PSNH

Public Service of New Hampshire

New Hampshire Yankee Division

George S. Thomas
Vice President-Nuclear Production

NYN- 88129

September 26, 1988

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

References: (a) Facility Operating License No. NPF-56, Docket No. 50-443

(b) PSNH Letter (NYN-87081), dated June 17, 1987, "Inservice Testing (IST) of Pumps and Valves (Changes to Revision 1 of the Inservice Testing Program)," G. S. Thomas to NRC

(c) PSNH Letter (NYN-88009), dated January 25, 1988, "Inservice Testing (IST) of Pumps and Valves (Changes to Revision 1)," G. S. Thomas to NRC

Subject: Inservice Testing (IST) of Pumps and Valves (Changes to Revision 1)

Gentlemen:

Reference (b) provided changes to Revision 1 of the Seabrook Station Inservice Testing (IST) Program for pumps and valves. These changes were reviewed by the NRC Staff and their contractor, EG&G. On December 18, 1987, members of the NRC Staff, EG&G and New Hampshire Yankee (NHY) discussed, by telephone, several concerns that were identified during the review. These concerns were incorporated and submitted to the NRC in Reference (c). After reviewing Reference (c), further comments by the NRC Staff were discussed with NHY on March 25, 1988 and May 9, 1988.

Following these telephone conferences, NHY performed technical analyses to identify the minimum design flow and head requirements for each of the operating modes of the Service Water system and to determine the current operating conditions. These analyses demonstrate that there is a wide margin between the required and actual system characteristics. (Ref: Relief Request P-3 attached).

Similar worst case minimum design performance requirements will be identified by NHY for all IST program pumps. The lower limit for all monitored performance parameters will be adjusted as necessary to ensure that the specified value satisfies the code requirements as well as the minimum design requirements.

The enclosed material provides changes to the IST Program to resolve the Staff concerns. Additionally, trends of total developed head observed to date, as well as vendor supplied performance characteristic curves for all pumps covered by Relief Request P-3 are provided in Attachment 1 to illustrate actual fluctuations in test data as well as the extremely narrow performance band before the upper limit is exceeded.

A047
1/1

Furthermore, a New Hampshire Yankee position is provided in Attachment 2, which assures the Service Water System minimum design performance parameters are well below the current reference flow conditions. As illustrated by these numerical values, the pump performance is above the design requirements when derated to the minimum allowable per ASME Section XI. A pump failure while operating at this derated performance value has been reviewed by the pump vendor with regard to degradation below the minimum design conditions without an associated rise in component vibrations. This evaluation shows that since there is such a large available margin for the Service Water System pumps above the minimum design requirements, quarterly pump vibration monitoring will easily detect any developing pump failures.

Should you have any further questions regarding this matter, please contact Mr Robert A. Gwinn at (603) 474-9574, extension 4056.

Very truly yours,

George S. Thomas

Enclosure

cc: Mr. William T. Russell
Regional Administrator
Region I
United States Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

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ENCLOSURE TO NYN

Relief Request: P-3

Pumps: SW-P-41A, SW-P-41B, SW-P-41C, SW-P-41D, SW-P-110A and SW-P-110B

Code Class: 2 and 3

Function: Pumps required to perform a function in shutting down the reactor or in mitigating the consequences of an accident, and are provided with an emergency power source.

Test Requirements: Table IWP-3100-2 specifies the allowable ranges of inservice test quantities in relation to reference values. This table limits the acceptable performance of the differential pressure (ΔP) for each pump to 103 percent ($1.03 \Delta Pr$). If the differential pressure of any pump exceeds this limit, the pump shall be declared inoperable and not returned to service until the cause of the deviation has been determined and the condition corrected.

Basis for Relief: The requirement to declare a pump inoperative when pump performance exceeds the reference value by 3 percent is impractical and is not clearly indicative of pump degradation for the following reasons:

a. The 3 percent limitation is overly restrictive when compared to the total accuracy of the instrumentation used to gather the test data. In order to consistently remain below the 3 percent limitation, extremely lower instrument loop accuracies than those required by Table IWP-4110-1 would have to be established. This is particularly evident when testing pumps that have high flow rates and low discharge head characteristics such as the pumps listed above.

b. Power plant operating systems were not designed to provide laboratory type conditions required to meet the 3 percent limitation. The service water (SW) systems require the use of large butterfly valves using remote manual control to throttle large volumes of water to the reference flow rate. Normally flow rates can only be established to ± 100 gpm of the specified reference flow.

c. Reference values are specific sets of data determined by measuring or observing pump performance when a specific pump is known to be performing its required function acceptably. Merely exceeding the 3 percent limitation is not a clear signal of pump degradation. It may signify that the reference value is at the lower side of the statistical scatter of the test data in comparison with other periodic test data.

Basis for Relief: (continued)

d. For the pumps listed, the difference between the differential pressure reference value and 103 percent required action value is approximately 2.0 psid. This is extremely restrictive and is easily exceeded by any combination of statistical scatter, instrument inaccuracy and minor flow variations. In the past, these pumps have been declared inoperable due to high differential pressure readings exceeding the [illegible] range by less than 0.5 psid. Further evaluation of these conditions has shown there has been no pump degradation. Furthermore, since an actual increase in pump differential pressure is not indicative of degraded pump performance, it is not necessary to maintain such a strict upper limit.

e. The minimum design flow requirements for the SW system pumps are as follows:

	Flow	Head
Service Water Pumps	8,700 gpm	34.9 psid
Cooling Tower Pumps	11,360 gpm	47.1 psid

These components are currently tested at the following reference conditions:

	Flow	Head	Minimum/Maximum Limits (0.90/1.03 x ΔP ref)	Proposed Limit (.93/1.10 x ΔP ref)
SW-P-41A	11,500 gpm	66.3 psid	59.7/68.3	61.2/72.9
SW-P-41B	11,500 gpm	67.1 psid	60.4/69.1	62.4/73.8
SW-P-41C	11,300 gpm	65.2 psid	58.7/67.2	60.6/71.7
SW-P-41D	11,500 gpm	66.1 psid	59.5/68.1	61.5/72.7
SW-P-110A	13,000 gpm	70.4 psid	63.4/72.5	65.5/77.4
SW-P-110B	13,000 gpm	69.6 psid	62.6/71.7	64.7/76.6

As can be seen from the above figures, there is a wide margin between the design flow requirements and the lower limit while the difference between the current upper limit of 103% and the reference values is very small. The proposed upper limit of 110% would expand the allowed operating band to minimize unnecessarily declaring the pump inoperable due to a slightly high differential pressure.

f. Relief from the 3 percent limitation will provide an acceptable level of quality and safety and will not endanger the health and safety of the public.

Alternate Testing: The subject pumps shall be tested in accordance with ANSI/ASME OM-6, Table 6100-1.

Relief Request: P-4

Pumps: SW-P-110A, SW-P-110B, SW-P-41A, SW-P-41B, SW-P-41C and SW-P-41D

Code Class: 3

Function: Pumps required to perform a function in shutting down the reactor or in mitigating the consequences of an accident, and are provided with an emergency power source.

Test Requirements: IWP-4200 requires direct pressure measurements. Table IWP-4110-1 acceptable instrument accuracy for pressure measurement.

Basis for Relief:

a) The above listed pumps are vertical turbine pumps with no direct means to obtain the inlet pressure measurements as required by IWP-4200.

b) Plant installed level instrumentation is accurate to ± 0.5% which is within the requirements of Table IWP-4110-1, but total loop accuracy is ± 2.5% which exceeds the requirement of Table IWP-4110-1.

Alternate Testing: The inlet pressure shall be calculated based on water level above the pump inlet using existing plant instrumentation to measure pump suction pressure.

