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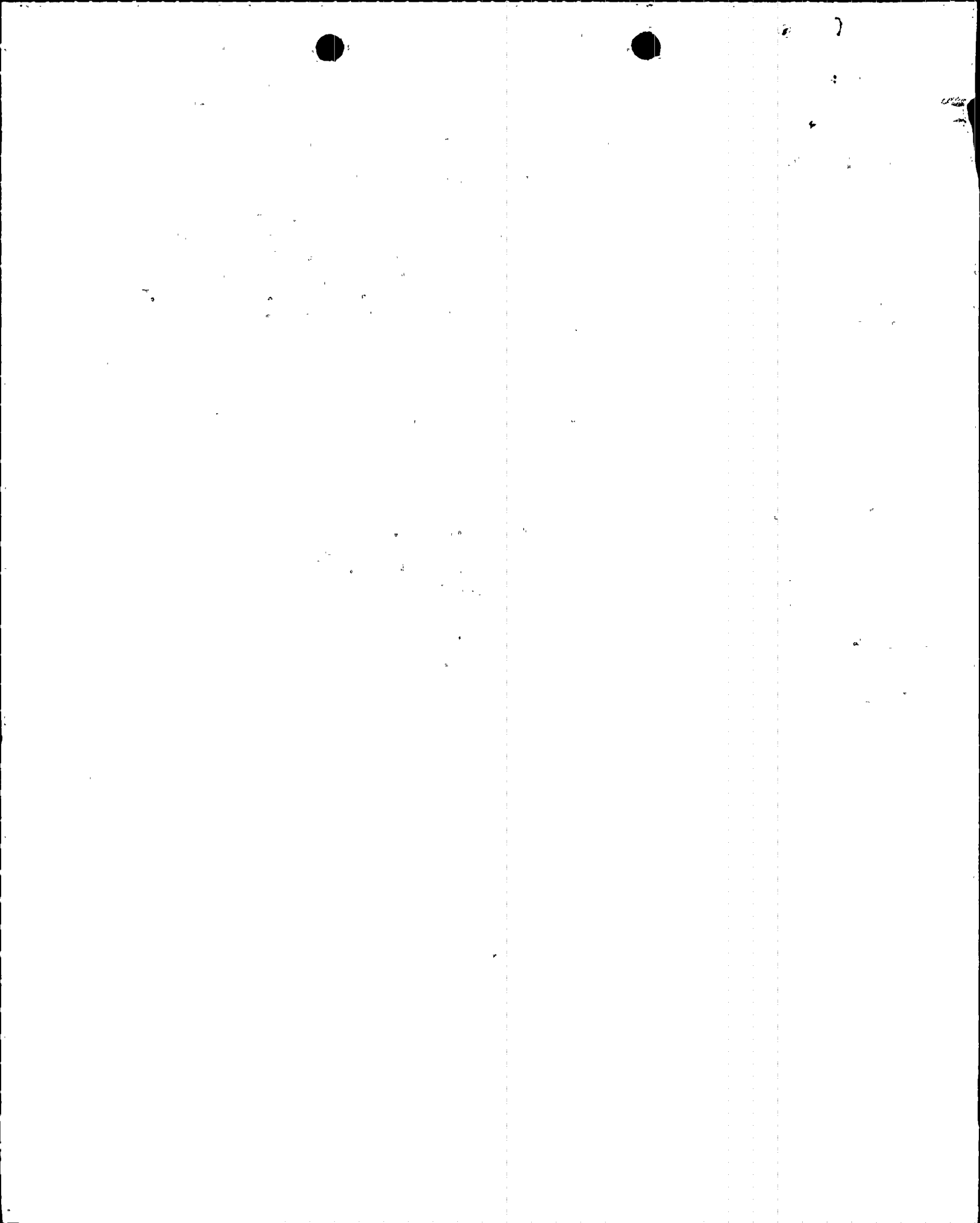
SUBJECT: Forwards documentation re 861223 failure of Emergency Diesel
 Generator B, subsequent engine trips due to testing of Main
 Bearing 2 & testing after bearing insp & reassembly after
 third high bearing temp trip. Problems discussed w/NRC.

