Form 34731 (10-81)
(Formerly SPD-1002-1)

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: CP/0/B/8150/04
Change(s) 0 to
0 Incorporated

(2) STATION: Catawba

(3) PROCEDURE TITLE: Chemistry Procedure for the Determination of Dissolved Oxygen, Auto Analyzer

(4) PREPARED BY: RL Painter DATE: 12/8/82

(5) REVIEWED BY: [signature] DATE: 12-9-82

Cross-Disciplinary Review By: ______ N/R: [initials]

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: ______ (SRO) Date: ______

By: ______ Date: ______

(7) APPROVED BY: M. S. Tuckman Date: 12/11/82

(8) MISCELLANEOUS:

Reviewed/Approved By: ______ Date: ______

Reviewed/Approved By: ______ Date: ______

MASTER FILE

DUKE POWER COMPANY
NUCLEAR SAFETY EVALUATION CHECK LIST

(1) STATION: Catawba UNIT: 1 X 2 X 3 ____
OTHER: ____

(2) CHECK LIST APPLICABLE TO: CP/0/B/8150/04

(3) SAFETY EVALUATION - PART A

The item to which this evaluation is applicable represents:

Yes ____ No ✓ A change to the station or procedures as described in the FSAR or a test or experiment not described in the FSAR?

If the answer to the above is "Yes", attach a detailed description of the item being evaluated and an identification of the affected section(s) of the FSAR.

(4) SAFETY EVALUATION - PART B

Yes ____ No ✓ Will this item require a change to the station Technical Specifications?

If the answer to the above is "Yes," identify the specification(s) affected and/or attach the applicable pages(s) with the change(s) indicated.

(5) SAFETY EVALUATION - PART C

As a result of the item to which this evaluation is applicable:

Yes ____ No ✓ Will the probability of an accident previously evaluated in the FSAR be increased?

Yes ____ No ✓ Will the consequences of an accident previously evaluated in the FSAR be increased?

Yes ____ No ✓ May the possibility of an accident which is different than any already evaluated in the FSAR be created?

Yes ____ No ✓ Will the probability of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?

Yes ____ No ✓ Will the consequences of a malfunction of equipment important to safety previously evaluated in the FSAR be increased?

Yes ____ No ✓ May the possibility of malfunction of equipment important to safety different than any already evaluated in the FSAR be created?

Yes ____ No ✓ Will the margin of safety as defined in the bases to any Technical Specification be reduced?

If the answer to any of the preceding is "Yes", an unreviewed safety question is involved. Justify the conclusion that an unreviewed safety question is or is not involved. Attach additional pages as necessary.

(6) PREPARED BY: R L Painter DATE: 12/8/82

(7) REVIEWED BY: [signature] DATE: 12-9-82

Form 18855 (3-80)

DUKE POWER COMPANY

ALARA EVALUATION CHECKLIST

(1) Station Catawba Unit: 1 X 2 X 3 ____

Other: ____

(2) Checklist Applicable to: CP/0/B/8150/04

(3) ALARA Evaluation

Check those items below which were considered applicable during the preparation and review of this document.

____ Flushing and draining were used to minimize source - strength and contamination levels prior to performing an operation.

____ Permanent and/or movable shielding was specified for reduction of levels.

____ Use of permanent or temporary local exhaust ventilation systems was used for control of airborne contamination.

____ Operation was designed to be completed with the least practicable time spent in the radiation field.

____ Appropriate tools and equipment were specified for the operation to be performed.

____ The operation was designed considering the minimum number of people necessary for safe job completion.

____ Remote handling equipment and other special tools were specified to reduce external dose.

____ Contamination - control techniques were specified.

____ The operation was designed to be conducted in areas of as low an exposure as practicable.

____ Additional ALARA considerations were:

____

____

____

✓ ALARA Principles were not considered since the procedure did not involve work in a radiation area.

(5) Prepared by: RE Painter Date 12/8/82

(6) Reviewed by: TD Evans Date 12-9-82

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
CHEMISTRY PROCEDURE FOR THE DETERMINATION OF
DISSOLVED OXYGEN, AUTO ANALYZER

1.0 DISCUSSION

1.1 Scope

This procedure describes the determination of dissolved oxygen in high purity water using the Weston and Stack Continuous Flow Analyzer.

