UNCONTROLLED

B.J. Stout / C. HABICHT
Work Group _____

* Please attach copy of original work order for field change

RECORD OF FIELD CHANGE

Procedure/Work Order# SOP 63-3 Date 11/29/88

Field Change Number 1

Page 1 of 2

No. of Page	Description of Field Change	Signature/Date
	See Attached Pages	
	PURPOSE: AH B[illegible] SPAN GAS MONITORING POSITIONS ∴ AH D-1 is Unnecessary	

NA STS/PSO Manager	Date	or	[illegible] LLW Operations Manager	Date
NA D/D Operations Mngr.	Date		[illegible] Vitrification Test Mngr.	11/30/88 Date
George H. [illegible] Radiation/Safety Mngr	11/30/88 Date		[illegible] Quality Assurance	11/30/88 Date
+ B/ Stout Originator	11/29/88 Date		[illegible] Cognizant Manager	11/29/88 Date
NA Maintenance Supt.	Date		NA Plant Ops. Support Mngr.	Date

WV-1240, Rev. 1
BLC-ROFC:FAC-55

8910260161 891025
PDR PROJ
M-32 PDC

UNCONTROLLED

Applicable Field Changes

SOP 63-3

VITRIFICATION NOx SCRUBBER -

MONITORING SYSTEM OPERATION PROCEDURE

Rev 2

Approved _____
Operations Manager

Date 9/23/88

Approved _____
Cognizant Engineering Manager

Date 9/28/88

Approved _____
Radiation and Safety Manager

Date 9/22/88

Approved _____
Quality Assurance Manager

Date 9/23/88

System Safety Class C

System Quality Level C

The estimated accumulated dose for the work described in this document is less than 100 mRem per 100 mRem.

WEST VALLEY NUCLEAR SERVICES CO., INC.

September 1988

Prepared by: _____
B. J. Stout

BMS0134:SOPI87-3

RECORD OF REVISION

PROCEDURE

If there are changes to the procedure, the revision number increases by one. These changes are indicated in the left margin of the body by an arrow (>) at the beginning of the paragraph that contains a change. If the paragraph or section contains partial revision and/or addition, the revised section is enclosed with arrows (>>....<<).

Example:

>The arrow in the margin indicates a change. >>These arrows indicated that this section has been revised and/or added.<<

Procedure No. SOP 63-3, Rev. 2 Date: August 1988

Rev No.	Description of Changes	No. of Page
0	Original document	All
1	Complete document revision	All
2	Complete document revision due to relocation of equipment, additional valving installation, and renaming of valves	All

RECORD OF REVISION (CONTINUATION SHEET)

Rev No.	Description of Changes	No. of Page

LIST OF EFFECTIVE PAGES

Page	Revision	Date
All	0	May 1987
All	1	April 1988
All	2	September 1988

VITRIFICATION NOx SCRUBBER

MONITORING SYSTEM OPERATION PROCEDURE

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VITRIFICATION NOx SCRUBBER

MONITORING SYSTEM OPERATION PROCEDURE

>

1.0 SCOPE

This procedure establishes standard operating procedures for operation of the Vitrification NOx Scrubber On-line Monitoring System located in the 01-14 building.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

2.1.1 Chemiluminescent - luminescence due to chemical reaction.

2.1.2 Photomultiplier - an electron multiplier in which electrons released by photoelectric emission are multiplied in successive stages by dynodes that produce secondary emission.

2.1.3 Span Gas - a gas with a known concentration used as the sample calibration gas for analytical equipment.

2.1.4 Dynode - an electrode in an electron tube that functions to produce secondary emission of electrons.

2.2 Abbreviations

2.2.1 NO - nitric oxide
2.2.2 NOx - oxides of nitrogen
2.2.3 NO2 - nitrogen dioxide
2.2.4 O3 - ozone
2.2.5 hv - emitted light

3.0 RESPONSIBILITIES

3.1 The Vitrification Operations Supervisor is responsible for directing the overall operation of the Vitrification System.

3.2 Vitrification Test Engineering is responsible for the technical operation of the Vitrification System.

3.3 The Vitrification Operations Shift Supervisor is responsible for assignment of properly trained Vitrification operators and for day-to-day direction of these operators.

3.4 The Vitrification Operator is responsible for operation of the plant according to approved operating procedures, test procedures, sample schedules, and the operating procedures in this SOP. **When a situation is not covered by a procedure, he/she is responsible for notifying the shift supervisor.**

3.5 Quality Assurance will perform surveillance of the ongoing work as deemed appropriate and perform the verification identified herein.

4.0 TOOLS, EQUIPMENT, COMPONENTS, AND REFERENCES

See Figure 8 for NOx equipment and component physical layout.

4.1 Tools and Equipment

The following equipment is available in the 01-14 area for use by Vitrification Operations during analyzer operation:

4.1.1 NO detector

4.1.2 Respirators with chemical vapor canisters for NOx.

4.1.3 Thermo Electron TE-2000 oil or Mobil 10W40

4.1.4 Small and large combination wrenches

4.1.5 Teflon tubing and fittings (1/4" and 3/8")

4.1.6 One calibration gas mixture (cylinder) meeting the following specifications:

Type of mixture: primary standard NO in Nitrogen Concentration: 2500 ppm Preparation Tolerance: + 2% of component Certification Accuracy: + 0.02 absolute or 1% of the component whichever is smaller.

4.1.7 One calibration gas mixture (cylinder) meeting the following specifications:

Type of mixture: certified standard NO in Nitrogen Concentration: 250 ppm Preparation Tolerance: + 10% of component Certification Accuracy: 2% of component.

4.2 Components

4.2.1 Heated Sample Conditioning Unit (Model 900)

Heated Chamber
Flow Accumulator
Sample Pump
By Pass Pump

4.2.2 NO/NOx Analyzer Units (Model 10A)

4.2.2.1 Analyzer Unit (2 each)

Reaction Chamber
Photomultiplier Tube
Ozone Generator and Ozone Scrubber
Converter
Vacuum and By Pass Pumps

4.2.2.2 Control Unit (2 each)

Potentiometers
NO/NOx Dual Scale Meter
Photomultiplier Power Supply

4.2.3 Perma Pure Sampling System (Model 1612E)

Perma Pure Dryer (Model PD 625-24SS)
Glass Fiber Filter on Stainless Steel Teflon Coated Aluminum Manifold (Model F-275-4AFG)

4.2.4 Bellows Booster Pump (Model MB 158)

4.2.5 Chart Recorder (Linear Model 500)

4.2.6 Vitrification Operations Control Panel

4.3 References

4.3.1 Model 10A Chemiluminescent NO/NOx Analyzer Instruction Manual, Thermo Electron Corporation

4.3.2 Instruction Manual Model 900 Heated Sample Gas Dilution and Conditioning Unit, Thermo Electron Corporation

4.3.3 Instruction and Operation Manual for Perma Pure Dryer

4.3.4 Metal Bellows Booster Compressors and Vacuum Pumps Catalog

4.3.5 Linear Model 500 Chart Recorder Operating Instructions

5.0 GENERAL INFORMATION

5.1 The sample analysis most essential to routine, nonradioactive Vitrification Off-Gas Treatment control is for NO and NO2. Accurate determination of sample concentration is essential for environmentally approved operation. See Figure 9 for overall monitoring system flow.

Anticipated Levels of NOx in the 01-14 Off-Gas

4000 - 5000 ppm before scrubbers
2000 - 4000 ppm between scrubbers
0 - 400 ppm after scrubbers

NO2 limit at Post Scrubber Position = 2600 ppm
NO2 limit at Stack Position = 1300 ppm

5.2 Chemiluminescent NO/NOx Analyzer Model 10A (Figure 1)

5.2.1 Principle of Operation

This system measures the nitric oxide and total oxides of nitrogen in stack monitoring applications. The chemiluminescent reaction of NO and O3 provides the basis for operation of this group of instruments. Specifically,

$NO + O_3 \longrightarrow NO_2 + O_2 + h\nu$.

Light emission results when electronically excited NO2 molecules revert to their ground state.

To measure NO concentrations, the gas sample is blended with O3 in a heated reaction chamber, where the above reaction occurs. The resulting chemiluminescence is monitored through an optical filter by a high sensitivity photomultiplier positioned at one end of the reaction chamber. The filter/photomultiplier combination responds to light in a narrow wavelength band unique to the above reaction. The output from the photomultiplier is linearly proportional to the NO concentration. See Figure 2 for NO/NOx Gas Analyzer Conceptual Schematic.

To measure NOx concentrations (i.e., NO plus NO2), the sample gas flow is diverted through an NO2-to-NO converter. The chemiluminescent response in the reaction chamber to the converter effluent is linearly proportional to the NOx concentration entering the converter.

5.2.2 Operating Conditions

Sample (gauge vacuum)	5 ±1 in Hg
Reaction Chamber (vacuum)	27-30 in Hg
Converter Temperature	675 + 25 C
By Pass Flow Meter	1.5 - 2.0 SCFH

5.2.3 Analyzer Component Functions (See Figure 3 for Model 10A Analyzer Flow Diagram)

5.2.3.1 Reaction Chamber - the sample gas containing NO molecules is mixed with O3 molecules from the ozonator creating electronically excited NO2 molecules which emit light (chemiluminescence) as the orbital electrons relax to their ground state.

5.2.3.2 Filter/Photomultiplier Tube - The emitted light from the reaction chamber passes through the filter/photomultiplier tube which responds to light in a narrow wavelength band unique to the desired electron relaxation. The output from the photomultiplier tube is linearly proportional to the NO concentration.

5.2.3.3 Ozone Scrubber - absorbs ozone coming from the reaction chamber to minimize oxidation of vacuum pump oil. See Figure 4

5.2.3.4 Ozone Generator - provides O3 to the reaction chamber for the chemiluminescent reaction.

5.2.3.5 Converter - converts NO2 to NO by applying heat to the NO2 molecules in the presence of a catalyst.

5.2.3.6 Vacuum Pump - maintains the reaction chamber pressures between -27 to -30 inch-Hg. See Figure 4

5.2.3.7 By-Pass Pump - pulls the portion of the sample gas which does not pass through the reaction chamber through the bypass flowmeter then through the by pass pump to the exhaust valve.

5.2.3.8 Drierite Column - The column removes moisture from the air in order to provide dry air to the ozone generator. When Drierite is activated it is a blue color. When the Drierite is exhausted/deactivated it turns pink and must be replaced or regenerated.

5.2.3.9 Capillaries - The 3 capillaries restrict the gas flows through the analyzer:

Color	Size Opening	Length
blue	0.020"	1-1/2"
red	0.008"	1-1/2"
yellow	0.005"	1-1/8"

See Figure 3A for Model 10A Analyzer Internals.

5.3 Heated Sample Gas Dilution and Conditioning Unit (Figure 5)

5.3.1 Principle of Operation

This unit filters and dilutes a gas sample. The dilution plumbing, housed in the heated chamber, blends dry air with a gas sample to reduce its dew point, thereby preventing the formation of condensed water in the system. See Attachment A for flow of system.

5.3.2 Operating Conditions

Dilution Air (instrument air)	10-14 psig
Chamber Vacuum	20 + 1 in Hg
Sample Vacuum	5 in Hg
Chamber Temperature	180°F ±5°F
Flow Rate	0.75-2.0 scfh

5.3.3 Component Functions

5.3.3.1 Heated Chamber - filters and heats the entering sample gas.

5.3.3.2 Flow Accumulator - smooths the pulsations of the by pass pump.

5.3.3.3 Sample Pump - pulls the sample gas through the heated chamber.

5.3.3.4 By-Pass Pump - pulls the portion of the sample gas that does not go through the heated chamber to the exhaust valve.

5.3.3.5 Capillaries - restrict the gas flow through the Model 900 Conditioner:

Color	Size Opening	Length
blue	0.020"	1-1/2"
purple	0.015"	1-1/8"
white	0.025"	1-1/2"

See Figure 5A for Model 900 Conditioner Internals.

5.3.4 Safety Features

5.3.4.1 If the chamber temperature is below 170 F the sample/span valve will energize and place the unit in the span mode preventing condensate from forming in the unit.

5.3.4.2 Deleted

5.4 Perma Pure Sampling System

5.4.1 Principle of Operation

The Perma Pure Sampling System is designed to condition gas vapor streams by continuous, selective removal of particulates, condensates, and water vapor without loss of the gases being measured.

5.4.2 Operating Conditions

Heater Temperature	110-140°F
Dilution Air Flow Rate	Approximately 1.5 times the sample flow rate

5.4.3 Perma Pure Sampling System Component Functions

5.4.3.1 Perma Pure Dryer

The Perma Pure Dryer utilizes a hygroscopic (likes to absorb water), ion exchange membrane in a continuous drying process to selectively remove water vapor from mixed gas streams. A single tube is fabricated in a shell and tube configuration and sealed into an impermeable shell. If a wet gas stream flows through the tubes and a countercurrent dry gas stream purges the shell, water vapor molecules are transferred through the walls of the tubing. The key to continuous separation of the water vapor from its gas stream is the countercurrent.

5.5 OPERATORS SHOULD PERFORM FREQUENT CHECKS ON SYSTEMS THAT ARE TURNED ON OR SHUT DOWN TO ASSURE THE SYSTEM DOES WHAT IS EXPECTED, I.E., WATER FLOWS, PRESSURE RISES, LEVEL INDICATORS, ETC. IF THE REQUIRED ACTION THAT IS SUPPOSED TO HAPPEN DOES NOT HAPPEN, (1) STOP DO NOT ATTEMPT TO PERFORM THE NEXT STEP, (2) SECURE SYSTEM IN A SAFE MODE, AND (3) NOTIFY SHIFT SUPERVISOR IMMEDIATELY.

6.0 PROCEDURES

ALL STEPS IN THIS PROCEDURE WHICH REQUIRE AN INSPECTION, THE RECORDING OF DATA, OR A SIGN OFF WILL BE DENOTED BY A [+] IN THE LEFT HAND MARGIN. THE INSPECTION RESULTS, DATA, OR SIGN OFF WILL BE RECORDED ON THE PROCEDURE DATA SHEETS. DATA SHEETS SHALL BE SENT TO MRC FOR PERMANENT STORAGE FOLLOWING EACH RUN. A COPY OF THE DATA SHEETS SHALL BE DELIVERED TO VITRIFICATION TEST ENGINEERING.

6.1 Prestart-up Conditions

NOTE: Verification initials and date for prestart-up conditions shall be recorded on Attachment D.