Relief Request:	V-48
Valves:	FW-V99, FW-V216, FW-V357 and CO-V-340
Category:	C
Code Class:	3 and NNS
Function:	Active
Test Requirments:	IWV-3530 (3 months)
Basis for Relief:	Full flow through these normally closed check valves quarterly during power operations would require establishing emergency feedwater flow to the steam generators and would unnecessarily introduce cold water into the steam generators causing thermal shock to the feed nozzles. This is only full flow path for these valves. Thermal shocking of the feed nozzles could lead to their premature failure. Also, introducing the required flow to full-stroke exercise these valves could cause feedwater control problems during operation which could lead to a plant trip.
Alternate testing:	All of these valves shall be full stroke exercised during cold shutdowns. CO-V-340 shall be partially stroked on a quarterly basis.

FIGURE 5.3

VALVE TESTING REQUIREMENTS

SYSTEM - REACTOR COOLANT - LOOP 1 P&ID NO. 805003			
VALVE	RC-V22	RC-V23	RC-V24
COORDINATES	B2	B1	C1
FUNCTION	A	A	A
CODE CLASS	1	1	2
CATEGORY	A	A	A[2]
SIZE (IN.)	12	12	3/4
VALVE TYPE	G	G	S
ACTUATOR	M	M	--
NORM POSIT	C	C	C
LEAK TEST REQ	1	1	2
LEAK TEST REL	X	X	
LEAK TEST ALT	1	1	
EXER TEST REQ	1	1	2
EXER TEST REL	X	X	
EXER TEST ALT	2	2	
F.S. TEST REQ			
POS IND TEST	X	X	
NOTES:	10 11	10 11 61	1
REMARKS:		X	X

Rev. 2

FIGURE 5.3

VALVE TESTING REQUIREMENTS

SYSTEM - REACTOR COOLANT - LOOP 4 P&ID NO. 805006			
VALVE	RC-V887	RC-V888	RC-V889
COORDINATES	B2	B1	C1
FUNCTION	A	A	A
CODE CLASS	1	1	2
CATEGORY	A	A	AC
SIZE (IN.)	12	12	3/4
VALVE TYPE	G	G	S
ACTUATOR	M	M	-
NORM POSIT	C	C	C
LEAK TEST REQ	1	1	2
LEAK TEST REL	X	X	
LEAK TEST ALT	1	1	
EXER TEST REQ	1	1	2
EXER TEST REL	X	X	
EXER TEST ALT	2	2	
F.S. TEST REQ			
POS IND TEST	X	X	
NOTES:	10 11	10 11 61	1
REMARKS:		X	X

Rev. 2

FIGURE 5.3

VALVE TESTING REQUIREMENTS

SYSTEM – CONTAINMENT SPRAY P&ID NO. 805023

VALVE	CBS-V2	CBS-V3	CBS-V5	CBS-V7	CBS-V8	CBS-V9	CBS-V11	CBS-V12	CBS-V14	CBS-V15	CBS-V17	CBS-V18	CBS-V25	CBS-V26	CBS-V31	CBS-V32	CBS-V33	CBS-V38	CBS-V43	CSL-CV112D	CSL-CV112E
COORDINATES	B1	B3	B2	B2	B1	B3	D3	D1	B1	A2	C1	C1	A2	C4	D1	D2	D1	D4	D3	D3	D3
FUNCTION	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
CODE CLASS	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CATEGORY	B	C	B	C	B	C	A	A	B	C	A	A	C	C	B	B	B	B	B	B	B
SIZE (IN.)	12	12	12	12	16	12	6	8	16	12	8	8	16	16	4	4	4	6	6	8	8
VALVE TYPE	G	C	G	C	G	C	G	C	G	C	G	C	C	C	B	B	B	G	G	G	G
ACTUATOR	M	–	M	–	M	–	M	–	M	–	M	–	–	–	P	P	P	M	M	M	M
NORM POSIT	O	C	O	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
LEAK TEST REQ							2	2			2	2									
LEAK TEST REL																					
LEAK TEST ALT																					
EXER TEST REQ	1	3	1	3	1	3	1	3	1	3	1	3	3	3	1	1	1	1	1	1	1
EXER TEST REL		X		X		X		X		X		X	X	X						X	X
EXER TEST ALT		3		3		3		3		3		3	3	3						2	2
F.S. TEST REQ															X	X	X				
POS IND TEST	X		X		X		X		X		X				X	X	X	X	X	X	X
NOTES:		47		47		29		28		29		28	29	29						31	31
REMARKS:							X	X			X	X									

ATTACHMENT 1
TO NYN

Vendor Supplied Pump Curves and
Service Water Pump Trend Data

CERTIFIED J. L. Dumas

DATE 7/27/76

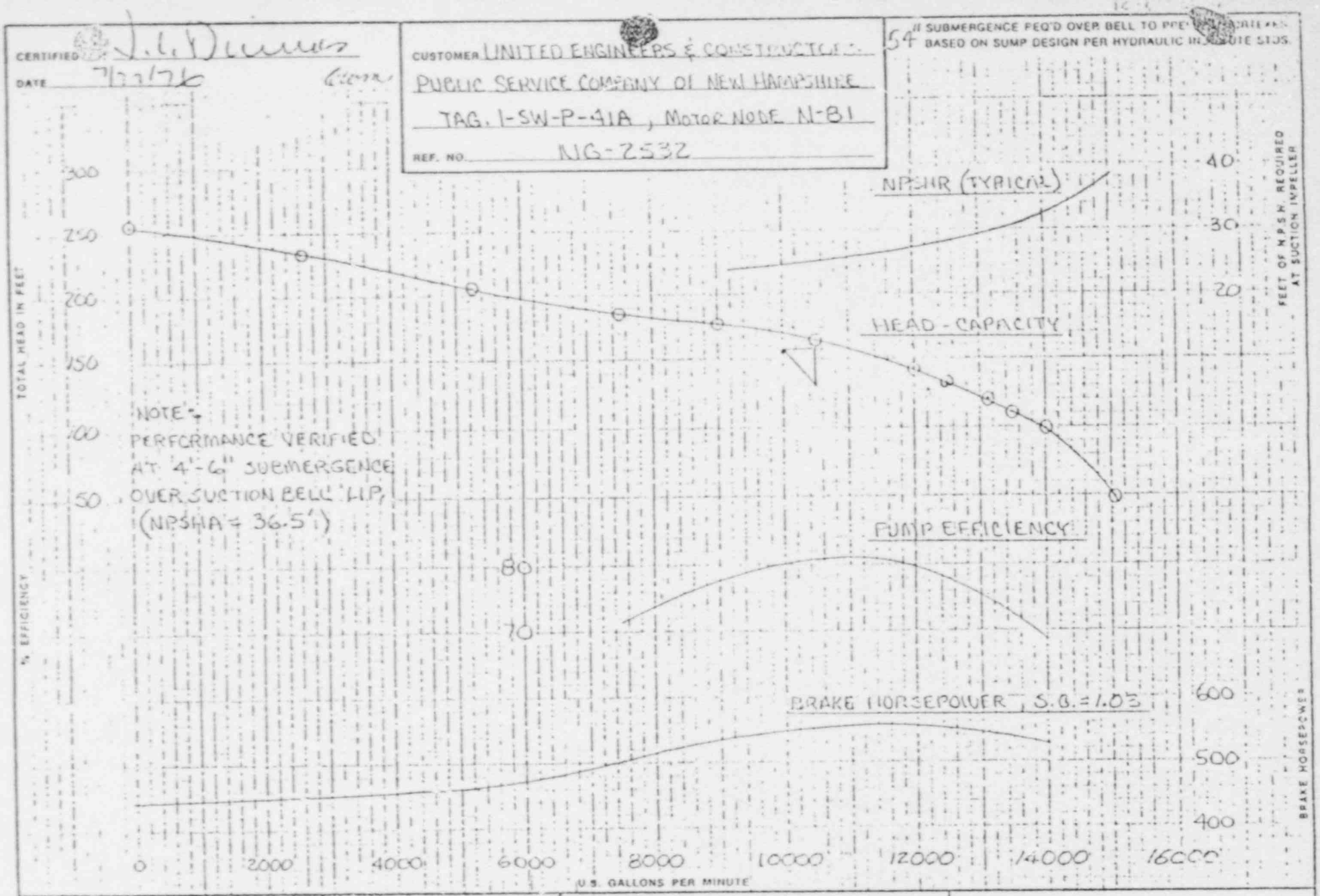
CUSTOMER UNITED ENGINEERS & CONSTRUCTORS

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

TAG. 1-SW-P-91A, MOTOR NOTE N-81

REF. NO. NG-2532

54" SUBMERGENCE REQ'D OVER BELL TO PREVENT VORTEXING BASED ON SUMP DESIGN PER HYDRAULIC INSTITUTE STDS.



THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY. IT IS BASED ON SHOP TESTS WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER ST. STL. DIA 22 3/4"

BOWLS ST. STL.

LIQUID SEA WATER

SP. GR. 1.03

DATE 7/27/76 BY DJ Hayes

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE

2 STAGE 30 DC PUMP

892 R.P.M.

CURVE NO. IC-0252-9

JP-152A

CERTIFIED BY: [illegible]

DATE 7/26/76

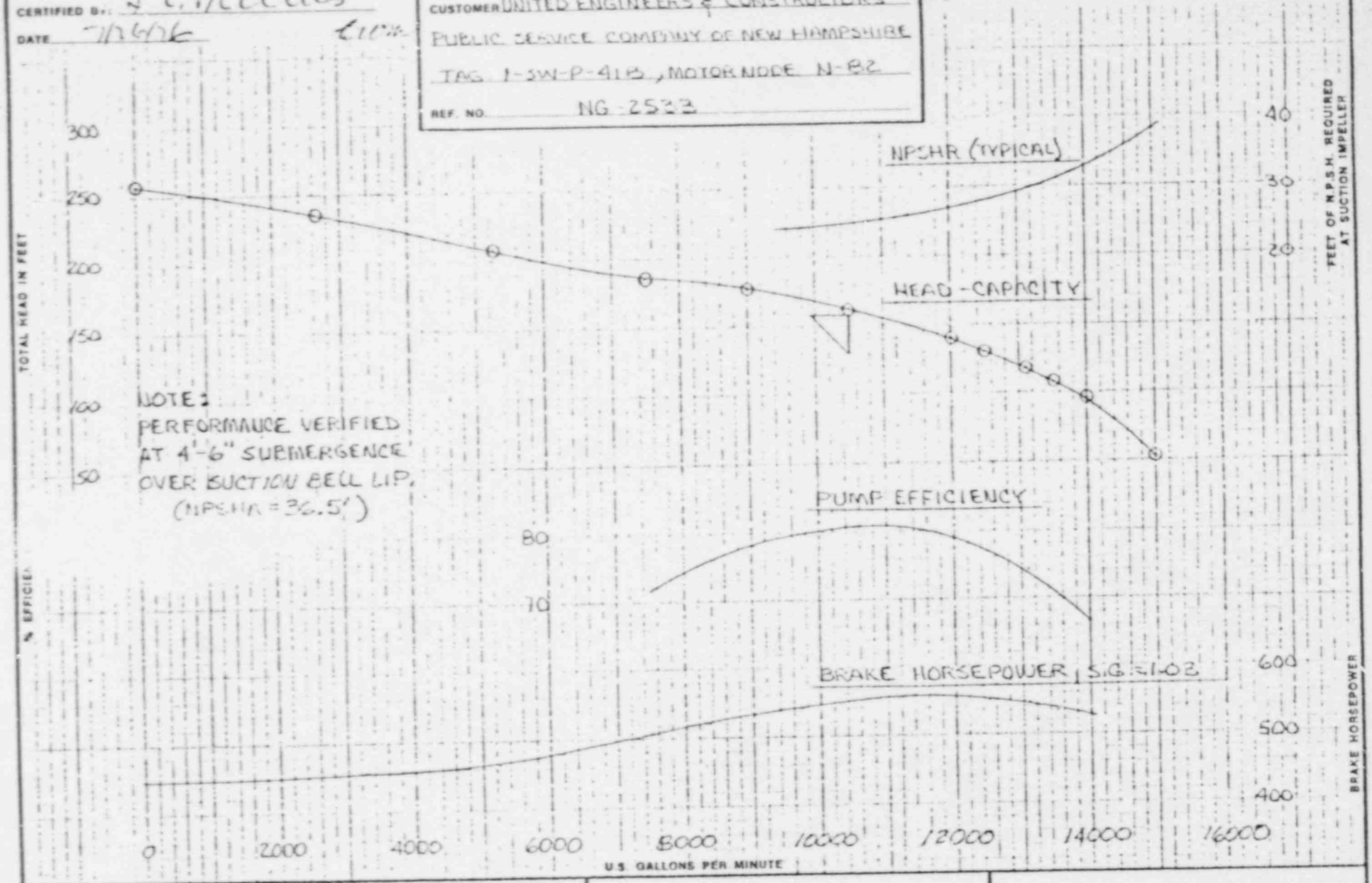
CUSTOMER UNITED ENGINEERS & CONSTRUCTORS

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

TAG 1-SW-P-41B, MOTOR NODE N-82

REF. NO. NG-2523

54" SUBMERGENCE REQ'D OVER BELL TO PREVENT VORTEXES BASED ON SUMP DESIGN PER HYDRAULIC INSTITUTE STDS.



THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY: IT IS BASED ON SHOP TESTS WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER 5T STL DIA 22 3/4"

BOWLS 5T STL.

