

B-D BECTON-DICKINSON

Route 7 and Grace Way, North Canaan, Connecticut 06018 / (203) 824-5487 / Division of Becton, Dickinson and Company

June 3, 1985

MS 16
K2

U.S. Nuclear Regulatory Commission
Region 1
631 Park Avenue
King Of Prussia, Pennsylvania 19406

Attn: Jack Davis

Reference: Docket No.: 030-06891
License No.: 06-13514-01
Control No.: 03572

Your telephone conversation of 5/21/85, with Tony Piniat,
R. Crook, W. Case
Our telephone conversation of 5/28/85

Please find attached the additional information requested for our license renewal.

1. Delete, Item 10.3 entitled "Leak Test Procedures--Cobalt⁶⁰ Source". Replace with Item 10.3, entitled "Leak Testing" utilizing DLZ monitors.
2. Delete the names of Shelly Bunce and James Blanquart as licensed operators.
3. Item 5a, b & c
Item 2. change RA226 to read:
Cesium 137 Test Source 10 Microcuries
4. Add under Item 8, Individuals will be trained to operate the irradiator under the supervision of a responsible individual, listed in Item 7, per training outline.
5. License number 06-13514-01 is hereby amended in its entirety for renewal.

8511190088 850911
REG1 LIC30
06-13514-01 PDR

03572
"OFFICIAL RECORD COPY"

W. R. Case
W. R. Case
Sterilization Supervisor, Canaan Facility
WRC/sac

ML10

JUN 06 1985

ITEM 6

Purpose(s) for which licensed material will be used:

To be used in an A.E.C.L. Type J6500, Serial No. IR 21 Irradiator for the sterilization of medical/surgical/laboratory products. Explosives, unsealed flammables or corrosives will not be irradiated.

Revised 5/22/85

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Revised 5/22/85

ITEM 8

addl to item 8

AECL-RCC

RADIATION PROTECTION
FOR INDUSTRIAL IRRADIATORS

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SESSION #1 WELCOME ADDRESS (1/2 hour)

WELCOME
HISTORY OF NUCLEAR PHYSICS

SESSION #2 BASIC MATHEMATICS (1 hour)

USEFUL MATHEMATICS FOR CALCULATIONS AND MEASUREMENTS
OF RADIOACTIVITY
GRAPH OF FUNCTIONS
SCIENTIFIC NOTATION
COUNTING STATISTICS

SESSION #3 THE ATOM (1/2 hour)

STRUCTURE OF THE ATOM
ISOTOPES AND NUCLIDES

RADIOACTIVITY (1/2 hour)

NATURALLY OCCURRING RADIOACTIVITY,
PRODUCTION OF RADIONUCLIDES
RADIOACTIVE DECAY
NUCLEAR FISSION
NUCLEAR FUSION
NUCLEAR REACTORS
ANEUTRONIC FISSION

DRAFT

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FOR INDUSTRIAL IRRADIATORS

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SESSION #5	<u>RADIATION QUANTITIES AND UNITS (1 hour)</u> ACTIVITY - CURIE SPECIFIC ACTIVITY EXPOSURE - ROENTGEN ABSORBED DOSE - RAD DOSE EQUIVALENT - REM QUALITY FACTOR
SESSION #6	<u>INTERACTION OF RADIATION WITH MATTER (1/2 hour)</u> IONIZING RADIATION GAMMA RAYS X-RAYS PHOTOELECTRIC EFFECT COMPTON SCATTERING PAIR PRODUCTION
SESSION #7	<u>BIOLOGICAL EFFECTS OF RADIATION, LOW DOSES (1 hour)</u> A.L.A.R.A. GENETIC EFFECTS MUTATIONS THE PERCEPTION OF RISK CAUSED INCIDENCE LINEAR DOSE EFFECT THEORY THRESHOLD DOSE EFFECT THEORY

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SESSION #10	<u>EXERCISES AND REVIEW (2 hours)</u> 1. DEFINITIONS 2. HALF-LIFE 3. INVERSE SQUARE LAW CALCULATIONS 4. CALCULATE NATURAL BACKGROUND DOSE 5. DOSE LIMITS

