Detroit Edison
2000 Second Avenue
Detroit, Michigan 48226
(313) 237-8000

August 31, 1981
EF2 - 54,624

Mr. L. L. Kintner
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Washington, D. C. 20555

Dear Mr. Kintner:

Reference: Enrico Fermi Atomic Power Plant, Unit 2
NRC Docket No. 50-341

Subject: Diesel Engine Lubrication

Detroit Edison agreed to supply information regarding the manufacturer suggested piping modification to the lube oil system of the Emergency Diesel Generators. These modifications will help assure engine lubrication for all starts. The design and test information is provided in the attached Colt Industries Engineering Report (File Number VTS-985-082881-0IR).

This is associated with outstanding issue No. 13 in Section 1.8.1 of the Fermi 2 Safety Evaluation Report. The commitment for the design and test information was made in response to licensing question 222.48.

Sincerely,

W. F. Colbert

W. F. Colbert
Technical Director
Enrico Fermi 2

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WFC:jl
Attachment

cc: Mr. B. Little

Fairbanks Morse
Engine Division

ENGINEERING REPORT

SHEET 1 OF 5	PAGE NO. 5
FILE NUMBER	VTS-095-082881-01R
DATE	AUGUST 28, 1981
SUBJECT	ENGINE PRELUBE/KEEPWARM SYSTEM REQUIREMENTS
PREPARED BY	V.T. STONEHOCKER
REPORT TITLE	KEEPWARD L.O. SYSTEM MODIFICATION NUCLEAR STANDBY UNITS (OP ENGINES)
APPROVED BY	

GENERAL

This report covers modifications to be made to the OP skidded engine units to provide an engine more readily prepared to make fast starts such as are required in Nuclear service. In the previous engine skid designs, the unit was provided with two systems to precondition the engine lube oil system. The one referred to as the keepwarm system, consisted of a motor driven pump and a heater thru which a small flow of lube oil was run while the engine was not in operation. The oil was pumped from the L.O. sump, thru the heater and back into the opposite end of the sump. The heater was thermostatically controlled to attempt to maintain the L.O. sump at a moderate temperature. The other system consisted of a somewhat larger capacity pump which was used immediately prior to operating the engine to fill the engine with lube oil in preparation for an engine start. This arrangement was used when ever the engine was started for testing or maintenance operations. In the event of a need for emergency service, startup was made without prelubing the engine.

Research work was undertaken to see if it was possible to derive a system which would allow the engine to be continuously lubricated but not to the point of over-oiling the upper crankline. Work was done at a commercial power plant having a skidded engine unit similar to those in nuclear applications to develop such a system. This report covers the results of that work and explains the modification to be accomplished on nuclear units in the field.

RESULTS OF THE DEVELOPMENTAL WORK

Field testing was done that demonstrated that a system could be made to provide oil flow to the engine while at rest without filling the upper crankline. The test work demonstrated that with a properly sized L.O. circulating pump, with the oil at the proper temperature, an oil level could be maintained somewhat above the lower crankline, but below the level of the upper crankline. With such a system, oil was more readily available to the upper crankline upon fast startup of the engine. The leakage rate of the oil thru the bearings of the lower crankline, oil spitters, and return flow thru the main (engine driven) L.O. pump could be controlled by the oil temperature (viscosity) to the point of keeping the engine full to a level just above the lower crankline. However, it was discovered that if lube oil circulation was reinitiated immediately after the engine was shut down, without allowing some oil drainback from the upper

crankline, the upper crankline could still be overfilled when the engine came to rest. It was demonstrated that if a period of 6 to 10 minutes was allowed before circulation was commenced, that the overfilling of the upper crankline could be prevented.

Figure 1 shows the final system arrived at resulting from this development program. In summary, the lube oil circulating system was modified so that oil was delivered to the system at a point near the engine driven pump discharge, thru a check valve. The L.O. circulating heater was increased in capacity from 6 to about 15KW in order to maintain L.O. temperature (viscosity) and to account for the greater losses in the L.O. system because of the increase in the extent of piping thru which the oil would then flow.

The selected changes to the system and engine are covered in two parts; modification of the systems external to the engine, and internal modifications. The specific investigation enumerated here, covers the Alabama Power units (F.M. S.O. 205917), but are generally also applicable to other similar units. (Specific reports/instructions will be written for other contracts.)