1.2 Principle

Dissolved oxygen in the high purity water sample diffuses through a semipermeable membrane which retains an electrolyte. The electrolyte surrounds a platinum and a lead electrode (Enclosure 6.2). Oxygen in the sample undergoes reduction at the platinum electrode (or cathode) to form hydroxyl ions (Enclosure 6.1):

$$O_2 + 2\ H_2O + 4e^- \rightarrow 4\ OH^-$$

The hydroxyl ions formed simultaneously undergo oxidation at the lead electrode (or anode) to form an oxide (Enclosure 6.1):

$$2\ Pb + 4\ OH^- \rightarrow 2\ PbO + 2\ H_2O + 4e^-$$

Since the anode and cathode are connected through an external circuit, a current is produced due to transfer of electrons. This current is related to the dissolved oxygen content in the water and is detected and measured by a sensitive amp meter in the analyzer.

The oxidation - reduction reaction occurring in the sensor requires an applied potential of 0.5 volts or greater. The cathode and anode materials are therefore selected such that a generated or "galvanic" potential existing between the two metals will be adequate to support the oxidation - reduction reaction.

Compounds present in the electrolyte do not undergo oxidation - reduction reactions at the potential of the probe; therefore, when oxygen is absent, a current does not flow and the reading from the probe is zero.

The sample flow cell provides for a turbulent flow past the probe membrane. Good agitation is required to minimize the resistance to oxygen transfer from the sample to the cathode.

Temperature variations of the sample are corrected for by the use of a thermistor. All samples pass through sample cooling heat exchangers to adjust temperature to 77°F prior to entering the probe.

1.3 Precision and Interferences

1.3.1 System accuracy with automatic temperature compensation is ± 1 percent of the reading for sample temperatures within 10°C (50°F) of the calibration temperature.

1.3.2 The only known interference to the Weston and Stack D.O. probe is free chlorine. If the sample is alkaline sc that hypochlorous ion exists rather than free chlorine, there is no interference.

The following do not interfere: hydrogen, hydrogen sulfide, sulfur dioxide, ammonia, carbon monoxide, carbon dioxide, and hydrazine.

1.3.3 Unless sufficiently agitated, the sample flow forms a stagnant film of deoxygenated water that will act as a diffusion barrier for dissolved oxygen.

1.4 Limits and Precautions

1.4.1 The formation of a coating (collodial iron hydroxide or rust particles) on the membrane decreases probe sensitivity.

1.4.2 The life of a membrane is more than six months when it is in constant use, as long as membrane damage does not occur.

1.4.3 When changing the membrane on the probe be careful to insure that there are no internal deposits of crystalized electrolyte or oxidized deposits on the anode that could puncture the membrane.

1.4.4 The probe will stabilize in 1 - 2 hours after changing the electrolyte and membrane. If the anode is cleaned at this time, 24 hours is required for stabilization.

1.4.5 Minimum flow through the sample flow cell is 150 ml/min when using a 1 mil membrane.

1.4.6 Air inleakage into the system must be avoided.

1.4.7 The recommended sample temperature is 50°C (122°F).

1.4.8 The probe must be recalibrated anytime the membrane is changed.

2.0 <u>APPARATUS</u>

2.1 Weston and Stack Analyzer - Model 3400-5

2.2 Weston and Stack Model 60 Probe

2.3 Weston and Stack Model 152 Thermistor

2.4 Weston and Stack Model 102 Sample Flow cell

2.5 Teflon Membranes - 1 or 2 mil

3.0 REAGENTS

3.1 Potassium Iodide Electolyte

Dissolve 50 grams of potassium iodide and 0.1 gram of sodium sulfite in 100 ml of demineralized water. Electrolyte is commercially available from Weston and Stack in 32 ounce bottles, part number 096-003.

4.0 PROCEDURE

4.1 Preparation of the Probe

4.1.1 Disassemble the probe as shown in Enclosure 6.2. Place the membrane, item No. 2 in the stainless steel holder, item No. 1.

4.1.2 Screw cap onto end of outer housing, item No. 3. Be careful not to overtighten.

4.1.3 Holding housing vertically, add approximately 100 ml of electrolyte (Section 3.0).

4.1.4 Slowly insert inner electrode, item No. 4, into the outer housing assembly.

4.1.5 Replace three screws and small nylon air bleeder screw.

NOTE: Air bubbles may tend to collect at the tip and around the lead anode. Gentle tapping of the probe will usually free these so they will escape to the top of the probe.

4.2 Calibration (Weekly)

4.2.1 Remove oxygen probe and thermistor from respective sample wells. Carefully wipe dry.

4.2.2 Place the function switch (Enclosure 6.4, Item No. 4) in the "ZERO" position. Adjust the "ZERO" control (Enclosure 6.4, Item No. 3) for a zero reading.