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SESSION #12	<u>USNRC REGULATIONS (4 hours)</u> TITLE 10, CHAPTER 1, CFR PART 19 TITLE 10, CHAPTER 1, CFR PART 20 TITLE 10, CHAPTER 1, CFR PART 21 REGULATORY GUIDE 10.9 CALIBRATION OF SURVEY METERS NRC GUIDELINE WIPE TEST WASTE DISPOSAL TRANSPORTATION
SESSION #13	<u>ADMINISTRATIVE CONTROLS (2 hours)</u> RECORD KEEPING NOTIFICATIONS OF INCIDENTS
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SESSION #18	<u>SURVEY TECHNIQUES (2 hours)</u> IRRADIATOR SURVEY CONTAMINATION WATER SAMPLING AIR SAMPLING

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	DESIGN PRINCIPLES DIFFERENT TYPE OR IRRADIATOR
SESSION #22	<u>IRRADIATOR SAFETY SYSTEM</u> (1 hour)
	REVIEW OF ALL SAFETY INTERLOCKS OPERATION OF SAFETY INTERLOCKS SHIELD INTEGRITY CONTINUOUS MONITORING
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SESSION #24 RADIATION STERILIZATION (1 hour)

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DOSIMETER PLACEMENT
DOSIMETER READING
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SHIELDING CALCULATION
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SESSION #28 EXAM (3 hours)

SESSION #29 REVIEW EXAM (2 hours)
QUESTION PERIOD

PROCEDURE FOR CHANGING RESIN SAQS

Resin sags should be changed when conducting meter reads 10 micromhos or greater.

1. Shut off water pump.
2. Check unit with geiger counter. *See note below.
3. Remove top of unit.
4. Again check over opening of units with geiger counter.
*See note below.
5. Remove resin sags. Dispose.
6. Replace resin sags with new ones as per attached drawing.
1 activated charcoal/3 resin
Arrows on side of cartridge saw are to be pointing downward or unit will not operate properly.
7. Replace top of units and secure.
8. Turn water pump on. Insure there are no leaks. Water flow should be approximately 5 GPM.

*Note: Geiger counter should be set on Scale 1. If meter reading exceeds background count, immediately secure area and contact supervisor.

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ITEM 134
PRACTICAL PRODUCTS OF SCIENTIFIC RESEARCH

CRYSTALAB

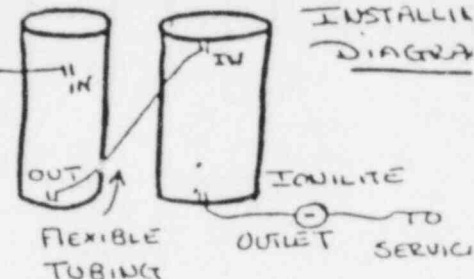
INCORPORATED

612 CAPITOL AVENUE, HARTFORD, CONN. 06106 • (203) 527-3215

INCOMING SUPPLY
LINE

AQ6-60

INSTALLATION
DIAGRAM



INSTALLATION AND OPERATING INSTRUCTIONS FOR THE CRYSTALAB AQ6-30 DEMINERALIZER

SPECIFICATIONS

Mounting: Free standing on floor or with shelf supports
Dimensions: 10-1/2" W X 9" D X 34" H
Weight: Approximately 20 lbs.
Fittings: 3/8" NPT inlet and outlet with 3' lengths
3/8" O.D. Polyethylene Tubing
Operating pressures: Maximum 125 psi
Maximum water temperatures: 100°F
Flow rates: Normal service - 90 GPH maximum
Recirculated systems - 180 GPH Maximum

LOCATION

The AQ6-30 is a free standing unit and can be installed directly on the floor or a supporting platform for elevated installations. Unit should be located near point of use to avoid long runs of piping and, if practical, near a drain or sump, since cartridge changes require that it be drained. A bucket can be used if no drains are available. Units equipped with Ionilite or Ionimeter will require electrical outlets (110V 60 Cycle).

INSTALLATION

1. Remove unit from shipping container and place in position. To be sure that unit is easily accessible, allow at least six (6") inches of space behind and on each side; and at least two (2') feet of head room above unit. (Cartridges are removed from the top.)
2. Two (2) pieces of flexible tubing are supplied with this unit and should be connected to the inlet and outlet. Connect inlet tubing to cold water supply line. If no shut-off valve is located in this line near the unit, one should be installed to facilitate cartridge replacements. Connect outlet tubing to supply line of equipment in which the purified water will be used. This line should also have a shut-off valve.

