APPENDIX C

Test Procedure

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

PLANT PROCEDURES MANUAL

WNP-2

PROCEDURE NUMBER	APPROVED	DATE
*8.2.92		03/20/85
VOLUME NAME		
8	OPERATING AND ENGINEERING TEST PROCEDURES	
SECTION		
8.2	POWER ASCENSION TEST PROGRAM	
TITLE		
*8.2.92	ULTIMATE HEAT SINK PERFORMANCE	

8.2.92.1 Purpose

It is the objective of the Ultimate Heat Sink (UHS) performance test to determine the drift loss characteristics of the spray ponds. This confirmatory drift loss testing has been committed to the NRC to verify the conservatism of the upper bound drift loss used in FSAR Safety Analyses (9.2.5). The UHS must contain a 30-day supply of water without makeup.

8.2.92.2 Discussion

Drift loss characteristics are determined by measuring total water loss directly, spray evaporation indirectly, and by calculating surface evaporation. Leakage is determined from total water loss measurements without spraying by subtracting surface evaporative losses.

The testing is performed during relatively high winds (average greater than 6 mph) since drift losses then become an important water loss mechanism.

Pond level measurements are taken with hook gauges to determine total water loss, and spray evaporation is determined by measuring the cooling range of the sprays and calculating evaporation from the range and flow rate. Surface evaporation is calculated from the meteorological and surface temperature data.

The results of this test are expressed as drift loss as a function of wind speed. If the results remain below the upper bound value used in the FSAR safety analysis, no additional analyses will be required. If the new data shows drift losses greater than the previous upper bound, further safety evaluation analyses will be required to determine the impact on UHS capability to meet functional criteria (30-day water supply requirement).

8.2.92.3 Acceptance Criteria

A. Level 1

Not Applicable

B. Level 2

Drift loss at the design wind speed of 6.91 mph (RMS average over 30 days for worst water loss meteorology) is less than or equal to 1.02% of spray flow rate.

8.2.92.4 References

A. Regulatory Guide 1.27

B. FSAR Section 9.2.5

C. WNP-2 Safety Evaluation Report Section 2.4.5

D. 1979 Ultimate Heat Sink Spray System Test Results Report, WPPSS-EN-81-01

E. WNP-2 Spray Pond Drift Loss Test Plan

F. Plant Operating Procedure PPM 2.4.5, Standby Service Water System

8.2.92.5 Materials, Tools, Test Equipment and Temporary Installations

A. Two Weather Measure meteorology stations, or equivalent:

1. Cup anemometer (Model W103-3SS), with signal conditioning module MD103-HF. Accuracy to be greater of ± 0.15 mph or 1%.

2. Vane (Model W104-2), with signal conditioning module MD104-540. Threshold 0.75 mph or less, and resolution 0.72 degree or less.

3. Wet and dry bulb temperature unit (Model R020-10). Accuracy ± 0.5°C.

4. Power Supply Module MD910

5. Anemometers and wind vanes to be not more than 15 feet above the ground.

B. Fifty-six (56) catch pans nominally three feet in diameter, with one 2 inch inside diameter drain pipe at apex of pan. Each catch pan to be put inside an inflated automotive tire innertube for floatation. A thermocouple will be attached to each catch pan to measure water temperature as it leaves the catch pan.

C. Hook gauge and stilling well, accuracy to 0.001 foot. One required for each pond.

D. Data logger (Doric Model 220-100.04 or equivalent) with 100 channel capability and loop temperature resolution of ± 0.5°F, sampling speed two channels/second. The data logger will record the temperatures measured by the thermocouples.

E. Strip chart recorder suitable for continuous recording of wind speed and direction data.

F. Surface temperature measurement thermocouples mounted in an innertube or other suitable floatation device with thermocouple tip at least 3" but not more than 9" deep in water. Ten required (see Figure 1).

G. Discharge water temperature measurement thermocouples (2) to be installed down stream of valve SW-V-1708.

NOTE: Instrumentation locations to be as shown in Figure 11.1.

8.2.92.6 Precautions and/or Limitations

A. Standby Service Water System operation is to be in compliance with plant operating procedure PPM 2.4.5.

B. Testing is not to be conducted during periods of precipitation.

8.2.92.7 Prerequisites

A. Loop B of the Standby Service Water System is available to support this test.

B. Wind speed is averaging above 6 mph as estimated from brush recorder.

C. An approved plant operating procedure exists and is used for operation of the Standby Service Water System.

D. This test procedure is that revision currently approved for UHS performance testing.

E. Shift Manager's approval for testing has been obtained on Table 11.1.

F. The test acceptance criteria have been reviewed by the test engineer.

G. Precautions and/or limitations have been reviewed and are understood by the test engineer.

H. All necessary temporary installation has been installed, and instrument calibration due dates are appropriate for the duration of this test (up to 30 days).

3. Surface Evaporation

Surface evaporation is calculated from meteorological data and pond surface water temperature, using methods from Reference 8.2.92.4.4:

$$M_{es} = 181.6 \frac{Q_{es}}{\rho h_{fg}} \qquad (2)$$

Where:

M_{es} = Rate of water loss from pond due to surface evaporation, gpm

ρ = Density of water at pond surface temperature, lbm/ft^3

h_{fg} = Heat of vaporization of water at pond surface water temperature, Btu/lbm

Q_{es} = Rate of heat transfer from pond due to surface evaporation, Btu/ft^2 - day

= $(e_s - e_a)(70 + \frac{70U}{.7U})$

e_s = Saturated vapor pressure at the water surface temperature, mmHg

e_a = Air vapor pressure, mmHg

U = Wind velocity, mph

Equation two is integrated step wise over the period of the testing to determine the water loss due to surface evaporation.

4. Leakage

Leakage is determined just prior to this test by observing pond level changes over a period of several days. Pond level measurements taken with hook gauges are used to determine the leakage rate at full pond level. This rate is then used with test duration to determine leakage rate during the testing period.

5. Drift Loss Verses Wind Speed

The data taken is reviewed to identify time periods when wind speed is relatively constant. For these periods the total loss, spray evaporation, surface evaporation and leakage are determined and drift loss calculated. This is done for as many time periods as are available, and each calculation provides one point on the drift loss verses wind speed plot. An upper bound is determined from the data and compared to the drift loss data used in the FSAR Safety Analysis. The safety analysis will be repeated if the new drift loss data results in higher design basis drift loss values at the design wind speed (1.02% of flow at 6.9 mph).

