SAFETY EVALUATION

SE 94 - 0073 Rev A

PART 1: DESCRIPTION OF CHANGE (Preparer)

A) Document Identification	B) Revision if Approved	C) PIS Number
EDP 26726	A	N3011C001

D) Description of Change The 7th and 8th stage rotating and stationary blading at each end of each of the three low pressure main turbine cylinders (LP) are being removed (see attached figure 1a). The blade root section of the stage 7 and stage 8 blade discs are being protected by blade stubs which remain fastened in their normal manner (i.e. the majority of the blade airfoil section is removed, but the blade roots remain). Pressure plates are being installed in place of the 7th and 8th stage stationary blading (see attached figure 1b). The pressure plates are thick steel plates with a large number of small holes designed to ensure that the steam pressure drops between stages are maintained at levels similar to the original design, thus allowing safe and reliable operation during cycle-5. The details of the pressure plate design are specified in EDP 26726.

E) List of affected/revised UFSAR/TS sections: UFSAR 1, 3.5.2.1, 3.5.4, 10.1. 10.2, 10.3, 10.4

F) List any associated license change requests (LCRs): LCR-94-149-UFS

PART 2: SAFETY EVALUATION (Preparer)

A) Will the proposed change

Yes	No		
[ ]	[X]	1.	Increase the probability or the consequences of an accident previously evaluated in the UFSAR?
[ ]	[X]	2.	Increase the probability or the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR?
[ ]	[X]	3.	Create the possibility of an accident of a different type than any previously evaluated in the UFSAR?
[ ]	[X]	4.	Create the possibility of equipment malfunction of a different type than any previously evaluated in the UFSAR?
[ ]	[X]	5.	Reduce the margin of safety as defined in the bases for any technical specification?

Provide the basis for each answer above on a Continuation Sheet.

B) Unreviewed safety question? Answer "Yes" if any of the above boxes are checked "Yes."
[ ] Yes [X] No

C) Prepared by M. Deora Date 9/28/94
W. Ackerman Date 9/28/94

PART 3: REVIEW AND APPROVAL (Rvwr/Appvr/OSRO)

A) Reviewed by K. E. Howard K. E. Howard Kenneth Howard Date 9-28-94

B) Approved by J. G. Walker John Walker Date 9/28/94

C) OSRO Chairman Wayne F Guthrie Date 10/6/94

NOTE: If an unreviewed safety question is involved, and/or the proposed activity leads to the need for a change in the Operating License, Technical Specifications, or Environmental Protection Plan, consult Nuclear Licensing.

Reasons for change:
Investigation of the root cause and inspection of the turbine generator following the December 25, 1993 incident revealed significant damage to the 8th stage blades and a number of cracks on 7th stage blades of the LP turbines. A decision has been made to replace the steam path during the RF-05 (scheduled for March, 1996) and to install 7th and 8th stage pressure plates for one cycle (Cycle 5 operation). The pressure plates are designed to replicate the pressure drop exhibited by the stationary and rotating blades it is replacing. Therefore, the stage 6 blades will continue to have the same pressure forces exerted on them as existed with the 7th and 8th stage blades in place. Pressure plates have been used throughout the industry on numerous occasions without adverse consequences. Fermi previously operated with 5th stage blades removed from all LP turbine flows, 4th stage blades removed from both flows of LP 3, and pressure plates installed in both flows of LP 3 at stage 4. During this operation (January-March, 1991 at 80% power), the plant operated safely and no abnormal vibrations were observed.

Results of change :

Heat balance:

Operation with entire 7th and 8th stage rotating blading removed from both ends of the double flow rotors on all three LP turbines, and the corresponding stage 7 and 8 stationary blade diaphragms replaced with the pressure plates (to maintain appropriate pressure drop), will result in a change in the plant heat balance around heater #1 and in the condenser. A revised heat balance showing predicted cycle performance at rated power (3430 mwth) has been issued by GEC-Alsthom in response to this change (ref. dwg DECo file T1-3690). The revised heat balance with pressure plates installed was compared to the UFSAR fig.10.1-1. The following are the principal differences in the heat balance nominal values:

