AmerGen

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An Exelon Company

10 CFR 50.55a

July 19, 2004
5928-04-20175

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Three Mile Island, Unit 1
Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Response to Request for Additional Information Concerning Relief Request PR-03 for the Fourth Ten-Year Interval Inservice Testing Program

Reference: Letter from M. P. Gallagher (AmerGen Energy Company, LLC) to U. S. Nuclear Regulatory Commission, dated March 26, 2004

In the referenced letter, AmerGen Energy Company, LLC (AmerGen) submitted for your review and approval proposed relief requests in accordance with 10CFR 50.55a, associated with the fourth ten-year interval Inservice Testing (IST) program for Three Mile Island (TMI), Unit 1. In response to a conversation with the U. S. Nuclear Regulatory Commission on June 2, 2004 concerning Relief Request PR-03, attached is additional information. Also attached is an updated PR-03, which reflects the additional information.

If you have any questions or require additional information, please contact T. R. Loomis at 610-765-5510.

Very truly yours,

Michael P. Gallagher
Director, Licensing and Regulatory Affairs
AmerGen Energy Company, LLC

Attachments: 1) Additional Information For Pump Relief Request PR-03
2) Revised Relief Request PR-03

cc: H. J. Miller, Administrator, Region I, USNRC
D. M. Kern, USNRC Senior Resident Inspector, TMI-1
D. M. Skay, USNRC Senior Project Manager
File No. 02078

A047

ATTACHMENT 1

ADDITIONAL INFORMATION FOR PUMP RELIEF REQUEST PR-03 CONCERNING TURBINE-DRIVEN EMERGENCY FEEDWATER PUMP COMPREHENSIVE PUMP TESTING REQUIREMENTS

Question:

1. *Provide maintenance and repair records for this pump.*

Response:

The maintenance records for the EF-P-1 pump from October, 1989 to present are provided below. This list does not include maintenance specifically for oil changes.

11/18/03	Upgraded pump oil seals
04/18/01	Thermography inspection of bearings
01/04/01	Replace pump shaft outboard packing
01/02/01	Repaired leak on outboard bearing housing cover
09/16/00	Repaired outboard bearing flinger ring
10/08/99	Replaced outboard bearing
10/08/99	Repaired leak on turbine end bearing bottom plate
09/20/99	Repaired leak on oil drain plug on outboard bearing housing
05/26/99	Oil sample, change and inspection of outboard bearing
10/19/94	Repaired leak on inboard packing
10/12/93	Adjusted pump inboard packing

Question:

2. Provide the details on how the full flow test is performed during the pre-service test.

Response:

The preservice test of this pump was performed in June 1974, during plant startup testing. The unit was at hot shutdown conditions. This testing was designed to verify that the emergency feedwater system was able to supply feedwater (from the condensate storage tanks) when the Once Through Steam Generator (OTSG) pressure was 1015 PSIG, and that EF-P-1 was able to deliver at least 920 GPM.

The following parameters were recorded during testing:

EF-P-1 flow	920 GPM
EF-P-1 discharge pressure	1100 PSIG

EF-U-1 speed	3800 RPM
EF-P-1 suction pressure	7 PSIG

These parameters were compared to the manufacturer's head curve developed during shop testing performed in December 1969. This curve was developed by testing EF-P-1 at nine different speeds, with the majority of testing at 3600 RPM (nine data points). This data was extrapolated for operation at 3800 RPM to develop the pump curve used for comparison.

Question:

3. Provide the system modification costs including temporary piping such that comprehensive flow test can be performed at the design flow test, and any complications.

Response:

A preliminary cost estimate indicates that the necessary modifications would cost in excess of one million dollars. To be able to perform the comprehensive flow test near the design flowrate without introduction of excessive quantities of highly oxygenated water into the OTSGs, piping modifications to the emergency feedwater system would be required to divert flow from entering the OTSGs. Based on a preliminary review, this piping would be installed near the discharge of EF-P-1, and would be directed to the condensate storage tank(s). The current discharge piping is six (6) inch outer diameter and has a pressure rating of 1300 PSIG. The condensate storage tanks are rated for 0 PSIG. This difference in pressure ratings will require review of pressure relief requirements for this piping modification. The diameter of the return piping to the condensate storage tanks is four (4) inch outer diameter. The comprehensive test modification would require either modification of this existing piping (some of which is below grade) or installation of a separate return line, including tank modification to accommodate the return line. In addition, to provide adequate steam supply to EF-P-1 these piping modifications would be required to support testing with main steam during hot shutdown conditions and realignment to support normal Mode 1 alignment. This would require that additional isolation valves be installed in the existing EFW supply lines to the OTSGs.

Question:

4. Recognizing delta P reference value is higher for higher flow while the change in delta P is smaller at a lower flow, the acceptance criteria needs to be adjusted for test results at the lower flow rate. For certain pumps, the 2% measured degradation could be 9% at the higher flow. Therefore to obtain approval for the lower flow, we must demonstrate that the adjusted acceptance criteria for lower flow can meet the code requirements of ISTB-3300(e)(1) for the comprehensive flow test. The information for staff review should include, but not be limited to, the methodology and technical data used for the adjustment of the acceptance criteria for the comprehensive flow test at the lower flow.

Response:

The original relief request was intended to request relief from the requirement of ISTB-3300(e)(1), which requires that reference values shall be established within +/- 20% of pump design flow rate for the comprehensive pump testing. Specifically, the relief requests approval to perform comprehensive pump testing of the steam-driven emergency feedwater pump (EF-P-1) at a flow rate reference point of 500 gpm rather than the ASME O&M code required 80% of pump design flowrate of 736 gpm. The specified +/- 20% of pump design flow rate can not be achieved for this pump during comprehensive pump testing without introducing large volumes of highly oxygenated water into the OTSGs which increases the potential for corrosion of the steam generators.

The current OTSGs are original plant equipment. These components were subjected to five (5) identifiable incidents of chemical intrusion on the primary side of the tubes during the extended shutdown from 1979 to 1981. These excursions did not affect the secondary portion (EFW side) of the steam generators. Currently, consideration is being given to replacing both OTSGs. If replaced, the new generators will be more resistant to corrosion than the current model; however, they will still be susceptible. Minimizing introduction of oxygenated water into these vessels will remain a concern.

The following information provides a justification for a reduced acceptance criteria band while testing at a reduced flow. In summary, head versus flow degradation curves have been developed utilizing a polynomial fit for the acceptance criteria (Figure 3), which were based on the RELAP5 model for hydraulic transient analysis of the TMI, Unit 1 EFW piping configuration and capabilities. This model contained a degradation curve for an estimated 9.7% degradation of pumping capability for EF-P-1 based on a RELAP5 calculation. This model was developed to support Technical Specification Change Request 279, Core Protection Safety Limit with an Average of 20% Steam Generator Tubes Plugged, dated December 3, 1998. This Technical Specification Change Request was approved in an NRC Safety Evaluation dated August 19, 1999. In that Safety Evaluation, "the staff reviewed the proposed methods for evaluating the EFWS performance and establishing surveillance test acceptance criteria using the RELAP5 model and finds them to be acceptable." Using this degradation curve and the original pump manufacturer's head curve, additional curves at various degradation levels were developed. These head versus flow curves can be compared against the original manufacturer's head versus flow curve and the current ASME 7% acceptance criteria. These curves will allow extrapolation from the lower flow of 500 gpm, to expected results at the higher flow of 740 gpm.

The following additional information is being provided regarding the development, test plan, and acceptance criteria for EF-P-1 in the fourth ten-year interval:

1. Figure 1 provides a plot of the pump head versus flow, based on the manufacturer's curve and the ASME 7% acceptance criteria. Also provided on this curve are the EF-P-1 required accident flow rates (total pump flow):

   Loss of Feedwater Event (LOFW) – 272 gpm (455 gpm) at 2661 feet of developed head

Loss of AC Power Event (SBO) – 350 gpm (533 gpm) at 2541 feet of developed head

2. Figure 2 provides a 9.7 % degradation curve developed for the EF-P-1, which bounds the ASME 10% acceptance criteria for the current interval. The current inservice testing acceptance criteria were established in 1999 using the computer program RELAP5 to perform hydraulic transient analysis of the specific system configuration at TMI, Unit 1. This analysis used the original pump manufacturer's shop testing curve, as shown in Figure 1, as the basis for expected pump performance and benchmarked the pump performance testing during refueling outage 12R (1999). During this testing, a maximum flow of 675 GPM from EF-P-1 to OTSG "B" was recorded. This point was not the reference point, but was recorded to verify flowpath capability. (Current refueling interval testing of this pump includes testing at higher flowrates, but only for very short durations.) This calculation used for establishing the acceptance criteria also determined degradation curves for all of the emergency feedwater pumps. At the time of this analysis, a 9.7 % degradation curve was developed for EF-P-1. This degradation bounded the ASME 10% acceptance criteria, and also bounded the design accident requirements of EF-P-1. It should be noted that this curve is specific to EF-P-1.