IMPORTANT

Unit to be connected to cold water only. If water pressure exceeds 125 pounds per square inch, a pressure regulator will be required in the inlet line to prevent damaging the unit.

3. To install cartridges into unit, proceed as follows:

- A. Loosen the four (4) hand knobs from the top of the column. Lightly tap the underside of the top cover to break "O" ring seal, work it off the column, and set it aside. CAUTION: Only a gentle tap is required.
- B. Place cartridge bags in column in accordance with instructions enclosed with them. IMPORTANT: Install cartridge into unit with the arrows on side of cartridge bags pointing downward or unit will not operate properly.
- C. Replace cover on column and tighten hand knobs evenly and firmly.

4. Close vent and drain cocks.

5. Before operating, unit should be tested at full pressure for leaks.

IMPORTANT: Apply a thin coat of silicone lubricant, or other non-petroleum based lubricant, to "O" rings at least once a year to keep "O" rings in proper condition.

6. To place unit in operation, proceed as follows:

A. Open inlet valve.

B. Open drain cock only until water comes through. This procedure allows column to fill with water.

C. Close drain cock and then open valve to equipment supply line.

7. Connect power cord of purity monitor. NOTE: Ionilite will remain on until clean water from cartridges displaces the impure water left in the line and at the bottom of the unit. Purity monitors will read high for a few gallons or so of operation. This is normal, and if the small amount of impure water is objectionable, run unit with discharge to drain for a few minutes. (Drain cock can be used for this purpose before being placed in service.)

CARTRIDGE REPLACEMENT

When Crystalab IONILITE shows read or when impurity levels in the effluent water reaches the maximum allowable level, the filter cartridges should be changed as follows:

1. Unplug power cord of conductivity monitor and shut off inlet and outlet water valve to isolate unit.
2. Open drain cock to relieve pressure. Then open vent cock. If no drains are available, allow unit to drain into a pail.
3. After unit half drained, remove used cartridges and replace with new ones, following the instructions outlined in sections 3 through 7 of the installation instructions.