Prior to this system going on-line, it must be calibrated with 250 ppm (Lo Span) and 2500 ppm (Hi Span) span gases. During on-line operations, this system shall be calibrated using both span gases once a day. See Figure 9 for NO_x flow schematic and Figure 10 for vitrification operator's panel board layout.

6.1.1 Prior to starting up this system an NO detector shall be placed in operation or be in operation at the rear of the system near the span gas cylinders and exhaust tubing.

[+] 6.1.2 SEE CAUTION. Notify the Vitrification operations control room operator you will be starting up the system.

CAUTION - a portable radio should not be used within 15 feet of this system.

6.1.3 Verification of Power Supply, Drierite Condition, and Pump Oil Level

6.1.3.1 Confirm the vacuum and bypass pumps for both Model 10A analyzers and the bellows booster pump are off.

6.1.3.2 Confirm the Drierite for both Drierite columns are not exhausted (color should be blue). If the Drierite is exhausted (more than 70% of the column is pink), replace the Drierite with fresh Drierite.

6.1.3.3 Confirm the Perma Pure Dryer is off.

6.1.3.4. Confirm the sample heating tapes are off.

6.1.3.5 Check both Model 10A Analyzer vacuum pumps oil level. The level should be between the two lines. If low refill with Thermo Electron TE-2000 oil CAT. 4824 or equivalent using a syringe or small diameter tube via the pump exhaust port. Caution: Do not get oil on the pump belt as belt slipping can occur. See Figure 4.

6.1.4 Verification of Valve Positions

[+] 6.1.4.1 Verify the 4-way span Inlet valve, V-3, is in the "ambient air" position.

[+] 6.1.4.2 Verify the 4-way sample Inlet valve, V-1, is in the "ambient air" position.

[+] 6.1.4.3 Verify the dilution air valve, V-5, is closed.

[+] 6.1.4.4 Verify both span gas cylinder pressure regulator outlet and Inlet valves are closed. See Figure 7.

[+] 6.1.4.5 Verify Prescrubber isolation valve, V-12, is in "ambient air" position.

[+] 6.1.4.6 Verify Between Scrubber isolation valve, V-13, is in "ambient air" position.

[+] 6.1.4.7 Verify post-scrubber isolation valve, V-14 is in "ambient air" position

[+] 6.1.4.8 Verify stack isolation valve, V-15, is in "ambient air" position.

6.1.5 Verification of Model 900 Sample Conditioner Switch Positions (See Figure 5)

6.1.5.1 Confirm the Model 900 Sample Conditioner "PUMP" and "POWER" toggle switches are in the "OFF" position. The indicator lights should be off.

6.1.5.2 Confirm the Model 900 Sample Conditioner "ZERO/SAMPLE/SPAN" toggle switch is in the "SAMPLE" position.

6.1.6 Verification of both Model 10A Analyzer Switch Positions

6.1.6.1 Confirm both Model 10A Analyzer "OZONE" generator power switches and "POWER" switches are off. The switch lights will be off. See Figure 1.

6.1.6.2 Confirm both Model 10A Analyzer "RANGE PPM" selection switches are in the "ZERO" position and the "NO/NOx" mode switches are in the "NO" position.

6.1.7 Verification of the Chart Recorder Switch Positions (See Figure 6)

6.1.7.1 Confirm the chart recorder "POWER" and "CHART SPEED" toggle switches are in the "OFF" position. The power light will be off.

6.1.7.2 Set the chart recorder "INPUT LOWER" and "UPPER" dials to the "10" mv position.

6.1.7.3 Place the chart recorder "ZERO STAND BY/RECORD" toggle switches in the "STAND BY" position. This prevents the chart recorder from receiving any signals.

6.1.7.4 Place the chart recorder "CHART SPEED" toggle switch in the "CM/HR" position and place the "CHART SPEED" dial in the "2" position.

6.1.7.5 Ensure printer wires are connected to the rear of the NOx analyzer control units. On each analyzer unit the red cord inserts in top jack and the black cord inserts in bottom jack.

[+] 6.1.7.6 Record the chart recorder speed, mv, date, time, and your initials on the chart recorder graph paper.

6.2 System Start-up

[+] 6.2.1 Verify exhaust valve, 6-64-HV-153, located on the 3rd floor north wall of the 01-14 building wall penetration 6-64-01-P136 and instrument air valve, 6-64-GT-155, located on 3rd floor south wall are open.

[+] 6.2.2 Verify the 30 amp disconnect switch located outside on the west side of the 01 cell is on and that all switches inside the NOx lighting panel located in the NOx room are closed ("ON").

6.2.3 Place the Model 900 Sample Conditioner "POWER" toggle switch in the "ON" position. **The Model 900 Sample Conditioner requires approximately 2 hours for the chamber temperature to stabilize at approximately 180 F.**

6.2.4 Turn both Model 10A Analyzers "POWER" switches on. The switches will illuminate.

6.2.5 Verify both Model 10A Analyzer "CONVERTER" temperature controllers are set 675 C and place both "NO-NOx" converter mode switches in the "NO" position. **NOTE: The converter will require ~ 20 minutes to reach operating temperature. The NOx mode can not be utilized until the converter has reached its operating temperature. The converter cycle lamp will flash on and off when the converter has reached its operating temperature.**

6.2.6 Turn on Perma Pure Sampling System. It will take 20 to 30 minutes to reach operating temperature (110 to 140 °F).

6.2.7 Turn on controllers for sample line heat tapes. Controllers will normally be operating on the "1" setting. OPERATING TEMPERATURE is 110 to 130°F (43° to 54°C).

6.2.8 Turn on the chart recorder by placing the power switch in the "ON" position. The green power light should illuminate. Remove the pen head covers and place on the standby-record toggle knobs.

6.2.9 Adjust both "ZERO STANDBY/RECORD" dials until their respective pens are resting on the 0 division line. This zeros the chart recorder.

6.2.10 Place the chart recorder "ZERO STANDBY/RECORD" toggle switches in the "RECORD" position. The chart recorder is ready for calibration of the Model 10A Analyzers.

6.2.11 Place both Model 10A Analyzer "RANGE PPM" selection switches in the "ZERO" position. This position is for checking the electronic connections between the analyzers and the chart recorder.

The chart recorder pens and the Model 10A Analyzer meter scales should be in the 0 position. If not, check for loose wire connections between the analyzers and the chart recorder.

6.2.12 Place both Model 10A Analyzer "RANGE PPM" selection switches in the "FULL SCALE" position. This position is for checking the electronic connections between the analyzers and chart recorder.

The chart recorder pens and the Model 10A Analyzer meter scales should be in the full scale positions. If not, check for loose wire connections between the analyzers and the chart recorder.

If pen and meter does not rest at full scale position and wire connections are not loose, then instrument technician should check and adjust the voltage across the output jack in the control unit to get 0 mv on "0" scale and 10 mv on "Full Scale".

6.2.13 Uncover the Drierite column inlets.

[+] 6.2.14 **Verify an off-gas blower is in operation and either valve 6-64-BU-133 or 6-64-BU-132 is open prior to proceeding with the rest of this procedure.**

6.2.15 Open sample to Perma Pure Valve, V-7.

[+] 6.2.16 **Verify the Model 900 Sample Conditioner chamber temperature has reached -180°F. The temperature indicator is located inside the chamber. Also, the cycle lamp will flash on and off when the chamber has reached operating temperature. Do not proceed with this procedure until this condition has been satisfied.**

[+] 6.2.17 Verify the Perma Pure Sampling System has reached operating temperature (100 - 140 °F).

[+] 6.2.18 Verify the heat tapes are at operating temperature (110 - 130 °F). Use a thermocouple and hand held thermocouple meter.

6.2.19 Open Exhaust Valves, V-10 and V-11.

6.2.20 Turn on both Model 10A Analyzer by pass and vacuum pumps.

6.2.21 Turn on the Model 900 Sample Conditioner pump by placing the "PUMP" toggle switch in the "ON" position. The "PUMP" light will illuminate.

6.2.22 Turn on BOOSTER PUMP.

6.2.23 Observe the "REACTION CHAMBER" pressure on both Model 10A Analyzers for pump down to ~ -27 to -30 inch Hg. If the vacuum remains less than -27 inch Hg after 5 minutes, check for possible leaks in the connections between the vacuum pumps, ozone scrubbers, and the Model 10A Analyzers. If the pressure continues to be above -27 inch Hg, the ferrules between the vacuum pumps and analyzers may need replacing.

6.2.24 Verify both Model 10A Analyzer "SAMPLE" vacuums are -5 inch Hg. If not, check capillaries for plugging. If still not able to get -5 inch Hg, adjust sample regulator screw (See Figure 3A).

6.2.25 Open Dilution air valves, V-5 and V-20. Regulate condition dilution air regulator, R-2, to ~11 psig. The setting will vary with the results of the adjustments made in the following step.

6.2.26 Adjust the "DILUTION AIR" dial on the Model 900 Sample Conditioner control panel until ~10 psig is reached. The Model 900 Sample Conditioner "CHAMBER VACUUM" should be 20 inch Hg and the "SAMPLE VACUUM" should be 5 inch Hg. The sample vacuum can be adjusted by the "SAMPLE VACUUM" dial next to the "SAMPLE VACUUM" pressure gauge.

6.2.27 Verify both Model 10A Analyzer "BYPASS" flow meters are 1.5 to 2.0 SCFH. If not, adjust the flow rates by adjusting the two analyzer needle valves, V-8 and V-9. It is important to maintain approximately equal flow through both Model 10A Analyzers.

6.2.28 Adjust Sample/Booster Exhaust Valve, V-6, and Sample to Perma Pure Valve, V-7, until a flow rate of ~1.5 through the conditioner is obtained

6.2.29 Open Perma Pure Air Regulator, R-1, to 20 psig and completely open Perma Pure Flow Meter, F-1, Adjust flow rate to the Perma Pure Sampling system by adjusting Perma Pure Valve, V-4. Flow rate should be ~1.5 to 2 times the sample flow rate. Flow meter will normally be set at 2.5 scfh.

6.2.30 Confirm Post Scrubber Valve, 6-64-GT-147, located on north wall of 2nd floor 01-14 building, is open.

6.2.31 Confirm 2nd floor between Scrubber Isolation Valve, V-17, and 2nd floor Post Scrubber Isolation Valve, V-18, are open.

6.2.32 Confirm the 4th floor Stack Isolation Valve, V-19, is open.

6.2.33 Confirm the Pre-Scrubber Isolation Valve, V-16, is open. V-16 is located in NOx Room.

6.3 System Calibration

[+] NOTE: QA shall verify calibration cycle once during an operating period (i.e., run, boildown). Sign-off shall be on Attachment D-2. Verification for system calibration shall also be on Attachment D-2.

6.3.1 Place the background suppression toggle switch and the calibration toggle switch on "low". Toggle switches are located inside the control unit near analog 915 device.

6.3.2 Place both Model 10A converters "NOx" mode switches in the "NO" position.

6.3.3 Place both Model 10A Analyzer "BACKGROUND SUPPRESSION" dials in the "0" position.

6.3.4 Place both Model 10A Analyzer "RANGE PPM" selector switches in the "2.5" position.

Observe the chart recorder pen positions. If there are no readings on either Model 10A Analyzer meter sales, check for loose coaxial cables between both Model 10A Analyzers control units and analyzer units. If there is still no change, place the "RANGE PPM" selector switch in the "1000" position and slowly switch down to the "2.5" position.

6.3.5 Adjust both "BACKGROUND SUPPRESSION" dials on the Model 10A Analyzers until the meter scales read 0 and the chart recorder pens are resting on the 0 division line. The chart recorder pens may fluctuate due to the noise level. It is more important for the chart recorder to be in the correct position than the meter scales. Lock both "BACKGROUND SUPPRESSION" dials in place.

If the background suppression dial does not bring the recorder pen to zero, try putting the suppression switch on high. If this still does not work, notify supervisor.

6.3.6 Turn both Model 10A Analyzer "OZONE" generator power switches on. The switch light will illuminate. The chart recorder pens and Model 10A Analyzer meter scales may move from their 0 positions slightly due to room temperature or ozone background noise. Do not adjust background suppression for this.

6.3.7 Open both span gas cylinder pressure regulator Inlet valves (about 1/4 of a turn) until the Inlet pressure stabilizes.

[+] 6.3.8 SEE CAUTION. Notify the Vitrification Operations control room operator you will be calibrating the Model 10A Analyzer on the 100X scale.

CAUTION. A portable radio should not be used within 15 feet of this system.

6.3.9 Place both Model 10A Analyzer "RANGE PPM" selection switches in the "100" position.

6.3.10 Confirm both Model 10A Analyzer converters are at operating temperature by observing the "CONVERTER" cycle lamp on the temperature controller is flashing.

[+] 6.3.11 Calibrate the NOx Analyzer with 2500 ppm span gas if expecting greater than 250 ppm NOx readings by following Step 6.3.11.1. Calibrate with 250 ppm span gas if expecting less than 250 ppm readings by following Step 6.3.11.2.

Indicate on Attachment D-2 which span gas used. The following chart recording paper scale will be used for calibration on the 100X range:

Range	Small Divisions (ppm)	Full Scale (ppm)
2.5X	.625	62.5
10X	2.5	250
25X	6.25	625
100X	25	2500
250X	62.5	6250
1000X	250	25000

6.3.11.1 Calibration with 2500 ppm Span Gas

1. Fully open Booster Sample Exhaust Valve, V-6, and turn the Span Inlet Valve, V-3 to the "Hi Span" position.

2. Place the Model 900 Sample Conditioner "ZERO/ SAMPLE/SPAN" toggle switch in the "SPAN" position.

3. Open the ~2500 ppm span gas cylinder pressure regulator outlet valve and adjust the pressure regulator until a flow rate of ~1.5 scfh passes through the 900 condition. Pressure regulator will be <1/4 psig.

4. Observe the chart recorder pen responses. If the pens are not resting on the graph paper division line correlating to the ~ 2500 ppm, adjust the appropriate Model 10A Analyzer

"CALIBRATION" dial until each pen is in the correct position on the graph paper. If the pens are not responding to the span gas the capillaries may need replaced or cleaned.

If the calibration dial does not bring the recorder pen to the correct position, try putting the calibration switch on medium, and if necessary, on high. If this still does not work, notify supervisor.

5. Confirm both Model 10A Analyzer meter scales are reading ~ 2500 ppm and lock the "CALIBRATION" dials.

[+] 6. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NO reading is ~ 2500 ppm on the 100x scale.

CAUTION - a portable radio should not be used within 15 feet of this system.

7. Place both Model 10A Analyzer converter "NO-NOx" mode switches in the "NOx" position.

8. Observe the chart recorder responses and the Model 10A Analyzer meter scales. The span gas should read approximately the same ± 1 small graph paper division.