3. Using a polynomial curve fit of the RELAP modeled 9.7% degradation curve at 3800 RPM, degradation curves from 1% to 7% were generated as shown in Figure 3. This graph displays these curves along with the manufacturers curve and the ASME 7% acceptance curve. The following equations were generated for each of the degradation curves presented:

   1 %: $y = 1.21378E\text{-}6x^3 - 0.00215x^2 - 0.7226x + 2898.0$
   2 %: $y = 1.13386E\text{-}6x^3 - 0.00205x^2 - 0.6309x + 2898.0$
   3 %: $y = 1.05394E\text{-}6x^3 - 0.00196x^2 - 0.5393x + 2900.3$
   4 %: $y = 9.74015E\text{-}7x^3 - 0.00186x^2 - 0.4477x + 2901.5$
   5 %: $y = 8.94092E\text{-}7x^3 - 0.00176x^2 - 0.3560x + 2902.6$
   6 %: $y = 8.14169E\text{-}7x^3 - 0.00167x^2 - 0.2643x + 2903.8$
   7 %: $y = 7.34246E\text{-}7x^3 - 0.00157x^2 - 0.1727x + 2904.9$
   9.7%: $y = 5.18454E\text{-}7x^3 - 0.00131x^2 - 0.0747x + 2908.1$
   where y = TDH (feet) and x = flow (gpm)

   All of these curves exhibited an R-squared value of greater than 99% and have a standard error of estimate ranging from 4.72 to 9.07 (ft.). As discussed above, these curves will allow extrapolation from the lower flow of 500 gpm, to expected results at the higher flow of 740 gpm.

4. The following information provides the proposed EF-P-1 testing and evaluations:

   a. EF-P-1 will be tested at 500 gpm total pump flow during the comprehensive pump test rather than the ASME O&M code required 740 gpm (20% of 920). Flow will be the set parameter while differential pressure and vibration will be the measured parameters. All other requirements of the comprehensive test will be performed. After measurement of the parameters, the values will be adjusted to 3800 RPM and compared to the ASME O&M code acceptance criteria. With regards to differential pressure, the following three comparisons will be made;

i. The differential pressure will be compared to the ASME O&M code acceptance criteria of +3 % and -7%, and;

ii. The differential pressure will be compared to both design accident requirements (LOFW and SBO), and;

iii. Any degradation will be measured as a percentage of head reduction and the appropriate degradation curve or equation will be used to extrapolate to a point at 740 gpm on the 7% degradation curve (the minimum ASME required test flow point).

b. The following corrective actions will be taken if the pump does not meet any of the above three comparisons:

i. If the pump exceeds the ASME O&M code-required acceptance criteria of +3% or -7%, the pump will be declared inoperable until the cause of the deviation is identified. The condition will be corrected or an analysis shall be performed to determine the need to establish new reference values.

ii. If the pump does not meet the design accident requirements for flow and differential pressure, the pump will be declared inoperable until the cause of the deviation is identified and the condition corrected.

iii. If the measured degradation at the 500 gpm test point exceeds -7% at the extrapolated point at 740 gpm, the pump will be declared inoperable until the cause of the deviation is identified. The condition will be corrected or an analysis shall be performed to determine the need to establish new reference values.

5. The following is an example (See Figure 4):

a. During the EF-P-1 test at 500 gpm, the differential pressure is calculated to be 2745 ft. At this test point, the pump meets the criteria in i) and ii) above. However, at the reference point of 500 gpm, the differential pressure of 2745 ft. corresponds to 5% degradation. When the 5% degradation curve is applied and extrapolated to 740 gpm (ASME required test flow point), the acceptance criteria of 7 % is not met. The pump would then be declared inoperable per TMI procedures. Additional testing would be performed as necessary to evaluate pump performance and to identify the most probable cause of the deviation. The condition will then be corrected or an analysis would be performed to determine the need to establish new reference values.

6. During this testing, vibration levels will be evaluated as required by the ASME O&M code. Vibration levels at the proposed testing point of 500 GPM are expected to be slightly higher than those at 920 GPM. This will provide a slightly better assessment of vibrations during operation at the accident-required flow of 290 GPM delivered to the OTSGs and will reduce wearing of the bearings during testing.

7. EF-P-1 has a fixed resistance minimum recirculation line which has a design flowrate of 174 gpm. Using the Cameron Hydraulic Data equation provided by the pump manufacturer (FlowServe), there would be no more than a 7 degree F rise in temperature through the pump during this testing. There is no concern for pump damage since the design maximum supply temperature is 130 degrees F. This computation result was verified by Flowserve Engineering.

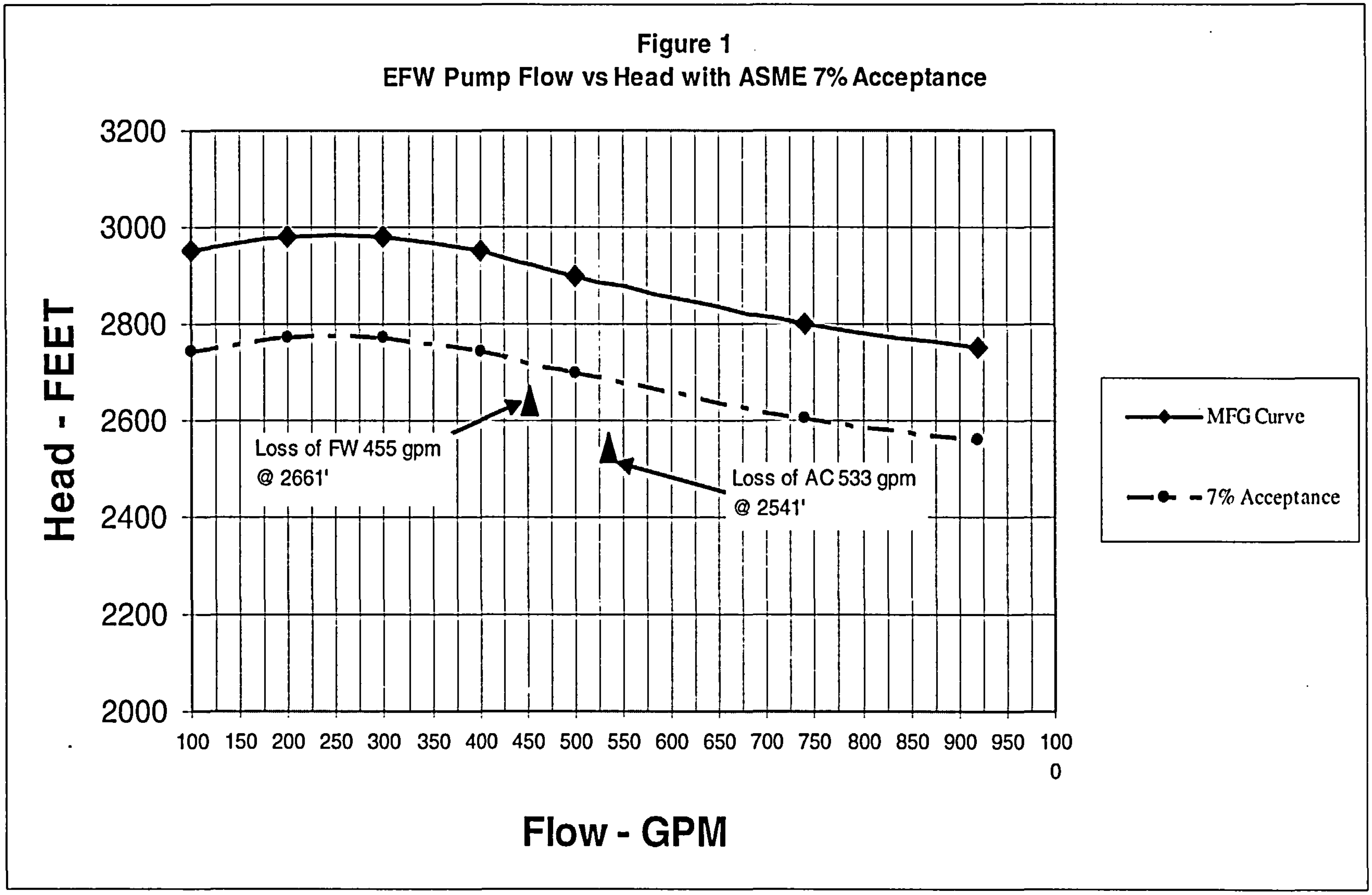


Figure 1
EFW Pump Flow vs Head with ASME 7% Acceptance
Head - FEET
3200
3000
2800
2600
2400
2200
2000
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 100
0
Flow - GPM
Loss of FW 455 gpm
@ 2661'
Loss of AC 533 gpm
@ 2541'
MFG Curve
7% Acceptance