B. Documentation

The test results will be evaluated and reported to the NRC in an FSAR Amendment. An Internal Report will be prepared which provides details of the data reduction and calculations performed.

8.2.92.11 Attachments

A. Data Sheets

1. 11.1, Spray Pond Level
2. 11.2, Spray Pattern

B. Tables

1. 11.1, Test Authorization
2. 11.2, Acceptance Criteria Verification
3. 11.3, Precautions and/or Limitations Verification
4. 11.4, Prerequisites Verification

C. Figures

11.1, Instrumentation Location

D. Tests

11.1, Spray Pond Leak Test

SPRAY POND LEVEL DATA

		Pond A Hook Gauge #_____ Cal. Due Date _____		Pond B Hook Gauge #_____ Cal. Due Date _____	
Data Point	Date	Time	Reading (In)	Time	Reading (In)

Data Sheet 11.1

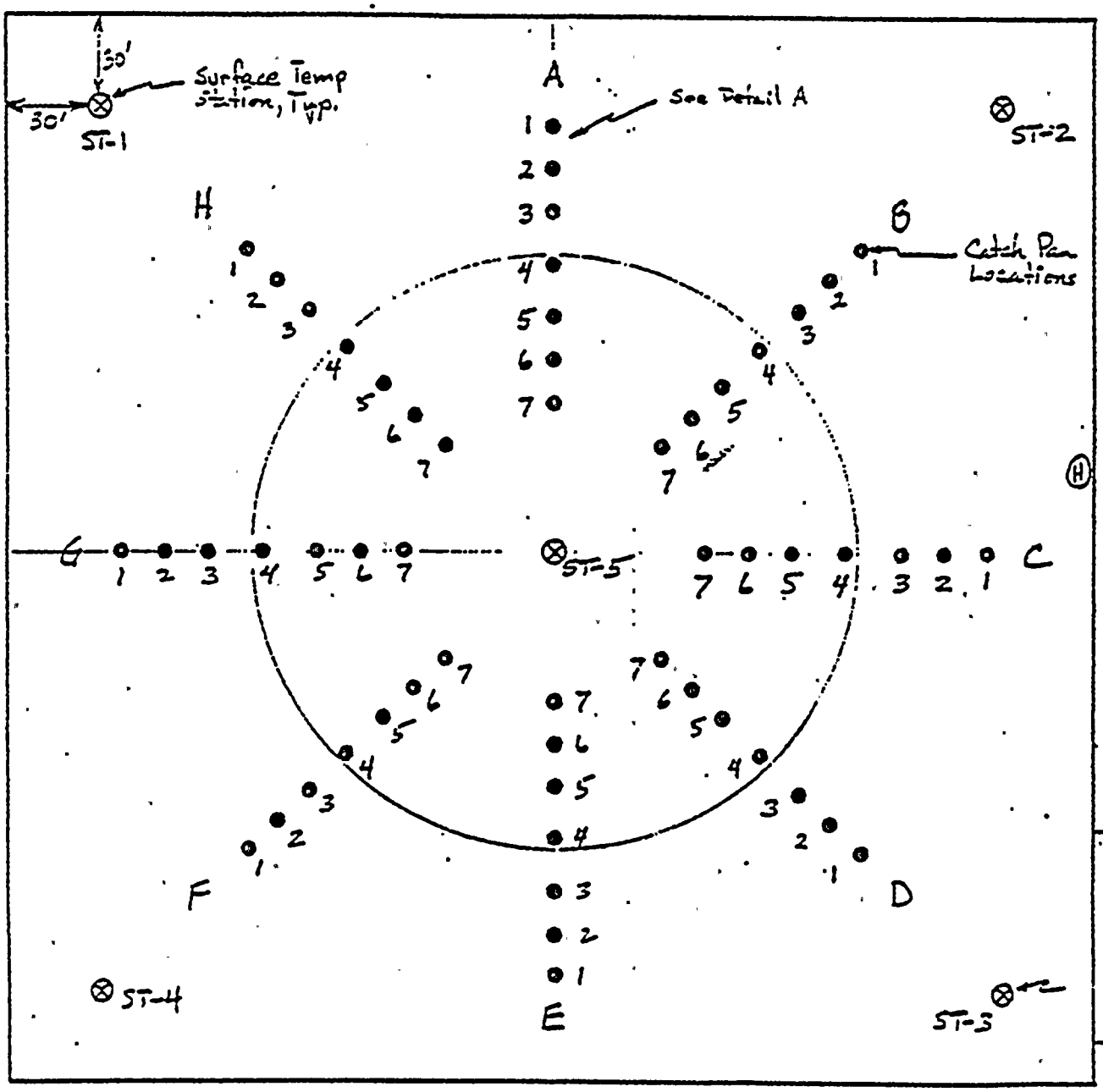
SPRAY PATTERN

Data Point _____

DATE _____ TIME _____

Service Water Flow Rate (SW-FI-9B) _____

Service Water Discharge Pressure (SW-PI-1BG) _____



Data Sheet 11.2

TEST AUTHORIZATION

ULTIMATE HEAT SINK PERFORMANCE TEST

Test Period No.	Test Engineer Signature	Shift Manager Signature	Date
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Table 11.1

TABLE 11.2

ACCEPTANCE CRITERIA VERIFICATION

PROCEDURE STEP NUMBER	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE
8.2.92.3.A												
3.B												

TABLE 11.3

PRECAUTIONS AND LIMITATIONS VERIFICATION

PROCEDURE STEP NUMBER	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE
8.2.92.6.A												
6.B												

TABLE 11.4

PREREQUISITE VERIFICATION

PROCEDURE STEP NUMBER	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE	VERIFIED INIT.	VERIFIED DATE
8.2.92.7.A												
7.B												
7.C												
7.D												
7.E												
7.F												
7.G												
7.H												
7.I												
7.J												
7.K												