Parameter description	Before	After
Generator gross output, MW	1203	994
#1 feedwater heater steam enthalpy (btu/lb.)	1028.0	1054.1
#1 feedwater heater steam flow (million lb./hr)	0.308	0.273
#1 feedwater heater separated water flow (million lb./hr)	0.234	0.000
#1 feedwater heater drain enthalpy (btu/lb.)	73.33	77.38
#1 feedwater heater drain temperature (^{0}F)	105.3	109.4
#1 feedwater heater drain flow (million lb./hr)	2.459	2.18
Turbine exhaust temperature (^{0}F)	92	96
Turbine exhaust flow (million lb./hr)	7.861	8.130
Turbine exhaust enthalpy (btu/lb.)	990.7	1054.1
Condenser back pressure (inches of Hg. abs.)	1.50	1.70

These changes in the power conversion system resulting from the pressure plates have not affected the following critical parameters which are inputs to the plant safety analysis:

Feedwater temperature
Turbine bypass flow
Moisture separator reheater steam flow
Steam dome pressure.

Evaluation of the effects of these changes:

Reliability of the turbine

Pressure plates have been used throughout the industry on numerous occasions without adverse consequences. According to GEC-Alsthom, with pressure plates installed the turbine can be operated in accordance with normal procedures with no additional restrictions. The design of these pressure plates provides for:

Capability to pass the same amount of flow as the stage it is replacing.
Pressure drops across the remaining blade rows that are similar to existing pressure drops.
Extraction pressures that are similar to existing conditions.

These design features assure safe and reliable operation.

To provide added assurances, the following actions were taken (reference memorandum TM-94-0010):

Westinghouse performed a detail review of the GEC-Alsthom proposed pressure plate design using their own design methodology and verification process. They concluded that the GEC-Alsthom design is adequate.

MPR Associates performed a survey of Westinghouse and GE turbines that have operated with pressure plates installed. Experience supports the installation of pressure plates at Fermi, including experience from other plants that also installed pressure plates in the last two stages of the LP turbines.

Technical and Engineering Services (DECo) personnel familiar with Fermi operational experience with pressure plates provided detailed review of the proposed operation with the 7th and 8th stage pressure plates and anticipate no adverse operational or vibrational effects.

An independent review by FPI of the work done by GEC, Westinghouse, MPR Associates, and Fermi confirms the position that there is no reliability issue associated with operation with pressure plates.

Reliability of the Heater drains

The pressure plate design only affects the extraction steam flow and drain flow to heater #1. The flows are decreased and thus are well within the design capabilities of the system.

Reliability of the condenser

Since the generator output will decrease by approximately 200 MW, this load will be added to the condenser. This additional heat load will cause the condenser back pressure to be higher by about 0.2 in. Hg. when compared to operation with blades. The turbine trip and alarm points (5.5 in. Hg & 4.5 in. Hg abs) remain the same. This could result in load reductions at times when circulating water temperatures are high. Such load reductions are possible even with the original configuration. Figure 2 depicts the predicted back pressure as a function of circulating water temperature.

Exhaust steam to the condenser is now at higher velocity and enthalpy. An evaluation was performed to assess the adequacy of the current condenser tube anti-vibration staking at the higher steam flow conditions. Results of this assessment indicate no adverse effects.

Cooling towers and circulating water system

Operation with pressure plates will increase the heat load to these systems by about 200 MW. This additional heat load will cause the average outlet temperatures of the circulating water system and the cooling tower to be higher. There are no safety related impacts to such a change, but plant load may need to be decreased if the condenser pressure gets sufficiently high at times. This would not be an abnormal operation since this possibility exists and has occurred even with the normal plant configuration.

LP Exhaust Temperature High Trip:

The LP exhaust spray cooling system is designed to keep the LP exhaust temperature well below the alarm setting of 230°F. A turbine trip is also set at 280°F. An evaluation was performed to assess the impact of higher heat load due to pressure plates on these alarm and trip set points. The exhaust steam from the 7th and 8th stage pressure plates will be at higher enthalpy but still saturated and therefore there is no change in LP exhaust temperature. The alarm and trip set points remain unchanged.

Effect on plant transients and accident analyses:

Plant transient analysis:

Plant transients in sections 15.1 through 15.5 of the UFSAR were reviewed. Table 15.0-1 of the UFSAR provides the listing of critical input parameters and initial conditions. These parameters and initial conditions remain unchanged. It is therefore concluded that the results and consequences of the transients analyzed in UFSAR remain unchanged.

