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

Gentlemen:

Subject: Docket No. 50-206
Auxiliary Feedwater Pump G10W, 48-Hour Endurance Run
San Onofre Nuclear Generating Station
Unit 1

By letter dated November 15, 1979, the NRC provided recommendations regarding the Auxiliary Feedwater (AFW) system at San Onofre Unit 1. In response to one of these recommendations, SCE performed endurance testing of the two existing AFW pumps. The test results were provided to the NRC by letter dated February 14, 1980. The purpose of this letter is to provide to you similar information regarding endurance testing of the new AFW pump (G10W) which has been installed as part of elimination of single failure susceptibilities in the AFW system. Based on this testing, the new AFW pump can run continuously for 48 hours (minimum) without exceeding design limits with respect to bearing/bearing lube oil temperatures.

If you have any questions regarding the enclosed information or require additional information, please let me know.

Very truly yours,

Enclosures

cc: J. B. Martin, Regional Administrator, NRC Region V
F. R. Huey, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

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The following information provides a summary of the conditions and results of the 48-hour endurance test of the third Auxiliary Feedwater pump, G10W.

1. Provide a brief description of the test method (including flow schematic diagram) and how the test was instrumented (i.e., where and how bearing temperatures were measured).

Response:

Section 8.11, "Pump G10W Forty Eight Hour Endurance Run," of Preoperational Test Procedure S01-XVI-9.3364.0.1 was developed to establish test methodology and acceptance criteria for bearing and lube oil temperatures and vibration levels. The acceptance criteria were derived from the pump and pump driver manufacturer instruction manuals and pump head curves, or from similar test criteria which have been developed for the In-Service Pump Testing Program performed in compliance with ASME Boiler and Pressure Vessel Code, Section XI requirements.

Pump bearing lube oil temperatures were measured utilizing surface pyrometers which were inserted into thermal wells at the outboard bearing and lube oil cooler inlet and outlet piping. Pump inboard bearing temperatures were obtained using a surface pyrometer on the bearing caps. Motor bearing temperatures were obtained by reading the normally installed temperature elements using fluke multi-meters. Wahl Model 392 MX Platinum Pyrometers were used for the surface pyrometer. Vertical, horizontal and axial (where possible) vibration readings were measured with an IRD Model 308 vibration analyzer at the pump and motor inboard and outboard bearings as shown in Figure 1.

Pump G10W was operated for at least 48 hours using the full flow recirculation path from and to the Auxiliary Feedwater Tank as shown on Figure 2. At the conclusion of the 48 hour endurance run, the pump was stopped and allowed to cool down. Approximately 39 hours later, G10W was restarted and a one hour operability run was conducted.

2. Provide a discussion of how the test conditions (pump flow, head, speed and steam temperature) compare to design operating conditions.

Response:

Pump G10W was operated at discharge pressure and flow conditions which are representative of design operating conditions. The established flow rate of approximately 390 gpm for this test is at the upper limits of the full flow recirculation line and was determined to be an optimum range of pump and driver operation.

3. Provide plots of bearing/bearing oil temperature versus time for each bearing of the AFW pump/driver demonstrating that temperature design limits were not exceeded.

Response:

Pump and driver bearing temperatures were recorded throughout the endurance test. Plots of bearing and bearing lube oil temperatures (pump and driver) versus time for the AFW pump are shown on Figures 3, 4 and 5. A tabulation of these results was extracted from the endurance run test procedure and is provided as Enclosure 2. All bearing and lube oil temperature readings remained within the acceptance criteria during the endurance tests. The acceptance criteria were as follows:

1. Motor bearing temperature not exceeding 194°F,
2. Pump bearing lube oil temperature not exceeding 155°F, and
3. Lube oil temperature out of the lube oil cooler not exceeding 128°F.

4. Provide a plot of pump room ambient temperature and humidity versus time demonstrating that the pump room ambient conditions do not exceed environmental qualification limits for safety-related equipment in the room.