SIGNAL
FROM POOL
LEVEL FLOAT

MAKE UP WATER
5 GPM
RESTRICTOR
CHECK
RAW
WATER
SUPPLY
VALVE

0-60 ppm
CONDUCTIVITY
METER
SIGNAL
TO CONSOLE
LIGHT

MANUAL
FEED
VALVE

SOLENOID

0-5 gpm

0-100
PSI

CHECK

COND.
CELL

UMP

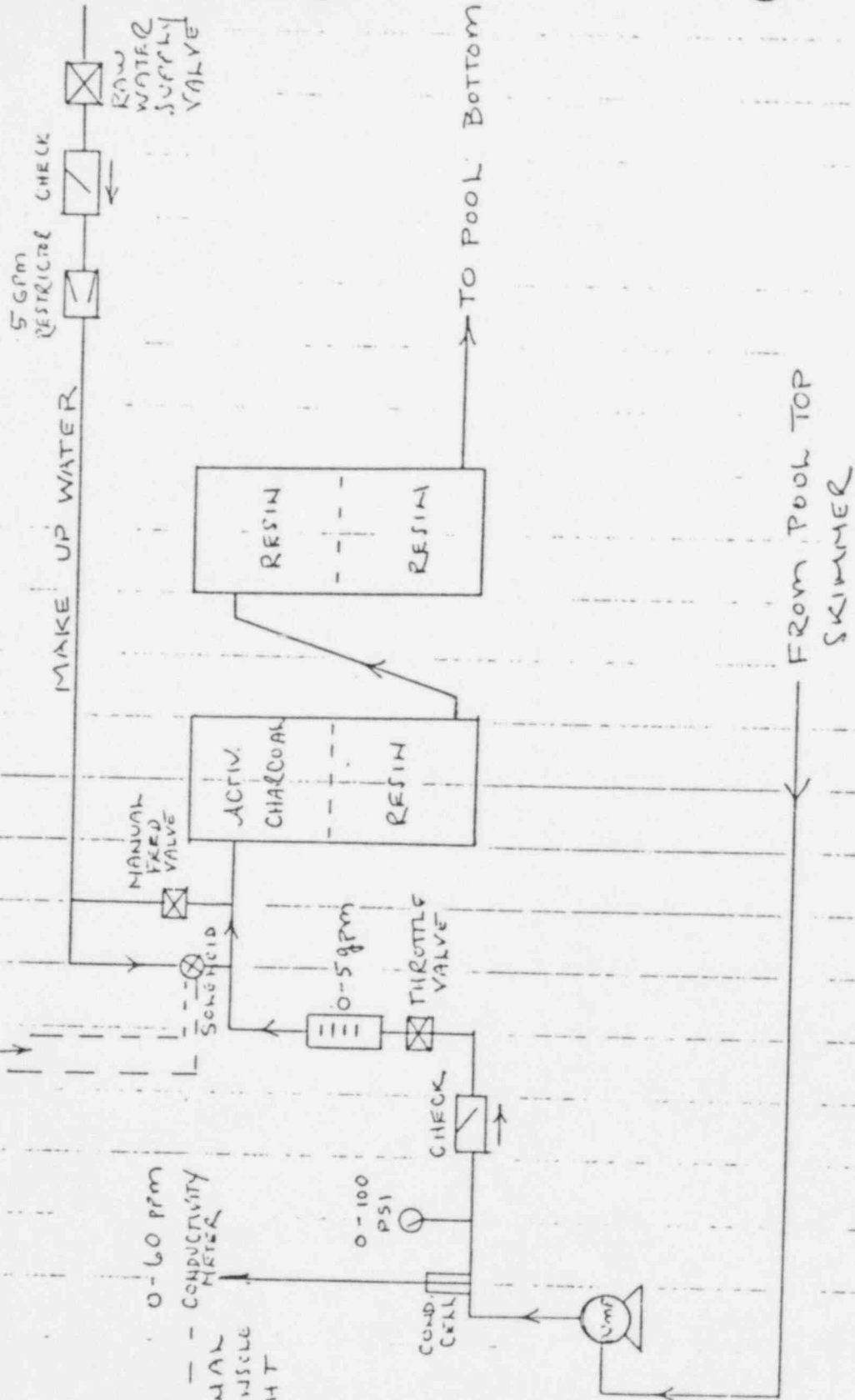
THROTTLE
VALVE

ACTIV.
CHARCOAL
RESIN

RESIN
RESIN

TO POOL BOTTOM

FROM POOL TOP
SKIMMER



OPERATING PARAMETERS AND SPECS

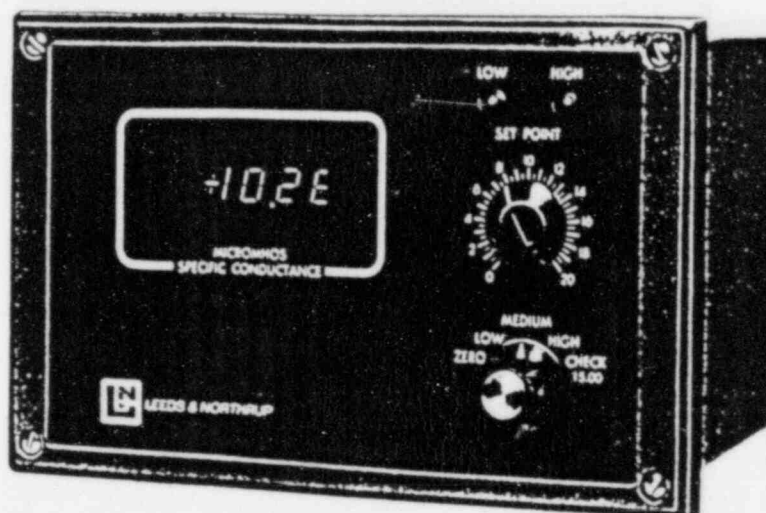
Flow: 5 GPM

Press: 72 lbs/in²

- 1) Flow manually set at throttle value.
- 2) Solenoid valve in make up water line operated by signal from float switch in pool. Pump shuts off during this sequence.
- 3) Conductivity meter preset for proper concentrations. Light on console lights when conductivity rises above set level. Meter may be read manually also.