4.2.3 Turn the function switch to the calibration position and adjust the "CAL" control (Enclosure 6.4, Item No. 2) until the meter reads full scale.

4.2.4 Recheck zero and adjust as necessary. If adjustment is necessary, place selector switch to "CAL" control and check for full scale deflection.

4.3 Standardization (Daily)

4.3.1 Turn selector switch to desired readout.

4.3.2 Replace probe and thermistor into sample wells.

4.3.3 Start sample flow to the probe chamber by throttling flow through the following valves for the designated sample:

	Unit 1	Unit 2
Hotwell Pump Discharge	1CT64	2CT64
Final Feedwater	1CT70	2CT70
Patch Sample	1CT202	

For a 1 mil membrane, sample flow must be a mininum of 150 ml/min.

4.3.4 Record concentration as shown on recorder.

4.3.5 Collect a sample and run manual D. O. as per CP/0/A/8100/11.

4.3.6 Adjust the oxygen meter to the actual dissolved oxygen concentration in the sample using the "CAL" control.

4.4 Determination of Unknown Concentration

4.4.1 Set the D.O. analyzer readout scale to the correct range.

4.4.2 Check sample flow and temperature to insure proper performance.

4.4.3 Read D.O. concentration shown on recorder.

5.0 <u>REFERENCES</u>

5.1 Instruction Manual for Model 3400-5 Dissolved Oxygen Analyzer - Weston and Stack Instruments.

5.2 MNS Procedure for the Determination of Dissolved Oxygen in High Purity Water - CP/0/B/8100/17.

6.0 <u>ENCLOSURES</u>

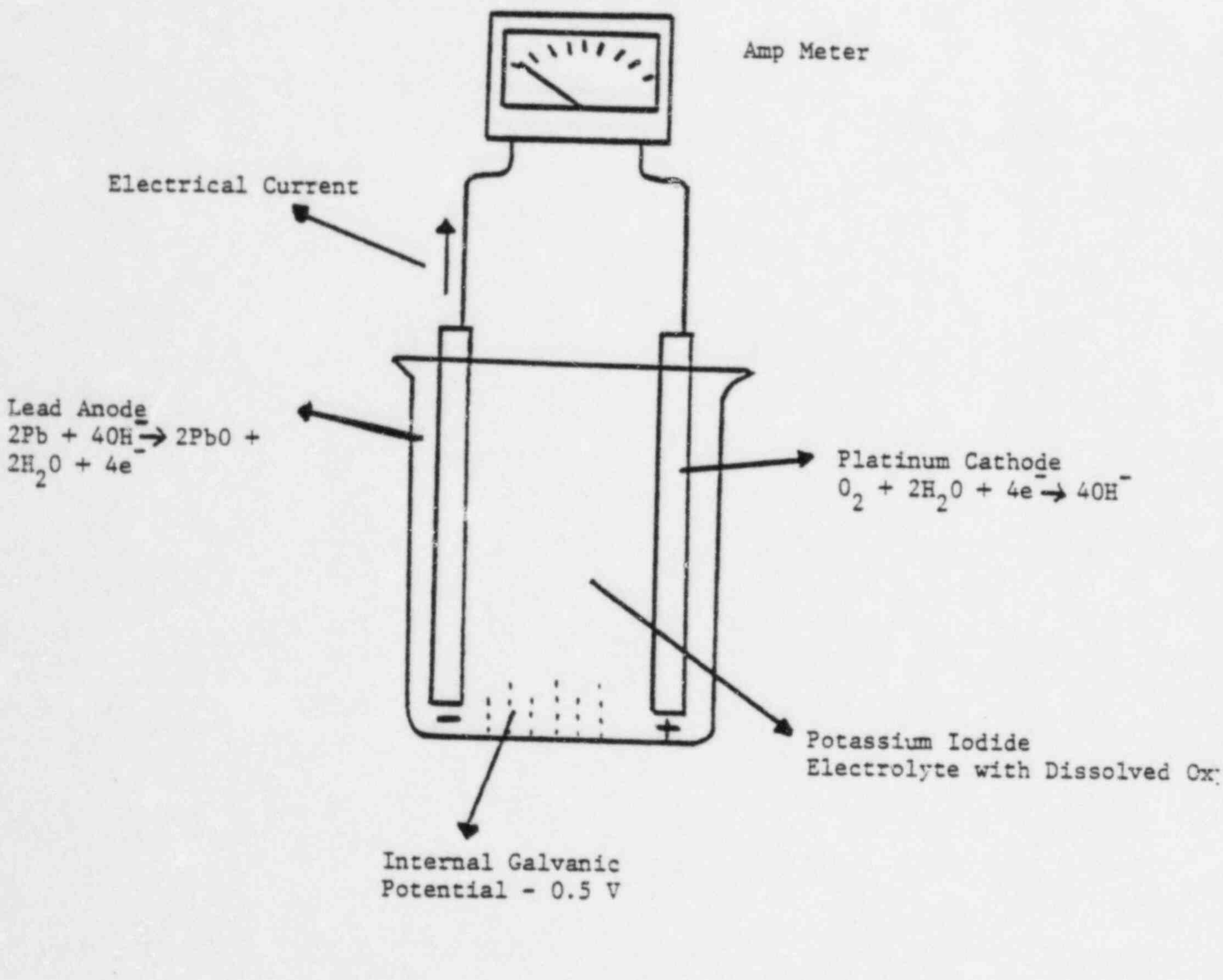
6.1 Principle of Weston and Stack Molecular Oxygen Probe.