LIQUID SEA WATER

SP. GR. 1.03

DATE 7-26-76 BY P Meyer

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE

2 STAGE 30DC PUMP

892 R.P.M.

CURVE NO. TC 03530

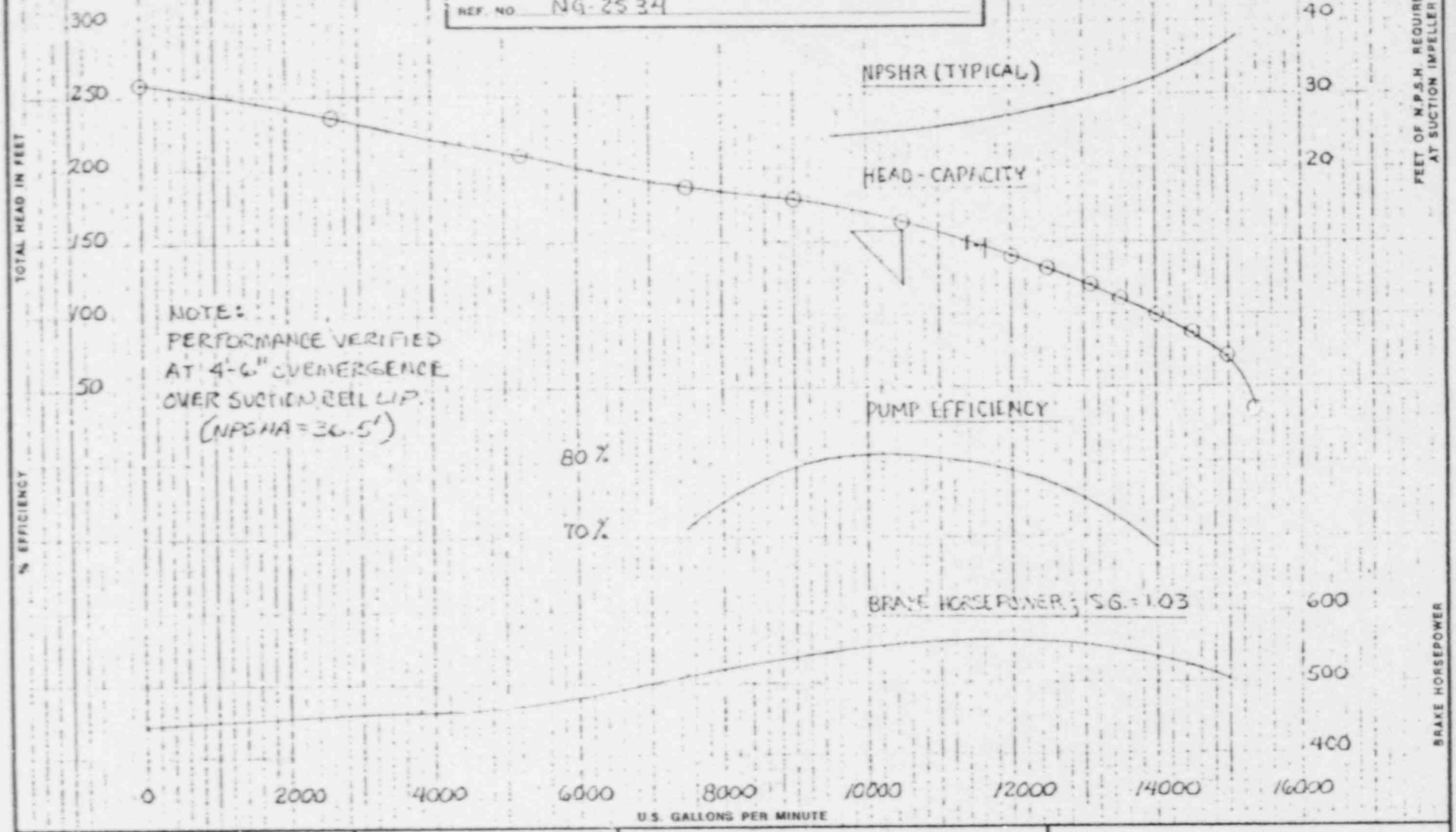
JP-157A

TC-03531

CERTIFIED BY: J. C. Dillon
DATE 7/16/76

CUSTOMER: UNITED ENGINEERS & CONSTRUCTORS
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
TAG. 1-SW-P-41C, MOTOR NODE N-63
REF. NO. NG-2534

51" SUBMERGENCE REQ'D OVER BELL TO PREVENT VORTEXES BASED ON SUMP DESIGN PER HYDRAULIC INSTITUTE STDS.



NOTE:
PERFORMANCE VERIFIED AT 4'-6" SUBMERGENCE OVER SUCTION BELL LIP. (NPSHA = 36.5')

THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY; IT IS BASED ON SHOP TESTS WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER S.T. S.S. DIA 22 3/4
BOWLS S.T. S.S.
LIQUID SEA WATER
SP. GR. 1.03
DATE 7-24-76 BY DAVE HANCOCK

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE
2 STAGE 30DC PUMP
892 R.P.M.
CURVE NO TC-03531

JP-157A

TC-02532

CERTIFIED by _____

DATE 7-26-76

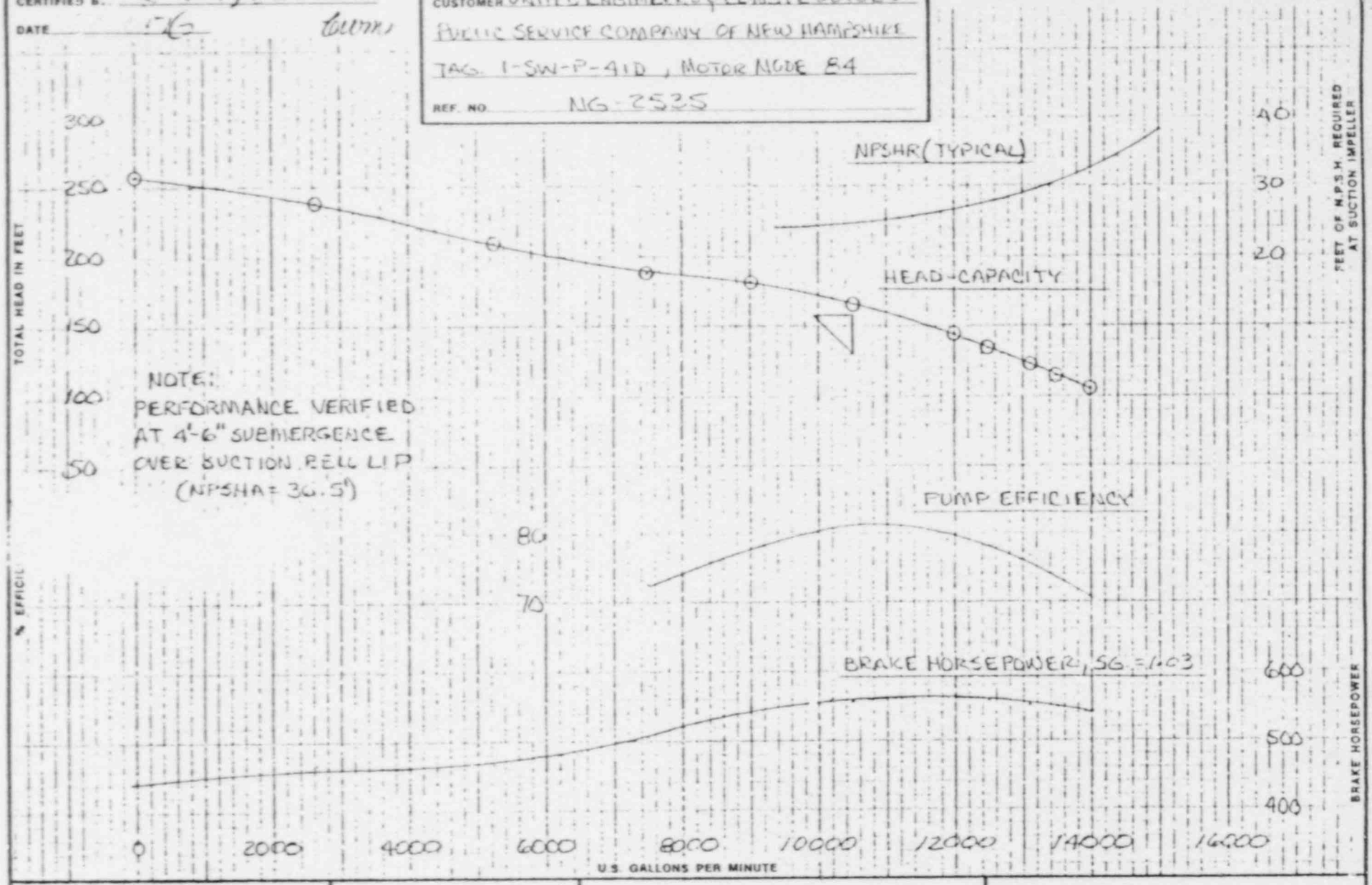
CUSTOMER UNITED ENGINEERS & CONSTRUCTORS

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

TAG. 1-SW-P-41D , MOTOR NODE E4

REF. NO. NG-2525

54" SUBMERGENCE REQ'D OVER BELL TO PREV ORTEXES
BASED ON SUMP DESIGN PER HYDRAULIC INSTITUTE STDS.



THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY. IT IS BASED ON SHOP TESTS. WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER 2T. STL. DIA 22 3/4"
BOWLS ST. STL.
LIQUID SEA WATER
SP. GR. 1.03
DATE 7-25-76 BY J. Ufer

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE
2 STAGE 30DC PUMP
E92 R.P.M.
CURVE NO TC-02532

JP-157A

IC-03595

CERTIFIED L... J. C. Dunn...

DATE 4/2/76

CUSTOMER UNITED ENGINEERS AND CONSTRUCTORS

SERVICE WATER: COOLING TOWER PUMP

SEABROOK NUCLEAR STATION

REF. NO. NG-2528

SUBMERGENCE REQ'D OVER BELL TO PRE... ORTEXES BASED ON SUMP DESIGN PER HYDRAULIC I... ...UTE STDS.