Response:

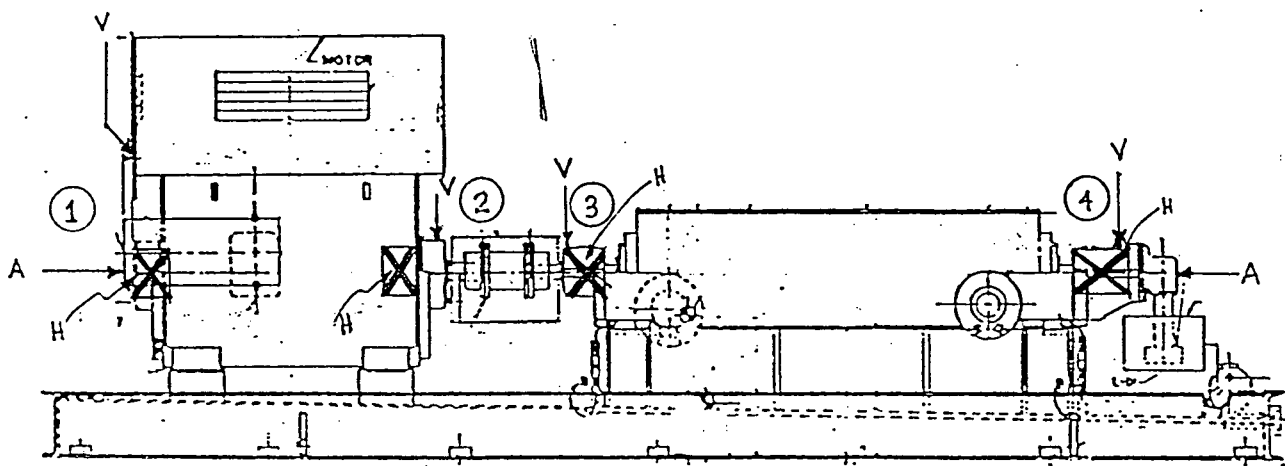
AFW pump G10W is located outside in an open area adjacent to the primary makeup tank and the Dedicated Safe Shutdown diesel generator. Therefore, ambient conditions (temperature, humidity) are not substantially affected by AFW pump operation. Actual temperature and humidity conditions were not measured during the endurance testing.

5. Include a statement confirming that the pump vibration did not exceed allowable limits during tests.

Response:

Pump and driver bearing vibration readings were recorded throughout the endurance test and are provided in Enclosure 2. All vibration readings remained within the 1.0 mil amplitude peak-to-peak acceptance criteria.