7076 Multi-Range Electrolytic Conductivity Monitor with Digital Readout

C2.2114-DS



- Low-cost digital-display expanded-scale readability for industrial electrolytic conductivity measurements
- Multi-range instrument (X1, X10, X100)
- Conductance or resistance ranges
- Built-in calibration check switch
- Automatic temperature compensation on all ranges to assure accuracy under varying process conditions
- Standard alarm can initiate control action
- Signal lights indicate high or low alarm conditions
- Standard isolated voltage-output signals for remote recording or auxiliary devices
- Optional plug-in isolated current-output module
- Designed to meet Class I, Division 2, Groups B, C and D requirements when hermetically sealed relays are specified
- NEMA 3R and NEMA 12 corrosion-resistant, rain-resistant, outdoor, weather-proof, dust-proof plastic case
- Panel-, pipe- or wall-mounting
- Designed to meet OSHA requirements

The 7076 Electrolytic Conductivity Monitor is an inexpensive instrument especially designed to provide low-

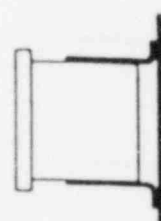
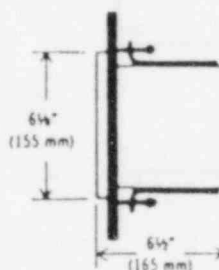
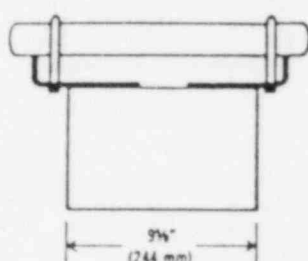
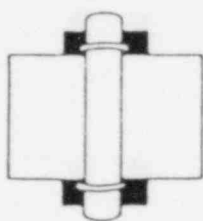
cost accurate measurement and/or control of conductivity or resistivity in industrial processes with continuous digital display. The value (micromhos or ohms) is indicated by a 3½ digit, seven-segment easy-to-read LED display. . . numerals are a nominal half-inch high.

Used with 4973, 4905, 4909 and 4800-Series conductivity cells, the 7076 Monitor provides high standards of reliability and operating convenience in the measurement of electrolytic conductivity in process solutions ranging from high-purity water to concentrated inorganic chemicals. It can be used for such diverse applications as pharmaceutical and chemical processing, pulp and paper processing, cation and anion exchangers, cooling-tower control, reverse osmosis, boiler-water blow-down, condenser tube-leak detection and rinse-tank control.

One independently-set alarm/control relay can operate an external alarm or initiate control action. Red or green signal lights on the front panel indicate when a high- or low-alarm condition has been reached; graduated knobs permit setting the high and low limits. Hermetically sealed relays can be specified, to meet Class I, Division 2, Groups B, C and D requirements.

Two standard output signals proportional to the input — 0 to 1 and 0 to 10 volts — can be used as inputs to most recorders, or such auxiliary devices as a 7080 Alarm/Control Module or an 099230 Isolated-Output Module. An optional plug-in circuit card can provide a proportional current output, with six selectable ranges.

The instrument is housed in a NEMA 3R and NEMA 12 plastic case which is corrosion-resistant, rain-resistant, dust-proof and suitable for outdoor use. Universal mounting hardware — to permit wall, pipe or panel-mounting — is included with the Monitor.



Mounting Styles

Every 7076 Monitor comes complete with hardware for panel, wall, or pipe mounting — and an optional portability kit lets you take the monitor to the process.

Pipe Mounting — Suspended below horizontal pipe, or attached to vertical pipe on right side left side, or rear. Two angle brackets and two "U" bolts do the job.

Panel Mounting — Same two angle brackets mount the monitor in 8 7/8" x 5 3/4" (225 x 146 mm) panel cutout.

Wall Mounting — Reverse the angle brackets and mount the monitor on any flat surface.

Portable — Part No. 324284 portability kit includes handle, feet, power cord and cord bracket. (Monitor weighs only 5 lb.)

Applications

Pharmaceutical and Chemical — Most pharmaceutical and chemical processes require close control of the chemical additions. When conductivity measurement is required, digital accuracy and readability are assets, assuring systems efficiency and conservation of costly raw materials. The wide versatility of the 7076 Monitor — measuring ranges from 0-0.2 micromhos to 0-200,000 micromhos — makes it an important tool for process control.