PUMP TAG NO: 1-SW-P-110A

MOTOR NODE NO: NG4

THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY. IT IS BASED ON SHOP TESTS WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER 316 SS DIA 20 3/8"

BOWLS 316 SS

LIQUID WATER

SP. GR. 1.03

DATE 9-22-76 BY J. Meyer

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE

2 STAGE 33 NLC PUMP

1191 R.P.M.

CURVE NO. IC-03595

JP-157A

TC-03594

CERTIFIED BY: J. C. Decker

DATE 9/26/76

CUSTOMER UNITED ENGINEERS AND CONSTRUCTORS

SERVICE WATER COOLING TOWER PUMP

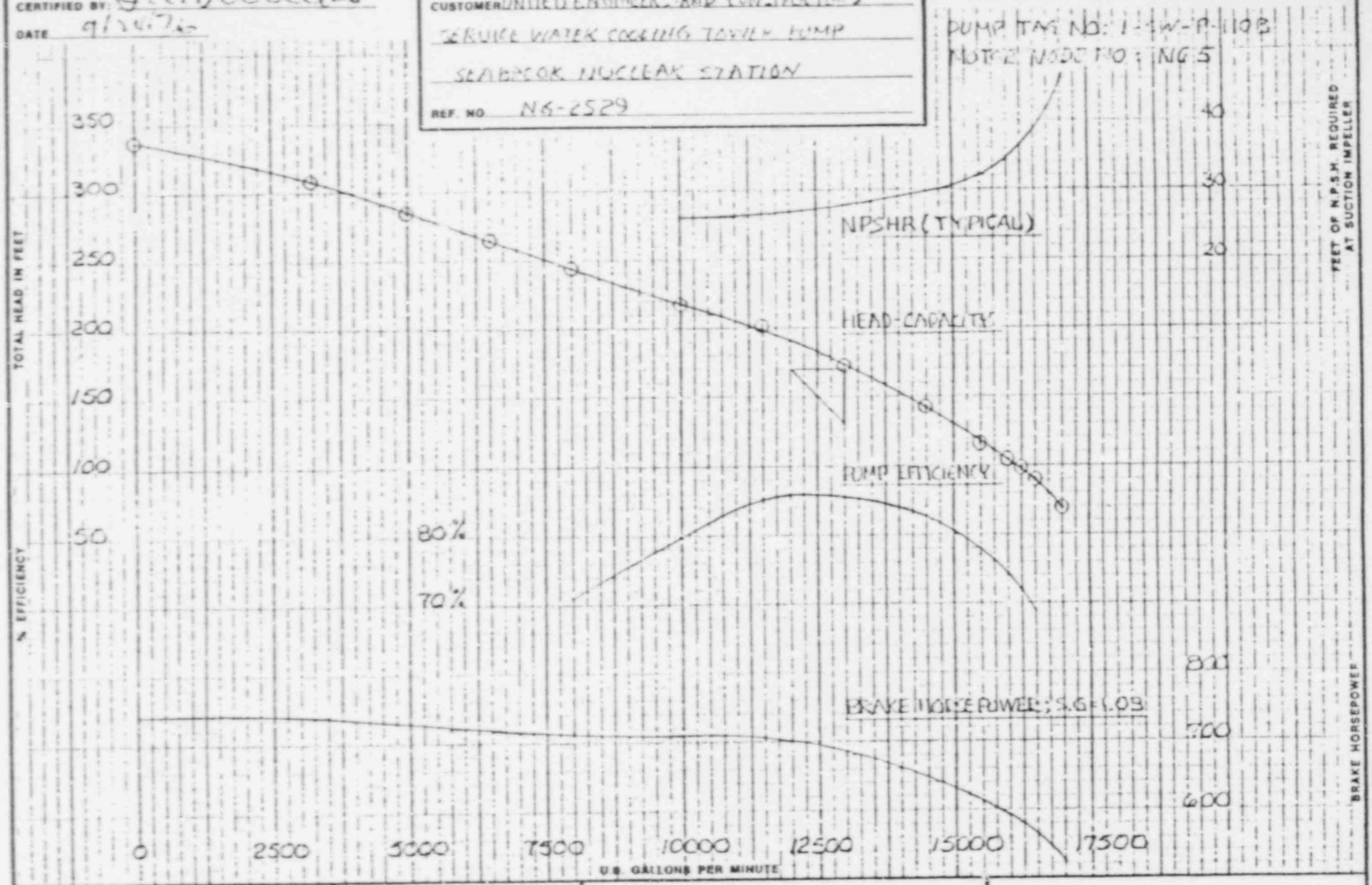
SEABROOK NUCLEAR STATION

REF. NO. NG-2529

SUBMERGENCE REQ'D OVER BELL TO PREV ORTEXES
BASED ON SUMP DESIGN PER HYDRAULIC IN... TUTE STDS.

PUMP TAG NO: 1-SW-P-10B

NOTE: MODEL NO: NG 5



THE CAPACITY, HEAD AND EFFICIENCY GUARANTEE IS FOR THE DESIGNATED POINT ONLY. IT IS BASED ON SHOP TESTS WHEN HANDLING CLEAR, FRESH WATER AT A TEMPERATURE OF NOT OVER 85° F. AND UNDER SUCTION CONDITIONS AS SPECIFIED IN THE CONTRACT.

IMPELLER 31655 DIA 20 3/8"

BOWLS 31655

LIQUID WATER

SP. GR 1.03

DATE 9-23-76 BY DAVE HARTANTO

Johnston Pump Company
Glendora, California 91740
ESTABLISHED 1909

TURBINE PUMP PERFORMANCE

2 STAGE 33NLC PUMP

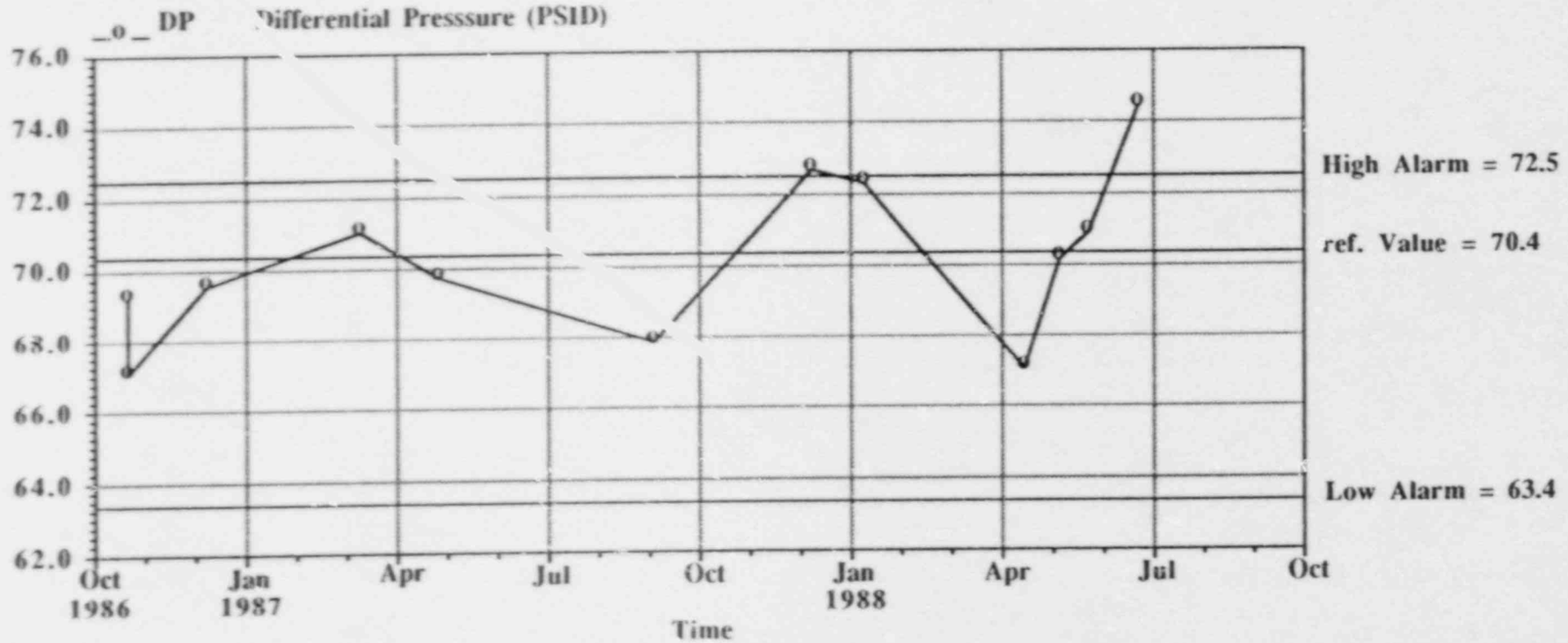
1191 R.P.M.