Figure 2
EFW Pump Flow vs Head with 9.7% Degradation

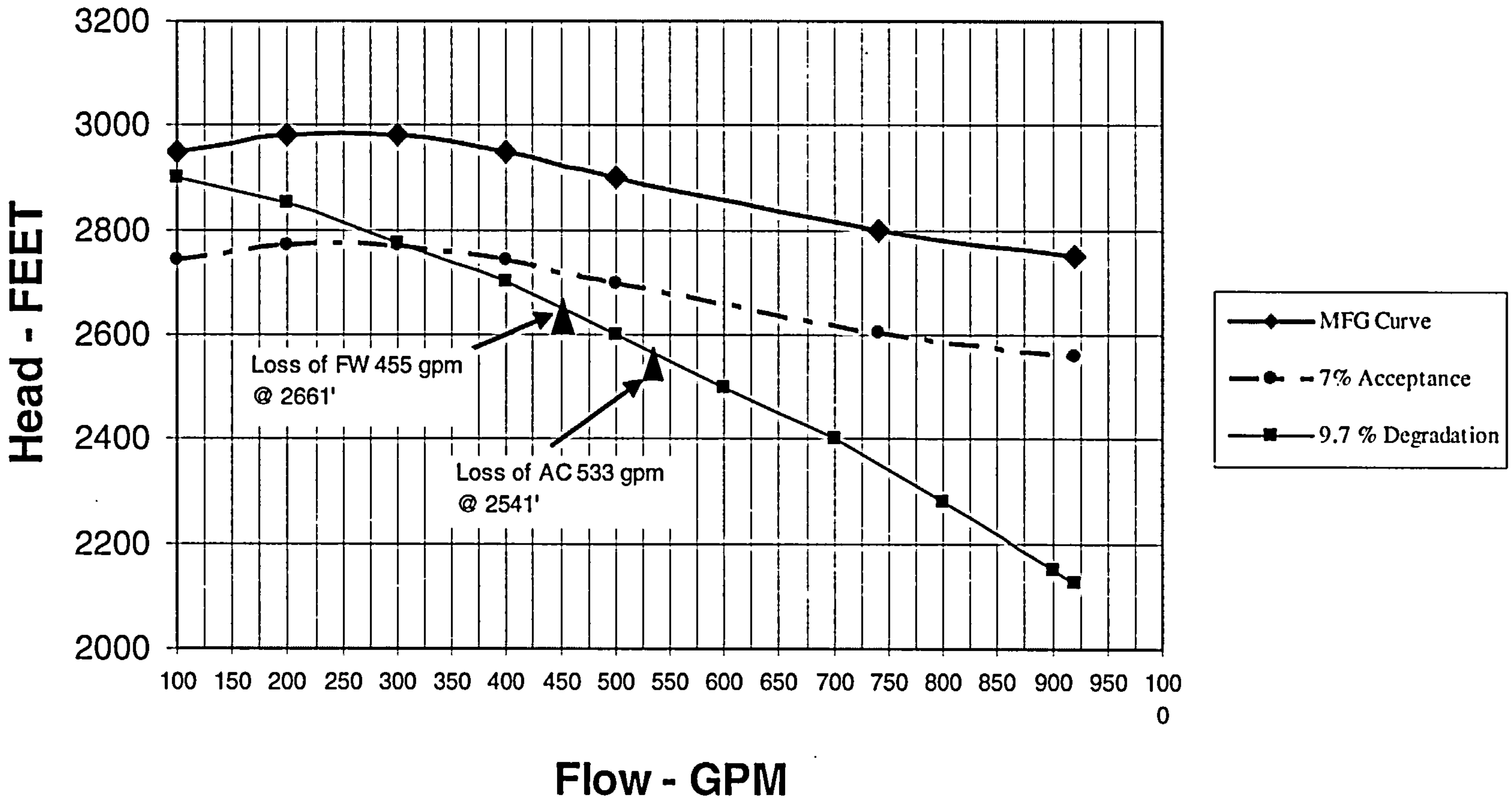


Figure 3
EFW Pump Flow vs Head with Degradation Curves

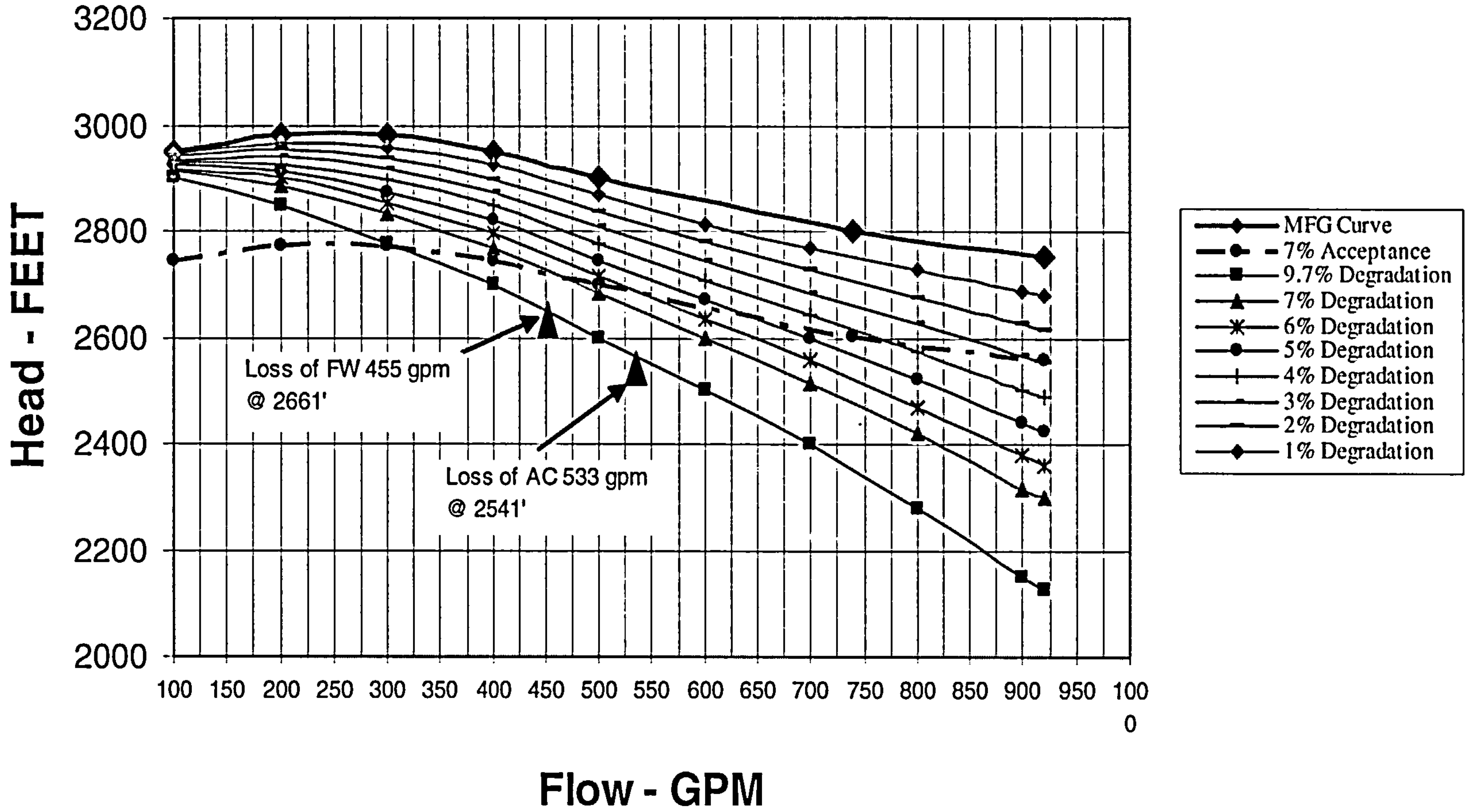
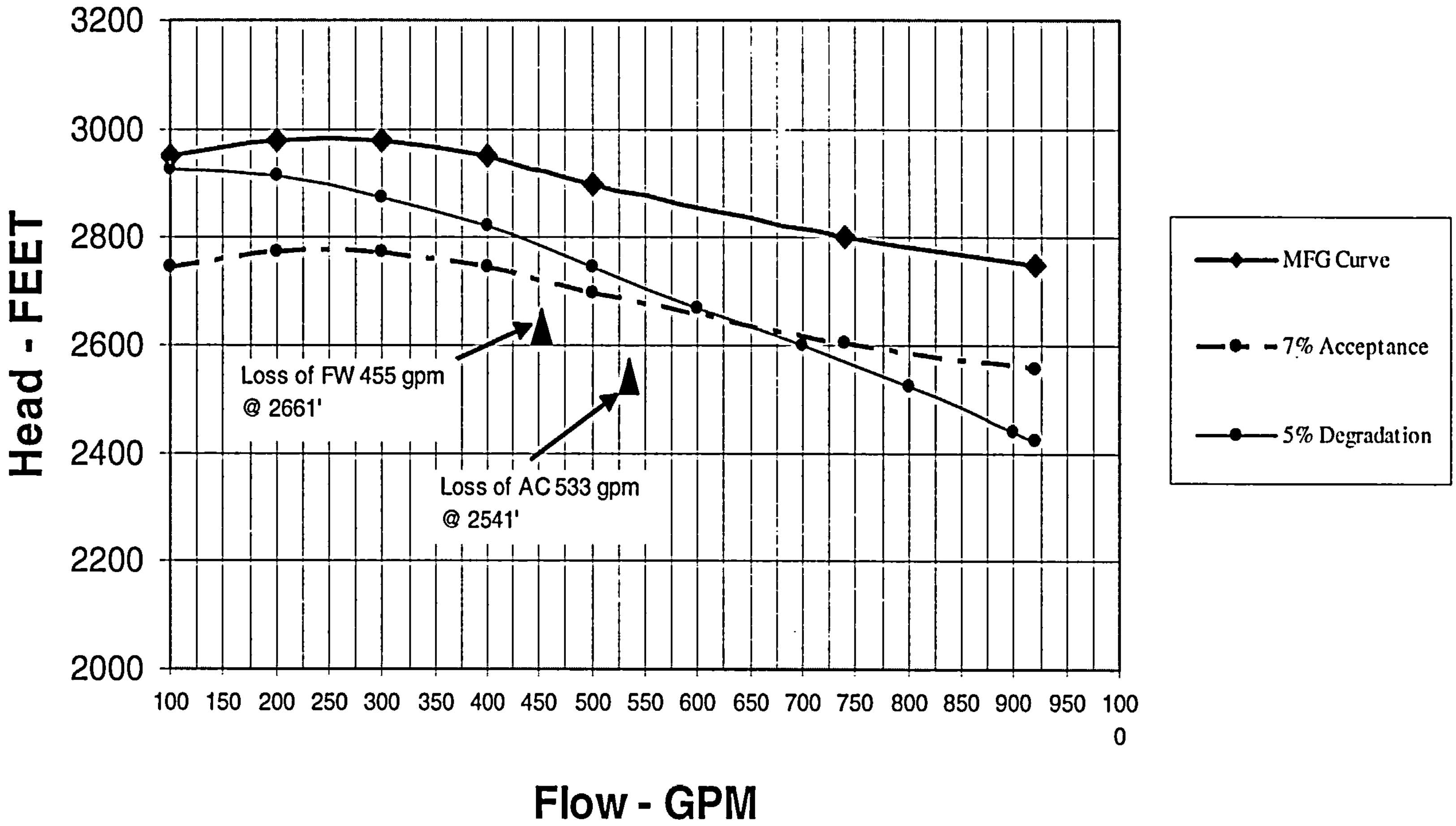