INSTRUMENTATION LOCATION

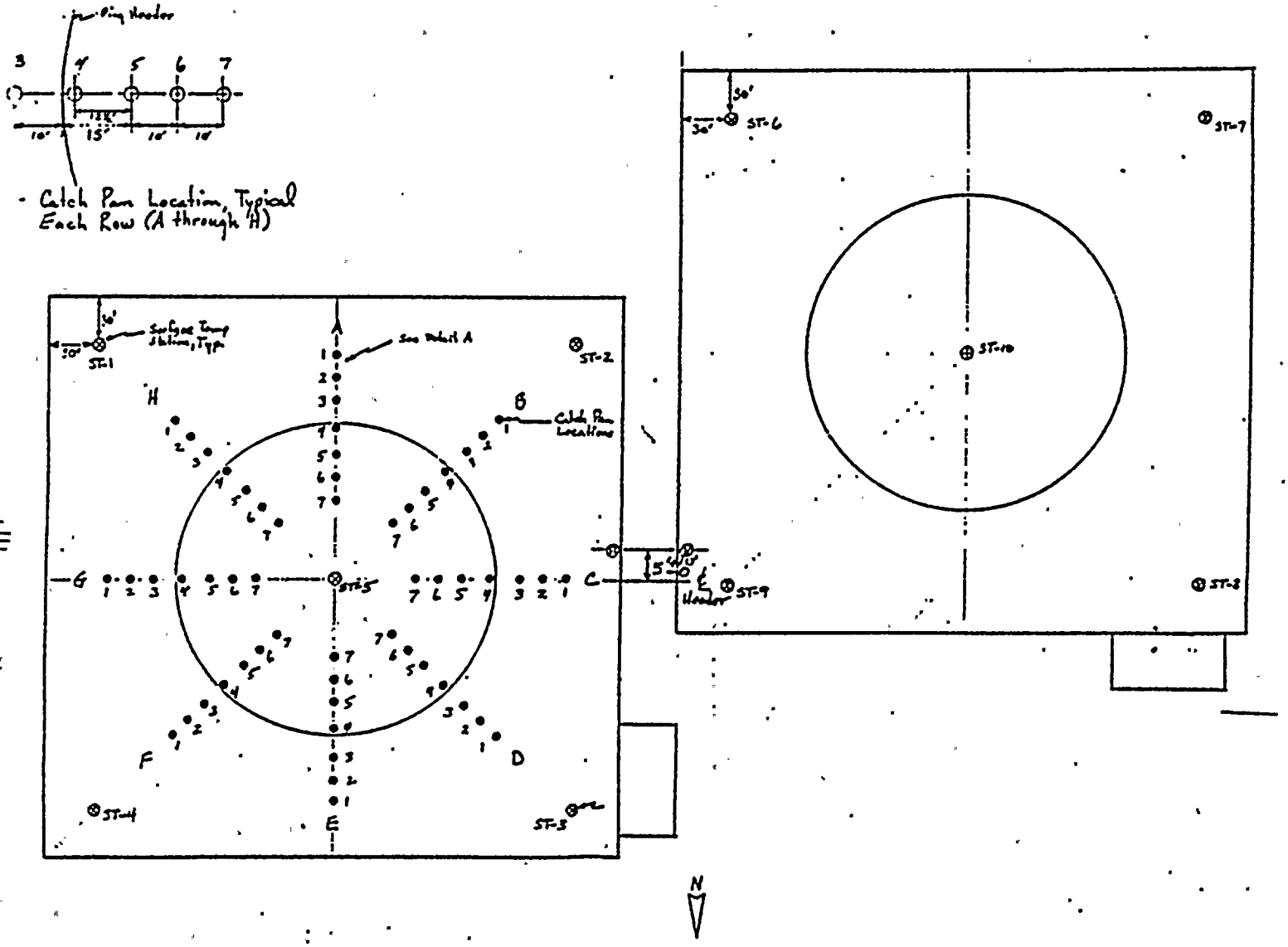


Figure 11.1

SPRAY POND LEAK TEST

1.0 Purpose

The purpose of this testing is to determine the leakage rate from the spray ponds to support the ultimate heat sink drift loss test.

2.0 Test Equipment

A. Weather measure meteorology station or equivalent.

1. Cup anemometer to measure wind velocity.
2. Vane to measure wind direction.
3. Wet and dry bulb temperature unit.

B. Ten thermocouples to measure pond surface.

C. Hook gages to measure pond level changes.

D. Stilling wells for hook gages.

E. Data logger to accept thermocouple input.

3.0 Prerequisites

A. Verify Spray Ponds are at normal operating level per PPM 2.4.5.

B. Shift Managers concurrence obtained for performing test.

C. All instrumentation has been calibrated and installed as shown in Figure 11.2.

D. TMU makup is isolated (TMU-V-10A and TMU-V-10B).

4.0 Procedure

A. Record the data on Data Sheet 11.3, daily, for a period of seven days.

NOTE: Record any conditions that may affect data such as operation of service water system, rain fall, etc.

B. Notify Shift Manager at completion of testing so system can be returned to normal standby condition.

5.0 Analysis

The leakage rate will be determined by taking total volume loss and subtracting the loss due to surface evaporation. Surface evaporation is calculated from meteorological conditions and surface temperature.