6.2 Model 60 Probe and Flow Cell.

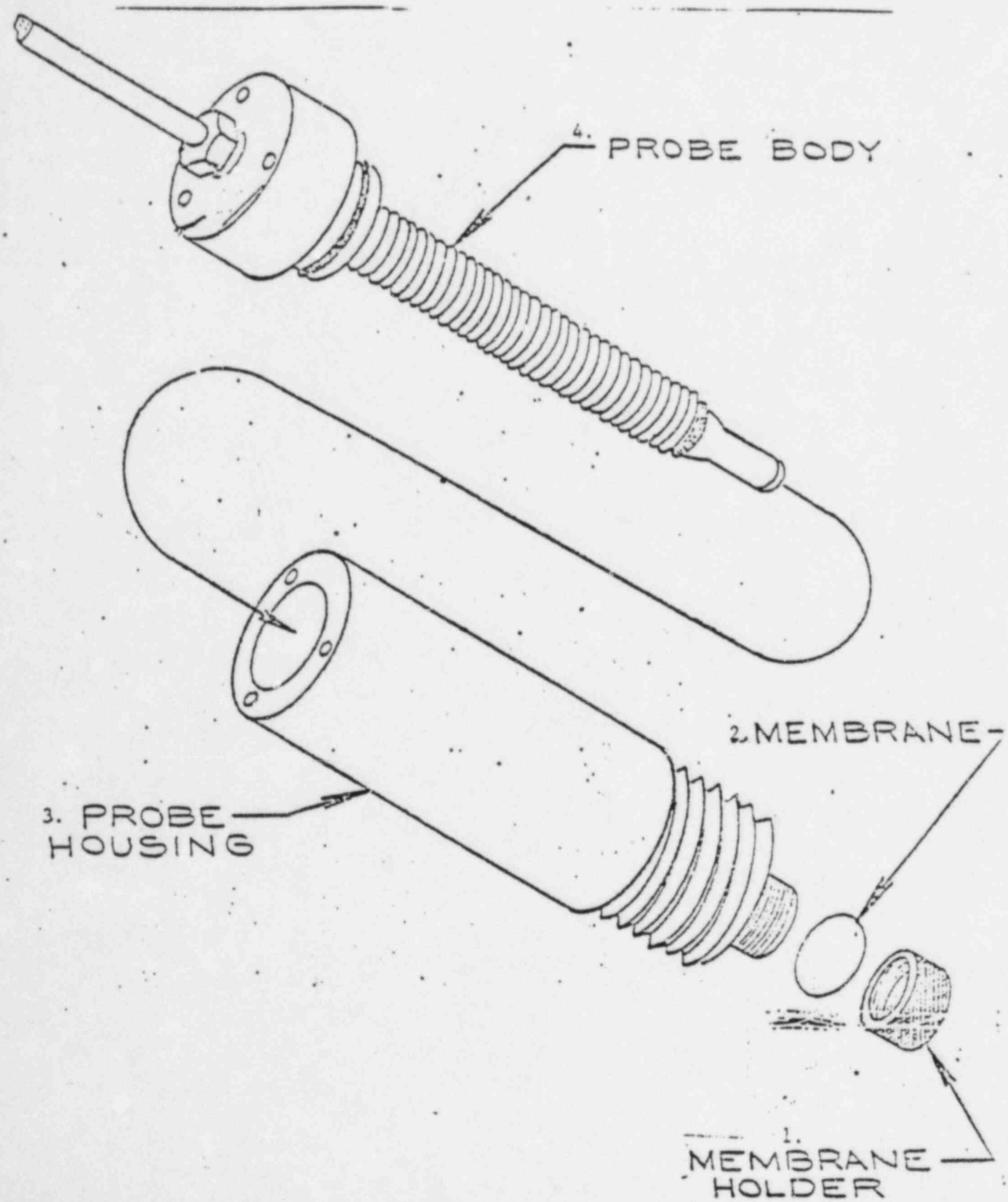
6.3 Flow Rate - Response Graph.