[+] 9. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NOx reading is ~ 2500 ppm on the 100x scale.

CAUTION - a portable radio should not be used within 15 ' of this system.

10. Close the ~2500 ppm span gas cylinder pressure regulator outlet valve.

11. Observe the chart recorder pens. They should return to the graph paper 0 division line and both Model 10A Analyzer meter scales should read 0. If the readings are slightly above 0, this is caused by residual gas left in the tubing. To return the pens to the 0 position, place the Span Inlet Valve, V-3, in the "Ambient Air" position.

[+] 12. **SEE CAUTION.** Verify with the Vitrification operations control room operator the DCS NO reading is ~0 in the 100x scale. Upon confirmation, inform the control room operator you will be using the ~250 ppm span gas and a "RANGE PPM" selection of 100x scale.

CAUTION - a portable radio should not be used within 15 feet of this system.

13. Place the Span Inlet Valve, V-3, in the "Lo Span" position.

14. Place both Model 10A converter "NO-NOx" mode switches in the "NO" position.

15. Open the ~250 ppm span gas cylinder pressure regulator outlet valve and adjust the pressure regulator until flow rate of ~1.5 scfh passes through the 900 conditioner. Pressure regulator will be <1/4 psig.

16. Observe both Model 10A Analyzer meter scales and chart recorder pen for a reading of ~ 250 ppm. Do not adjust calibration dial. If reading of ~250 ppm is not obtainable, repeat calibration with 2500 ppm span gas.

[+] 17. **SEE CAUTION.** Verify with the Vitrification operations control room operator the DCS NO reading is ~ 250 ppm on the 100x scale.

CAUTION - a portable radio should not be used within 15' of this system.

18. Place both Model 10A Analyzer converter "NO-NOx" mode switches in the "NOx" position.

19. Observe the chart recorder pen positions and both Model 10A Analyzer meter scales. The span gas should read approximately the same + 1 small graph paper division.

[+] 20. **SEE CAUTION.** Verify with the Vitrification operations control room operator the DCS NOx reading is ~250 ppm on the 100x scale.

CAUTION - portable radios should not be used within 15' of this system.

21. Close the ~250 ppm span gas cylinder pressure regulator outlet valve.

22. Observe the chart recorder pen responses and both Model 10A Analyzer meter scales should drop to ~0. If the pens and meter scales remain slightly above 0, this is caused by residual gas in the tubing. To obtain 0 pen responses, place the Sample Inlet Valve, V-3, in "Ambient Air" position.

[+] 23. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NO and NOx readings are ~0.

CAUTION - a portable radio should not be used within 15' of this system.

[+] 24. Record the date, time, span gas ppm, calibration factor, background suppression factor, reason for monitoring, remarks, and your initials in the NOx monitoring log book. See Attachment B.

25. Repeat step 6.3.11.1 until the chart recorder pen responses and meter scales responses are consistent.

26. Place the Span Inlet Valve, V-3, to the "Lo Span" position. close the ~250 ppm span gas cylinder pressure regulator Inlet valve and open the outlet valve to bleed off any remaining gas. The pressure regulator outlet

pressure should drop to ~0. Then close the outlet valve and back off the pressure regulator valve ~1-1/2 to 2 turns to open the regulator and relieve the excess pressure.

27. Place the Span Inlet Valve, V-3, in the "Hi Span" position.

28. Close the ~2500 ppm span gas cylinder pressure Inlet valve and open the outlet valve to bleed off any remaining gas. The pressure regulator outlet pressure should drop to ~ 0. Then close the outlet valve and back off the pressure regulator valve ~1-1/2 to 2 turns to open the regulator and relieve the excess pressure.

29. Place the Span Inlet Valve, V-3, in the "Ambient Air" position

30. Place the Model 900 Sample Conditioner "ZERO/ SAMPLE/SPAN" toggle switch in the "SAMPLE" position.

6.3.11.2 Calibration with 250 ppm Span Gas

1. Fully open Booster Sample Exhaust Valve, V-6 and turn the Span Inlet Valve, V-3, to the "Lo Span" position.

2. Place the Model 900 Sample Conditioner "ZERO/SAMPLE/SPAN" toggle switch in the "SPAN" position.

3. Open the ~250 ppm span gas cylinder pressure regulator outlet valve and adjust the pressure regulator unit a flow rate of ~1.5 scfh passes through the 900 Conditioner. Pressure regulator will be <1/4 psig.

4. Observe the chart recorder pen responses. If the pens are not resting on the graph paper division line correlating to the ~ 250 ppm, adjust the appropriate Model 10A Analyzer "CALIBRATION" dial until each pen is in the correct position on the graph paper. If the pens are not responding to the span gas the capillaries may need replaced or cleaned.

   If the calibration dial does not bring the recorder pen to the correct position, try putting the calibration switch on medium and, if necessary, on high. If this does not work, notify supervisor.

5. Confirm both Model 10A Analyzer meter scales are reading ~ 250 ppm and lock the "CALIBRATION" dials.

[+] 6. <u>SEE CAUTION</u>. Verify with the Vitrification operations control room operator the DCS NO reading is ~ 250 ppm on the 100x scale.

   <u>CAUTION</u> - a portable radio should not be used within 15 feet of this system.

7. Place both Model 10A Analyzer converter "NO-NOx" mode switches in the "NOx" position.

8. Observe the chart recorder responses and the Model 10A Analyzer meter scales. The span gas should read approximately the same ± 1 small graph paper division.

[+] 9. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NOx reading is ~ 250 ppm on the 100x scale.

CAUTION - a portable radio should not be used within 15 ' of this system.

10. Close the ~250 ppm span gas cylinder pressure regulator outlet valve.

11. Observe the chart recorder pens. They should return to the graph paper 0 division line and both Model 10A Analyzer meter scales should read 0. If the readings are slightly above 0, this is caused by residual gas left in the tubing. **To return the pens to the 0 position, place the Span Inlet Valve, V-3, to the "Ambient Air" position.**

[+] 12. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NO reading is ~0 in the 100x scale. Upon confirmation, inform the control room operator you will be using the ~2500 ppm span gas and a "RANGE PPM" selection of 100x scale.

CAUTION - a portable radio should not be used within 15 feet of this system.

13. Place the Span Inlet Valve, V-3, in the "Hi Span" position.

14. Place both Model 10A converter "NO-NOx" mode switches in the "NO" position.

15. Open the ~2500 ppm span gas cylinder pressure regulator outlet valve about 1/4 of a turn and adjust the pressure regulator until flow rate of ~1.5 scfh passes through the 900 conditioner. Pressure regulator will be <1/4 psig.

16. Observe both Model 10A Analyzer meter scales and chart recorder pen for a reading of ~ 2500 ppm. Do not adjust calibration dial. If reading of ~2500 ppm is not obtainable, repeat calibration with 250 ppm span gas.

[+] 17. **SEE CAUTION**. Verify with the Vitrification operations control room operator the DCS NO reading is ~ 2500 ppm on the 100x scale.

CAUTION - a portable radio should not be used within 15' of this system.

18. Place both Model 10A Analyzer converter "NO-NOx" mode switches in the "NOx" position.

19. Observe the chart recorder pen positions and both Model 10A Analyzer meter scales. The span gas should read approximately the same ± 1 small graph paper division.

[+] 20. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NOx reading is ~2500 ppm on the 100x scale.

CAUTION - portable radios should not be used within 15' of this system.

21. Close the ~2500 ppm span gas cylinder pressure regulator outlet valve.

22. Observe the chart recorder pen responses and both Model 10A Analyzer meter scales should drop to ~0. If the pens and meter scales remain slightly above 0, this is caused by residual gas in the tubing. To obtain 0 pen responses, place the Sample Inlet Valve, V-3, in "Ambient Air" position.

[+] 23. SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NO and NOx readings are ~0.

CAUTION - a portable radio should not be used within 15' of this system.

[+]

24. Record the date, time, span gas ppm, calibration factor, background suppression factor, reason for monitoring, remarks, and your initials in the NOx monitoring log book. See Attachment B.

25. Repeat step 6.3.11.2 until the chart recorder pen responses and meter scales responses are consistent.

26. Place the Span Inlet Valve, V-3, to the "Hi Span" position. Close the ~2500 ppm span gas cylinder pressure regulator Inlet valve and open the outlet valve to bleed off any remaining gas. The pressure regulator outlet pressure should drop to ~0. Then close the outlet valve and back off the pressure regulator valve ~1-1/2 to 2 turns to open the regulator and relieve the excess pressure.

27. Place the Span Inlet Valve, V-3, in the "Lo Span" position.

28. Close the ~250 ppm span gas cylinder pressure Inlet valve and open the outlet valve to bleed off any remaining gas. The pressure regulator outlet pressure should drop to ~ 0. Then close the outlet valve and back off the pressure regulator valve ~1-1/2 to 2 turns to open the regulator and relieve the excess pressure.

29. Place the 3-way Span Inlet Valve, V-3, in the "Ambient Air" position.

30. Place the Model 900 Sample Conditioner "ZERO/ SAMPLE/SPAN" toggle switch in the "SAMPLE" position.

6.4 Off-Gas Sampling

Prior to changing sample gas positions and/or ranges, contact the Vitrification control room operator. Verification steps shall be documented on Attachment D-1.

[+] 6.4.1 SEE CAUTION. Notify the Vitrification control room operator you are to begin sampling. Indicate the sample position and "RANGE PPM" to be used for NO and NOx.

CAUTION - a portable radio should not be used within 15 feet of this system.

6.4.2 Confirm the Model 900 Sample Conditioner "ZERO/ SAMPLE/SPAN" toggle switch is in the "SAMPLE" position.

6.4.3 Place both Model 10A Analyzer RANGE PPM in the appropriate range for the sample position chosen.

For the different locations of the sample points, the following Model 10A Analyzer "RANGE PPM" selections should be used as a guide:

Prescrubber Position	Range > 100x
Between Scrubber Position	Range > 100x
Post Scrubber Position	Range > 25x
Stack Position	Range > 25x

6.4.4 Place the Model 10A Analyzer (marked red pen) converter "NO-NOx" mode switch in the NOx position.

6.4.5 Place the Model 10A Analyzer (marked blue pen) converter "NO-NOx" mode switch in the NO position.

6.4.6 Place the isolation valves V-12, V-13, V-14, and V-15 in sampling position.

Prescrubber Isolation Valve is labeled V-12.

Between Scrubber Isolation Valve is labeled V-13.

Post Scrubber Isolation Valve is labeled V-14.

Stack Isolation Valve is labeled V-15.

6.4.7 Place the Sample Inlet Valve, V-1, in the selected sample position.

6.4.8 Adjust Booster Sample Exhaust valve, V-6, and booster sample to Perma Pure valve, V-7, until a flow rate of ~1.5 scfh is flowing through the conditioner.

[+] 6.4.9 Record date, time, "RANGE PPM" for NO and NOx, the sample position, the melter/mini melter feed rate (l/hr), off-gas flow rate (FI-6101 from DCS), calibration factor, background suppression factor, reason for monitoring (ie run #, SVS run #, boildown #), remarks, NO and NOx ppm, and your initials in the NOx monitoring log book. See Attachment B.

[+] 6.4.10 SEE CAUTION. Verify with the Vitrification operations control room operator the DCS NO and NOx readings are approximately the same as the chart recorder and meter readings.

CAUTION - portable radios should not be used within 15' of this system.

[+] 6.4.11 Record the date, time, RANGE, sample point, calibration factor, background suppression factor, reason for monitoring, remarks, and initials on the chart recorder graph paper.

6.5 System Calibration During On-Line - Operation

Verification steps shall be documented on Attachment D-2.

NOTE: QA shall verify calibration cycle once during an operating period (i.e., run, boildown).

[+] 6.5.1 SEE CAUTION. Notify the Vitrification operations control room operator you are going to calibrate the NOx Analyzer monitoring system on the 100x scale.

CAUTION - a portable radio should not be used within 15' of this system.

6.5.2 Place the 4-way "Ambient Air/Post Scrubber/Prescrubber/ Between Scrubber" valve, 6-64-HV-160 in the "Ambient Air" position. Watch the chart recorder pens and Model 10A Analyzer meter scales. The chart recorder pens should return to the 0 positions.

6.5.3 Confirm the Model 900 Sample Conditioner "ZERO/ SAMPLE/SPAN" toggle switch in the "SAMPLE" position.

6.5.4 Confirm both Model 10A Analyzer "REACTION CHAMBER" vacuums are -27 to -30 inch Hg and "SAMPLE" vacuums are -5 inch Hg. If not, see steps 6.2.23 and 6.2.24 for adjustments.

6.5.5 Confirm the Model 900 Sample Conditioner "POWER" and "PUMP" toggle switches are in the "ON' position. Their associated indicator lights should be on.

6.5.6 Confirm the Model 900 Sample Conditioner "DILUTION AIR" pressure is ~10 psig. If not, see steps 6.2.23 and 6.2.24 for adjustments.

6.5.7 Confirm both Model 10A Analyzer "BYPASS" flow rates are 1.5 to 2.0 SCFH. If not, see step 6.2.25.

6.5.8 Turn both Model 10A Analyzer "OZONE" generator power switches off. The switch lights should go out.

6.5.9 Place both Model 10A converters "NOx" mode switches in the "NO" position.

6.5.10 Place both Model 10A Analyzer "RANGE PPM" selector switches in the "2.5" position.

Observe the chart recorder pen positions. If there are no readings on either Model 10A Analyzer meter sales, check for loose coaxial cables between both Model 10A Analyzers control units and analyzer units. If there is still no change, place the "RANGE PPM" selector switch in the "1000" position and slowly switch down tot he "25." position.

6.5.11 Adjust both "BACKGROUND SUPPRESSION" dials on the Model 10A Analyzers until the meter scales read ~0 and the chart recorder pens are resting on the ~0 division line. The chart recorder pens may fluctuate due to the noise level. It is more important for the chart recorder to be in the correct position than the meter scales. Lock both "BACKGROUND SUPPRESSION" dials in place.

6.5.12 Turn both Model 10A Analyzer "OZONE" generator power switches on. The switch light will illuminate. The chart recorder pens and Model 10A Analyzer meter scales may move from their 0 positions slightly due to room temperature or ozone background noise. Do not adjust background suppression for this.

6.5.13 Open both span gas cylinder pressure regulator inlet valves (about 1/4 of a turn) until the inlet pressure stabilizes.

6.5.14 Place both Model 10A Analyzer "RANGE PPM" selection switches in the "100" position.

6.5.15 Confirm both Model 10A Analyzer converters are at operating temperature by observing the "CONVERTER" cycle lamp on the temperature controller is flashing.