MODIFICATION OF THE EXTERNAL SYSTEM

Investigation has shown that to adapt this system to the units at Alabama Power would require the following:

Mechanical (Ref: Figure 1)

1. Change the 6KW L.O. heater to 15KW. Information from the most probable vendor indicates that a 15KW heater unit, not exceeding 15 watts per square inch of heater element, can be provided and can be accomodated on the skid in place of the present heater, using the same mounting arrangement. The new unit is about the same size as the present J.W. heater. L.O. inlet would be at the same location.

2. Change the piping from the discharge of the new heater to a point in the piping at the discharge of the engine driven pump (at the same location to which the prelube pump is now piped), including a check valve (same check valve as used with the prelube piping). Include a connection for location of the thermostatic switch (OHT) at the heater outlet. 1 1/2" piping is required.

3. Block off the cross to which the old connection was made (drain to front of L.O. sump).

Electrical (Ref: Figure 2)

1. Relocate conduit to heater connection and thermostatic switch connection as required (raised approx. 12").

2. Replace CB3 (20A) with a 50A unit (Same as CB1). (Our drawings do not indicate source on this item. Customer should identify circuit breaker unit manufacture so that it can be duplicated.)

3. Replace M3 contactor with 11905926 (Cutler Hamner C20DN3A) (Same as M1).

4. Replace wiring (3 wires each) between CB3 and M3 and between M3 and the heater (OH) with #8 AWG (was #12).

5. Add a Time Delay Relay - TDX (FM #11904628 - Agastat 7012AH) in the circuit as shown on the electrical schematic - Figure 2.

   (One side of the coil to wire G, other side of coil to wire J7. One side of switch to wire J7 [removing J7 from coil of M4]. New wire J7X between other side of switch [N.O. contacts] to coil of M4 (from which wire J7 was removed.)

6. TDX has a range from 3 to 30 minutes and should be set at 10 minutes.

MODIFICATION TO INTERIOR OF ENGINE (Ref: Figure 3)

This modification consists of rerouting the supply to the upper L.O. header such that the header will not readily drain (a loop of tubing up over the crankshaft above the level of the header). See Figure 3.

This modification also consists of adding a lube oil booster/accumulator system to the upper crankline, similar to that used on the aft lower main bearing. This booster system fills with oil during normal engine operation. The next time the engine is started, the lube oil accumulated in the cylinder assembly is forced by starting air pressure acting on the opposite side of a piston, to be fed into the bearings along the upper crankline, thus filling the bearings with oil as the engine begins to be rotated in starting.

No external connections are required with this system as the air supply to the accumulator is tied internally to that of the aft main bearing booster system. The system is self regulating.

Parts for this system are identified on drawings and R/M #16403478 (Release PC3752).