6.4 Model 3400-5 Front Panel Controls.

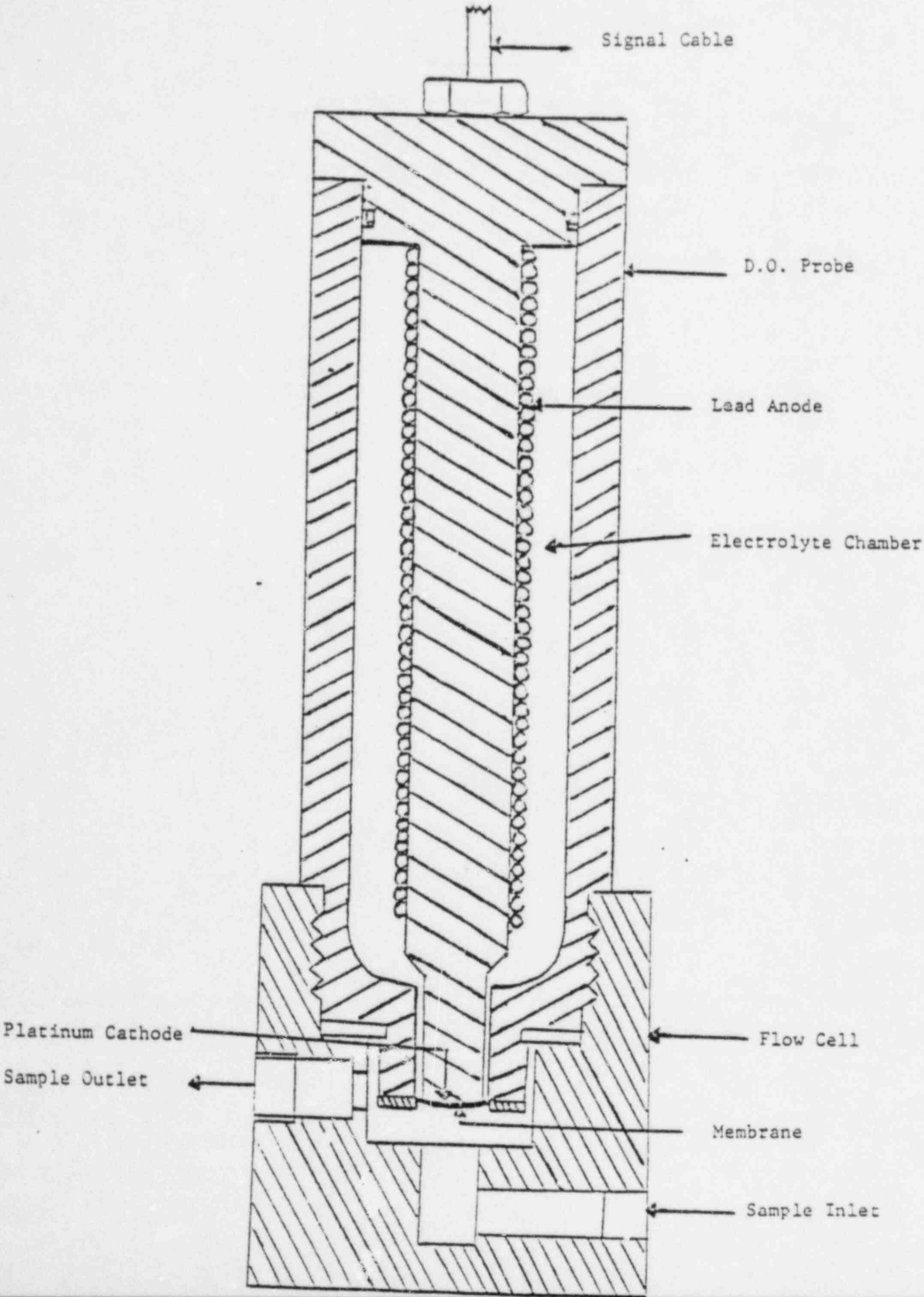
Enclosure 6.1
CP/0/B/8150/04
Principle of Weston and
Stack Molecular Oxygen Probe