6.0 Attachments

A. Data Sheet 11.3

B. Figure 11.2

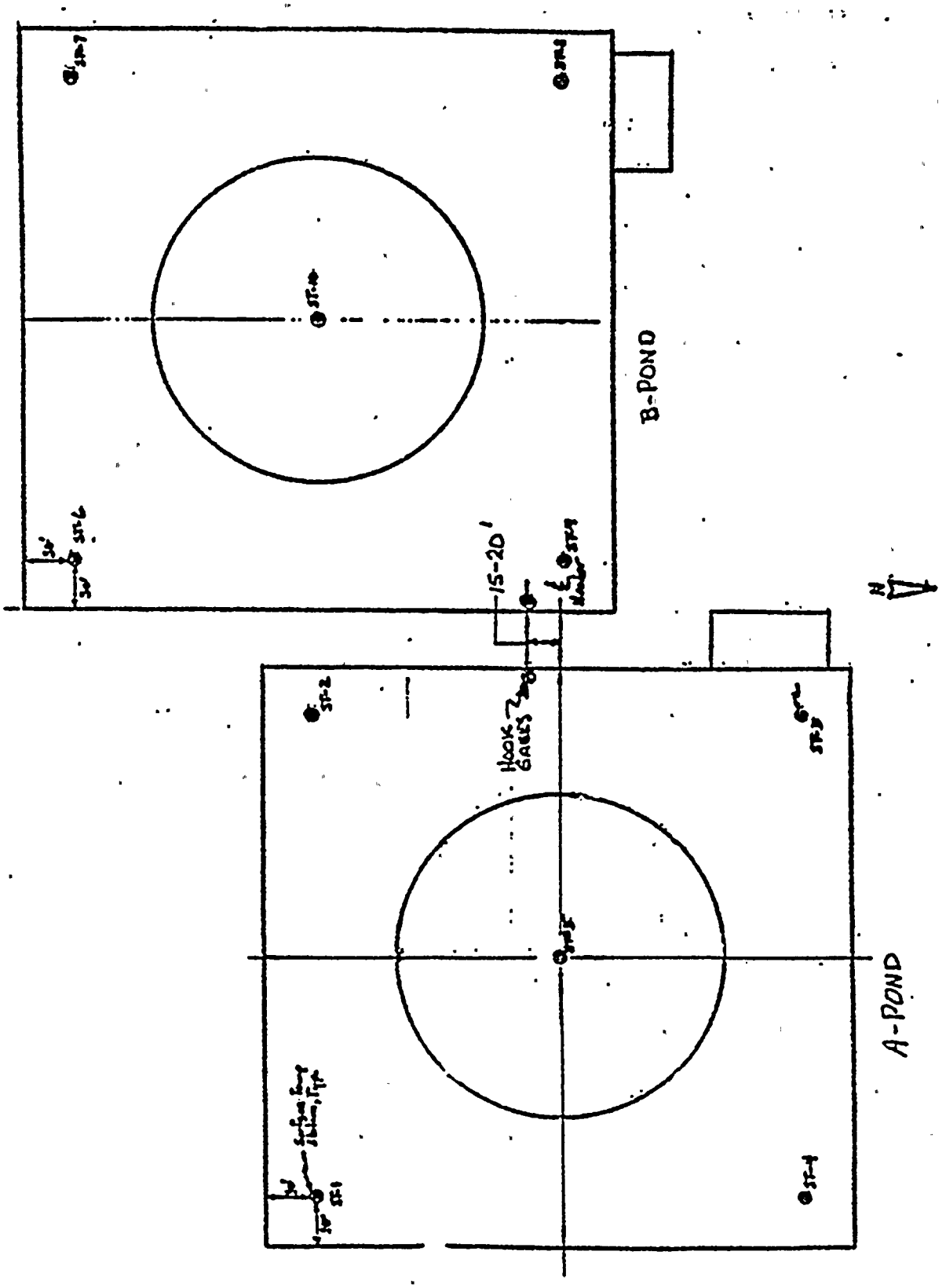
Data Sheet 11.3

LEAKAGE LEVEL DATA

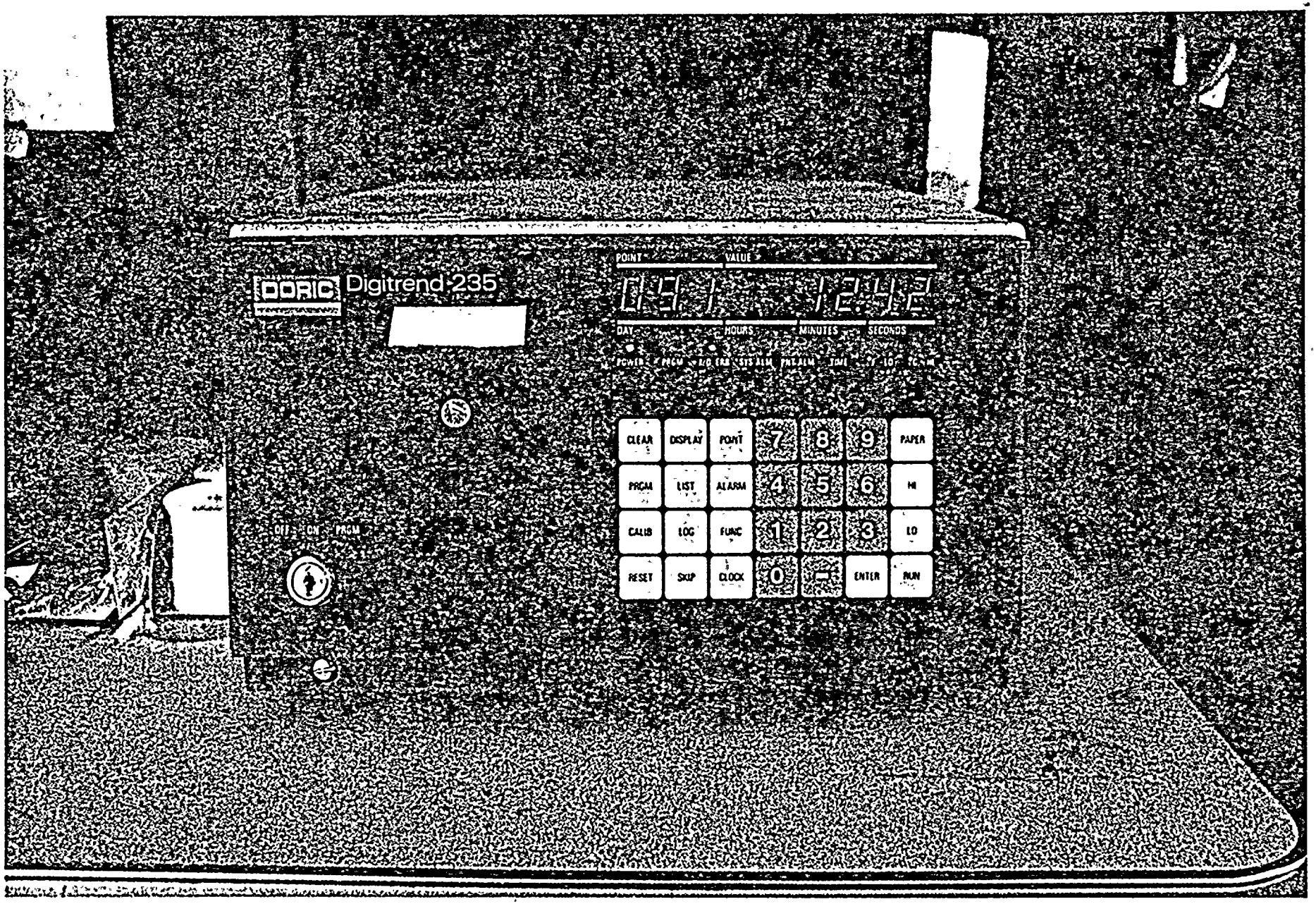
DATE	TIME	A-POND HOOK GUAGE	B-POND HOOK GUAGE	COMMENTS	NAME

NOTE: Record any conditions which may affect leakage data, e.g., system operation, rain fall, etc.