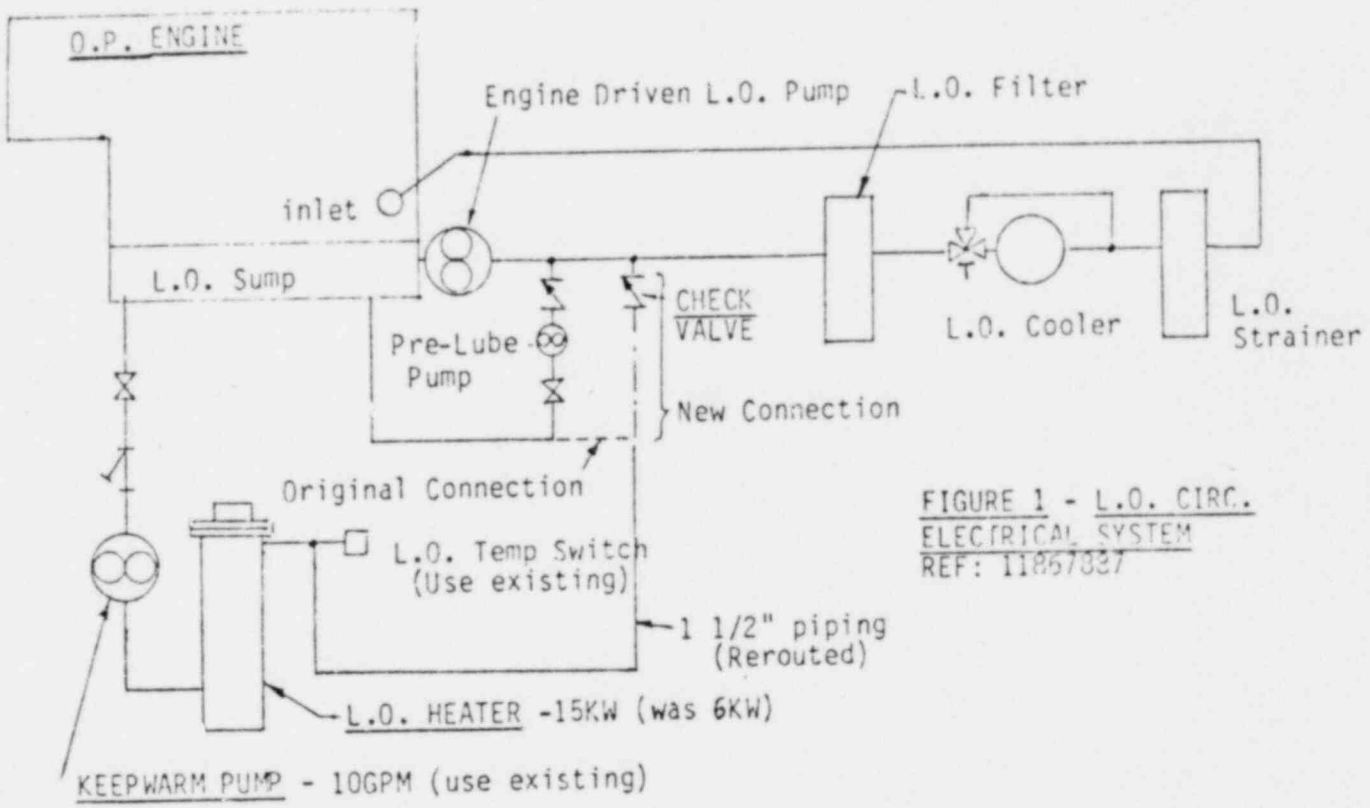

FIGURE 1 - L.O. CIRC. ELECTRICAL SYSTEM
REF: 11867337

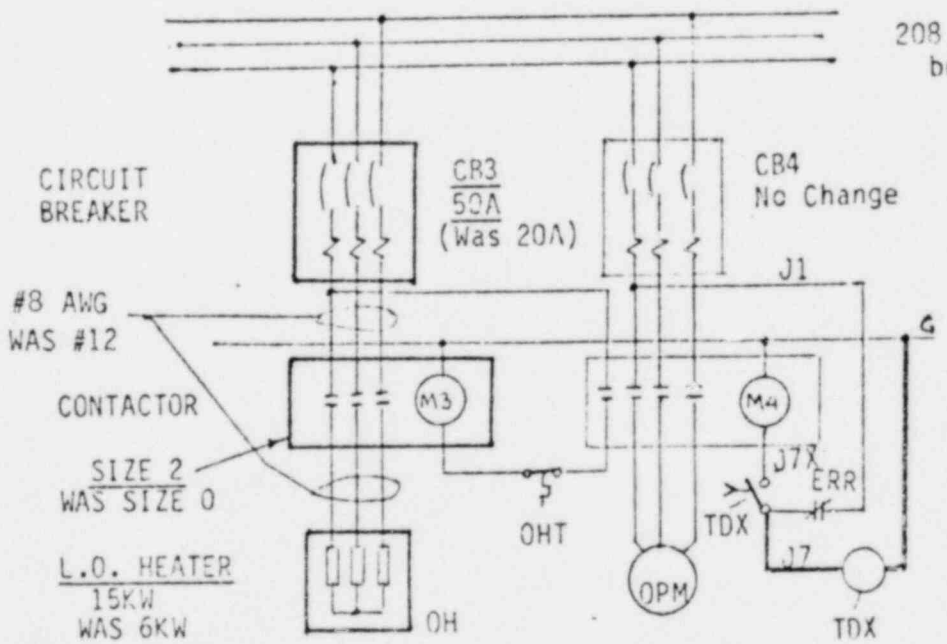

FIGURE 2