Accident analysis:

Safety related aspects of the operation with pressure plates were evaluated against the postulated failures within the power conversion system which are described as 'a' through 'd' in section 10.1, page 10.1-2, of the UFSAR. The following are the conclusions of this evaluation:

a. Radiological consequences of the postulated breaks in the feedwater system that allow the discharge of contaminated water into the turbine building are not affected because:
   There are no changes in feedwater temperature and flow.
   The radioactive coolant activity remains unchanged because the pump forward drain portion of the feedwater remains unchanged.

b. Radiological consequences of postulated failure of the steam jet air ejector line resulting in discharge of the activity directly into the turbine building is not affected since there is no change in the reactor power and steam flow to the turbine.

c. Turbine missile analysis:

   The original turbine missile analysis assumed failure of wheel 8 at 3000 rpm, well above the design overspeed of approximately 2000 rpm. The analysis was based on the stresses developed with stages 7 and 8 blading installed. Per re-analysis (reference TMPE-94-0533), the first wheel to fail with the stage 7 and 8 blades removed, assuming a speed increase beyond the design overspeed, would be the stage 6 wheel at 3280 rpm. The stage 8 wheel would not fail until 3600 rpm. The energy of the stage 6 wheel release at 3280 rpm remains bounded by the original analysis of stage 8 failure at 3000 rpm. However, for additional conservatism, the stage 8 wheel is assumed to fail at 3280 rpm as a consequence of a stage 6 wheel failure. This is more conservative than the original analysis which only included analysis of the first disc to fail, which was stage 8 but in the new analysis would have been stage 6. The new analysis results in a wheel 8 energy which is approximately 120% of the original analysis. The conclusion of the new analysis is that all missile structures remain adequate. Based on the re-analysis, LCR 94-149-UFS will revise the UFSAR. The missile barriers remain structurally adequate with the new turbine configuration.

   Postulated failure of the new last stage blading (stage 6) at up to 3280 rpm is bounded by the stage 8 wheel missile analysis.

d Coolant contamination: Introduction of contamination into the reactor vessel via the condensate/feedwater system has not been affected since the extraction steam affected is from the LP cylinders and the condensate is

routed to the condenser and treated in the condensate polisher/demineralizers. Additionally, the root block material and pressure plate material are comparable to the blading and diaphragms which are being removed. There are no coatings on the pressure plates. Cleaning materials are controlled by plant procedural requirements.

All other safety analyses, including LOCA, containment analyses, reactor over pressure analyses and ATWS were considered and have not been affected.

Part 2A

1. Previously evaluated accidents, such as feedwater and steam jet air ejector line breaks were evaluated for the new operating conditions with 7th and 8th stage pressure plates installed. Quantities and radiological consequences of the postulated breaks that allow discharge of contaminated fluids into the turbine building are found to be unaffected. For the proposed change, the rotating blades have been removed, which reduces the stresses on the 7th and 8th stage discs and which thereby reduces the probability of a design basis 8th stage disc missile at the speed currently analyzed in the UFSAR. However, a more conservative missile analysis has been performed which includes a higher energy turbine missile, although the missile structures remain adequate and therefore the consequences of such an assumed missile will not change. Therefore, it is concluded that for the proposed change there is no increase in the probability or consequences of an accident previously evaluated in the UFSAR.

2. Operation without the two largest blade rows (7th and 8th stages) actually reduces the probability and consequences of the malfunction of blading because of fewer number of blades which could fail and less severe consequences due to smaller size and weight of the remaining blades. The consequences of a turbine missile affecting safety related equipment is addressed in question 1 response, above. The power conversion system (feedwater/condenser/turbine generator) operation remains unchanged. Therefore, it can be concluded that the probability or the consequences of a malfunction of equipment important to safety previously evaluated in the UFSAR has not increased.

3. The power conversion system will operate similarly to previous operation, but at reduced electrical output and higher condenser back pressure due to removal of the 7th and 8th stage blades. These changes will not create the possibility of an accident of a different type than any previously analyzed. The physical change of using stationary pressure plates also could not result in a new type of accident. A postulated failure of a stationary (i.e. not rotating) pressure plate would not be a new type of missile, since it would fall into the condenser. The effects of this would be comparable to a postulated failure of the (previously installed) stage 8 blading. Therefore, for the proposed change, the possibility of an accident of a different type than any previously evaluated in the UFSAR is not created.

