating problem by blowing air on its exterior has the same effect as having someone blow on your head to relieve your ice cream headache.

An engine does not overheat because it is hot on the outside, it overheats because it is hot on the inside. This engine overheated whenever coolant coming into the engine was not cold enough to carry away enough engine heat and prevent its operating temperature from rising into the danger zone. The coolant was not cooling the engine because the keel cooler was not cooling the coolant.

It is likely that the hoary idea of using a keel cooler was dreamed up by some do-it-yourself dredge builder eons ago. (Rumor has it that Noah used the system to cool gensets in the ark) Even today the deceptive simplicity of the keel cooler continues to seduce some dredge manufacturing "engineers" into specifying them. Keel coolers constitute such a pernicious limitation to full performance that it could be said that manufacturers who provide keel coolers on their dredges are guilty of selling defective products.

Keel Cooler Problems

Swinging-ladder dredges (*aka* swishing-ladder dredges) are anchored stationary while the ladder is repeatedly powered through an arc and gradually lowered to complete a cut. If the stationary dredge is operating in relatively still water the hot coolant flowing from the engine and out into the keel cooler heats the surrounding water. The temperature differential between the hot coolant and the water that surrounds the keel cooler must be sufficient to carry away the engine's heat even when the dredge is floating in a puddle of hot water or the engine will overheat.

I have always advocated a procedure for sand and gravel dredge mining the first rule of which calls for the suction inlet to be worked down to the bottom of the deposit. The second rule calls for the suction inlet to be kept there. The many benefits that can be derived by following this procedure are detailed in other Willardsays papers. Two unique attributes of this operating method bear mentioning here: 1. The ability to obtain high, continuous production and, 2. A flow of a uniform mix of particle sizes to process. The promise of improvement in these areas should be sufficient to attract investigation by sand and gravel dredgers who want to improve these aspects of their operations.

This profitable dredging procedure can bring on an unintended consequence because it calls for relatively little dredge movement and so may pose a problem for keel cooler equipped dredges. Perhaps that is why I often see competitor's sand and gravel dredges whipping through arcs in frenzied pursuit of solids. Just as some sharks have to continually move to breathe, must these dredges have to keep moving just to assure function of their antediluvian keel coolers?

What Else Don't They Know?

When a dredge manufacturer does not know what causes the engine of their keel-cooled creation to overheat you have to ask, "What else don't they know?" For instance how do they know how long and how big to make the channel conduits to obtain adequate cooling? Monkey-see, monkey-do keel cooling design apparently is not susceptible to the ministrations of a much-touted engineering staff.

The bean counters that shepherd the affairs of keel-coolered dredge manufacturers apparently have not tumbled to the fact that buying and installing a simple, effective, tube-in-shell heat exchanger costs less than acquiring and welding heavy channels to the bottom of the hull.

More Problems

Another knock on keel coolers is that they are under the hull of a dredge that may not be taken out of the water for years during which time they accumulate crud on the surfaces of the conduit.

Crud growth is always accompanied by a steady degradation in heat transfer capability. Think of keel cooler crud as insulation that keeps coolant and engines hot.

Crud is only one peril that awaits keel cooler users. Damage from impact with underwater obstructions, transport damage, ever-present corrosion and leaks in a difficult-to-access location pretty much complete the keel cooler's articles of indictment.

Safety Problem?

One operator pointed out safety concerns that arise from keel cooling. The top of the keel cooler conduits is the hull floor so the floor is heated to coolant temperature. To step into bilge water is to get a hot foot. To reach into the bilge water to retrieve a dropped wrench or part is to come into possession of a parboiled hand. Another operator relates how steam usually rises from the floor of his hull to create sauna-like conditions in the engine room.

Unintended Benefit?

Perhaps there is an undocumented, positive feature of keel-cooled dredges. The hot bilge makes it possible to boil crawdaddies, throw a clambake or host a hot tub party on the dredge with little prior notice. Come on in, the bilge is always hot!

Heat Rejection

The excess heat generated by any internal combustion engine must be rejected to the environment to prevent damage due to overheating. Ways to reject engine heat to the environment include:

- Keel cooler.
- Fan-cooled radiator.
- Raw water used as coolant.
- Shell-in-Tube heat exchanger.
- Forced air (Air-cooled engines only).

Solution

If your keel-cooled dredge engine regularly overheats, install a properly sized tube-in-shell heat exchanger. These units are relatively small. They are available from engine dealers or from heat exchanger manufacturers. Installation requires that the engine coolant be piped into and out of the unit. Cooling is accomplished by running service water through the heat exchanger on its way to the pump-packing gland and other uses. Be sure to control the flow of service water through the heat exchanger and observe the manufacturer's recommendation to prevent tube erosion due to high velocity water flow.

Contact willard@willardsays.com with questions, comment or criticism.