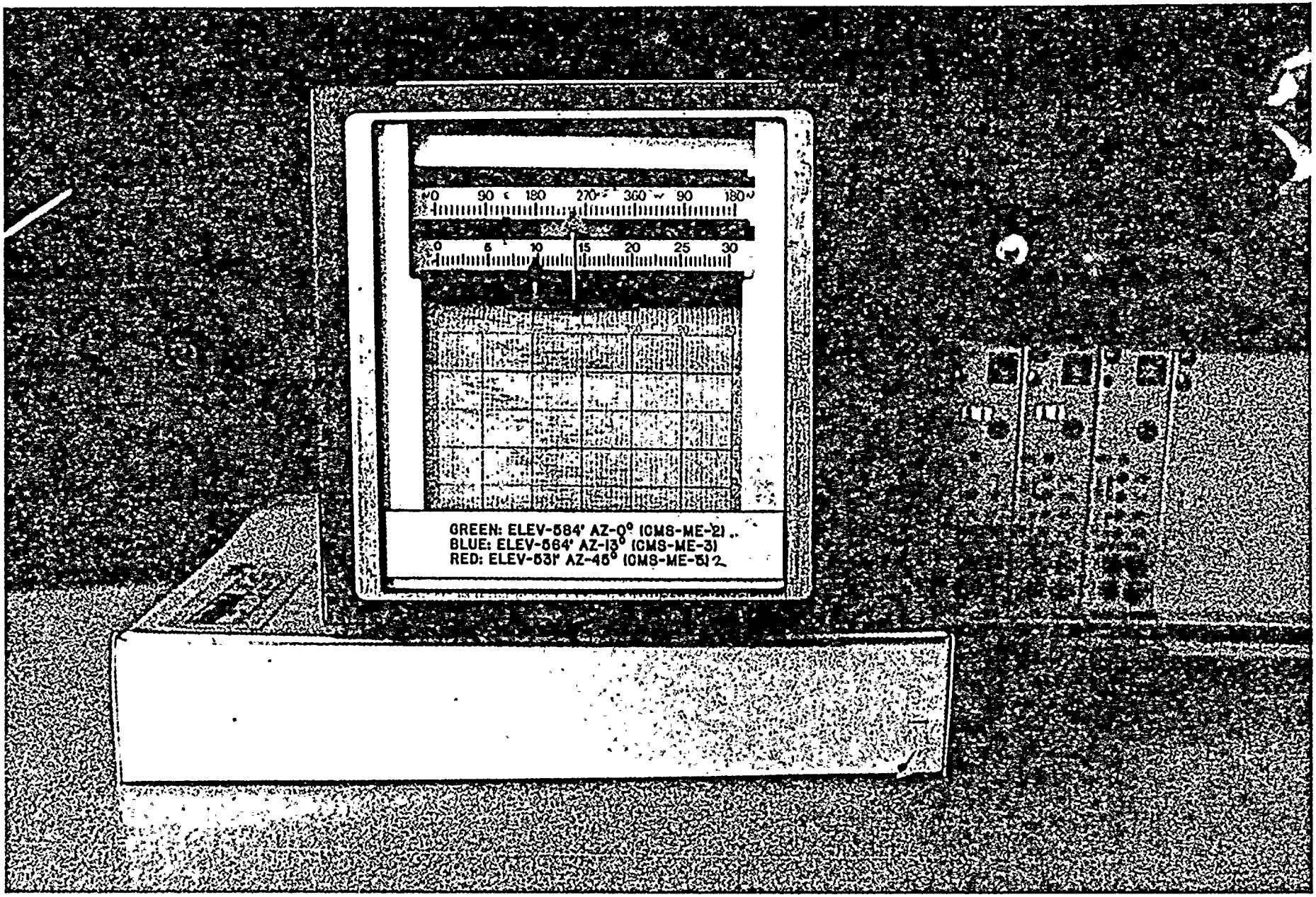
Figure 11.2 - INSTRUMENTATION LOCATION



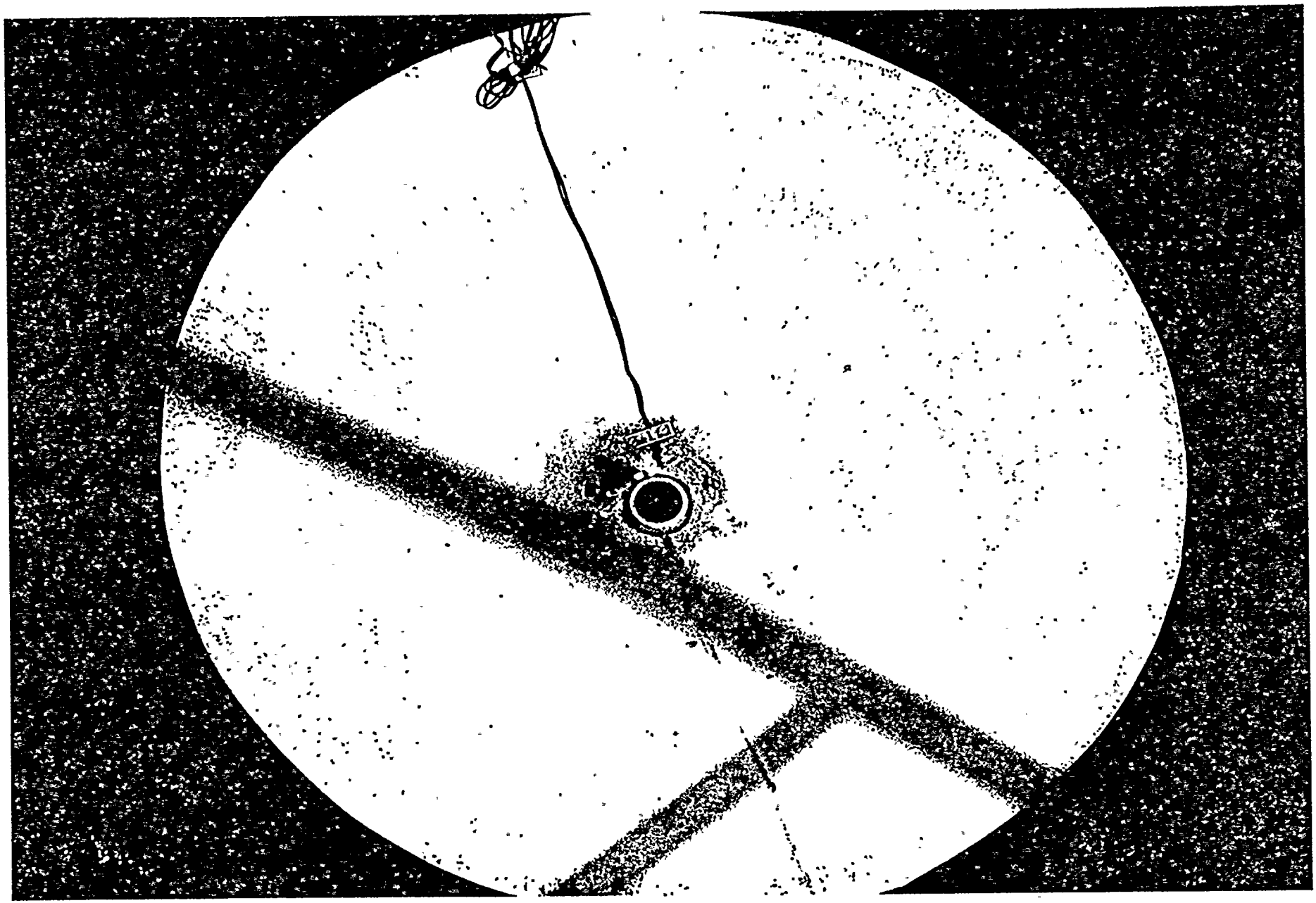
APPENDIX D