CURVE NO TC-03594

JP-157A

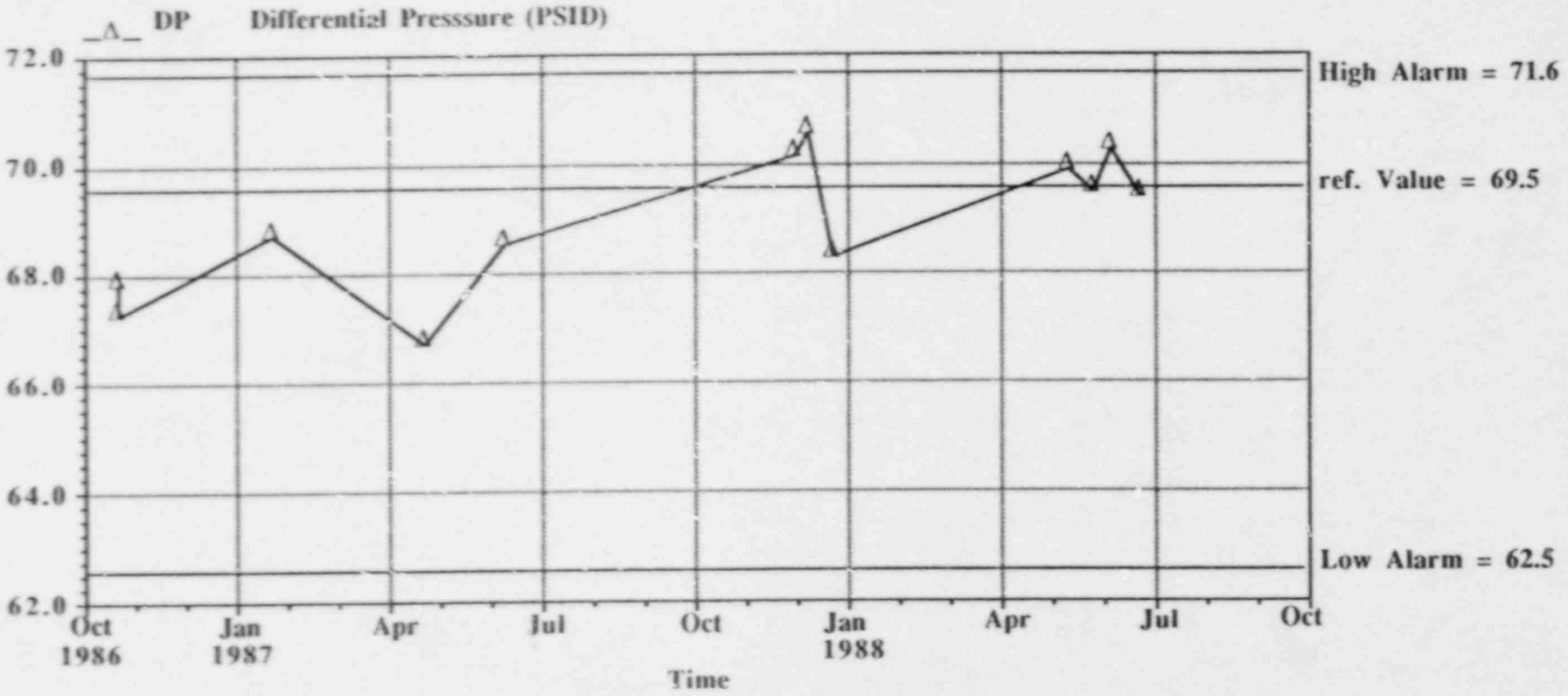
SEABROOK STATION

1-SW-P-110-A
PUMP
TREND



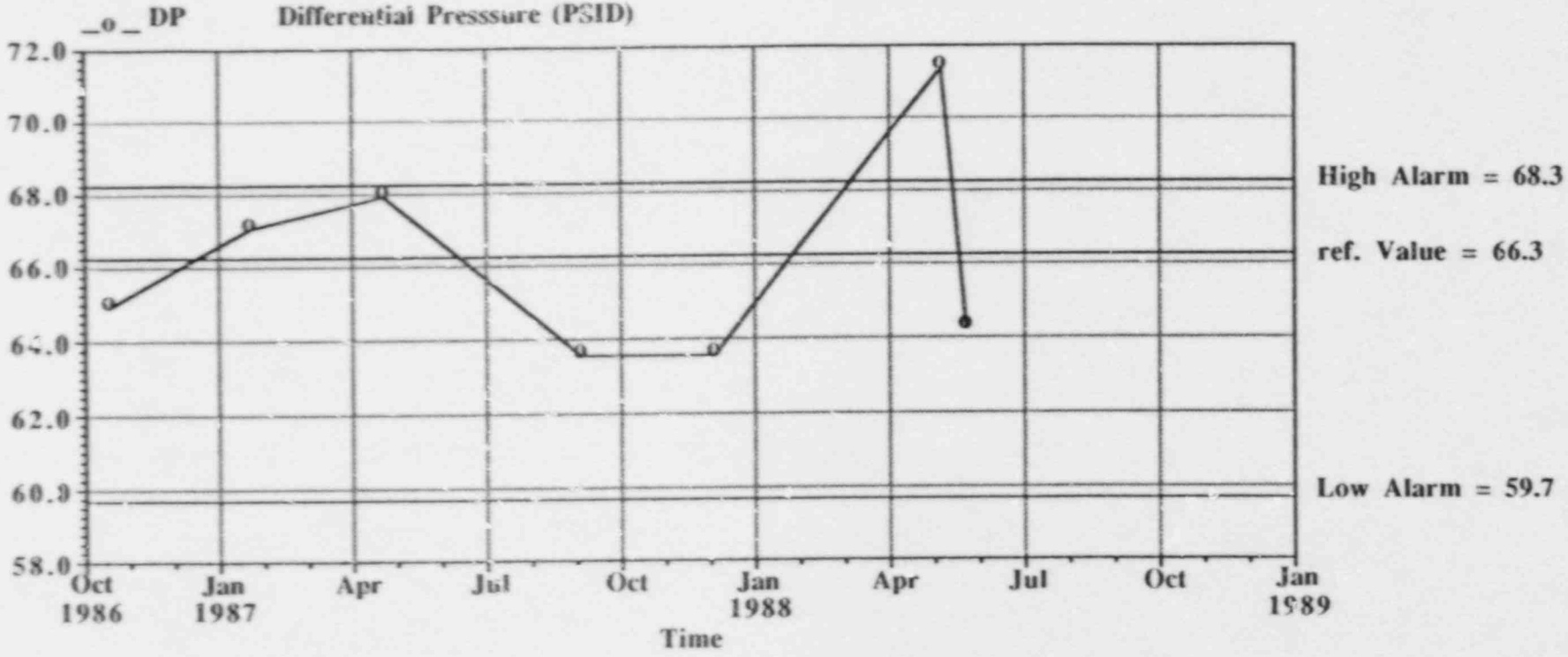
SEABROOK STATION

1-SW-P-110-B
PUMP
TREND



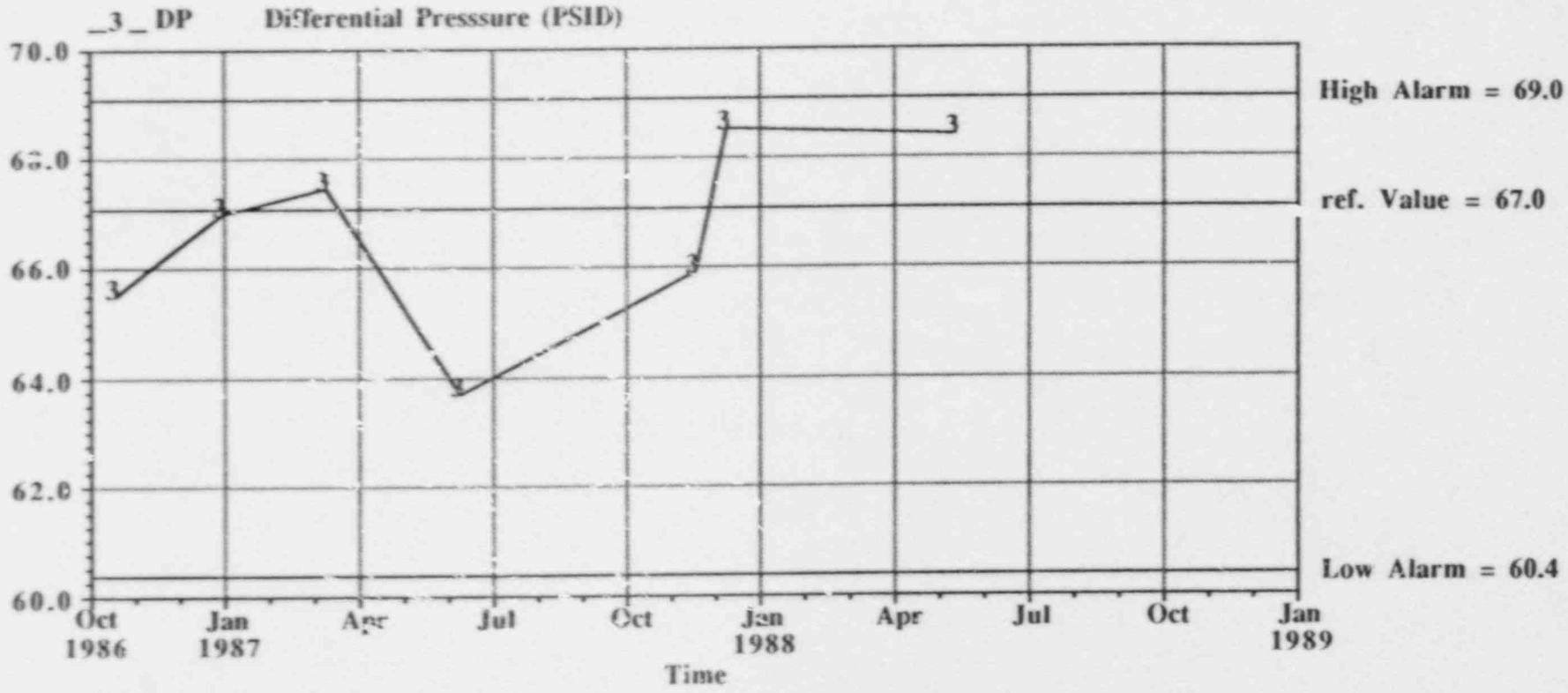
SEABROOK STATION

1-SW-P-41-A
PUMP
TREND



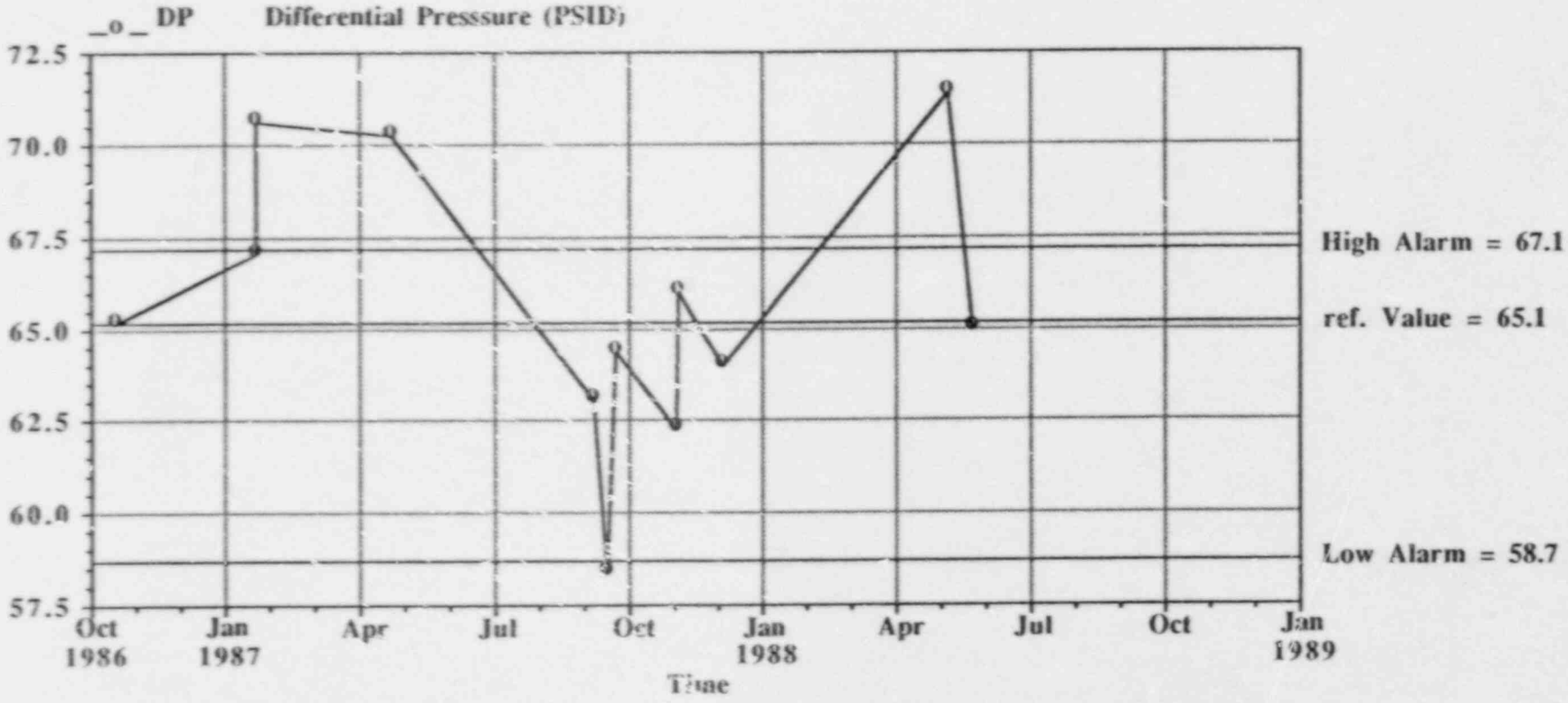
SEABROOK STATION

1-SW-P-41-B
PUMP
TREND



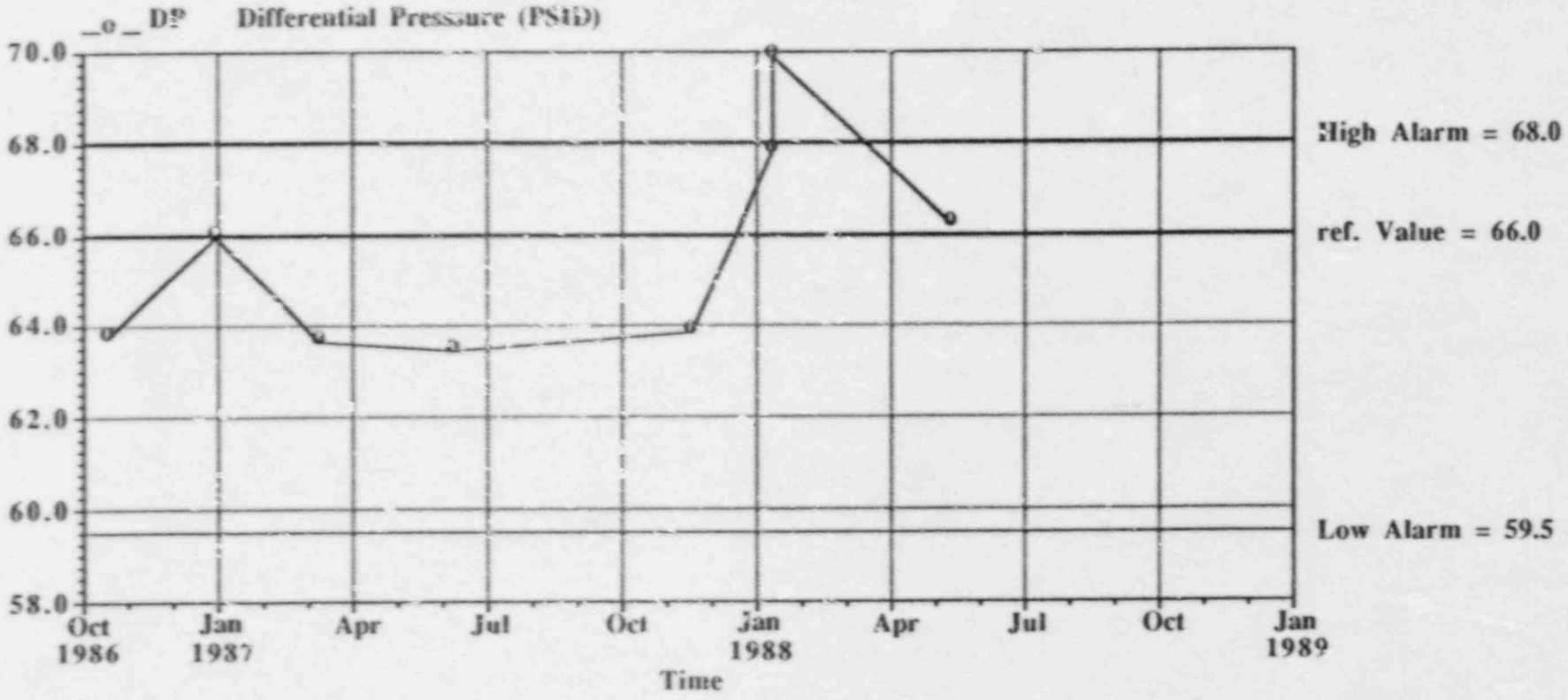
SEABROOK STATION

1-SW-P-41-C
PUMP
TREND



SEABROOK STATION

1-SW-P-41-D
PUMP
Trend



ATTACHMENT 2
TO NYN

New Hampshire Yankee ASME XI IWP
Position on Service Water Relief Request

New Hampshire Yankee Position

Detection of Failure of High Volume/Low Head IST Program Pumps to Achieve Minimum Design Flow Requirements

During a telephone conference call on May 9, 1988, between representatives of NHY and the NRC staff regarding proposed changes to revision 1 of the NHY Inservice Testing Program for Pumps and Valves, a question was raised regarding the potential failure mechanisms for pumps that would be characterized by a degradation in hydraulic performance without an associated rise in component vibration identifying the developing failure. Further, the specific concern was whether the possibility existed for a pump to be operating near the lower end of its ASME XI IWP allowed performance band when in fact an imminent failure would render it incapable of delivering the minimum design flow required in a worst case accident scenario. Engineering evaluation and discussions with the vendor have concluded that due to the large margin available above the minimum design requirements, there is no known hydraulic failure mechanism resulting in a rapid failure of the SW system pumps, rendering them incapable of delivering the minimum design required head and flow, which would not be preceded by symptomatic vibration readings. This evaluation is discussed in greater detail below.