6.5.16 Proceed with completing Step 6.3.11 to accomplish calibration of the system and document verification steps on Attachment D-2.

6.6 System Shut Down for One or Two Days (IDLING)

Verification signature shall be documented on Attachment D-3.

[+] 6.6.1 SEE CAUTION. Notify the Vitrification control room operator you are placing the system in the idling mode.

CAUTION - a portable radio should not be used within 15' of this system.

6.6.2 Turn both Model 10A analyzer "OZONE" generator power switches off. The switch lights will go out.

[+] 6.6.3 Verify the Sample Inlet Valve, V-1, is in the selected sample position.

[+] 6.6.4 Place the Isolation Valve, V-12, V-13, or V-14 in the air position for 5 minutes. The valve selected should correspond to the valve position of step 6.6.3.

[+] 6.6.5 If any other gas sample positions were used repeat steps 6.6.3 and 6.6.4.

[+] 6.6.6 Place the Sample Inlet Valve, V-1, and the Isolation Valves, V-12, V-13, V-14, and V-15 in the "Ambient Air" position.

6.6.7 Deleted.

6.6.8 Confirm the Model 900 Sample Conditioner "ZERO/SAMPLE/SPAN" toggle switch in the "SAMPLE" position.

[+] 6.6.9 Record the date, time, remarks, and your initials in the NOx monitoring log book and on the chart recorder graph paper. See Attachment B.

6.7 System Shut Down

For shut down of this system, complete the following:

[+] 6.7.1 SEE CAUTION. Notify the Vitrification control room operator you are shutting down the system.

CAUTION - a portable radio should not be used within 15' of this system.

6.7.2 Turn both Model 10A Analyzer "OZONE" generator power switches off. The switch lights will go out.

[+] 6.7.3 Verify the Sample Inlet Valve, V-1, is in the selected sample position.

[+] 6.7.4 Place the Isolation Valve, V-12, V-13, or V-14 in the air position for 5 minutes. The valve selected should correspond tot he valve position of Step 6.7.3.

6.7.5 If any other gas sample positions were used repeat steps 6.7.3 and 6.7.4.

[+] 6.7.6 Place the Sample Inlet Valve, V-1, and the Isolation Valves, V-12, V-13, V-14, and V-15 in the "Ambient Air" position.

[+] 6.7.7 Close V-16, V-17 and V-18.

6.7.8 Confirm the Model 900 Sample Conditioner "ZERO/SAMPLE/SPAN" toggle switch in the "SAMPLE" position.

6.7.9 Place both Model 10A Analyzer "RANGE PPM" selection switches in the "ZERO" position.

6.7.10 Place the chart recorder POWER and CHART SPEED switches in the "OFF" position and place the plastic covers on the pens.

6.7.11 Place both Model 10A Analyzer converter "NO-NOx" mode switches in the "NO" position.

[+] 6.7.12 Close Dilution Air Valve, V-5.

6.7.13 Turn off temperature for sample heat lines.

6.7.14 Turn off Perma Pure Dryer.

6.7.15 Place the Model 900 Sample Conditioner "PUMP" switch in the "OFF" position.

6.7.16 Turn off booster pump.

6.7.17 Turn off the by-pass and vacuum pumps.

6.7.18 Place the Model 900 Sample Conditioner "POWER" toggle switch in the "OFF" position.

6.7.19 Turn both Model 10A Analyzer "POWER" switches off. The switch lights will go out.

[+] 6.7.20 Close Exhaust Manifold Valve V-11.

6.7.21 Cover the Drierite column inlets with tape.

[+] 6.7.22 Record the date ,time, remarks, and your initials in the NOx monitoring log book and on the chart recorder graph paper. See Attachment B.

7.0 ATTACHMENTS

Attachment A - Deleted
Attachment B - NOx Monitoring System Log Sheet
Attachment C - NOx Monitoring system Check Lists
Attachment D - Verification Data Sheet
Attachment D-1 - Off Gas Sampling Data Sheet
Attachment D-2 - On Line Calibration Data Sheet
Attachment D-3 - Idle Data Sheet

8.0 FIGURES

Figure 1 - Model 10A Analyzer
Figure 2 - Chemiluminescent NO-NOx Gas Analyzer Conceptual Schematic
Figure 3 - Model 10A Analyzer Flow Diagram
Figure 3A - Model 10A Analyzer Unit Internals
Figure 4 - Vacuum Pump
Figure 5 - Sample Conditioner
Figure 5A - Conditioner Internals
Figure 6 - Chart Recorder
Figure 7 - Span Gas Cylinder Pressure Regulator
Figure 8 - NOx Equipment Layout
Figure 9 - NOx Flow Schematic
Figure 10 - Vit Ops NOx Control Panel Layout

ATTACHMENT B

NO_x MONITORING SYSTEM LOG

DATE	TIME	INITIALS	SAMPLE POINT	SPAN GAS	RANGE	MELTER/ MINI-MELTER FEED L/HR	OFF-GAS FLOW FI-6101	CALIBRATION Blue FACTOR Red	BACKGROUND Blue SUPP FACTOR Red	REASON FOR MONITORING	REMARKS	NO PPM	NO_x PPM

ATTACHMENT C

NOx MONITORING SYSTEM CHECKLISTS

SYSTEM START UP & CALIBRATION

	Step #	Description	Check Off
		PRESTART-UP CONDITIONS CHECKLIST	
	6.1.1	NO detector present and operational	_____
[+]	6.1.2	Notify Vit. Ops. control room operator	_____
	6.1.3.1	Vacuum and bypass pumps and booster pump off	_____
	6.1.3.2	Drierite activated	_____
	6.1.3.3	Perma Pure Dryer off	_____
	6.1.3.4	Sample heating tapes off	_____
	6.1.3.5	Pump oil level okay	_____
[+]	6.1.4.1	V-3 in "Ambient Air" position	_____
[+]	6.1.4.2	V-1 "Ambient Air"	_____
[+]	6.1.4.3	V-5 closed	_____
[+]	6.1.4.4	Span Gas Cylinder valves closed	_____

	Step #	Description	Check Off
[+]	6.1.4.5	V-12 valve in "Ambient Air" position (prescrubber)	
[+]	6.1.4.6	V-13 valve in "Ambient Air" position (between scrubber)	
[+]	6.1.4.7	V-14 valve in "Ambient Air" position (post scrubber)	
[+]	6.1.4.8	V-15 valve in "Ambient Air" position (stack)	
	6.1.5.1	Model 900 pump & power Off	
	6.1.5.2	Model 900 "ZERO/SAMPLE/SPAN" switch SAMPLE	
	6.1.6.1	Model 10A Ozone & Power Off	
	6.1.6.2	Model 10A RANGE on ZERO & NO mode	
	6.1.7.1	Chart recorder POWER & CHART SPEED OFF	
	6.1.7.2	Chart recorder INPUT UPPER & LOWER 10 mv	
	6.1.7.3	Chart recorder STANDBY/RECORD in STANDBY	
	6.1.7.4	Chart recorder CHART SPEED 2 CM/HR	
	6.1.7.5	Printer wires connected to Analyzer	
[+]	6.1.7.6	Record Chart Speed, mv, time, date, initials	

	Step #	Description	Check Off

SYSTEM START-UP CHECKLIST

[+]	6.2.1	6-64-HV-153 and 6-64-GT-155 valves open	_____
[+]	6.2.2	30 amp disconnect on and lighting panel switches closed	_____
	6.2.3	Model 900 POWER ON	_____
	6.2.4	Model 10A POWER ON	_____
	6.2.5	Model 10A Temperature Converter 675 C and NO-NOx mode NO mode	_____
	6.2.6	Perma Pure Sampling System on	_____
	6.2.7	Temperature controllers for sample heat tape on	_____
	6.2.8	Chart recorder Power ON	_____
	6.2.9	Chart recorder pens on 0 division line	_____
	6.2.10	Chart recorder ZERO STANDBY/RECORD RECORD	_____
	6.2.11	Model 10A range ppm on zero scale	_____
	6.2.12	Model 10A RANGE PPM on FULL SCALE	_____

	Step #	Description	Check Off
	6.2.13	Uncover Drierite inlets	
[+]	6.2.14	Roots blowers on and 64-BU-133 or 64-BU-132 valve open	
	6.2.15	V-7 open	
[+]	6.2.16	Model 900 chamber temperature ~180 F	
[+]	6.2.17	Perma Pure at temperature (110 - 140 °F)	
[+]	6.2.18	Heat tapes at temperature (110 - 130 °F)	
[+]	6.2.19	Exhaust Valves V-10 and V-11 open	
	6.2.20	Vacuum and Bypass Pumps ON	
	6.2.21	Model 900 pump ON	
	6.2.22	Booster pump on	
	6.2.23	Model 10A Reaction Chamber ~-27 in Hg	
	6.2.24	Model 10A Sample Vacuum -5 in Hg	
	6.2.25	V-5 and V-20 IA valve open and R-2 is ~11 psig	
	6.2.26	Model 900 Dilution Air ~10 psig	
	6.2.27	Model 10A Bypass Flow 1.5-2.0 SCFH	

Step #	Description	Check Off
6.2.28	V-6 and V-7 adjusted for conditioner flow rate of ~1.5 SCFH	
6.2.29	R-1 and F-1 fully open and V-4 adjusted for dilution air flow rate 1.5 - 2 times sample flow rate	
6.2.30	6-64-GT-147 post scrubber valve open	
6.2.31	V-17 and V-18 open (2nd floor)	
6.2.32	V-19 open (4th floor stack)	
6.2.33	V-16 open (Prescrubber Isolation at rack)	
	SYSTEM CALIBRATION	
6.3.1	Background suppression and calibration switch on low	
6.3.2	Both analyzer converter "NO - NOx" switches in the "NO" position	
6.3.3	Model 10A background suppression zero position	
6.3.4	Model 10A RANGE PPM in 2.5 position	
6.3.5	Model 10A meter scales 0 via Background Supp.	
6.3.6	Model 10A OZONE ON	

	Step #	Description	Check Off
	6.3.7	Span Gas Cylinder pressure regulator Inlet valves OPEN	_____
[+]	6.3.8	Vit. control room operator notified using span gas on 100x scale	_____
	6.3.9	Model 10A RANGE PPM in 100 position	_____
	6.3.10	Model 10A temperature converter light flashing	_____
[+]	6.3.11	Calibration span gas used indicated on Attachment D-2	_____
		/ / Step 6.3.10.1 is not applicable	_____
		/ / Step 6.3.10.2 is not applicable	_____
	6.3.11.1	Calibrate with 2500 ppm span	_____
	6.3.11.1.1	V-6 fully open and V-3 in "Hi-Span" position	_____
	6.3.11.1.2	Model 900 ZERO/SAMPLE/SPAN switch in SPAN	_____
	6.3.11.1.3	Span Gas Cylinder pressure regulator outlet valve OPEN and flow ~1.5 scfh	_____
	6.3.11.1.4	Chart recorder pens in ~2500 ppm position	_____
	6.3.11.1.5	Model 10A meter scales in ~2500 ppm position	_____
[+]	6.3.11.1.6	Verify readings with Vit. control room oper.	_____
	6.3.11.1.7	Model 10A NO-NOx mode switch in NOx mode	_____

	Step #	Description	Check Off
	6.3.11.1.8	Chart recorder pens in ~2500 ppm position	
[+]	6.3.11.1.9	Verify readings with Vit. control room oper.	
	6.3.11.1.10	Span Gas Cylinder ~2500 ppm pressure regulator outlet valve CLOSED	
	6.3.11.1.11	Chart recorder pens and Model 10A meter scales in ~0 positions	
[+]	6.3.11.1.12	Verify readings with Vit. control room oper. (0 ppm) and notify to span gas will be used	
	6.3.11.1.13	Span Inlet Valve V-3 in Lo Span position	
	6.3.11.1.14	Model 10A NO-NOx mode in NO mode	
	6.3.11.1.15	Span Gas Cylinder ~250 ppm pressure pressure regulator outlet valve OPEN	
	6.3.11.1.16	Model 10A meter scales chart recorder pens in ~250 ppm position	
[+]	6.3.11.1.17	Verify readings with Vit. control room oper.	
	6.3.11.1.18	Model 10A NO-NOx mode switch in NO_x mode	
	6.3.11.1.19	Chart recorder & Model 10A meter scales in ~250 ppm positions	
[+]	6.3.11.1.20	Verify readings with Vit. control room oper.	