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Arizona Nuclear Power Project

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August 24, 1987
161-00461-JGH/RAB

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530 (License No. NPF-65)
Additional Information on the Unit 3 Diesel
Generator Testing
File: 87-G-056-026

Reference: Letter from E. E. Van Brunt, Jr. (ANPP) to USNRC dated June 28,
1987. Subject: Status of Diesel Generator Testing.

Dear Sir:

The referenced letter discusses the December 23, 1986 failure of the Unit 3 B emergency diesel generator, the subsequent engine trips experienced due to the #2 main bearing during testing, and the testing to be done after the inspection and reassembly of the #2 main bearing after the third high bearing temperature trip. On July 9, 1987, the testing program to determine the acceptability of the engine repairs was completed. The NRC required inspections of the #9 crankpin, the #9 connecting rod bearing, and the #2 main journal and bearing were completed by Mr. Tomlinson of the NRC staff and representatives from ANPP, Copper Energy Services, and the bearing manufacturer, Clevite. The inspection indicated that the engine would perform its function. During the exit interview with Mr. Tomlinson, he requested that a written summary of the other problems which had occurred during the engine test program be provided to the Commission. The problems had all been previously discussed with the NRC staff, but had not been documented. The attachment to this letter provides the requested information.

If you have any additional questions on this matter, please contact Mr. W. F. Quinn or Mr. R. A. Bernier of my staff.

Very truly yours,

J. G. Haynes
Vice President
Nuclear Production

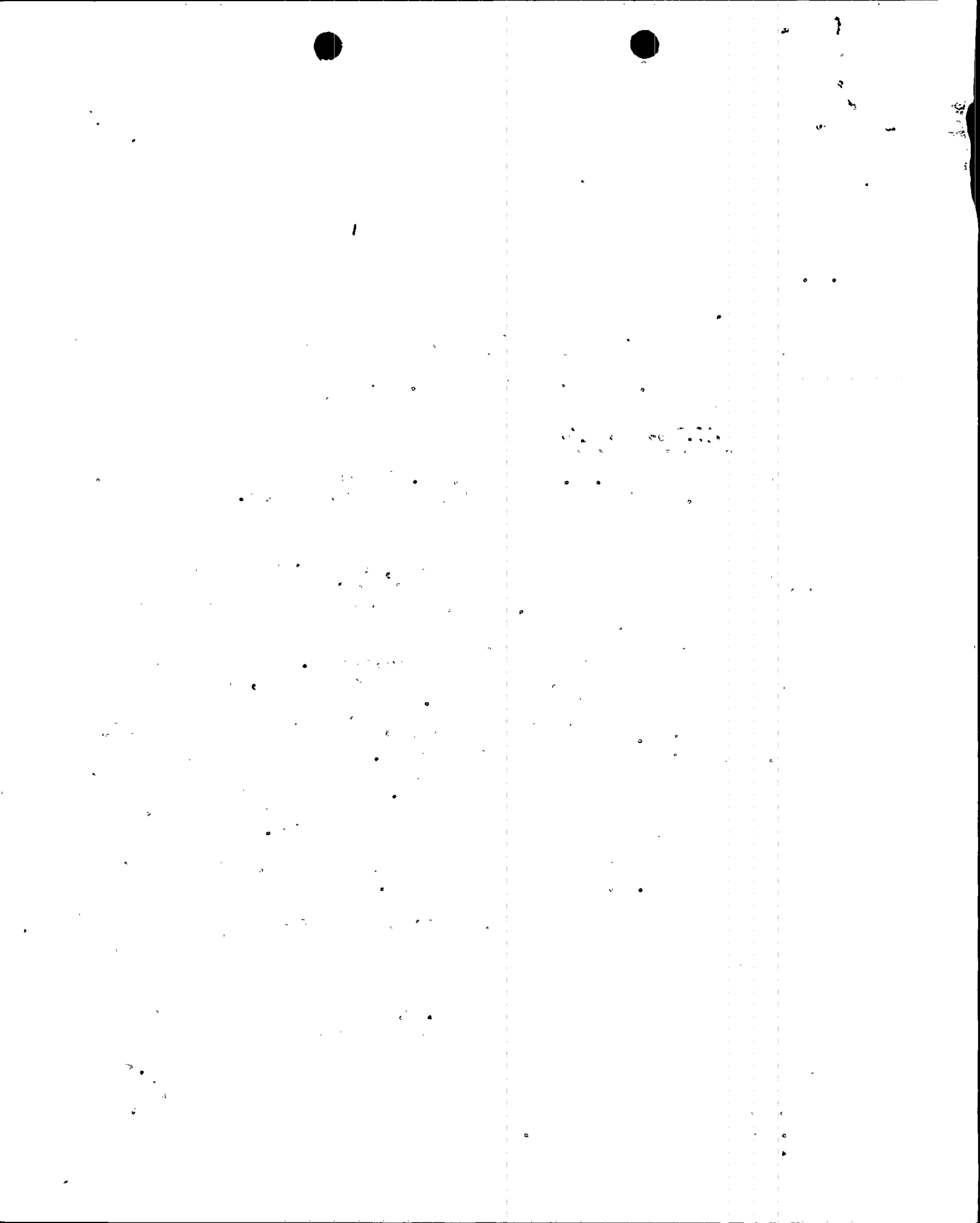
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Acc.
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ATTACHMENT