ELECTRICAL SYSTEM MODIFICATION
REF: 11867708
SHEET 2

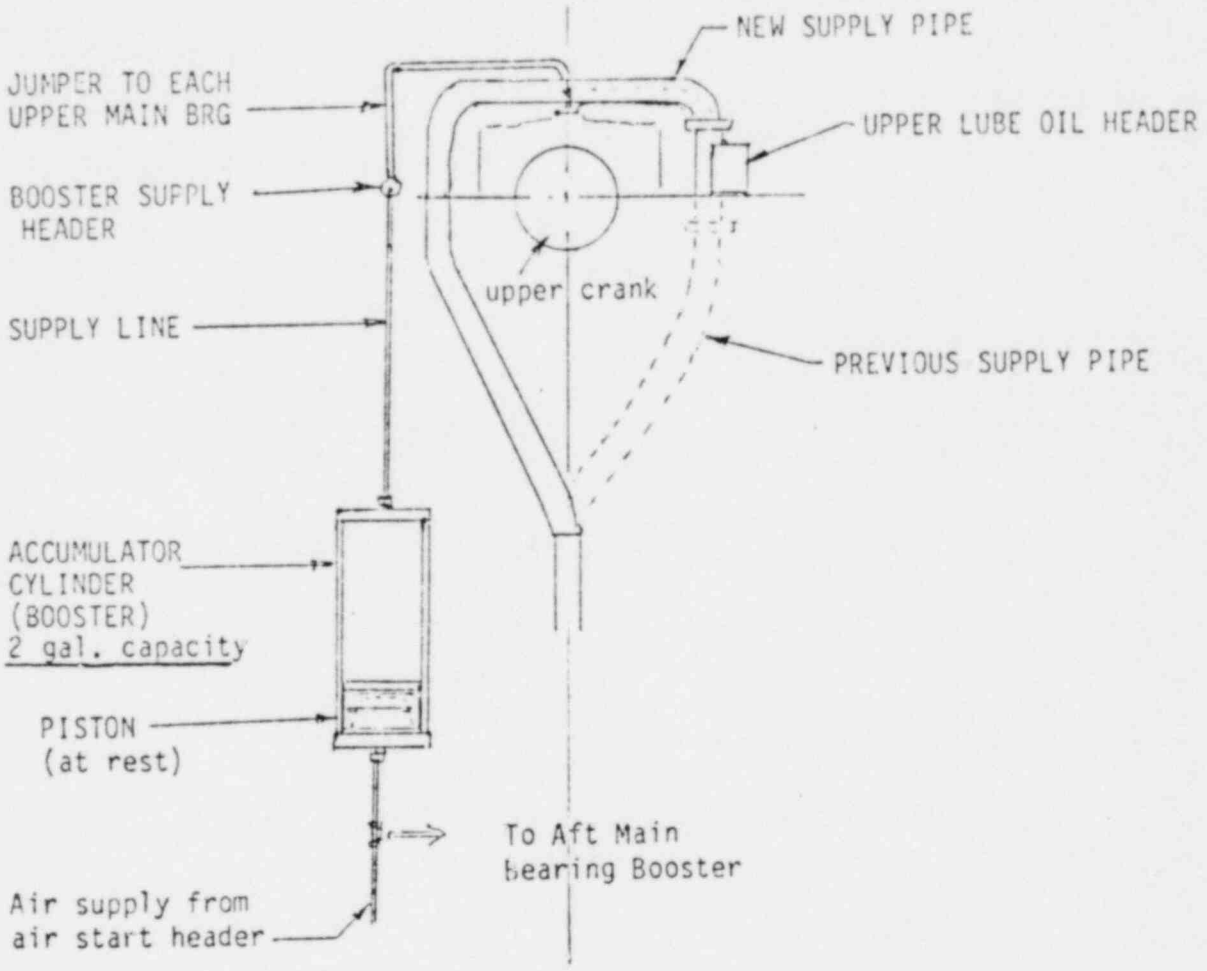

FIGURE 3 - ENGINE INTERNAL MODIFICATIONS

LUBE OIL SUPPLY & BOOSTER SYSTEM