Figure 4
Example EFW Pump Flow vs Head using Degradation Curves



ATTACHMENT 2
REVISED RELIEF REQUEST PR-03

10 CFR 50.55a Request Number PR-03

Proposed Alternative
In Accordance with 10 CFR 50.55a(a)(3)(i)

Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

EF-P-1 Turbine Driven Emergency Feedwater Pump

2. Applicable Code Edition and Addenda

ASME OM Code 1998 Edition through 2000 Addenda

3. Applicable Code Requirement

ISTB-3300(e)(1) – Reference values shall be established within +/- 20% of pump design flow rate for the comprehensive test.

4. Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and standards", paragraph (a)(3)(i), relief is requested from the requirement of ASME OM Code ISTB-3300(e)(1). The basis of the relief request is that the proposed alternative would provide an acceptable level of quality and safety. Specifically, relief is requested from ISTB-3300(e)(1) in meeting the specified +/- 20% of design flow (736 gpm [920 gpm x 80%]) during the comprehensive pump testing. The specified +/- 20% of pump design flow rate can not be achieved for the subject pump during Comprehensive testing without introducing large volumes of highly oxygenated water into the once-through-steam generators which increases the potential for corrosion of the steam generators. The manufacturer's design flow rate of the turbine driven Emergency Feedwater Pump is 920 gpm at 2750 feet of developed head (see Attachment 1).

This relief is intended to provide an alternative to supplying a large volume of highly oxygenated water into the Once-Through-Steam Generators (OTSGs), which increases the potential for corrosion of the steam generators.

5. Proposed Alternative and Basis for Use

Historically, the pump testing methodology has adequately measured pump performance, as demonstrated below. The current refuel testing procedure tests flow through one (of two) fully-open control valves to the OTSG. Figures 1 and 2 provide a simplified diagram of the EFW system flowpath and steam supply to EF-P-1. During refueling interval testing of EF-P-1, the pump is tested individually by injecting water from the condensate storage tanks into an OTSG. The OTSG is depressurized during this test. Flow to the steam generator is throttled until total flow delivered to the OTSG is at least the minimum accident-required flow rate of 290 GPM at a minimum pump head of 1165 PSIG. These testing requirements were submitted in response to a request for additional information related to TMI, Unit 1 technical specification change request number 279 (Core Protection Safety Limit, 20% tube plugging), in a letter dated May 21, 1999, and found to be acceptable.

During this test, flow is also set at approximately 500 gpm and the differential pressure is measured. Differential pressure data at 500 gpm from the last three refueling outage tests is presented in Attachment 2, EF-P-1 Test Data. This data has been speed corrected to 3800 rpm using pump laws for variable speed pumps with constant impeller diameter and plotted against the original manufacturers curve. Additionally, recent quarterly test data points are also presented on this attachment. It can be seen that the pump is operating at or near the original manufacturers curve for both the quarterly and refueling outage tests. Additionally, vibration data collected during the inservice tests has never exceeded 2.5 times the reference values or the 0.325 in/sec absolute value specified by ISTB.

Preoperational startup test data from 1974 is plotted against the original manufacturers curve in Attachment 3. Additionally, during TMI's 12R refueling outage, an EF-P-1 flow capacity test was performed. The data from 12R is also plotted against the original manufacturers curve in Attachment 3. This data closely matches the preoperational data and the manufacturers curve. As expected for a standby pump, the EF-P-1 pump has not degraded.

This relief will minimize the volume of fluid introduced from the condensate storage tanks into the Once-Through Steam Generators (OTSGs), thus minimizing the potential for corrosion of the OTSGs (specifically the tubes). Specifically, administrative controls are in place to minimize the amount of dissolved oxygen in the OTSGs. The inventory used during the testing of EF-P-1 originates in condensate storage tanks. These tanks are vented to the atmosphere and normally have a dissolved oxygen concentration between 6,000 ppb and 7,000 ppb.

During lay-up, dissolved oxygen concentrations in the OTSGs are normally maintained less than 100 ppb to minimize the potential for corrosion of the steam generator. Secondary chemistry controls require the steam generator volume to have a dissolved oxygen concentration below this level. To minimize the impact of this highly oxygenated water injected into the OTSGs (under non-emergency conditions), a number of steps are taken.

To reduce the dissolved oxygen concentration in the condensate storage tanks, a nitrogen tanker truck is specially staged in order to sparge dissolved oxygen from the tank water. Large volumes of nitrogen are injected just prior to the testing of all three emergency feedwater pumps. This normally reduces the dissolved oxygen concentration to between 600 ppb to 1,200 ppb. In addition, the chemistry of the OTSGs is adjusted to maximize the concentration of oxygenscavenging chemicals. Also, the levels of the steam generators are maintained as high as possible during the emergency feedwater testing in order to minimize the dilution of these chemicals. Finally, in the event that dissolved oxygen limits are exceeded during the testing, administrative controls require that the steam generator be drained and refilled under a nitrogen blanket and the water chemistry is adjusted as necessary to maintain the water chemistry within allowable limits within 48 hours. These actions are in agreement with TMI, Unit 1's commitments to the NRC for protecting steam generator tube integrity in accordance with NEI 97-06 and associated industry guidelines.

By minimizing the volume of fluid introduced from the condensate storage tanks into the OTSGs, the potential for corrosion of the OTSGs (specifically the tubes) is minimized.

The following information provides a justification for a reduced acceptance criteria band while testing at a reduced flow. In summary, head versus flow degradation curves have been developed utilizing a polynomial fit for the acceptance criteria (Figure 5), which were based on the RELAP5 model for hydraulic transient analysis of the TMI, Unit 1 EFW piping configuration and capabilities. This model contained a degradation curve for an estimated 9.7% degradation of pumping capability for EF-P-1 based on a RELAP5 calculation. This model was developed to support Technical Specification Change Request 279, Core Protection Safety Limit with an Average of 20% Steam Generator Tubes Plugged, dated December 3, 1998. This Technical Specification Change Request was approved in an NRC Safety Evaluation dated August 19, 1999. In that Safety Evaluation, "the staff reviewed the proposed methods for evaluating the EFWS performance and establishing surveillance test acceptance criteria using the RELAP5 model and finds them to be acceptable." Using this degradation curve and the original pump manufacturer's head curve, additional curves at various degradation levels were developed. These head versus flow curves can be compared against the original manufacturers head versus flow curve and the current ASME 7% acceptance criteria. These curves will allow extrapolation from the lower flow of 500 gpm, to expected results at the higher flow of 740 gpm.