Figure 1
Guide to Obtaining G10W Bearing
Vibration Data



1. Motor Outboard
2. Motor Inboard
3. Pump Inboard
4. Pump Outboard

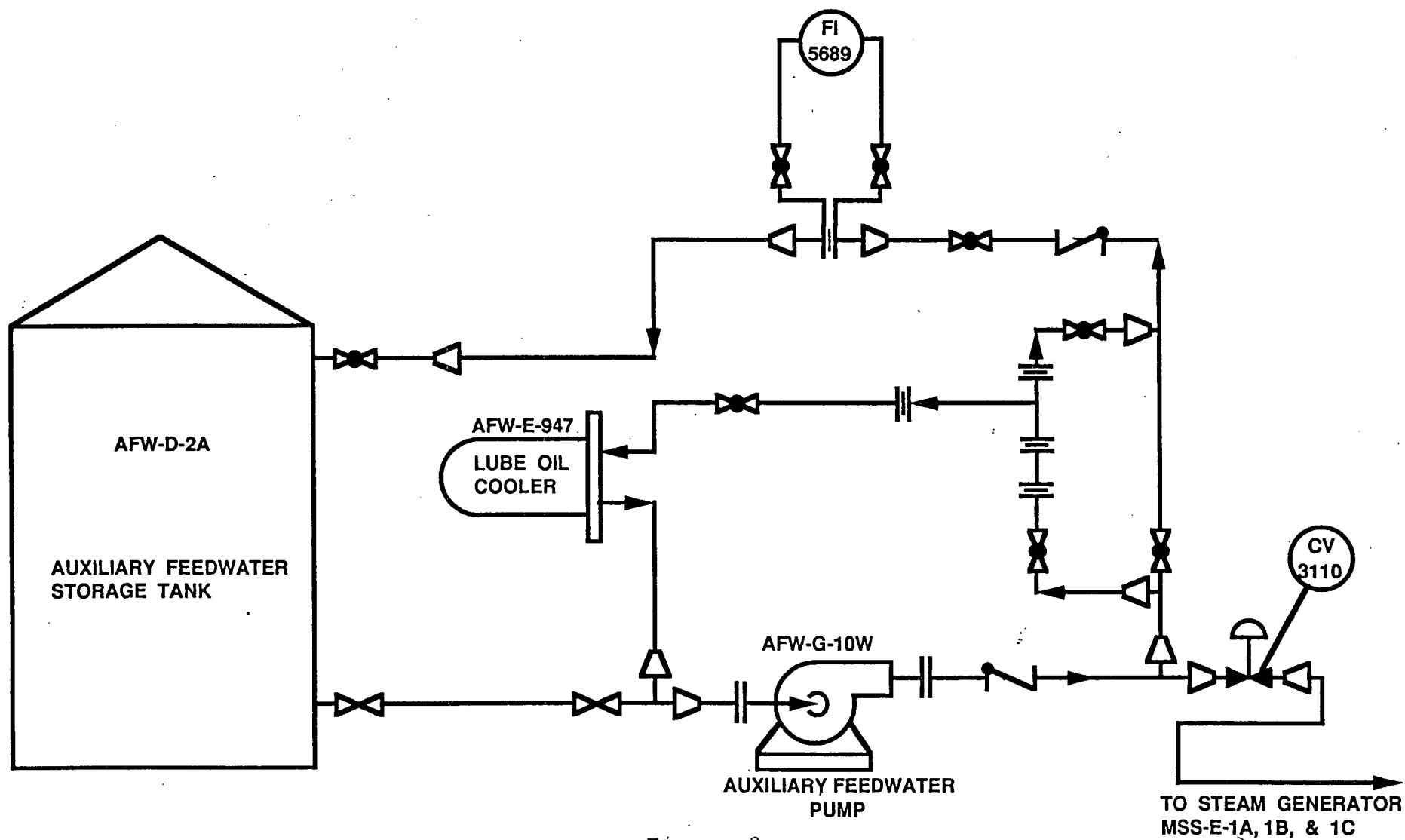


Figure 2