	Step #	Description	Check Off
	6.3.11.1.21	Span Gas Cylinder ~250 ppm pressure regulator outlet valve CLOSED	
	6.3.11.1.22	Chart recorder pens and Model 10A meter scales in 0 positions	
[+]	6.3.11.1.23	Verify readings with Vit. control room oper.	
[+]	6.3.11.1.24	Record date, time, span gas ppm, calibration factor, background suppression factor, reason for monitoring, remarks, and initials in NOx monitoring log book. (Attachment B)	
	6.3.11.1.25	Repeat Steps 6.3.11.1 until results are consistent	
	6.3.11.1.26	V-3 in "Lo Span" position. Span Gas Cylinder ~250 ppm pressure regulator Inlet valve CLOSED and outlet valve OPEN until pressure 0, then outlet valve CLOSED	
	6.3.11.1.27	Span Inlet Valve, V-3, in "Hi Span" position	
	6.3.11.1.28	Span Gas Cylinder ~2500 ppm pressure regulator Inlet valve CLOSED and outlet valve OPEN until pressure 0, then outlet valve CLOSED	
	6.3.11.1.29	V-3 placed in "Ambient Air" position	
	6.3.11.1.30	Model 900 ZERO/SAMPLE/SPAN switch in SAMPLE	

	Step #	Description	Check Off
	6.3.11.2	Calibrate with 250 ppm span	
	6.3.11.2.1	V-6 fully open and V-3 in "Lo Span" position	
	6.3.11.2.2	Model 900 ZERO/SAMPLE/SPAN switch in SPAN	
	6.3.11.2.3	Span Gas Cylinder pressure regulator outlet valve OPEN and flow ~1.5 scfh	
	6.3.11.2.4	Chart recorder pens in ~250 ppm position	
	6.3.11.2.5	Model 10A meter scales in ~250 ppm position	
[+]	6.3.11.2.6	Verify readings with Vit. control room oper.	
	6.3.11.2.7	Model 10A NO-NOx mode switch in NOx mode	
	6.3.11.2.8	Chart recorder pens in ~250 ppm position	
[+]	6.3.11.2.9	Verify readings with Vit. control room oper.	
	6.3.11.2.10	Span Gas Cylinder ~250 ppm pressure regulator outlet valve CLOSED	
	6.3.11.2.11	Chart recorder pens and Model 10A meter scales in ~0 positions	
[+]	6.3.11.2.12	Verify readings with Vit. control room oper.	
	6.3.10.2.13	V-3 in Hi Span position	

	Step #	Description	Check Off
	6.3.11.2.14	Model 10A NO-NOx mode in NO mode	
	6.3.11.2.15	Span Gas Cylinder ~2500 ppm pressure pressure regulator outlet valve OPEN	
	6.3.11.2.16	Model 10A meter scales chart recorder pens in ~2500 ppm position	
[+]	6.3.11.2.17	Verify readings with Vit. control room oper.	
	6.3.11.2.18	Model 10A NO-NOx mode switch in NO_x mode	
	6.3.11.2.19	Chart recorder & Model 10A meter scales in ~2500 ppm positions	
[+]	6.3.11.2.20	Verify readings with Vit. control room oper.	
	6.3.11.2.21	Span Gas Cylinder ~2500 ppm pressure regulator outlet valve CLOSED	
	6.3.11.2.22	Chart recorder pens and Model 10A meter scales in 0 positions	
[+]	6.3.11.2.23	Verify readings with Vit. control room oper.	
[+]	6.3.11.2.24	Record date, time, span gas ppm, calibration factor, background suppression factor, reason for monitoring, remarks, and initials in NOx monitoring log book. (Attachment B)	
	6.3.11.2.25	Repeat Steps 6.3.11.2 until results are consistent	

Step #	Description	Check Off
6.3.11.2.26	V-3 in "Hi Span" position. Span Gas Cylinder ~2500 ppm pressure regulator Inlet valve CLOSED and outlet valve OPEN until pressure 0, then outlet valve CLOSED.	_____
6.3.11.2.27	V-3 in "Lo Span" position	_____
6.3.11.2.28	Span Gas Cylinder ~250 ppm pressure regulator Inlet valve CLOSED and outlet valve OPEN until pressure 0, then outlet valve CLOSED.	_____
6.3.11.2.29	V-3 placed in "Ambient Air" position	_____
6.3.11.2.30	Model 900 ZERO/SAMPLE/SPAN switch in SAMPLE	_____

OFF-GAS SAMPLING CHECKLIST

(Document Verification Initials on Attachment D-1)

[+]	6.4.1	Notify Vit. control room oper. of sampling	_____
	6.4.2	Model 900 ZERO/SAMPLE/SPAN switch in SAMPLE	_____
	6.4.3	Model 10A RANGE PPM set for sample point	_____
	6.4.4	Model 10A NO-NOx mode switch in NOx for red pen	_____
	6.4.5	Model 10A NO-NOx mode switch in NO for blue pen	_____

	Step #	Description	Check Off
	6.4.6	Isolation Valves V-12, V-13, V-14, and V-15 open	_____
	6.4.7	Sample Inlet Valve, V-1, is in selected sample position	_____
	6.4.8	Adjust V-6 and V-7 for ~1.5 scfh	_____
[+]	6.4.9	Record date, time, RANGE PPM, sample position, melter/minimelter feed rate, off-gas flow rate, FI-6101, calibration factor, background suppression factor, reason for monitoring, remarks, NO and NOx ppm, initials in the NOx monitoring log book. (Attachment B)	_____
[+]	6.4.10	Verify readings with the Vit. control room operator	_____
[+]	6.4.11	Record date, time, sample position, RANGE, calibration factor, background suppression factor, NO and NOx ppm, and initials on chart recorder paper.	_____

SYSTEM CALIBRATION DURING ON-LINE OPERATION CHECKLIST

(Document Verification Initials on Attachment D-2)

[+]	6.5.1	Notify Vit. control room operator of calibration on 100x	_____
	6.5.2	Sample Inlet Valve, V-1, in "Ambient Air" position	_____

Step #	Description	Check Off
6.5.3	Model 900 ZERO/SAMPLE/SPAN switch in SAMPLE	
6.5.4	Model 10A reaction chamber vacuum ~-27 in Hg and sample vacuum -5 in Hg	
6.5.5	Model 900 POWER & PUMP ON	
6.5.6	Model 900 Dilution Air ~10 psig	
6.5.7	Model 10A Bypass flow meter 1.5-2.0 SCFH	
6.5.8	Model 10A OZONE OFF	
6.5.9	Model 10A in "NO" position	
6.5.10	Model 10A in "2.5" position	
6.5.11	Model 10A meter scales 0 via background suppression	
6.5.12	Model 10A OZONE ON	
6.5.13	Span Gas Cylinder Pressure Regulator Inlet Valve Open	
6.5.14	Model 10A is "100" position	
6.5.15	Model 10A temperature converter light flashing	
6.5.16	Complete step 6.3 and document on Attachment D-2.	

SYSTEM SHUT DOWN FOR 1 TO 2 DAYS CHECKLIST

(Document Verification Initials on Attachment D-3)

[+]	6.6.1	Notify Vit. control room operator of shut down	_____
	6.6.2	Model 10A OZONE OFF	_____
[+]	6.6.3	Sample Inlet Valve, V-1, in selected sample position.	_____
[+]	6.6.4	Sample Isolation Valve, V-12, V-13, or V-14 in air position. Sample valve selected should correspond to valve position in step 6.6.3.	_____
	6.6.5	Repeat steps 6.6.3 and 6.6.4 for other sample positions used during operation.	_____
[+]	6.6.6	V-1, V-12, V-13, V-14, and V-15, in Ambient Air	_____
	6.6.7	Deleted	
	6.6.8	Model 900 ZERO/SAMPLE/SPAN switch in SAMPLE	_____
[+]	6.6.9	Record date, time, remark, and initials in NOx monitoring log book and on chart recorder paper.	_____

SYSTEM SHUT DOWN CHECKLIST

[+]	6.7.1	Notify Vit. control room operator of shut down	_____
[+]	6.7.2	Model 10A "OZONE" generator power switch off	_____
[+]	6.7.3	V-1 in selected sample position	_____
[+]	6.7.4	V-12, V-13 or V-15 placed in ambient air position for 5 minutes	_____
	6.7.5	Steps 6.7.3 and 6.7.4 repeated if other sample gas positions were used.	_____
[+]	6.7.6	V-1, V-12, V-13, V-14, and V-15 in ambient air	_____
[+]	6.7.7	V-16, V-17 and V-18 closed	_____
[+]	6.7.8	Conditioner in "SAMPLE" position	_____
	6.7.9	Model 10A range in zero position	_____
	6.7.10	Chart recorder power and chart speed off	_____
	6.7.11	Model 10A and NO mode	_____

	Step #	Description	Check Off
[+]	6.7.12	Dilution Air Valve, V-5, closed	_____
	6.7.13	Temperature controller heat lines off	_____
	6.7.14	Perma Pure Dryer off	_____
	6.7.15	Model 900 pump OFF	_____
	6.7.16	Booster pump OFF	_____
	6.7.17	Vacuum and bypass pumps OFF	_____
	6.7.18	Model 900 power OFF	_____
	6.7.19	Model 10A power OFF	_____
[+]	6.7.20	V-11 exhaust manifold valve closed	_____
	6.7.21	Drierite column inlets covered with tape	_____
[+]	6.7.22	Record date, time, remarks, and initials in NOx monitoring log book (Attachment B) and on chart recorder paper.	_____

ATTACHMENT D

DATA SHEET

VITRIFICATION NOx SCRUBBER MONITORING SYSTEM OPERATION PROCEDURE

Step #	Description	Initials/Date
	PRESTART-UP CONDITIONS	
6.1.2	Notify Vit. control room operator of start up and calibration.	_____
6.1.4.1	Span Inlet Valve, V-3, in "Ambient Air" position	_____
6.1.4.2	Sample Inlet Valve V-1, in "Ambient Air position	_____
6.1.4.3	Dilution Air Valve V-5, Closed	_____
6.1.4.4	Span Gas Cylinder valves CLOSED	_____
6.1.4.5	Pre Scrubber Isolation Valve, V-12, in "Ambient Air"	_____
6.1.4.6	Between Scrubber Isolation Valve, V-13, in "Ambient Air"	_____
6.1.4.7	Post Scrubber Isolation Valve, V-14, in "Ambient Air"	_____
6.1.4.8	Stack Isolation Valve, V-15, in "Ambient Air"	_____
6.1.7.6	Record date, time, chart speed, mv, and initials on chart recorder paper.	_____

Step #	Description	Initials/Date
	SYSTEM START-UP	
6.2.1	6-64-HV-153 and 6-64-GT-155 exhaust valves OPEN	_____
6.2.2	30 amp disconnect switch turned on and lighting panel switches closed.	_____
6.2.14	Root blowers ON and 6-64-BU-132 or 6-64-BU-133 valve OPEN	_____
6.2.16	900 conditioner at temperature (180°F)	_____
6.2.17	Perma Pure at temperature (110 - 140 °F)	_____
6.2.18	Heat tapes at temperature (110 - 130 °F)	_____
6.2.19	Exhaust Valves V-10 and V-11 open	_____

SYSTEM SHUT DOWN

Step #	Description	Initials/Date
6.7.1	Notify Vit. control room operator of shut down.	_____
6.7.2	Model 10A "OZONE" generator power switch off	_____
6.7.3	V-1 in selected sample position	_____
6.7.4	V-12, V-13, or V-15 placed in ambient for 5 minutes	_____
6.7.6	V-1, V-12, V-13, V-14 and V-15 in ambient	_____
6.7.7	V-16, V-17 and V-18 closed	_____
6.7.12	Dilution Air Valve, V-5, Closed	_____
6.7.20	Exhaust Manifold valve, V-11, CLOSED	_____
6.7.22	Record date, time, remarks, and initials in NOx monitoring log book and on chart recorder graph paper.	_____

ATTACHMENT D-1
OFF GAS SAMPLING DATA SHEET

STEP	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE
6.4.1								
6.4.9								
6.4.10								
6.4.11								

STEP	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE
6.4.1								
6.4.9								
6.4.10								
6.4.11								

ATTACHMENT D-2

QA to verify
(req'd only once per operating period) SIGNATURE _____ DATE _____

STEP	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE
6.3.7 or 6.5.1								
6.3.11 2500 ppm Used								
250 ppm Used								
6.3.11.1.6 or 6.3.11.2.6								
6.3.11.1.9 or 6.3.11.2.9								
6.3.11.1.12 or 6.3.11.2.12								
6.3.11.1.17 or 6.3.11.2.17								
6.3.11.1.20 or 6.3.11.2.20								
6.3.11.1.23 or 6.3.11.2.23								
6.3.11.1.24 or 6.3.11.2.24								

ATTACHMENT D-3
IDLE SHUT DOWN SHEET

STEP	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE
6.6.1								
6.6.3								
6.6.4								
6.6.6								
6.6.9								

STEP	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE	INITIALS/DATE
6.6.1								
6.6.3								
6.6.4								
6.6.6								
6.6.9								