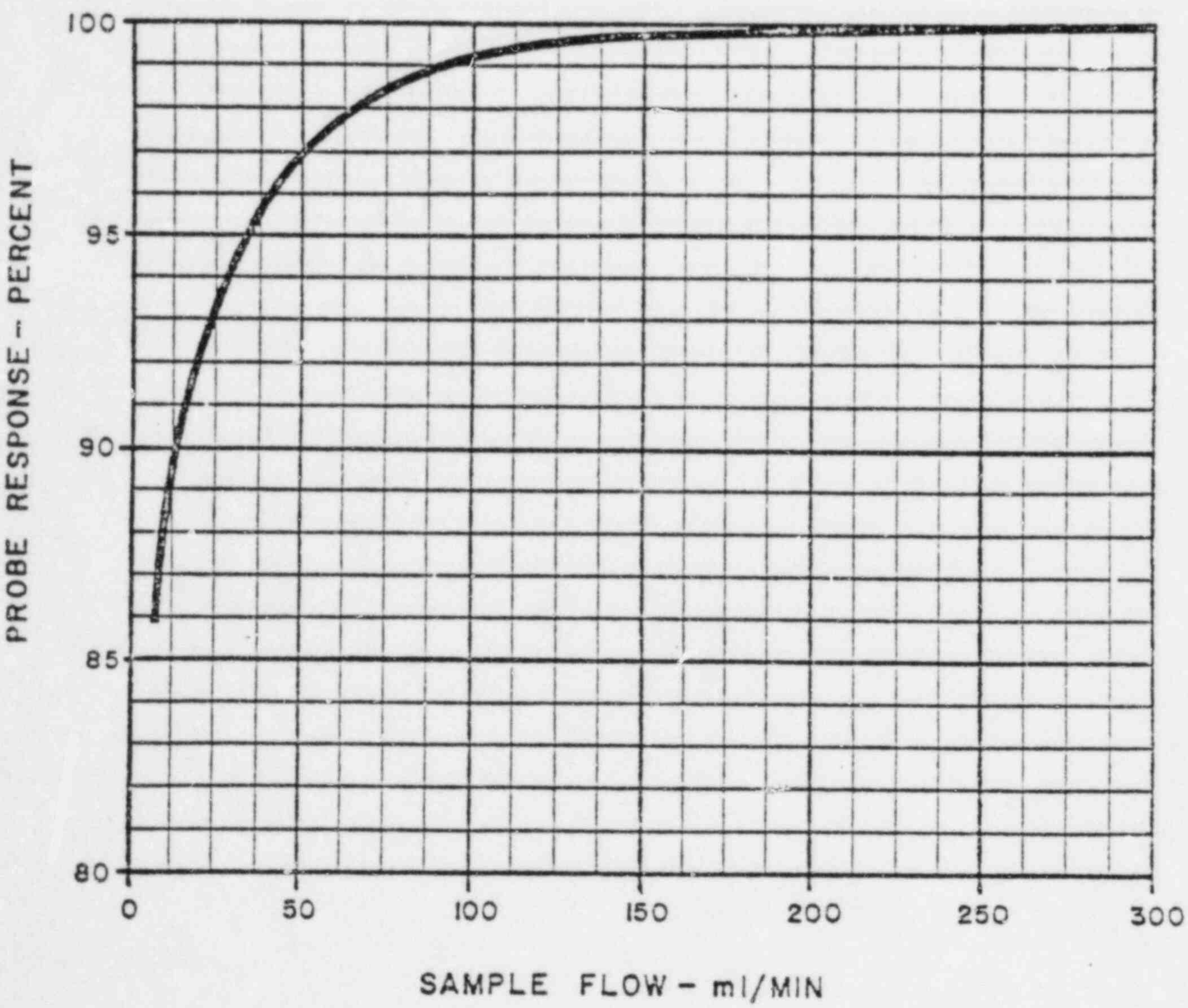
Enclousre 6.2
CP/0/B/8150/04
Weston and Stack Model 60 Probe



Model 60 Probe and Flow Cell



Enclosure 6.3
CP/0/B/8150/04
Flow Rate/Response for Weston
and Stack Dissolved Oxygen Probe



Enclosure 6.4
CP/0/B/8150/04
Weston and Stack Model 3400-5 Front Panel Controls