The following additional information is being provided regarding the development, test plan, and acceptance criteria for EF-P-1 in the fourth ten-year interval:

1. Figure 3 provides a plot of the pump head versus flow, based on the manufacturer's curve and the ASME 7% acceptance criteria. Also provided on this curve are the EF-P-1 required accident flow rates (total pump flow):

   Loss of Feedwater Event (LOFW) – 272 gpm (455 gpm) at 2661 feet of developed head

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2. Figure 4 provides a 9.7 % degradation curve developed for the EF-P-1, which bounds the ASME 10% acceptance criteria for the current interval. The current inservice testing acceptance criteria were established in 1999 using the computer program RELAP5 to perform hydraulic transient analysis of the specific system configuration at TMI, Unit 1. This analysis used the original pump manufacturer's shop testing curve, as shown in Figure 3, as the basis for expected pump performance and benchmarked the pump performance testing during refueling outage 12R (1999). During this testing, a maximum flow of 675 GPM from EF-P-1 to OTSG "B" was recorded. This point was not the reference point, but was recorded to verify flowpath capability. (Current refueling interval testing of this pump includes testing at higher flowrates, but only for very short durations.) This calculation used for establishing the acceptance criteria also determined degradation curves for all of the emergency feedwater pumps. At the time of this analysis, a 9.7 % degradation curve was developed for EF-P-1. This degradation bounded the ASME 10% acceptance criteria, and also bounded the design accident requirements of EF-P-1. It should be noted that this curve is specific to EF-P-1.

3. Using a polynomial curve fit of the RELAP modeled 9.7% degradation curve at 3800 RPM, degradation curves from 1% to 7% were generated as shown in Figure 5. This graph displays these curves along with the manufacturers curve and the ASME 7% acceptance curve. The following equations were generated for each of the degradation curves presented:

   1 %: $y = 1.21378E\text{-}6x^3 - 0.00215x^2 - 0.7226x + 2898.0$
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   6 %: $y = 8.14169E\text{-}7x^3 - 0.00167x^2 - 0.2643x + 2903.8$
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   where y = TDH (feet) and x = flow (gpm)

   All of these curves exhibited an R-squared value of greater than 99% and have a standard error of estimate ranging from 4.72 to 9.07 (ft.). As discussed above, these curves will allow extrapolation from the lower flow of 500 gpm, to expected results at the higher flow of 740 gpm.

4. The following information provides the proposed EF-P-1 testing and evaluations:

   a. EF-P-1 will be tested at 500 gpm total pump flow during the comprehensive pump test rather than the ASME O&M code required 740 gpm (20% of 920). Flow will be the set parameter while differential pressure and vibration will be the measured parameters. All other requirements of the comprehensive test will be performed. After measurement of the parameters, the values will be adjusted to 3800 RPM and compared to the ASME O&M code acceptance criteria. With regards to differential pressure, the following three comparisons will be made;

i. The differential pressure will be compared to the ASME O&M code acceptance criteria of +3 % and -7%, and;

ii. The differential pressure will be compared to both design accident requirements (LOFW and SBO), and;

iii. Any degradation will be measured as a percentage of head reduction and the appropriate degradation curve or equation will be used to extrapolate to a point at 740 gpm on the 7% degradation curve (the minimum ASME required test flow point).

b. The following corrective actions will be taken if the pump does not meet any of the above three comparisons:

i. If the pump exceeds the ASME O&M code-required acceptance criteria of +3% or -7%, the pump will be declared inoperable until the cause of the deviation is identified. The condition will be corrected or an analysis shall be performed to determine the need to establish new reference values.

ii. If the pump does not meet the design accident requirements for flow and differential pressure, the pump will be declared inoperable until the cause of the deviation is identified and the condition corrected.

iii. If the measured degradation at the 500 gpm test point exceeds -7% at the extrapolated point at 740 gpm, the pump will be declared inoperable until the cause of the deviation is identified. The condition will be corrected or an analysis shall be performed to determine the need to establish new reference values.

5. The following is an example (See Figure 6):

a. During the EF-P-1 test at 500 gpm, the differential pressure is calculated to be 2745 ft. At this test point, the pump meets the criteria in i) and ii) above. However, at the reference point of 500 gpm, the differential pressure of 2745 ft. corresponds to 5% degradation. When the 5% degradation curve is applied and extrapolated to 740 gpm (ASME required test flow point), the acceptance criteria of 7 % is not met. The pump would then be declared inoperable per TMI procedures. Additional testing would be performed as necessary to evaluate pump performance and to identify the most probable cause of the deviation. The condition will then be corrected or an analysis would be performed to determine the need to establish new reference values.

6. During this testing, vibration levels will be evaluated as required by the ASME O&M code. Vibration levels at the proposed testing point of 500 GPM are expected to be slightly higher than those at 920 GPM. This will provide a slightly better assessment of vibrations during operation at the accident-required flow of 290 GPM delivered to the OTSGs and will reduce wearing of the bearings during testing.

7. EF-P-1 has a fixed resistance minimum recirculation line which has a design flowrate of 174 gpm. Using the Cameron Hydraulic Data equation provided by the pump manufacturer (FlowServe), there would be no more than a 7 degree F rise in temperature through the pump during this testing. There is no concern for pump damage since the design maximum supply temperature is 130 degrees F. This computation result was verified by Flowserve Engineering.

To compensate for testing the EF turbine driven pump at a reduced flow rate during the comprehensive test, as required by ISTB-3300(e)(1), additional activities will be performed as follows to assess operational readiness and determine pump health. Full spectrum bearing vibration analysis as well as oil sampling and analysis is performed as part of the preventative maintenance program. Finally, during each shift the operations staff inspects these pumps to ensure that no problems are present. Based on the full spectrum bearing vibration analysis, the oil sampling and analysis, operational inspections, continued quarterly Group B testing and comprehensive testing within 54% (500 gpm) of design pump flow during refueling outages, an accurate assessment of pump health and operational readiness is assured.

The proposed alternative testing coupled with OTSG water chemistry concerns provides for: a) testing verification of pump performance and identification of degradation, b) verification of piping flowpath capability to deliver accident design flow rates and c) appropriate secondary chemistry precautions to protect OTSG tube integrity.

6. Duration of Proposed Alternative

This proposed alternative will be utilized for the 4^{th} 120 month interval.

7. Precedents

- Similar relief request P-6 was previously approved for North Anna Power Station on January 28, 2002. Docket Nos. 50-338 and 50-339 (TAC Nos. MB2221and MB2222).
- Similar relief request PR-1 was previously approved for Seabrook Station on May 30, 2003. Docket No. 50-443 (TAC No. MB6676).