AUXILIARY FEEDWATER PUMP G-10W ENDURANCE TEST FLOW PATH

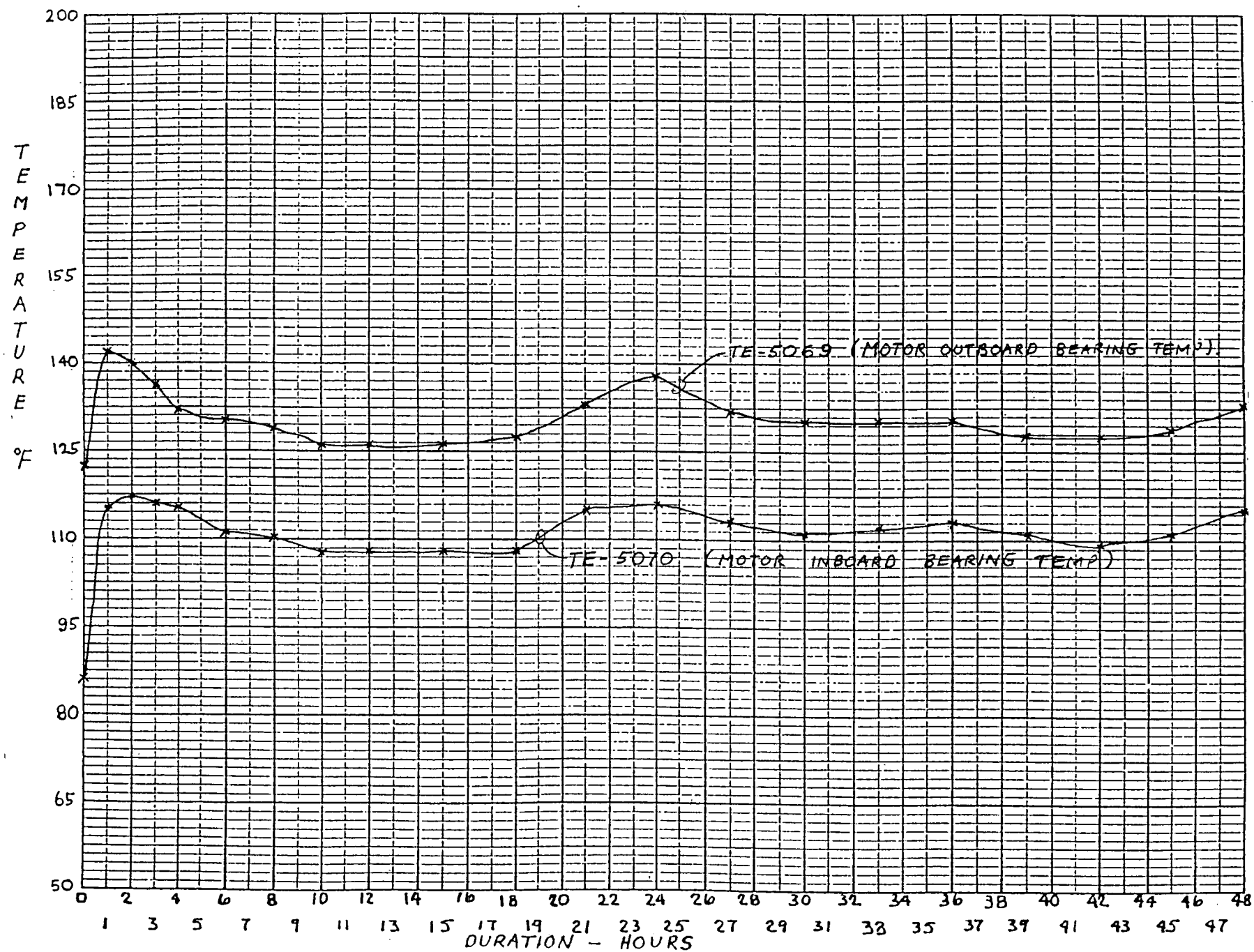


Figure 3
G10M Endurance Run Data - Plot of Motor Bearing Temperatures
(TE-5069 and TE-5070)