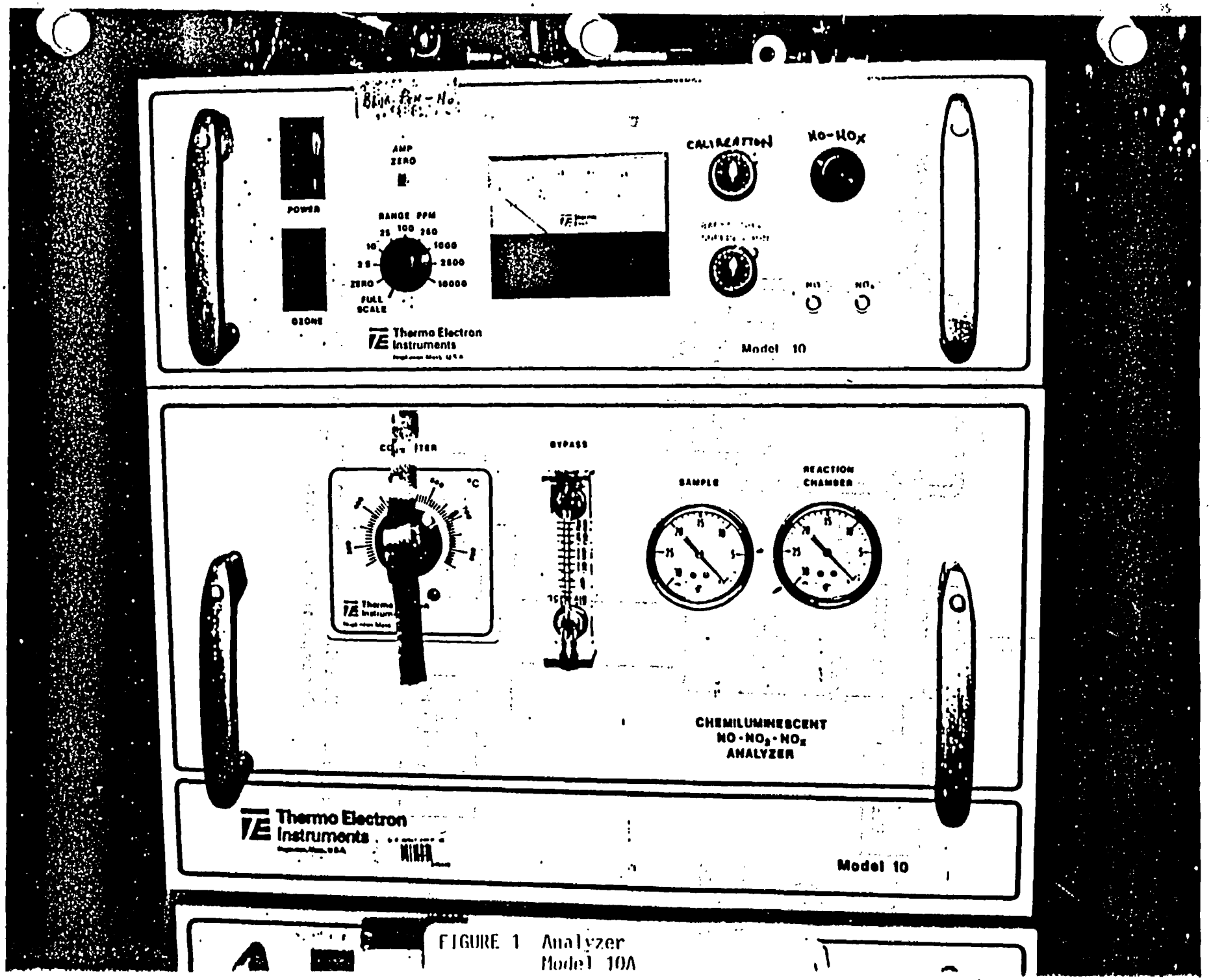


FIGURE 1 Analyzer Model 10A

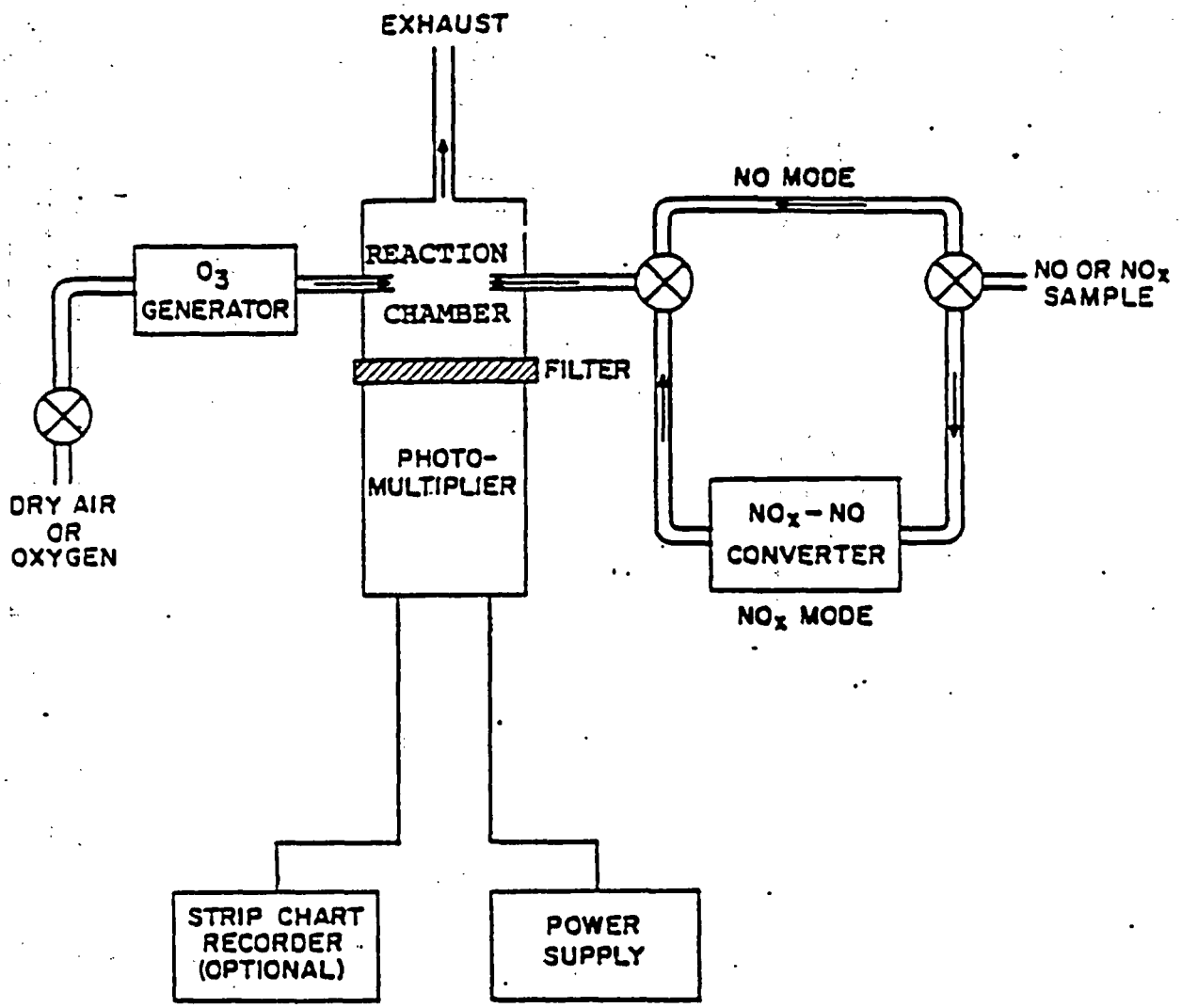


Figure 2. Chemiluminescent NO-NO_x Gas Analyzer Conceptual Schematic.

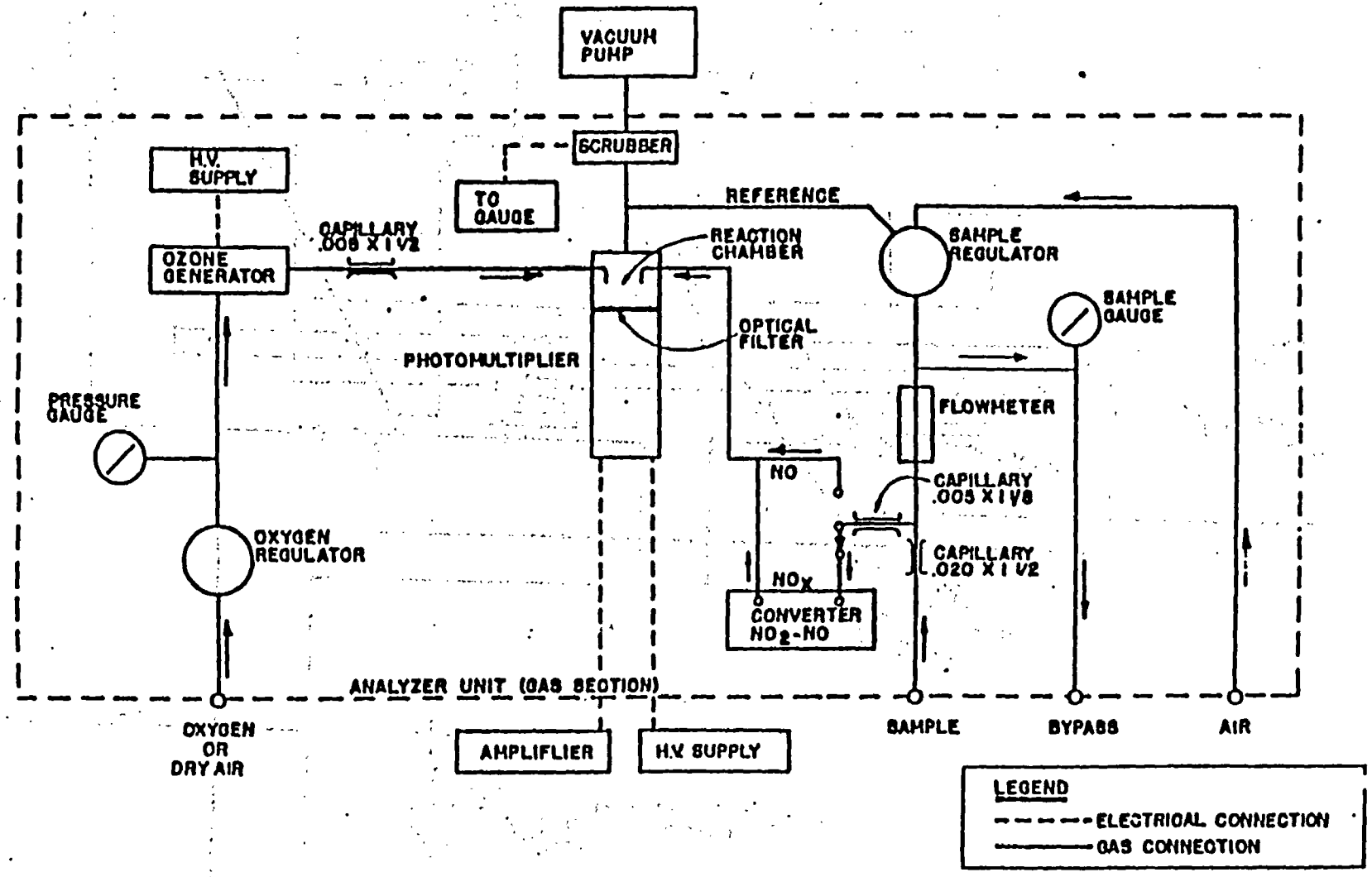
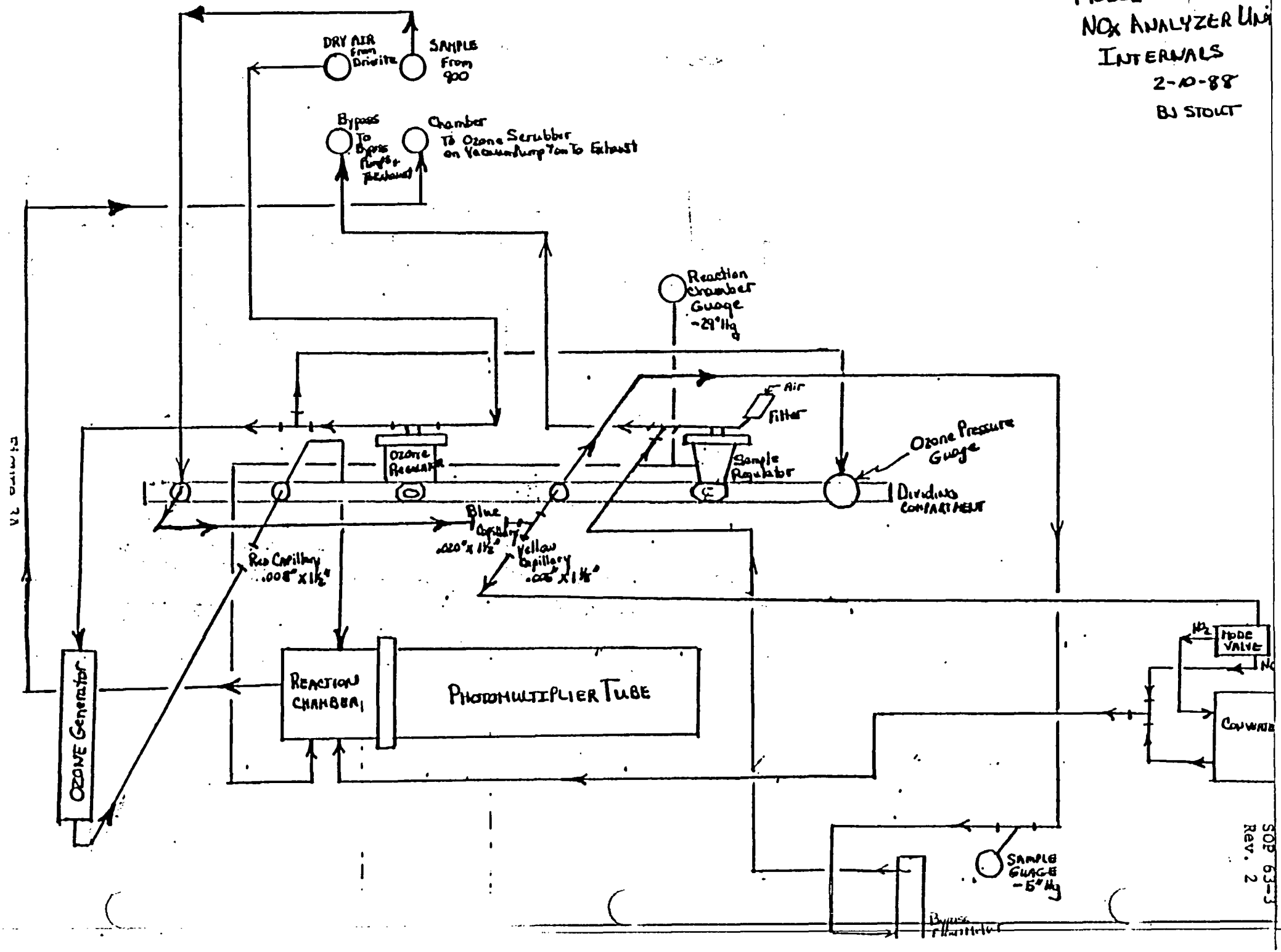