FIGURE 1 - EMERGENCY FEEDWATER

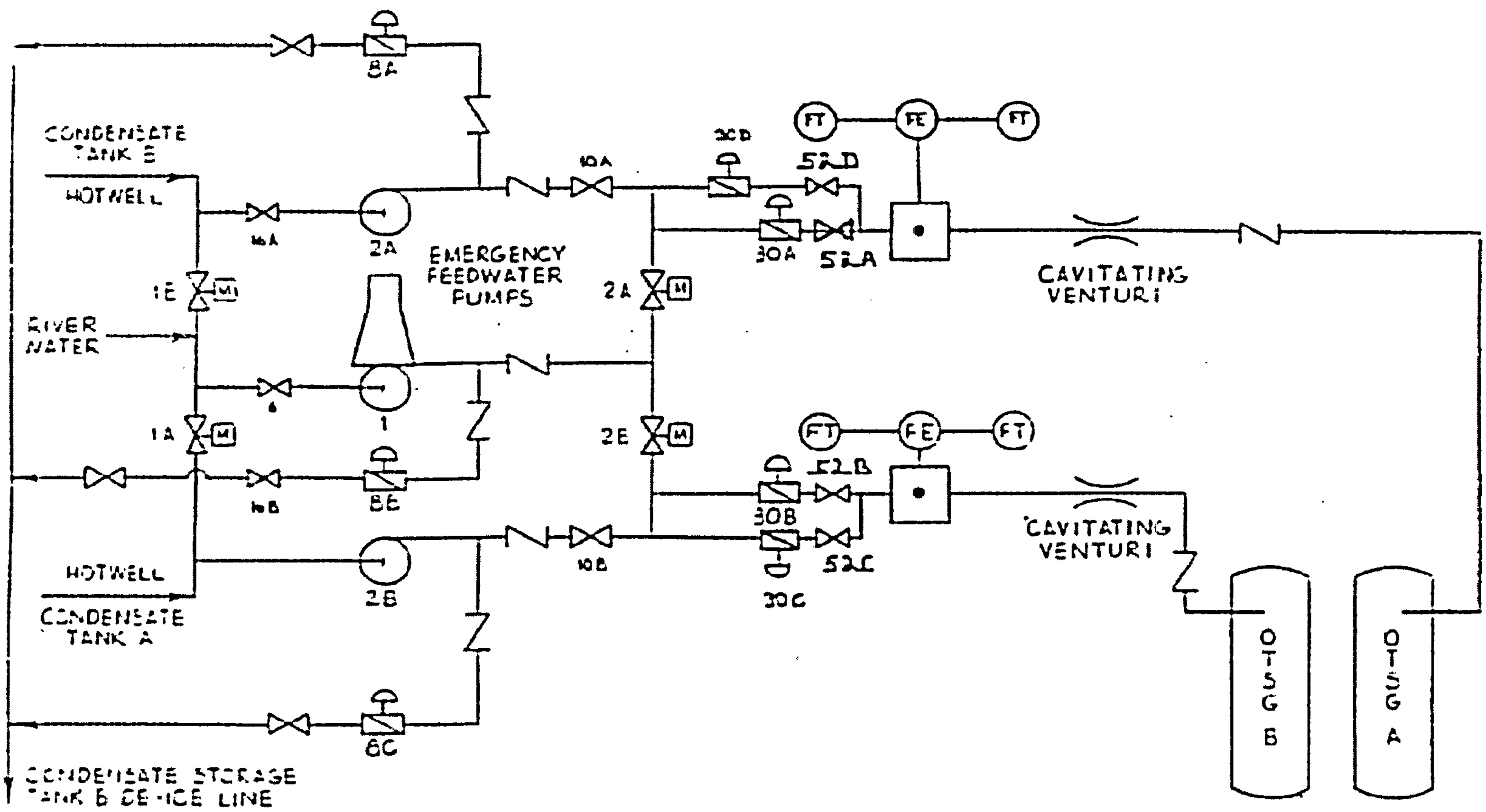
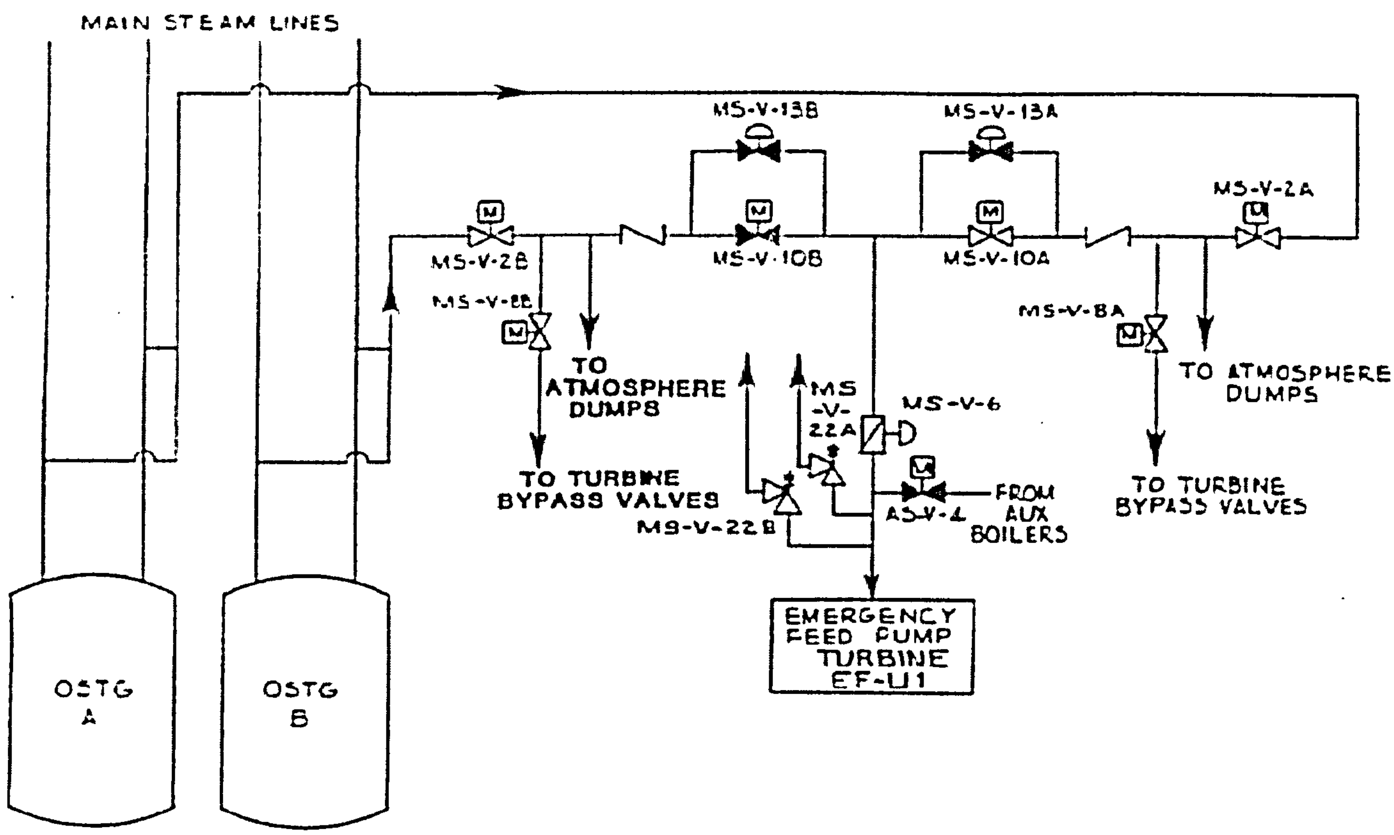
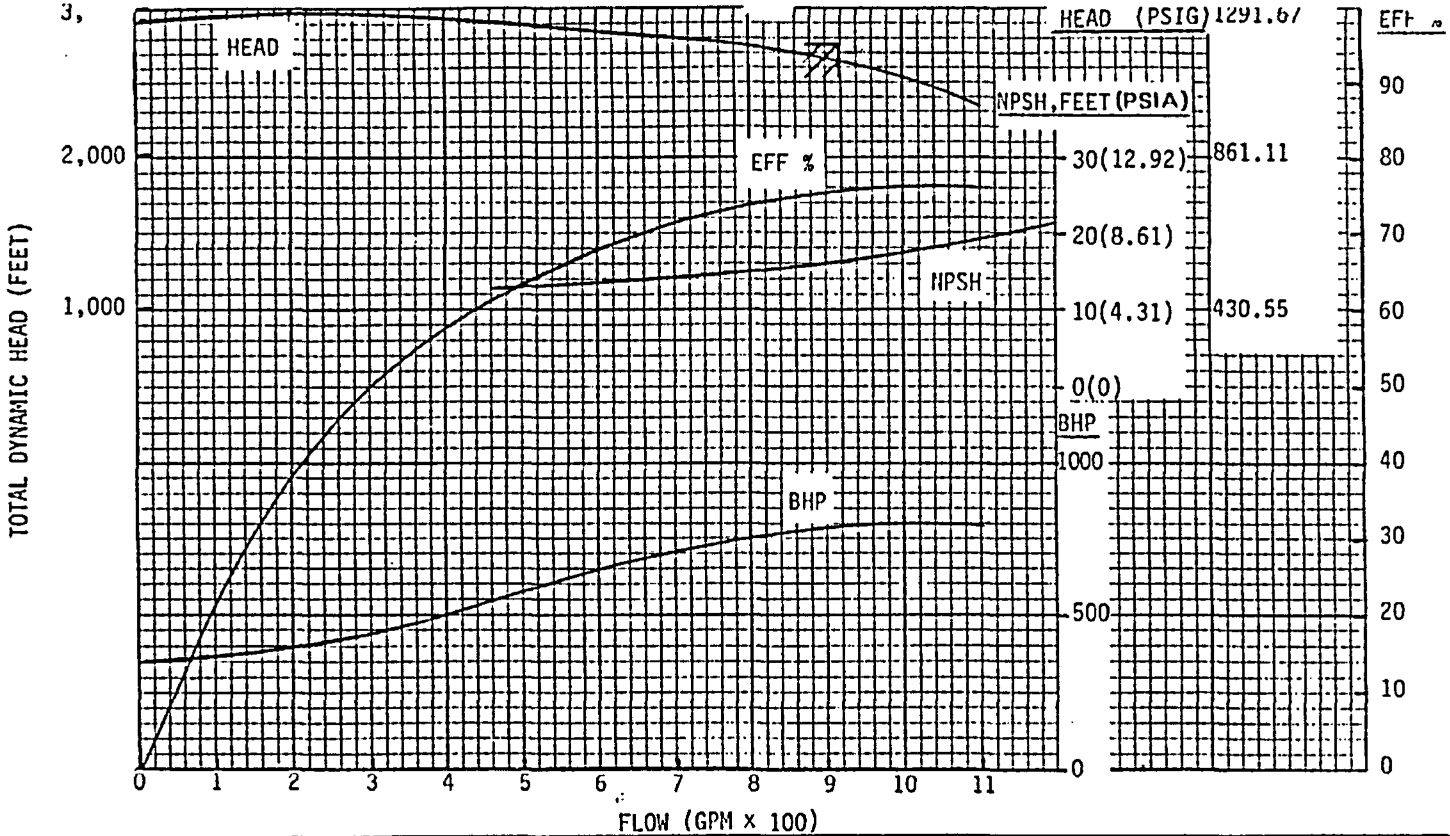