4. The revised operating parameters (heat balance) of the power conversion system are well within their design limits and the low pressure turbine blades and newly installed pressure plates stress levels are within the permissible design values. Furthermore, the pressure plates are stationary and do not have any centrifugal force, so would not create a new type of missile. Therefore, the changes do not create the possibility of equipment malfunction of a different type than any previously evaluated in UFSAR.

5. For the proposed change, the turbine bypass steam flow, moisture separator reheater (MSR) flow, final feedwater temperature, and operating steam dome pressure remain unchanged. Therefore, the UFSAR chapter 15.0 accident analysis and the margin of safety as defined in Technical Specification bases 3/4.2.3 (minimum critical power ratio) and 3/4.7.9 (turbine bypass & MSR) remain unchanged. All reactor analyses, including LOCA, containment, and reactor over pressure analyses remain unchanged. ATWS considerations remain unchanged. Service water systems remain unchanged. Radioactive effluents are unrelated, so are unaffected. The margin of safety in the SER(s) and UFSAR as bases for technical specifications has not been reduced. It is concluded that the proposed change does not reduce the margin of safety as defined in the bases for any technical specification.

FERMI 2
LP STAGE 7 & 8
PRESSURE PLATE INSTALLATION

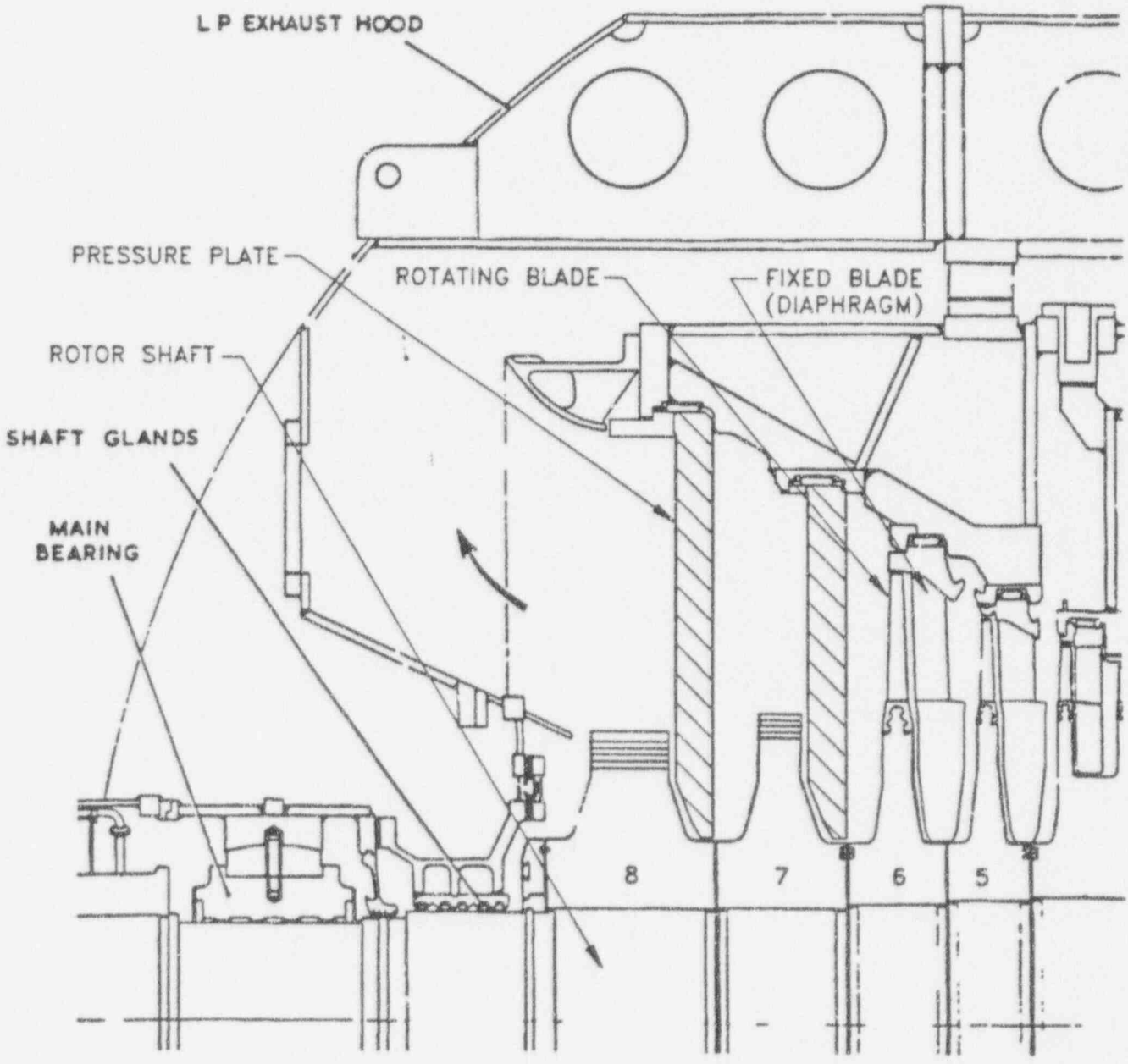
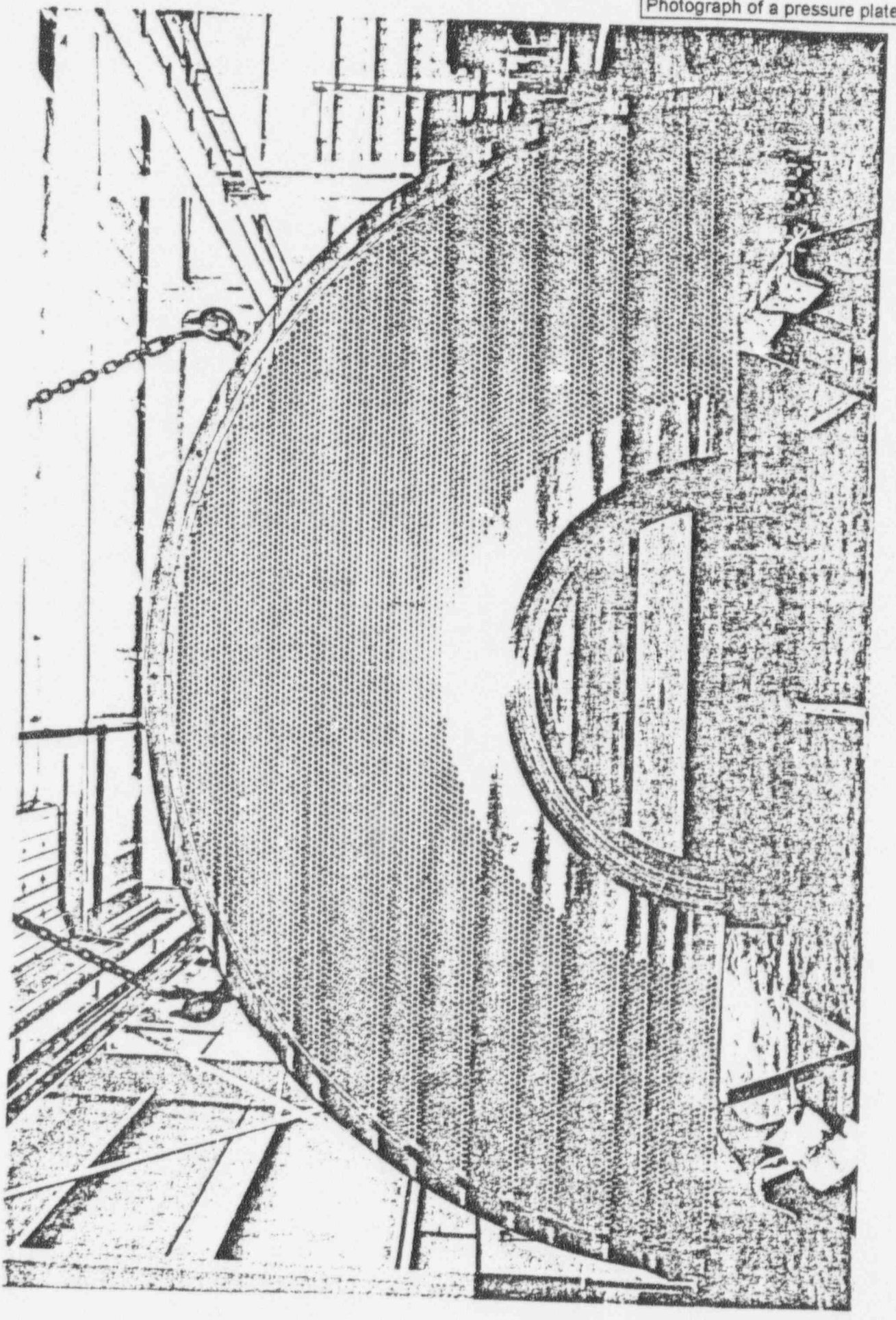


