TECHNICAL BULLETIN

TB NO. 1001
REV. 1

SUBJECT: Cavitation - Corrosion
Superior (Inline-Vee) Engine Block
825 Series Engines

PROBLEM: Deterioration of the cylinder block in the upper and lower liner bores. Premature liner pitting and deterioration. Coolant leakage into the engine crankcase or bedplate which could cause extensive damage and costly repairs.

The cavitation/corrosion problem has existed for several years because of the cylinder block design and water treatment procedures. The two primary causes of cavitation/corrosion are:

1. **Cavitation** is defined as mechanical movement (vibration) of the cylinder liner at very high frequencies commonly referred to as the bell ringing effect. The movement of the liner is usually perpendicular to the axis of the crankshaft. In all water systems there is a certain amount of air entrained within the system and the mechanical vibration of the liner causes air bubbles to form and collapse on the liner and block surfaces. As the bubbles collapse shock forces are imparted to these surfaces causing pitting and erosion. This is referred to as cavitation.

2. **Corrosion**: When a chemical change in a metal or an electrochemical reaction occurs, the metal exposed to the coolant is changed into various compounds such as iron oxide (which attacks the surfaces). Where and to what degree it will progress depends on the quality of the water, type of corrosion inhibitor, the metals that are exposed, surface temperature, vibration and stress. As little as 1/16" of iron oxide buildup can affect the head transfer and coolant flow. This chemical reaction is referred to as corrosion.

RECOMMENDATION: Water Treatment

EnDyn recommends that the water be de-ionized rather than raw water which contains high concentrations of chlorides, sulfates, dissolved solids and visible suspended solids such as silt. If raw water is used as a dilution or added to the system as make up water it should not have a hardness in excess of 170 PPM.

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The coolant and additive package must provide adequate cooling to the engine, protect against freezing, give adequate boiling protection and provide corrosion protection. The coolant is normally an ethylene or propylene glycol based antifreeze. The propylene glycol based antifreeze provides superior cavitation/corrosive protection. The commercial automotive type ethylene glycol antifreeze does not provide adequate corrosion protection for industrial heavy duty continuously operated engines.

The freezing point of pure ethylene glycol based antifreeze is 0°F and when it is diluted with water it provides freezing protection below 0°F. As the percent by volume of ethylene glycol is diluted from 100% to 60% the freezing point drops from 0°F to -60°F. As the percent is diluted further the freezing point raises to +32°F in approximately a straight line relationship. The recommended coolant concentration for engines is not less than 33% ethylene glycol and not more the 60%. The boiling point is also affected by coolant concentration. The greater the coolant concentration the higher the boiling point.

A good quality of water, the proper coolant concentration and the proper additive package will assist in reducing the severity of cavitation/corrosion problems. Coolant analysis programs are also very important and should be conducted on a regularly scheduled basis.

CYLINDER BLOCK REPAIR:

In many cases, cylinder blocks can be repaired in the upper and lower liner bores rather than purchasing a new block. The repair consists of machining the upper or lower bores and installing an insert to bring the bore back to standard dimensions. (Reference Technical Bulletins #1027 & #1028 for repair recommendations to the block.)

Lower bore insert - P/N P-G825-203
Upper bore insert - P/N P-G825-204

If one or two bores need repair this can be accomplished in the field. However, if the damage is extensive and several or all of the bores are in need of repair it is more economical to send the block to a qualified machine shop.

IN ADDITION, listed below are preventive measures used successfully by various Superior engine users to alleviate the severity of cavitation/corrosion.

1. Raise the elevation of the expansion tank 1'-2' to provide more head pressure to the suction side of the engine water pump. In all instances the expansion tank should be vented to the atmosphere.

2. Maintain at all times the recommended cylinder head torque which reduces liner movement.

3. Coating on the O.D. of the cylinder liner with chrome or polymer coating. A nitrided liner shows no significant improvement.

4. Pressurize the water system from 2 - 5 PSI by installing a cap on the expansion tank.

5. Use of oversized liners in the upper liner area just below the liner flange which reduces liner movement and water pressure on the liner to block gasket reducing water leaks in this area.

6. Vent the water pump suction housing to the bottom of the expansion tank. This vents entrained air at the pump suction. This is in addition to venting the thermostat housing and high highest point in the cooler to the bottom of the expansion tank.

EnDyn recommends that you contact a reliable water treatment company and review the details of the engine water system to be treated, metals in the system, operating temperature and pressures, history of the cavitation and corrosion problems, the type of engine and the engine operation.

For further information, concerning Superior engine water systems, cavitation or corrosion, please contact **EnDyn's** Technical Service Department direct or your local authorized **Power**Parts® Distributor.

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