Figure 3 Model 10A Analyzer Flow Diagram

MODEL 10A
NOx ANALYZER UNI
INTERNALS
2-10-88
BJ STOLT



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Rev. 2

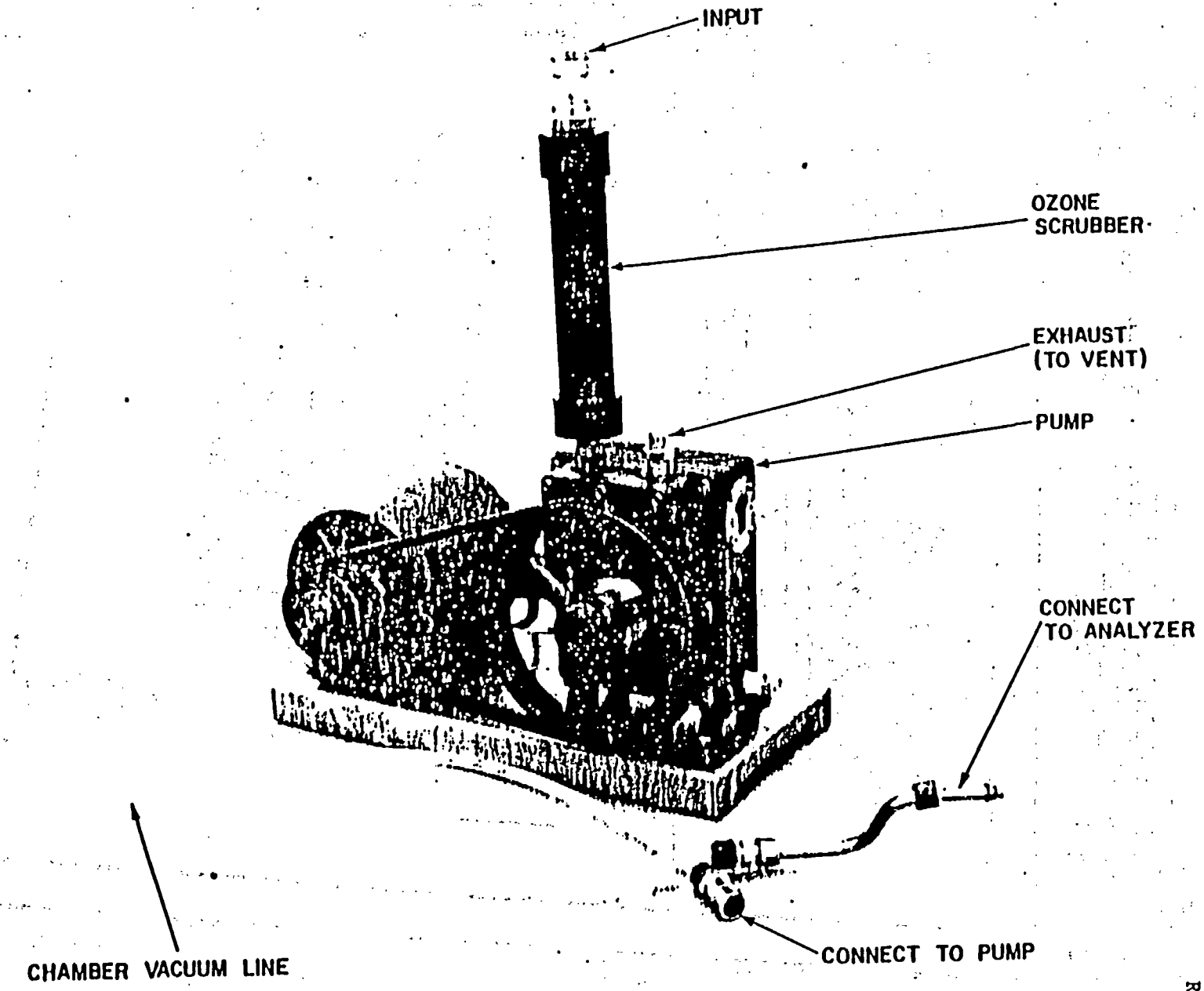


Figure 4 Vacuum Pump

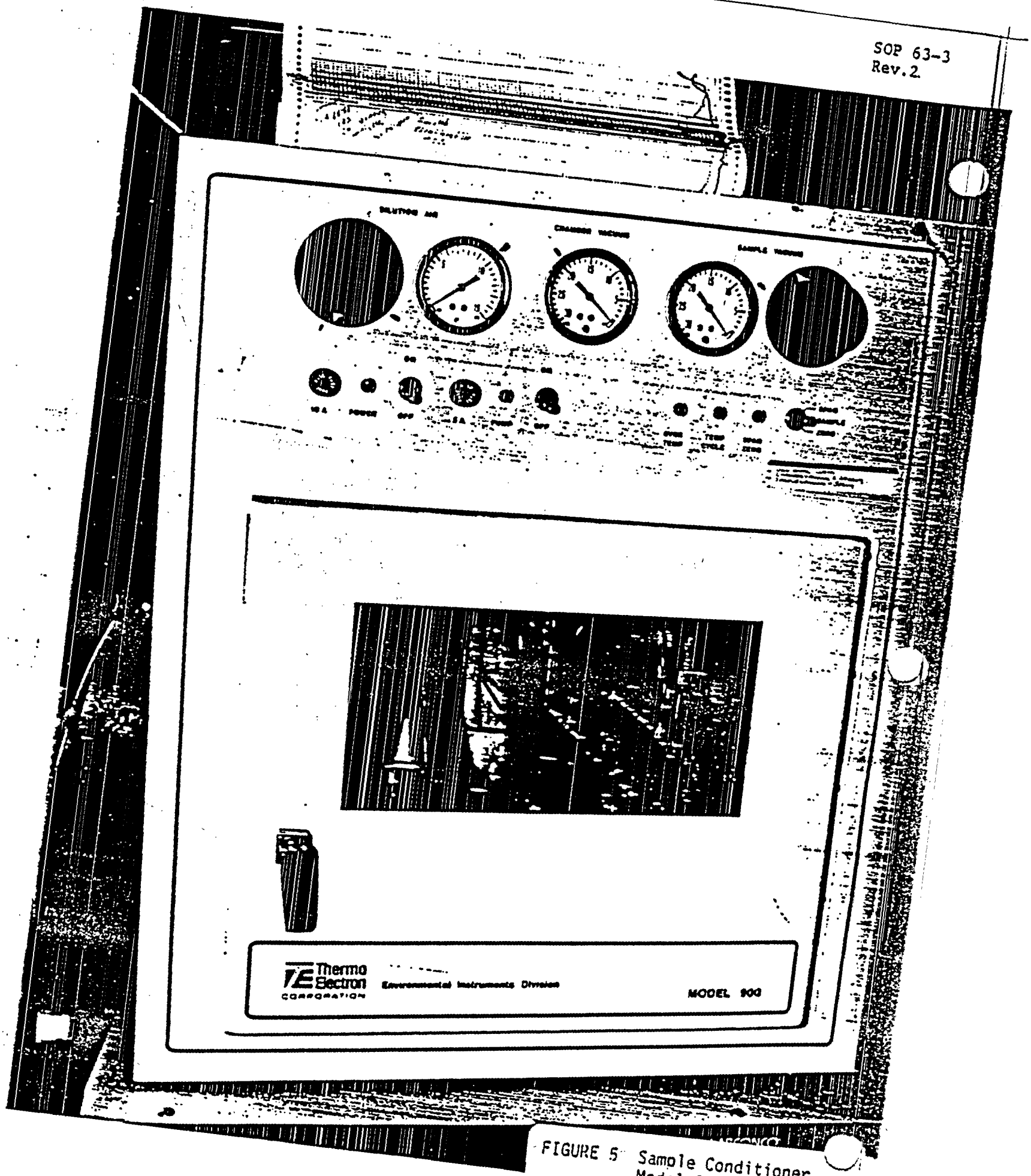


FIGURE 5 Sample Conditioner Model 900

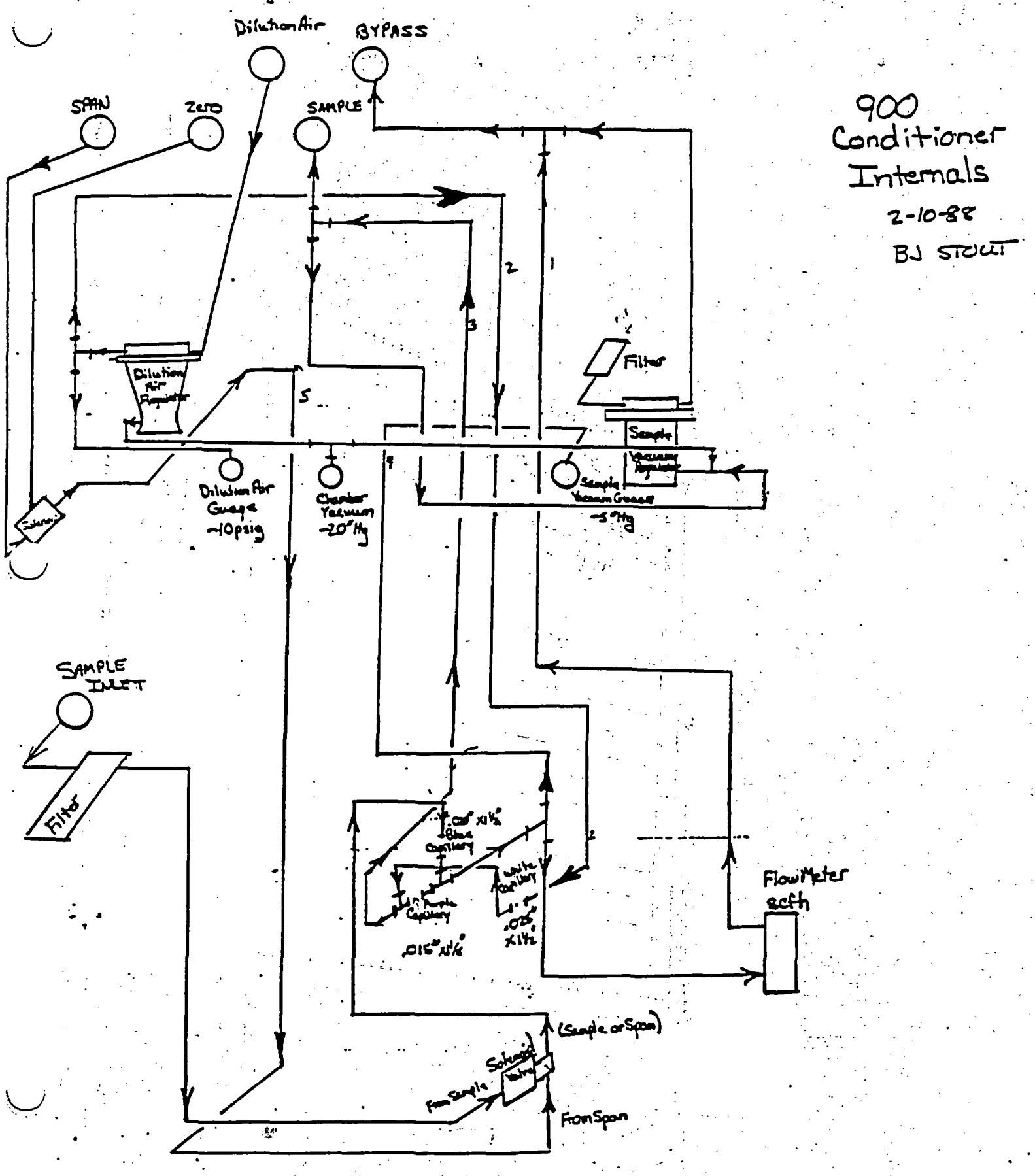

900
Conditioner
Internals
2-10-88
BJ STOUT
Dilution Air
BYPASS
SPAN
Zero
SAMPLE
Filter
Sample
Dilution Air Gauge
~10psig
Chamber Vacuum
~20" Hg
Sample Vacuum Gauge
~5" Hg
SAMPLE INLET
Filter
Blue Capillary
White Capillary
Purple Capillary
.015" x 1/8"
.025" x 1 1/2"
Flow Meter
scfh
(Sample or Span)
Solenoid Valve
From Sample
From Span