The relief request in question pertained to raising the upper limit for Total Developed Head for high volume/low head pumps in the Primary Component Cooling Water (PCCW) and Service Water (SW) systems. There were a total of ten pumps affected by this relief request, six of which are two stage, deep draft, vertical line shaft pumps and four of which are single stage, horizontal, centrifugal pumps.

The horizontal PCCW pumps have since been removed from the relief request pending an analysis to determine actual system performance above the design margin. For the deep draft SW system pumps (including the Cooling Tower Pumps), vibration monitoring is performed at the driver end of the pump which is significantly removed from the submerged pump impellers. For this reason, it cannot be assumed that all pump hydraulic degradation for the SW pumps would initially be detected by vibration monitoring. However, due to the large available margin for the SW system pumps above the minimum design requirements, vibration monitoring will easily detect a developing failure and render the pump inoperable due to high vibration readings well before the pump approaches the design required flow or differential pressure. This is because there would have to be extreme degradation of pump performance before the design limits would be approached.

Therefore, vibration monitoring combined with monitoring the hydraulic performance of these pumps does provide reasonable assurance that they are always capable of supplying at least the minimum required design flow. Surveillance testing demonstrates that there is adequate margin between the test point and the minimum required hydraulic design requirements even when allowed degradation, test data scatter and cumulative instrument errors are

factored into the calculation. Per Request for Engineering Services, (RES) 88-0186, NHY has determined that the minimum required design performance requirements for the SW system pumps are as follows:

	Head	Flow
Service Water Pumps		