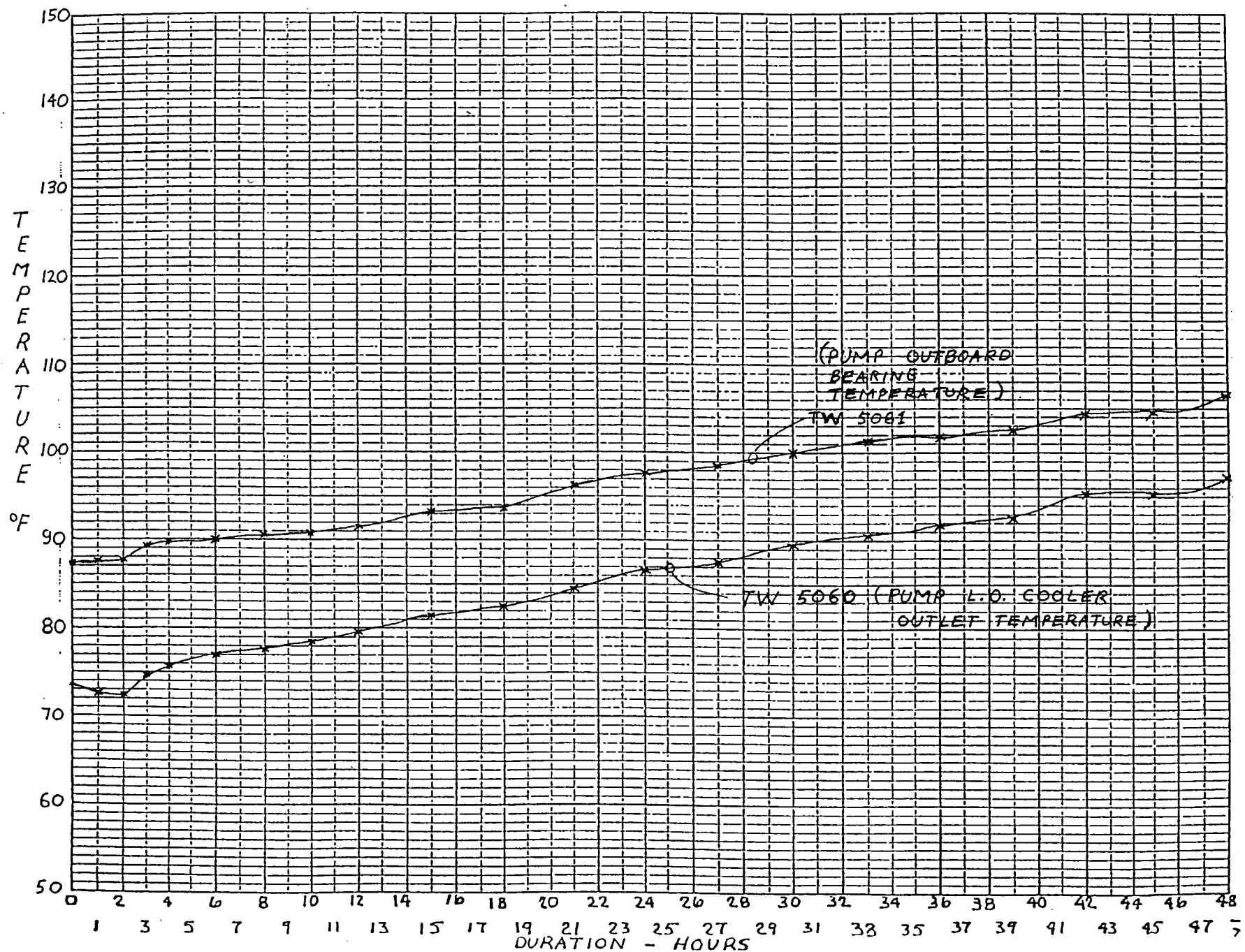


Figure 4
G10W Endurance Run Data - Plot of Pump Bearing Lube Oil Temperature
(TW-5060 and TW-5061)