FIGURE 2 - STEAM FLOW TO EF-P-1



Attachment 1

EF-P-1 Manufacturers Pump Curve

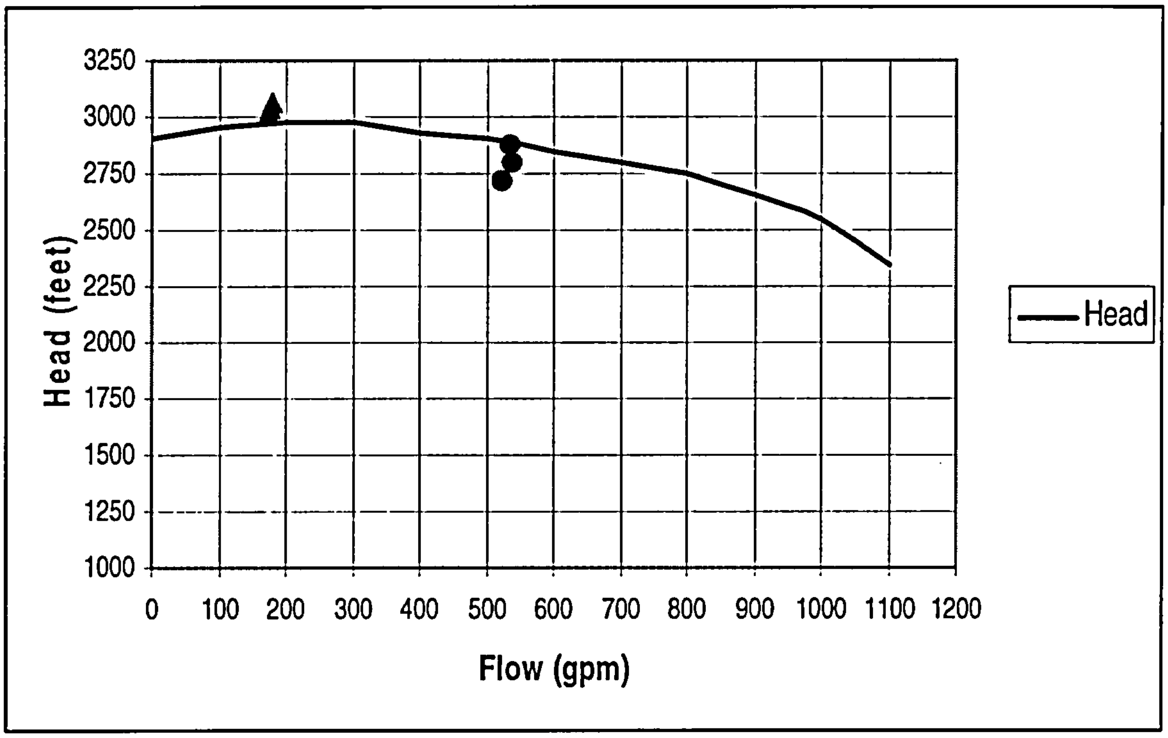


PUMP DATA: NAME EMERGENCY FEED MFR WORTHINGTON MODEL 4WTF-125
SER. NO. ______ . DESIGN HEAD OF 2750 FEET AT 3800 RPM YIELDS 720 GPM.
NO. OF STAGES 2 LOCATION ______ B/M RC-13 IMP. DIA. ______
COMMENTS: NOTE: DATA IS BASED ON 3800 RPM

TURBINE DATA: MFR. WORTHINGTON HP 835 MODEL T2RA
POWER SOURCE N/A STYLE ______
COMMENTS: TURBINE DRIVEN SERIAL NO. 27754

Attachment 2

EF-P-1 Test Data.

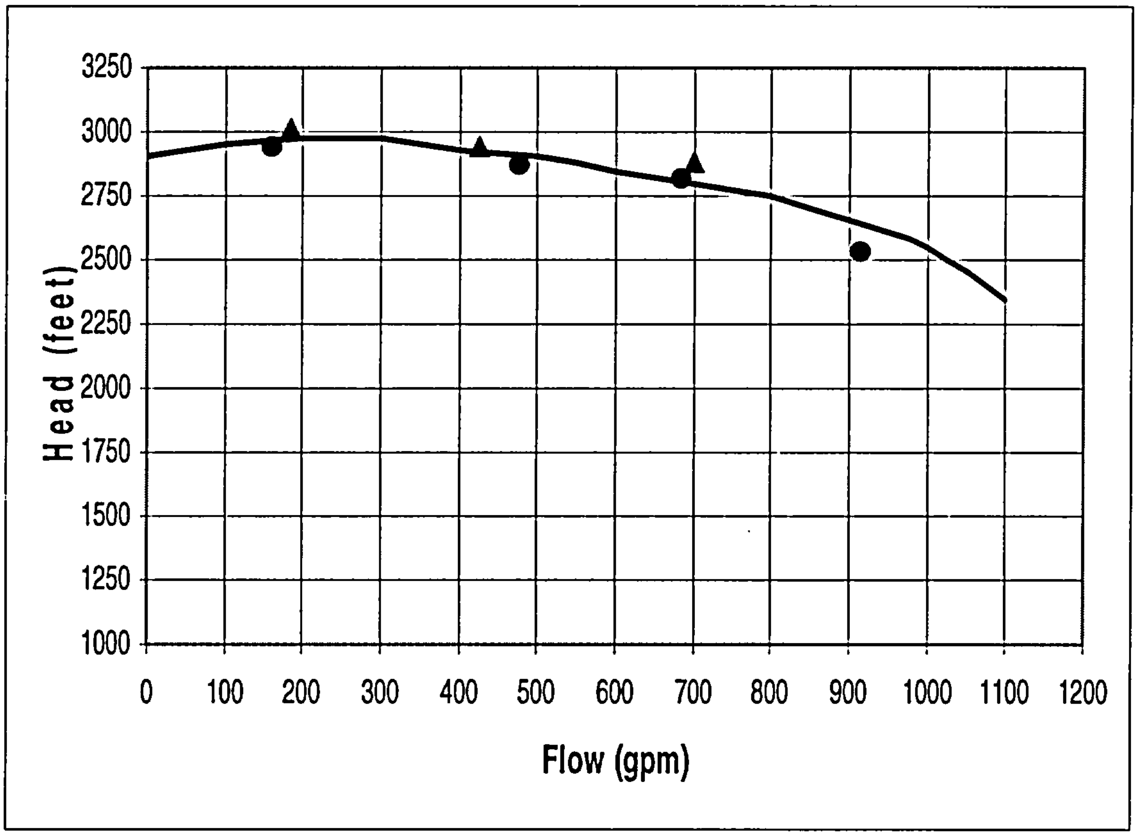


▲ **Quarterly Test** ● **Refueling Outage Test**

Quarterly Test Data			Refueling Test Data		
Date	Flow	TDH	Date	Flow	TDH
5/07/03	182	3003	10/14/99	536	2787
11/18/03	180	3027	11/28/01	533	2894
2/03/04	180	3025	12/01/03	526	2729