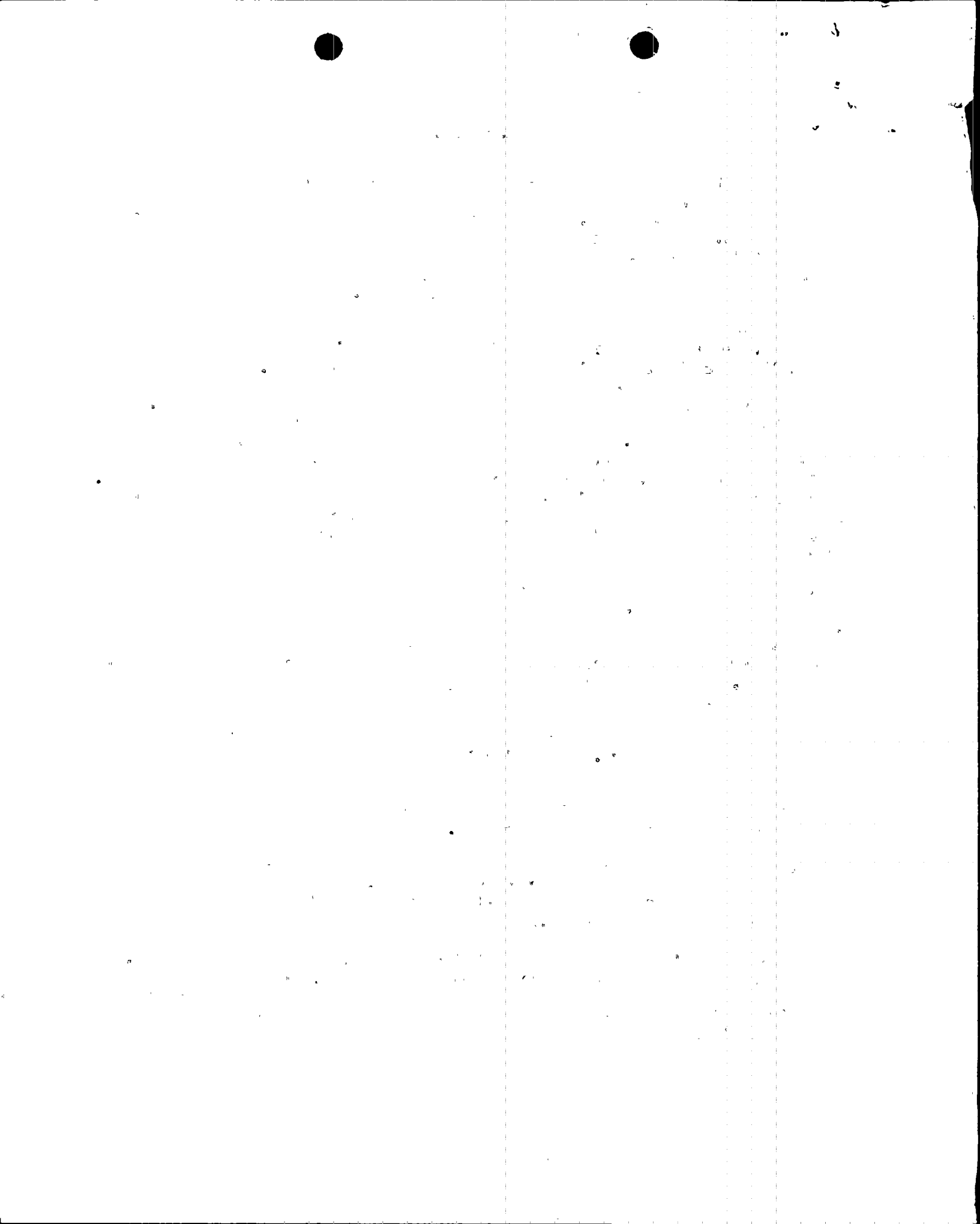
The first of the events, for which information was requested, occurred on June 5, 1987 during the engine start subsequent to the first run after engine repairs had been completed. The initial run after repairs was a 15 minute unloaded run. After the initial run the engine remained shutdown for approximately 36 hours. On the next start the engine tripped on an incomplete starting sequence when the engine would not turnover. Investigation determined that there was water in the #8R cylinder.