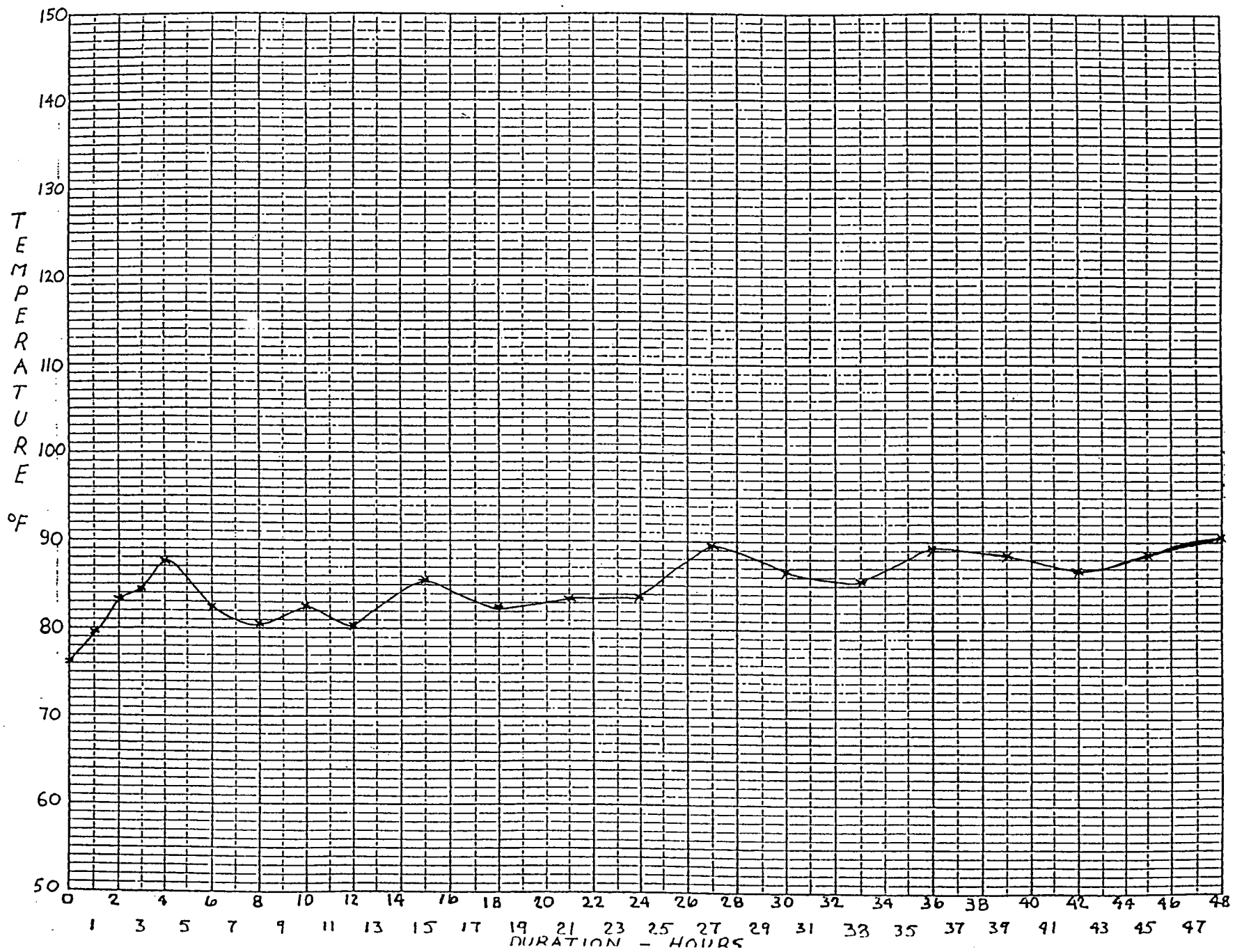


Figure 5
G10W Endurance Run Data - Plot of Pump Inboard Bearing Temperature

Enclosure 2

G10W Endurance Run
Data Record

ATTACHMENT 10.10

O		10.97	10.20	AUXILIARY FEEDWATER PUMP GLOW ENDURANCE RUN DATA RECORD																		m	
		122	86	73.2	87.6	76.2	11.5	1040	390	7.5	42	61.1	.037	.035	.040	.10	.14	.35	.47	.25	.38	.64	1/31/89
(Hrs)	*Motor Bearing	Pump Bearing Lube	M&TE Temp	Suction	Discharge	GLOW Flow	Lube Oil	LO Cooler	Pump Vibration	Motor Vibration	PERF./												
Time	Temp (Ohms/°F)	Oil Temp (°F)	Indicator	Pressure	Pressure	(GPM)	Inlet	Water Inlet	(Mils)	(mils)	DATE												
	TE-5069	TE-5070	TE-5060	TE-5061	Inboard	PI-5650	PI-5651	Pressure	PI-5658	PI-5659	H	V	A	H	V	A	H	V	A	H	V		
			TW	TW	Bearing			PI-5063		TW													
1	11.34	10.80																				DEB	
	142	115	72.9	87.7	79.7	10.0	1040	390	7.6	41	61.7	.035	.030	.032	.10	.15	.35	42	.24	.40	.64	1/31/89	
2	11.32	10.85																				DEB	
	140	117	72.4	87.7	83.2	9.0	1040	390	7.6	41	61.9	.035	.030	.032	.10	.15	.35	42	.23	.36	.64	1/31/89	
3	11.24	10.83																				DEB	
	136	116	74.9	89.2	84.4	7.0	1040	390	7.6	37	64.5	.035	.030	.032	.10	.14	.34	45	.25	.40	.64	1/31/89	
4	11.16	10.80																				DEB	
	132	115	75.8	89.8	87.5	7.0	1040	390	7.6	38	65.3	.035	.030	.040	.10	.14	.40	45	.23	.40	.64	1/31/89	
6	11.10	10.74																				DEB	
	130	111	77.0	90.0	82.3	6.9	1040	390	7.6	38	66.7	.040	.030	.050	.10	.16	.36	45	.24	.39	.63	1/31/89	
8	11.08	10.70																				DEB	
	129	110	77.8	90.4	80.4	6.9	1040	390	7.6	38	67.8	.040	.035	.040	.10	.15	.36	44	.24	.41	.64	1/31/89	
10	11.03	10.66																				DEB	
	126	108	78.7	90.8	82.5	6.9	1040	390	7.6	39	69.0	.040	.035	.045	.10	.15	.36	44	.24	.40	.64	2/1/89	
12	11.02	10.65																				DEB	
	126	108	79.8	91.7	80.1	6.9	1040	390	7.6	41	70.0	.045	.035	.045	.11	.16	.37	44	.24	.40	.64	2/1/89	
15	11.03	10.65																				DEB	
	126	108	81.6	93.1	85.5	6.9	1040	390	7.8	44	71.5	.040	.040	.045	.12	.17	.38	45	.26	.44	.64	2/1/89	
18	11.05	10.65																				DEB	
	127	108	82.6	93.9	82.5	7.0	1040	390	7.8	45	73.0	.040	.035	.040	.10	.15	.33	42	.24	.37	.60	2/1/89	

* Use Attachment 10.10.1 to determine equivalent temperature from measured resistance.