Attachment 3

EF-P-1 Preoperational Startup Test Data and 12R Outage Data



▲ **12R Refueling Data**

● **1974 Preoperational Data**

Figure 3
EFW Pump Flow vs Head with ASME 7% Acceptance

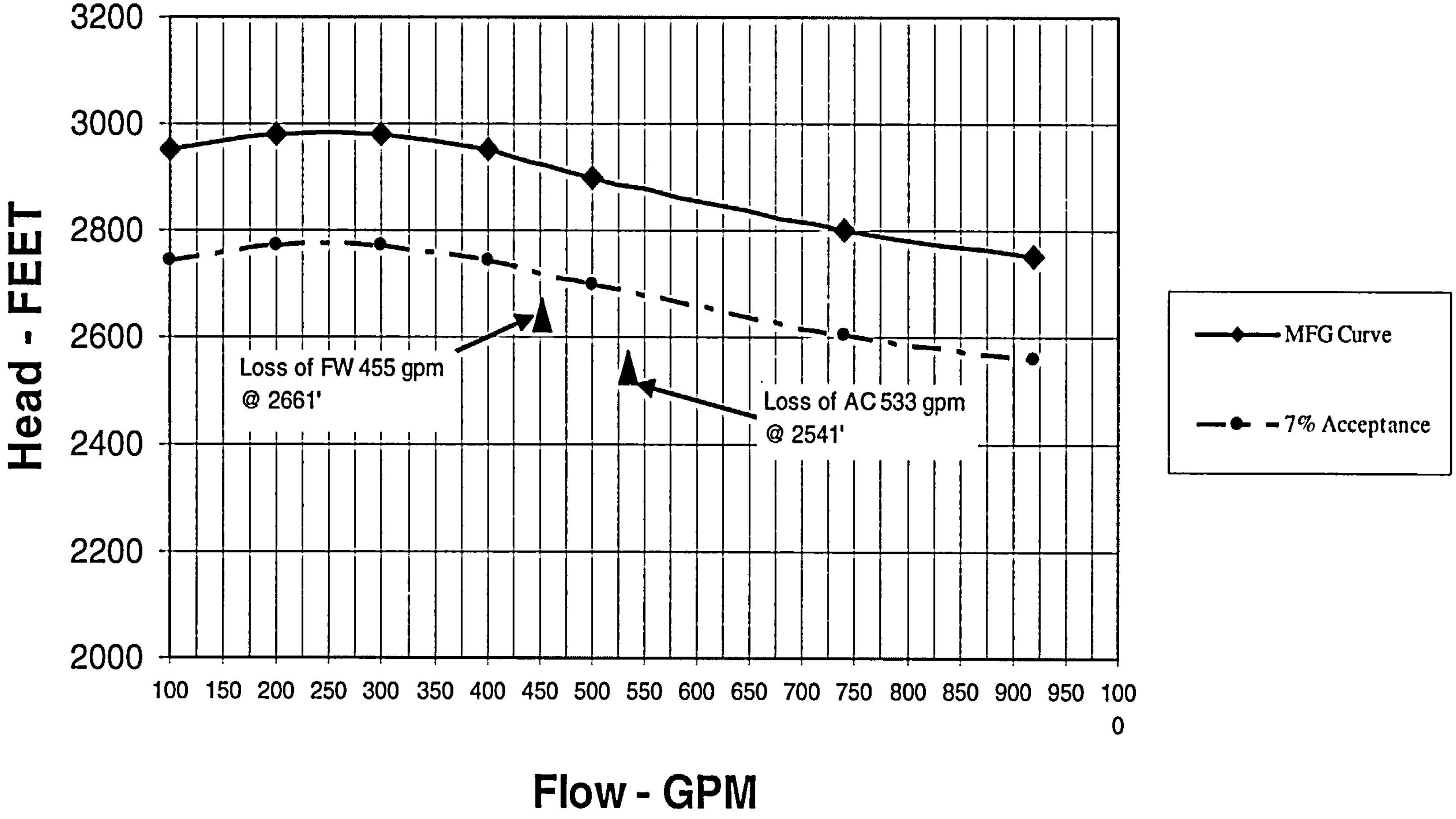


Figure 4
EFW Pump Flow vs Head with 9.7% Degradation

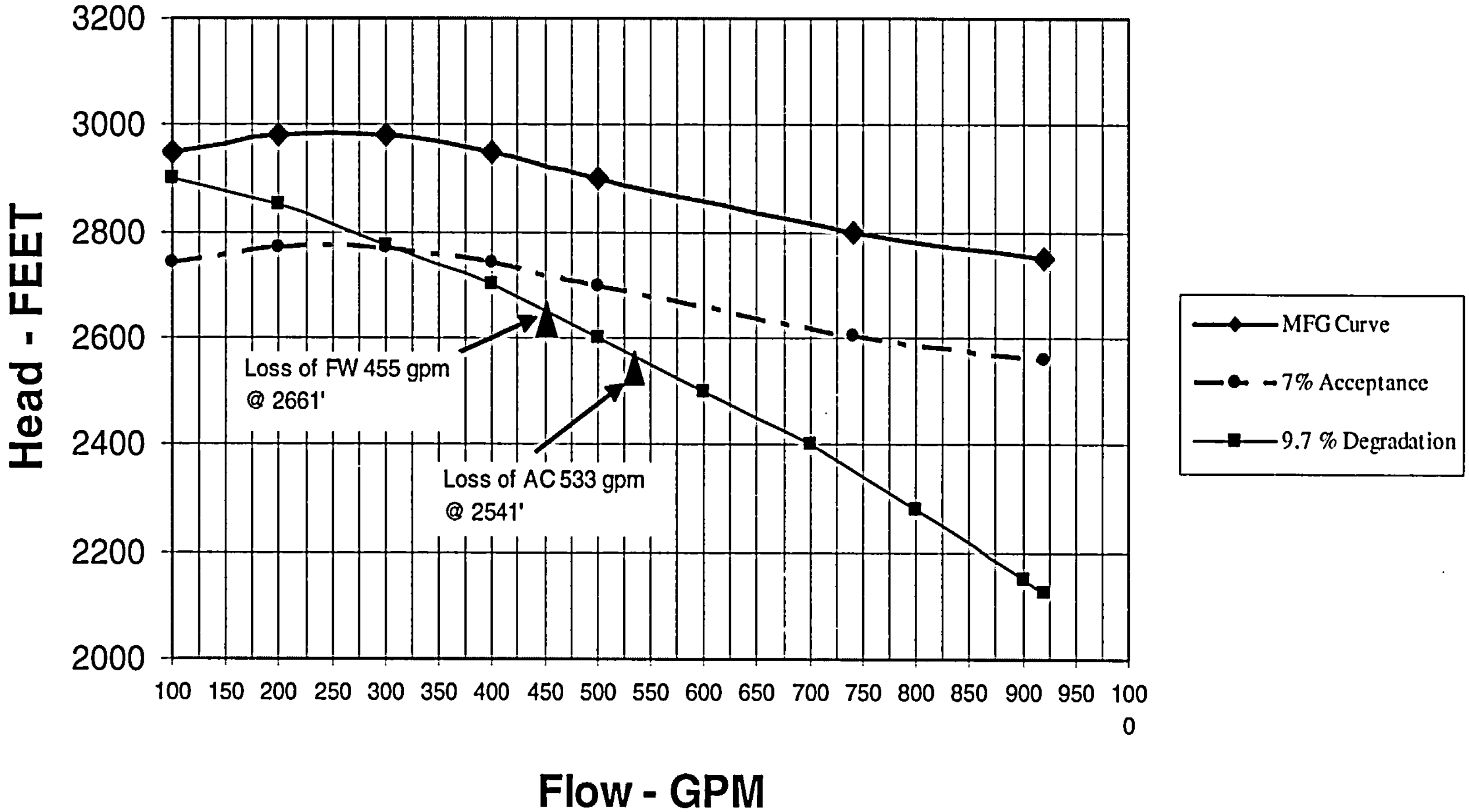


Figure 5
EFW Pump Flow vs Head with Degradation Curves

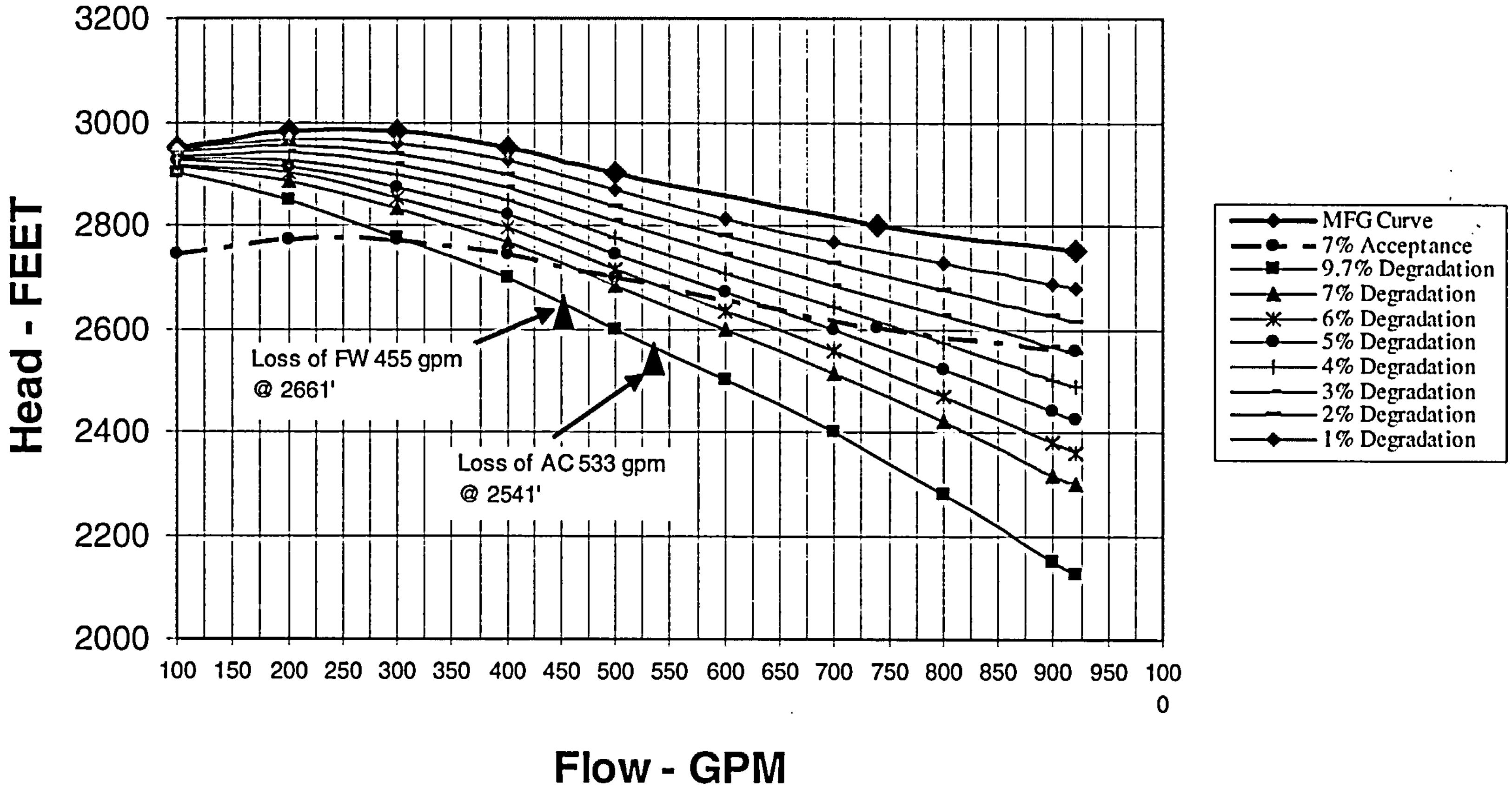


Figure 6
Example EFW Pump Flow vs Head using Degradation Curves