The head on #8 right was removed and inspected. A crack was located on the head between the two exhaust valves. The cylinder liner was cracked vertically about 20 inches long on the inside (exhaust side). Results from an independent Lab has revealed that the crack originated at the water jacket side of the head. The outer surfaces of the head received a NDE inspection after the #9 rod failure; this examination would not have detected any failures at that time. It is suspected that the crack propagated to the surface of the head during the initial 15 minute run. During the time the engine was shut down, the jacket water leaked in to the #8 right cylinder. When the next start was initiated, the #8 right piston was coming up on the compression stroke and therefore ruptured the liner. The liner, head, and piston were replaced, and subsequent engine operation indicate satisfactory results.

On June 28, 1987, the engine tripped because of an indicated turbocharger thrust bearing failure. Investigation revealed that the eutectic trip device had not been properly adjusted during reinstallation after the December engine failure. The thrust bearing clearance was checked and found to be the same as recorded during the inspection of the turbo charger after the rod failure of December 23, 1986. The trip device was properly reinstalled and has operated satisfactorily.

The last of these events occurred on June 30, 1987 when the engine tripped due to crankcase overpressure. Investigations revealed the following at the #9L cylinder:

- 1) Heavy scuffing was readily visible on the liner of about 10 inches around the circumference and 12 inches high.
- 2) The piston showed signs of distress equal to the liner, and the area of heaviest contact was "heat-checked", however, all rings were free to move in their grooves and had suffered no damage beyond that which arose from the expansion of the piston.
- 3) When the piston and its articulated rod were removed from the liner, it was not possible to move the piston pin in its bushing. Seizure of the piston pin was such that the piston was cut apart in order to remove the pin and bushing together, then the bushing was cut to remove the pin for evaluation.



- 4) The piston pin had an area of approximately 3 inches around the pin by 4 inches long that exhibited very heavy contact with the bushing.
- 5) A review of the reassembly records revealed the clearance between the pin and bushing of .005 inches (.005 to .006 inches required).
- 6) The records also showed no reference to a "blueing" check for the #9L piston pin to bushing to ensure a minimum of 80% contact area.

The crankcase overpressure occurred when vapors in the crankcase flashed, due to friction induced heat generated by contact of the piston and cylinder liner.

It has been determined that an inadequate contact area was the cause of the piston pin seizure. The piston pin has been sent to an independent lab for analysis, but at this time, their report has not been finalized.

The test program was restarted after the reassembly of the 9L cylinder and was completed on July 9, 1987 as stated above. ANPP, in conjunction with the engine manufacturer, has concluded that all of the problems encountered during the Restart Testing Program have been totally independent of each other and have been corrected.