Photographs



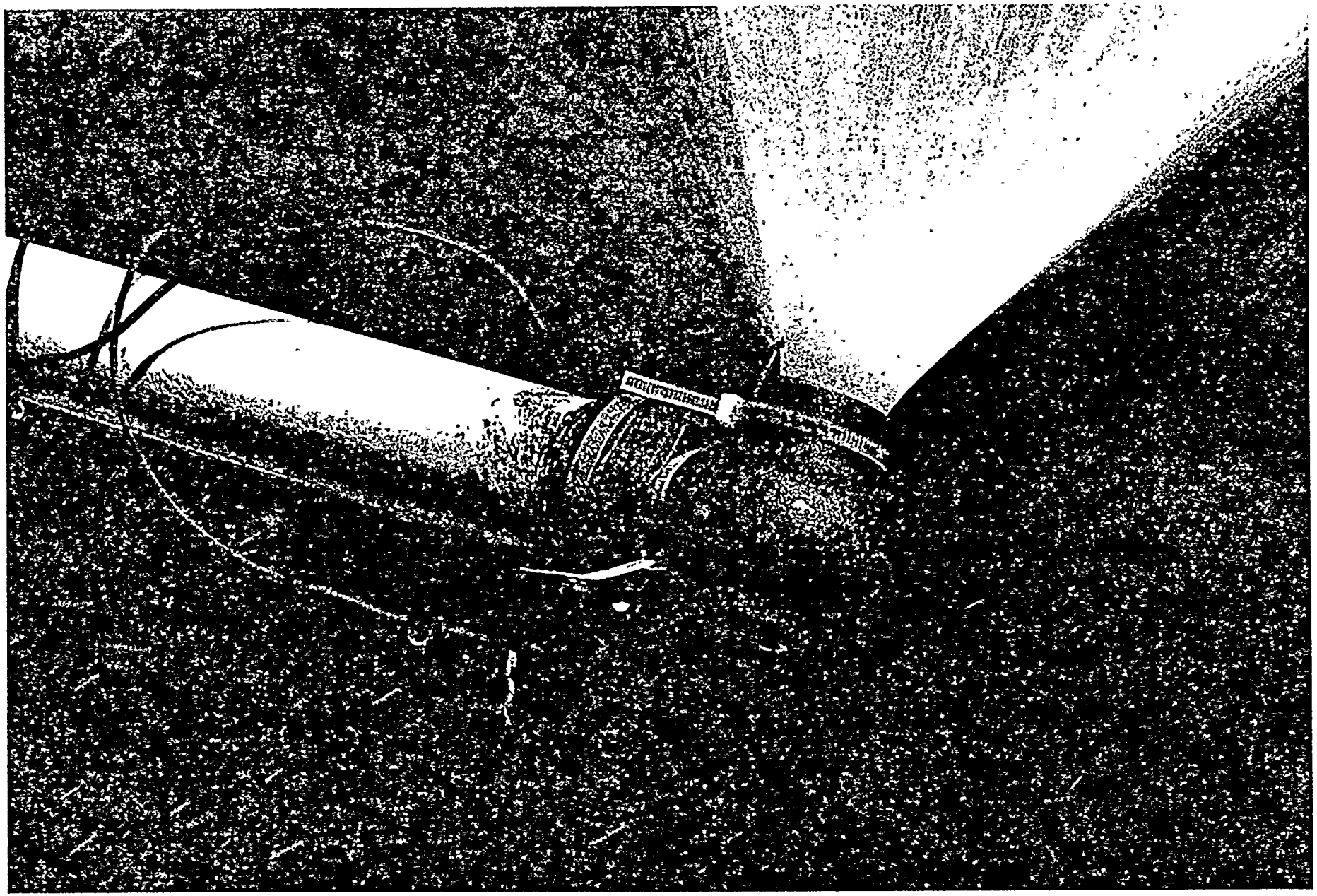
DORIC DATA RECORDER



WIND SPEED AND DIRECTION INDICATOR
(Primary Record on Doric)