Figure 1b
Photograph of a pressure plate half



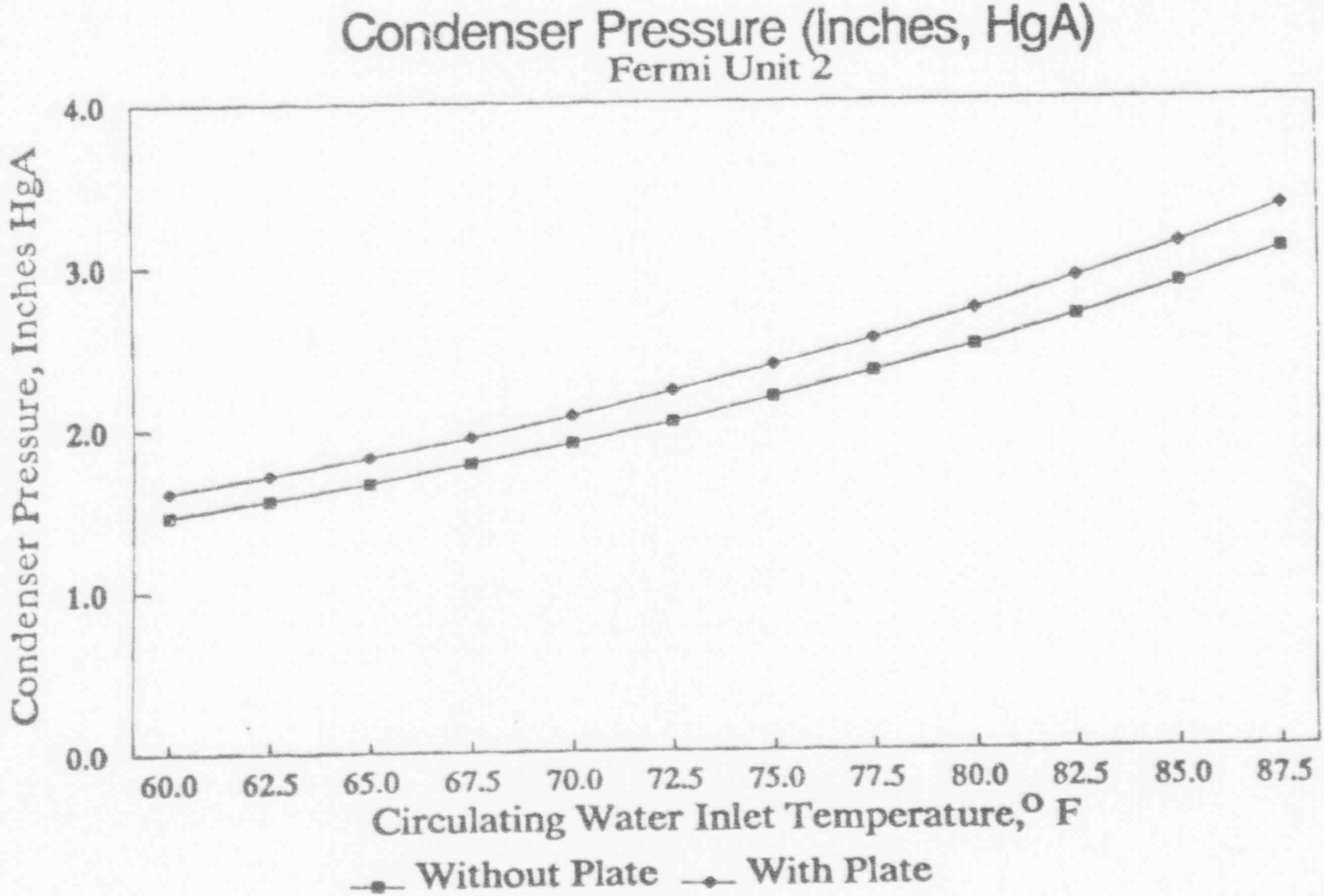


FIGURE: 2

IMPACT OF PRESSURE PLATES ON CONDENSER

5 CIRC PUMPS - 90% CF

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Figure 2