Figure 5A

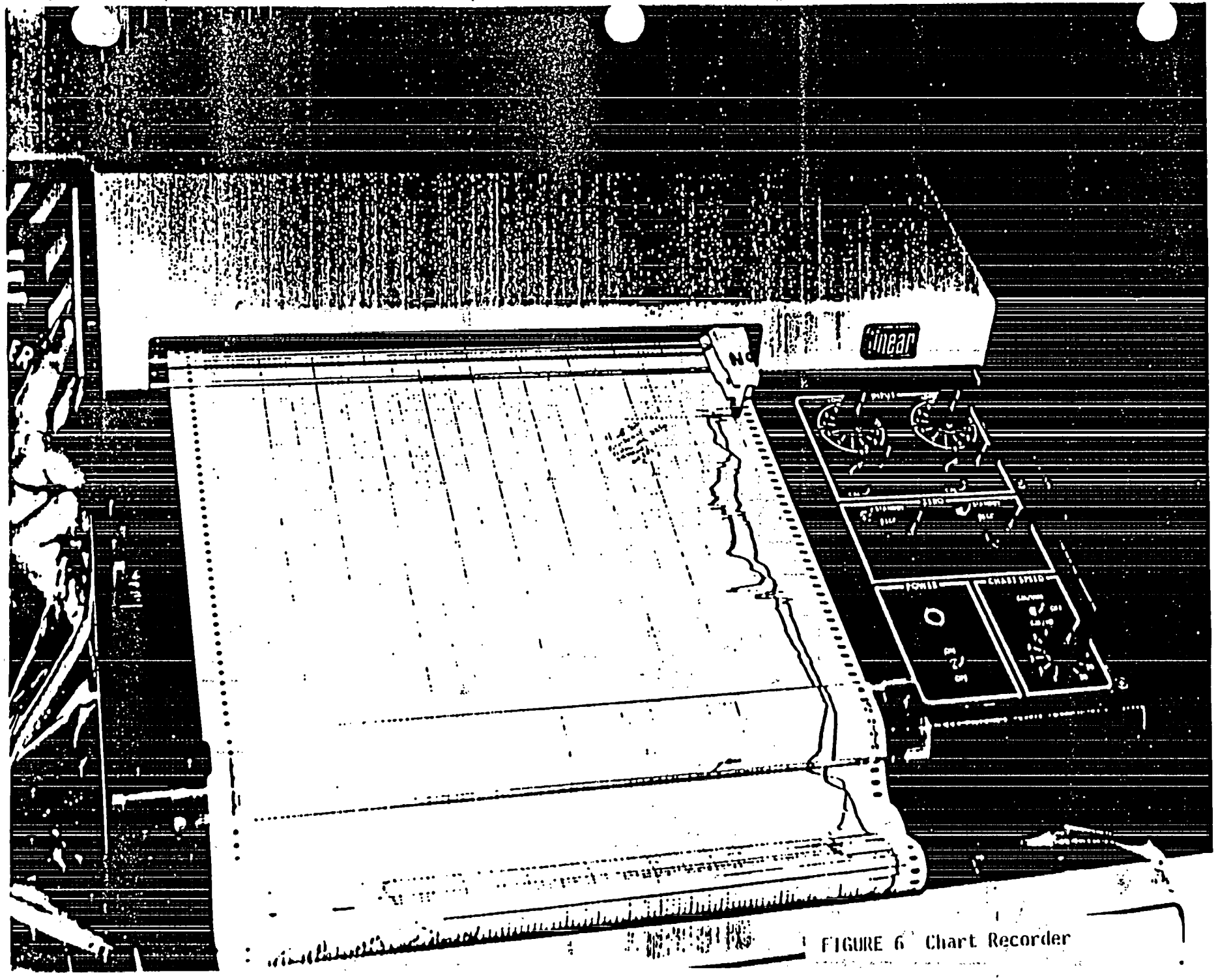


FIGURE 6 Chart Recorder

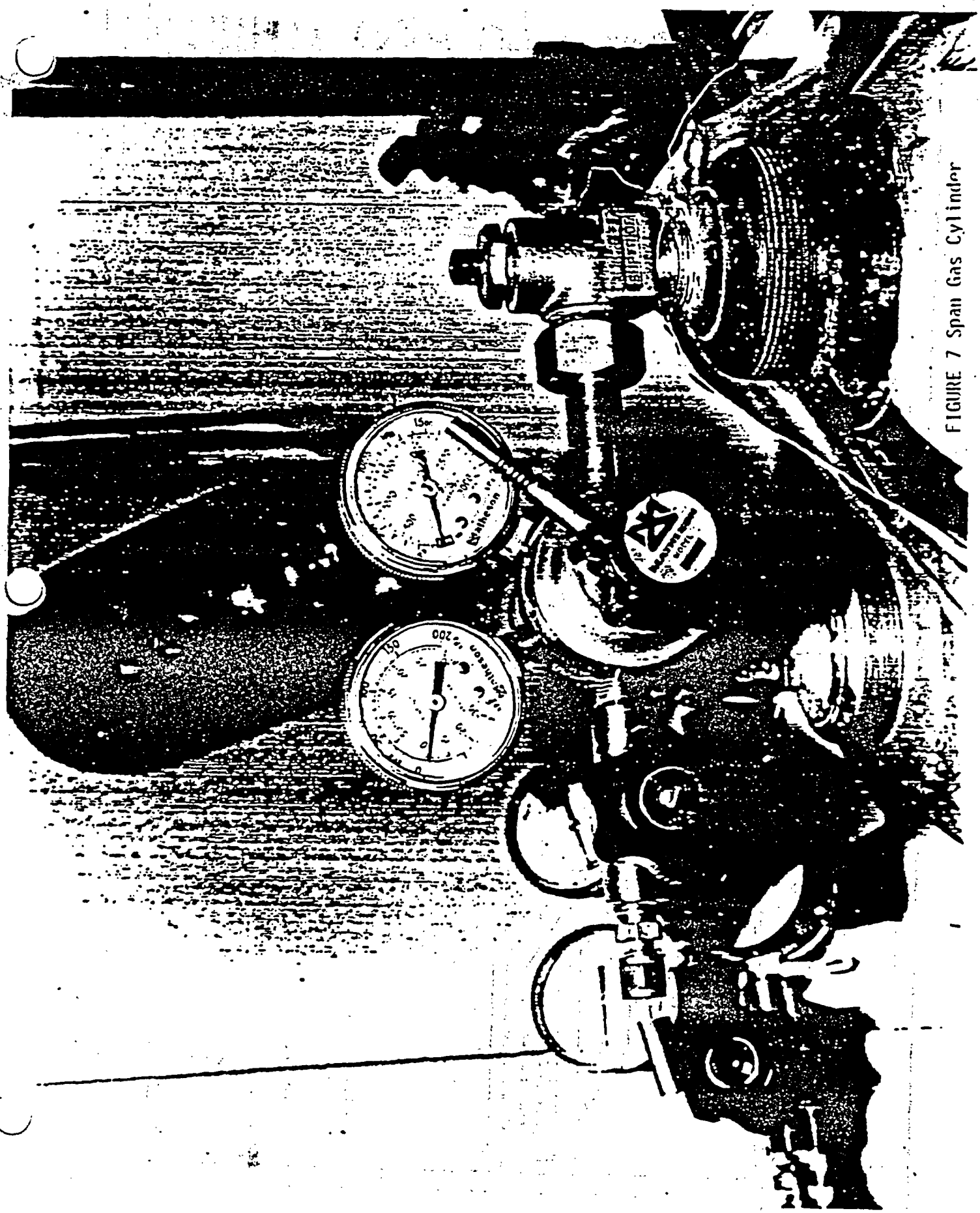
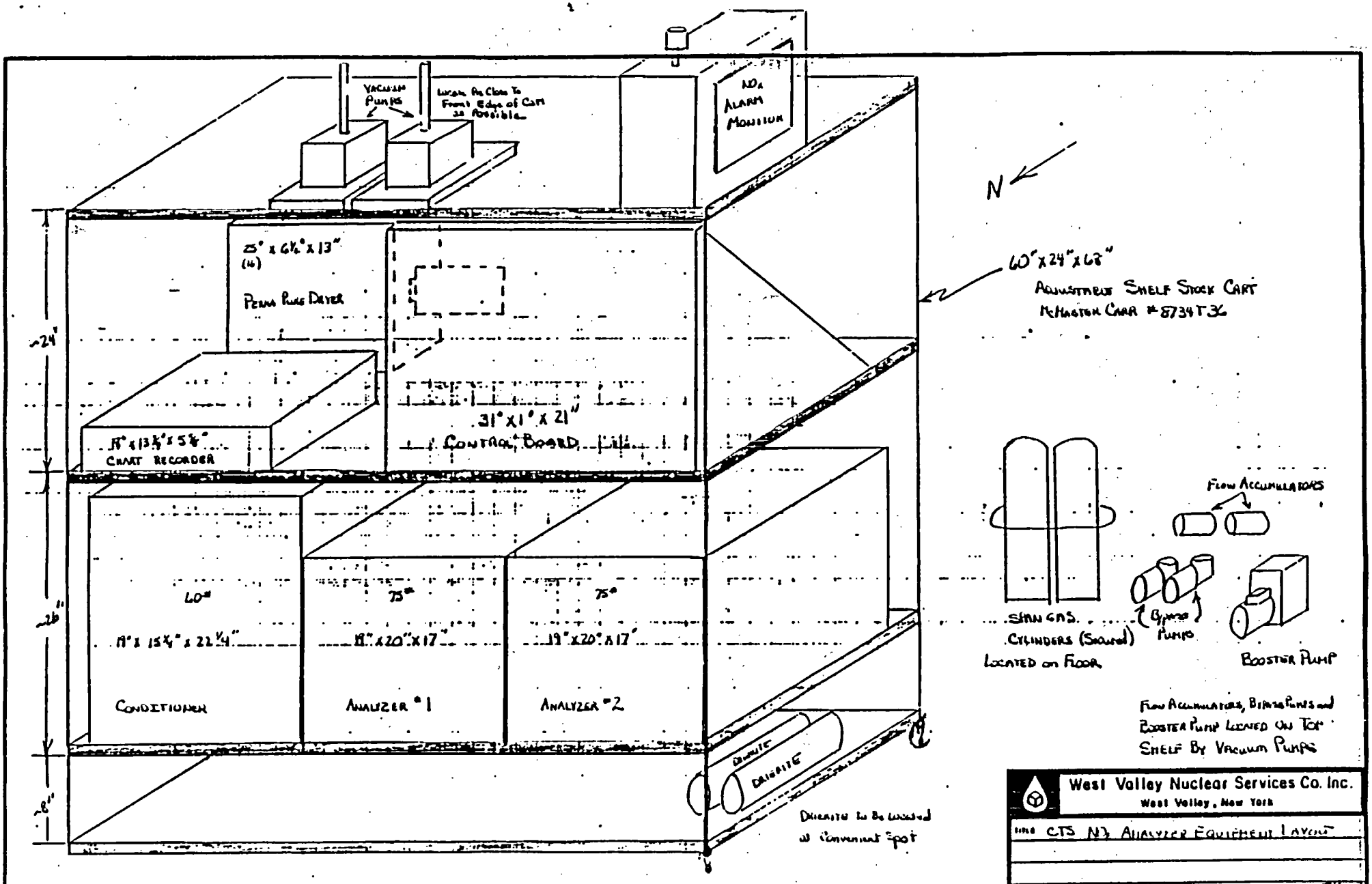


FIGURE 7 Span Gas Cylinder



Location: Small Room Between 2nd & 3rd Floor 01-14 Bldg

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Rev. 13

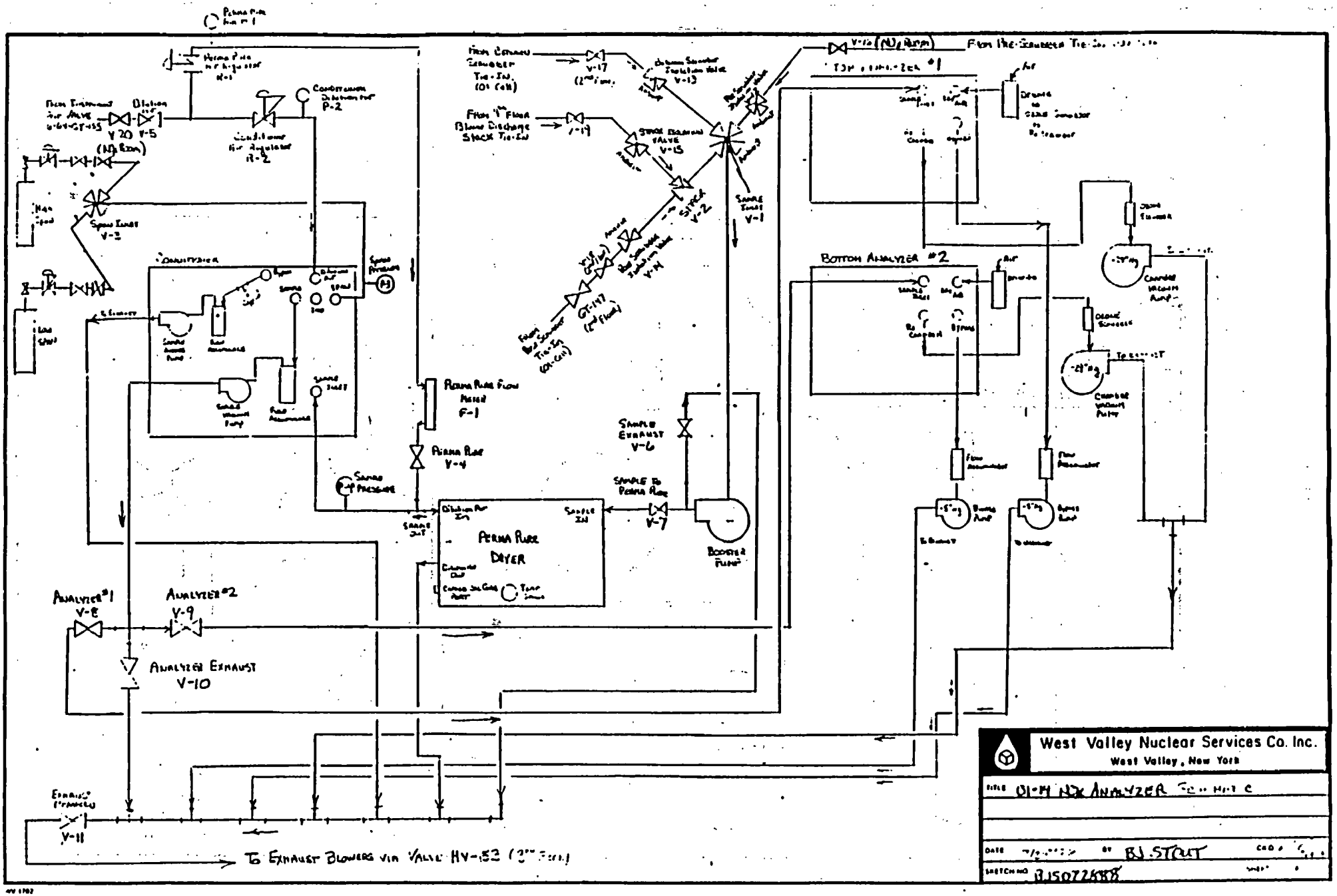
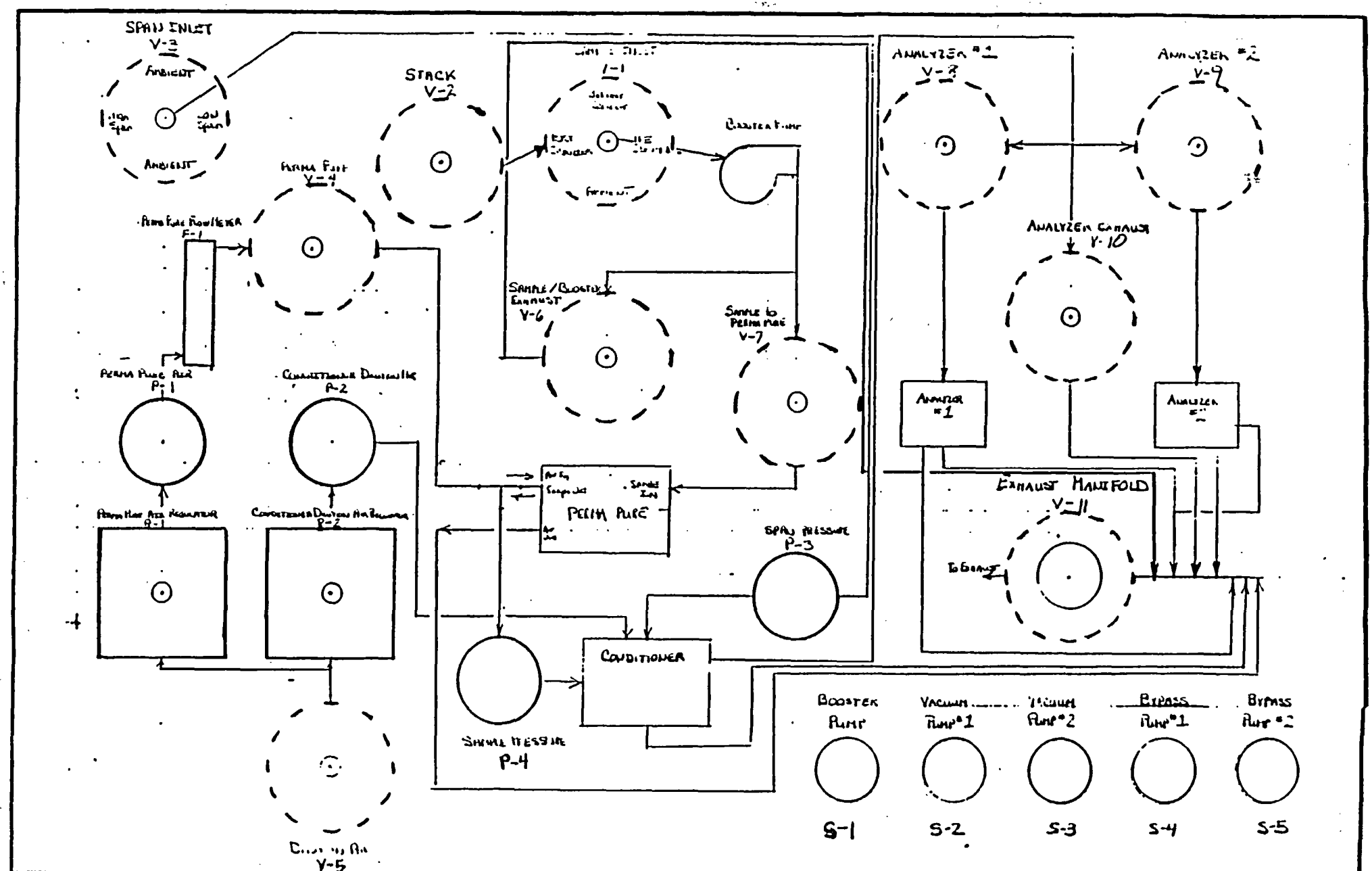

West Valley Nuclear Services Co. Inc.
West Valley, New York
BJ STOUT
Perma Pure Dryer
Analyzer #1
Analyzer #2
Analyzer Exhaust
V-10
V-11
V-8
V-9
V-4
V-6
V-7
V-15
V-17
V-19
V-20
V-5
Bottom Analyzer #2
Perma Pure Flow Meter
F-1
Booster Pump
Sample Exhaust
To Exhaust Blowers via Valve HV-153

Figure 9



Layout for V, 1 Ops NOx Bond Board

BP B 6-14-88

Figure