SW-P-41A - D	34.9 psid	8,700 gpm
Cooling Tower Pumps		
SW-P-110A and B	47.1 psid	11,360 gpm

These performance requirements were calculated using the following assumptions and information:

a) System fouling at the maximum design allowance
b) Suction pressure (tide or tower basin level) at minimum
c) Simultaneous Loss of Coolant Accident (LOCA) and Loss of Offsite Power (LOOP)
d) Design calcuation 4.3.8-72F, a computer program providing an iterative solution of Bernoulli's equation adjusted for actual performance results observed during startup testing.
e) Design calcuation 4.3.8-57F identifying the cooling requirements for individual components cooled by the SW system.

Calculation 4.3.8-57F, was used to determine the minimum design required flow based on the sum of the individual cooling flow requirements for each component. Calculation 4.3.8-57F was used to identify the minimum pump head required to deliver this design flow rate assuming the worst case conditions identified in (a) through (c) above.

These components are tested at the following reference conditions:

	Head	Flow
Service Water Pumps		
SW-P-41A	66.3 psid	11,500 gpm
SW-P-41B	67.1 psid	11,500 gpm
SW-P-41C	65.2 psid	11,500 gpm
SW-P-41D	66.1 psid	11,500 gpm
Cooling Tower Pumps		
SW-P-110A	70.4 psid	13,000 gpm
SW-P-110B	69.6 psid	13,000 gpm

As can be seen from the above figures, the worst case minimum operating parameters are significantly above the design requirements even when 7% pump wear, test data scatter and cumulative instrument errors are considered.

Based on these margins, there is no failure mechanism which would cause degradation in the hydraulic performance of the SW pumps in question which could result in a pump satisfactorily passing all surveillance requirements while being unable to achieve minimum design flow requirements.

This evaluation has been reviewed with Mr. Ron Low of Johnston Pumps (1-800-227-2601) on July 1, 1988 and he has concurred with the conclusions reached.