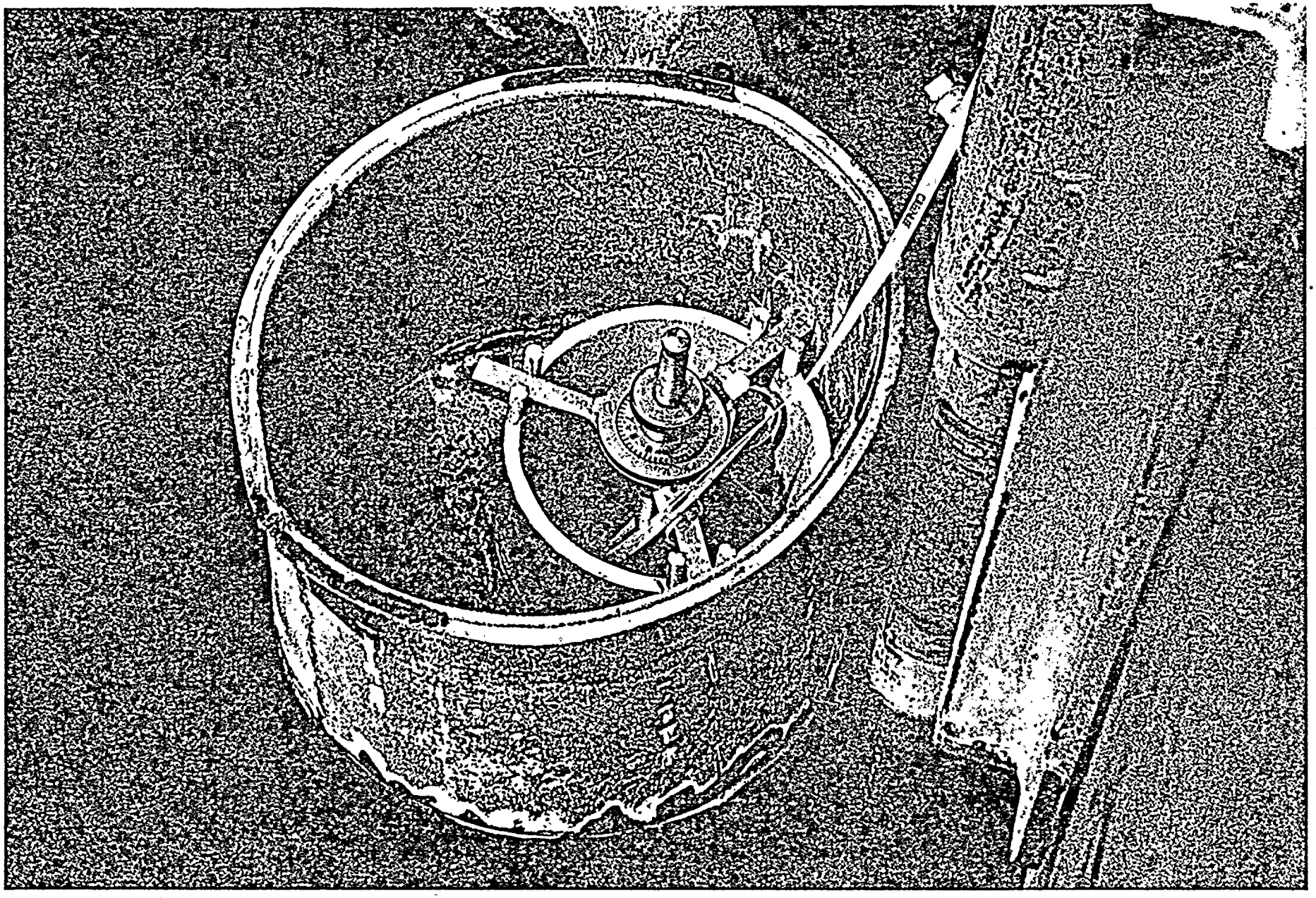


WATER CATCH PAN WITH THERMOCOUPLE

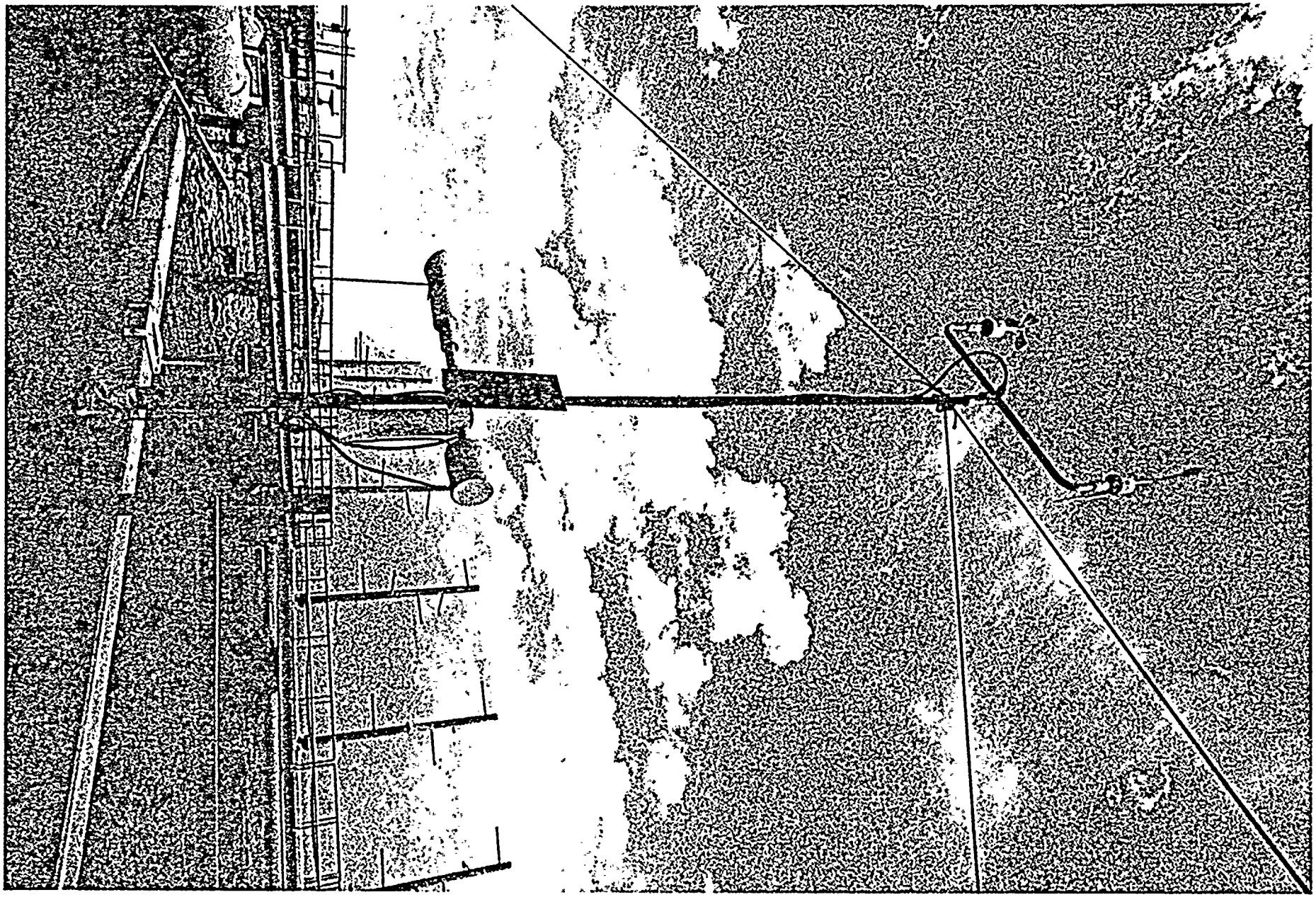


THERMOCOUPLE MEASURING HOT WATER TEMPERATURE

POND LEVEL MEASUREMENT FIXTURE, POND A

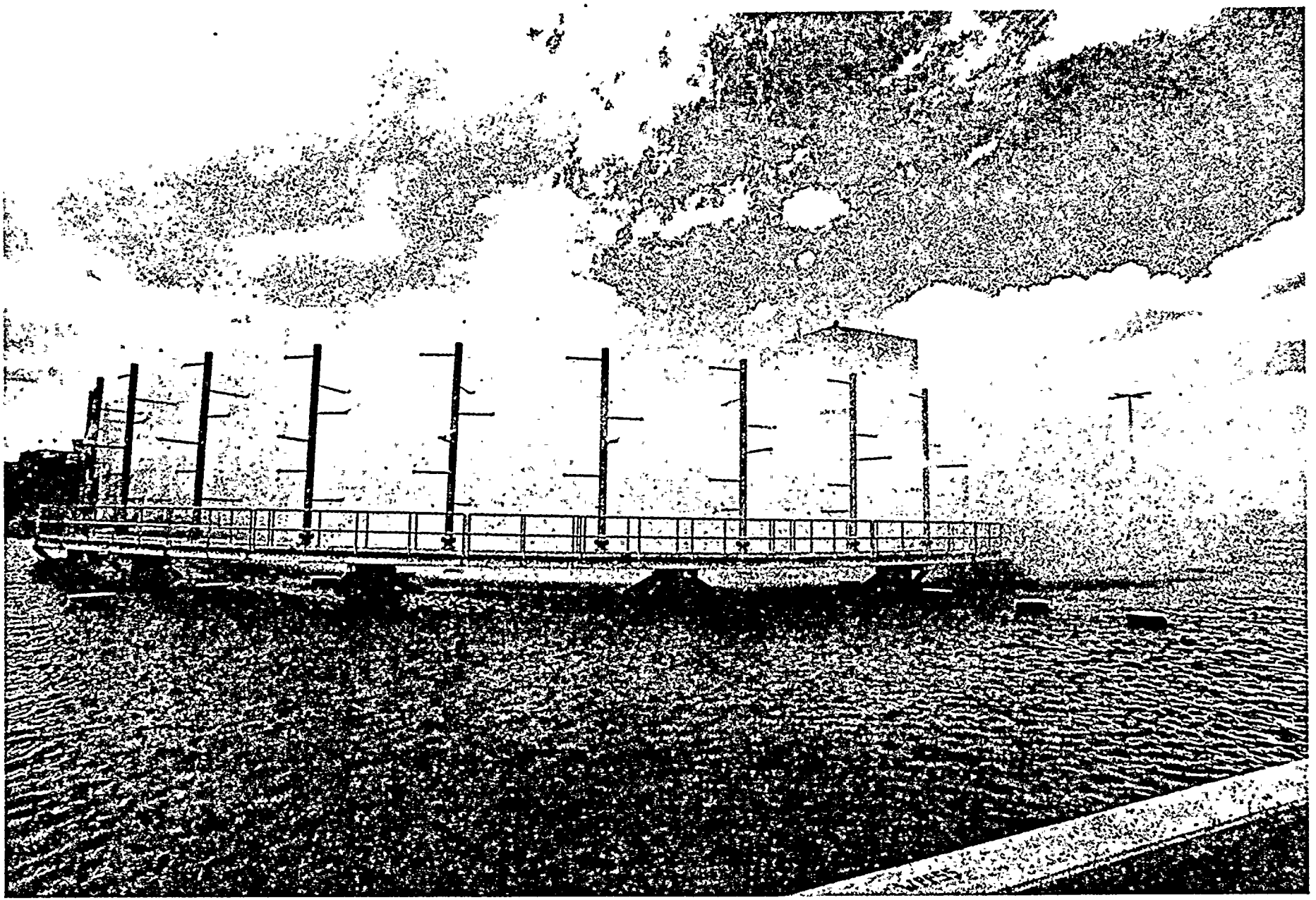


HOOK GAUGE AND STILLING WELL, WITH
SPLASH SHIELD, POND B



METEOROLOGICAL STATION

SPRAYPOND SHOWING DRIFT



SPRAY POND SHOWING DRIFT

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Sept. 09, 1985

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Mr. G. C. Sorensen, Manager
Washington Public Power System
P.O. Box 968
3000 George Washington Way
Richland, Washington 99352

SUBJECT:

The following documents concerning our review of the subject facility are transmitted for your information.

☐ Notice of Receipt of Application, dated _____.

☐ Draft/Final Environmental Statment, dated _____.

☐ Notice of Availability of Draft/Final Environmental Statement, dated _____.

☐ Safety Evaluation Report, or Supplement No. _____, dated _____.

☐ Notice of Hearing on Application for Construction Permit, dated _____.

☐ Notice of Consideration of Issuance of Facility Operating License, dated _____.

☒ Monthly Notice; Applications and Amendments to Operating Licenses Involving no Significant Hazards Considerations, dated August 28, 1985.

☐ Application and Safety Analysis Report, Volume _____.

☐ Amendment No. _____ to Application/SAR dated _____.

☐ Construction Permit No. CPPR- _____, Amendment No. _____ dated _____.

☐ Facility Operating License No. _____, Amendment No. _____, dated _____.

☐ Order Extending Construction Completion Date, dated _____.

☐ Other *(Specify)* _____

_____

Office of Nuclear Reactor Regulation

Enclosures:
As stated

cc: See next page

OFFICE➤	LB#2/DL/LA						
SURNAME➤	EGHylton						
DATE➤	09/16/85						

NRC FORM 318 (1/84) NRCM 0240