ATTACHMENT 10.10

ATTACHMENT 10.10
AUXILIARY FEEDWATER PUMP GLOW ENDURANCE RUN DATA RECORD

(Hrs) Time	*Motor Bearing Temp (Ohms/°F)	Pump Bearing Lube Oil Temp (°F)	M&TE Temp Indicator (°F) Pump	Suction Pressure (psig)	Discharge Pressure (psig)	GLOW Flow (GPM)	Lube Oil Inlet Pressure (psig)	LO Cooler Water Inlet (°F)	Pump Vibration (Mils)	Motor Vibration (mils)	PERF./ DATE					
	TE-5069	TE-5070	TI-5060 TW-5060	TI-5061 TW-5061	Inboard PI-5650	PI-5651	FI-5689 PI-5063	Pressure (psig)	PI-5658 TW-5659	Outboard H V A	Inboard H V	Outboard H V A	Inboard H V			
21	11.19 133	10.81 115	84.7	96.1	93.4	7.0	1040	388	7.7	46	75.0	.04 .03 .03	.10 .18 .34	.42 .24 .38	.12	2/1/89
24	11.26 138	10.82 116	86.5	97.6	93.5	7.0	1040	388	7.7	47	77.3	.04 .03 .04	.10 .15 .34	.42 .25 .38	.62	2/1/89
27	11.15 132	10.77 113	87.8	98.5	89.5	6.9	1025	387	7.7	48	78.8	.038 .026 .05	.10 .14 .34	.42 .24 .38	.61	2/1/89
30	11.11 130	10.74 111	89.3	100.0	86.3	6.9	1025	387	7.7	48	80.6	.038 .025 .032	.10 .14 .35	.44 .24 .38	.64	2/1/89
33	11.11 130	10.73 112	90.5	101.1	85.4	6.9	1025	387	7.7	48	82.1	.04 .03 .04	.10 .15 .34	.45 .23 .39	.61	2/1/89
36	11.12 130	10.77 113	91.8	101.9	89.2	6.9	1025	387	7.7	48	83.7	.04 .03 .04	.11 .16 .36	.45 .25 .41	.63	2/2/89
39	11.07 128	10.74 111	92.9	102.7	88.3	7.0	1025	387	7.7	48	84.9	.042 .025 .04	.10 .15 .36	.45 .25 .38	.64	2/2/89
42	11.06 127	10.67 109	95.1	104.3	86.5	7.0	1025	387	7.7	48	86.6	.04 .035 .028	.10 .14 .34	.42 .24 .34	.60	2/2/89
45	11.09 129	10.74 111	95.1	104.6	88.8	6.9	1030	388	7.7	48	87.8	.04 .032 .035	.095 .14 .33	.40 .25 .38	.61	2/2/89
48	11.18 133	10.80 115	97.1	106.5	90.3	7.0	1030	388	7.8	49	89.7	.04 .034 .038	.08 .13 .34	.42 .24 .37	.64	2/2/89

* Use Attachment 10.10.1 to determine equivalent temperature from measured resistance

ATTACHMENT 10.10

OFFICIAL TEST COPY

ATTACHMENT 10.10
AUXILIARY FEEDWATER PUMP GLOW ENDURANCE RUN DATA RECORD

(Hrs) Time	*Motor Bearing Temp (Ohms/°F)		Pump Bearing Lube Oil Temp (°F)		M&TE Temp Indicator (°F) Pump	Suction Pressure (psig)	Discharge Pressure (psig)	GLOW Flow (GPM)	Lube Oil Inlet Pressure (psig)	LO Cooler Water Inlet (°F)	Pump Vibration (Mils)			Motor Vibration (mils)			PERF./ DATE	
	TE-5069	TE-5070	TI-5060	TI-5061	Inboard Bearing	PI-5650	PI-5651	FI-5689	PI-5658	PI-5659	H	V	A	H	V	A		
0845 **0	10.53 98.6	10.10 77	90.5	99.5	78.9	7.0	1020	394	7.6	48	84.7	.03	.02	.02	.08	.12	.34	cm 2/4/89
0945 1	11.07 122	10.72 104.0	920	101.8	80.6	6.9	1020	394	7.7	48	85.0	.03	.03	.035	.09	.13	.34	cm 2/4/89

* Use Attachment 10.10.1 to determine equivalent temperature from measured resistance.

** One hour operability run.

IRD F2-10110 Due 6/19/89
Wahl I2- 8161 Due 3/29/89
Fluke I2- 8821 Due 2/12/89

OFFICIAL TEST COPY

GLOW MOTOR BEARING RTD'S
(TE-5069 AND TE-5070)
TEMPERATURE VS. RESISTANCE GRAPH