The 4973-, 4905-, 4909- and 4800-Series conductivity cells are all compatible with the 7076 Monitor. The 4973 cells are available in four cell constants (0.01, 0.1, 1.0 and 10) and feature a rugged, corrosion-resistant Victrex® polyethersulfone (PES) body. Fast-responding, built-in automatic temperature compensation is standard. The cells can be dipped into a tank, or screwed into a 3/4" NPT pipe tee.

The 4905 cells should be used when other cell constants are required, or where a 1" NPT pipe thread is needed for installation. If a removal device is required, the 4909 cells can be used for most ranges.

Paper Industry — The 7076 Monitor can be used for control of the white-liquor addition in digester applications when the caustic in the black liquor reaches a pre-set minimum control point. Either 4801-Series or 4905-Series cells can readily withstand the corrosive effects of the black liquor.

Cation and Anion Exchangers — With the 7076 Monitor, digital readout and multi-range capability make the instrumentation of anion, cation and mixed-bed exchangers relatively easy and inexpensive. The multi-

ti-range capability permits the installation of one basic instrument at any stage of demineralization or deionization. Since the Monitor can measure ranges from 0-0.2 micromhos to 0-20 micromhos with only one cell constant, there is no need for a variety of monitor or cell constants.

The 4973 cell is especially applicable to demineralizer and ion-exchange applications — may be used to measure the inlet to the resin beds, various levels in the beds, and the outlet of the ion exchanger. With its rugged PES body, the cell is inert to all regeneration acids and bases, and will perform accurately and consistently for years, with no maintenance requirement except occasional cleaning.

The 4905-, 4909- and 4800-Series cells may also be used.

Reverse Osmosis — Many new reverse-osmosis systems perform significantly better, since advanced technology has provided even greater efficiencies. The 7076 Monitor has the accuracy and readability required to match the improvements in membrane technology in the newer, larger units. The range of 0-20, 0-200 and 0-2000 micromhos, using a 1.0 cell constant, makes this Monitor especially suitable for this application.

The 4973 cell, with automatic temperature compensation, can operate over all the water ranges encountered in reverse-osmosis applications. Mounted in the inlet or the outlet of the unit, this cell can function efficiently and accurately at the working pressures of most units.

The multi-range feature of the 7076 Monitor and the variety of cell constants available in the 4973 cell combine to provide an excellent measuring and control "package" for any reverse-osmosis system.

Boiler-Water Blowdown — The 7076 Monitor provides excellent multi-range capability for continuously monitoring all levels of boiler-water condensate, which vary in range depending on the type of boiler and the treatment used. Its triple-range expanded-scale accuracy and readability eliminate the need for non-linear ranges, permitting the 7076 to be used over conductivity ranges from 0-0.2 to 0-20 micromhos with one cell constant, and ranges up to 0-200,000 micromhos with various cell constants.

The 7076 Monitor, connected to a 4973 cell with its built-in automatic temperature compensator, can control the dissolved-solids level to achieve maximum operating efficiency, as recommended by the boiler manufacturers, and insure the equipment warranty.

Condenser-Tube Leak Detection — The 7076 Monitor, connected to a 4973 cell located in the condensate line, assures continuous monitoring of the boiler condensate for fast and accurate detection of a condenser-tube failure. The alarm/control contacts of the 7076 Monitor can be used to signal the operator, or take direct control action. Excellent readability of the instrument and the multi-range feature assure easy, accurate set-point adjustment.

Cooling Towers — Cooling-tower measurements are easy and inexpensive with the 7076 Monitor. Accurate blow-down control can be achieved with excellent readability of the conductivity value, and good water and chemical efficiency. Typical ranges of 0-1000, 0-2000 and 0-5000 micromhos can now be covered by one monitor without even changing a switch.

The 7076 Monitor (with a 4973 or 4905 cell) can systematically open a drain valve at a predetermined set point to remove a high concentration of solids, and also allow new water to enter. The 7076 Monitor can combine with a 7075-3 pH Receiver to form a high-precision, low-cost cooling-tower control system which will prevent potential scale build-up and cut maintenance costs.

Rinse-Tank Control — The wider conductivity ranges of the 7076 Monitor permit its use for monitoring and controlling the rinse water in plating-rinse tanks, in applications well above the maximum conductivity levels found in conventional equipment.

The 7076 Monitor (with 4973- 4905- or 4800-Series cells) may also be used in concentration systems for metal or acid recovery. Selection of the proper range for the chemical solution is simplified by the range-change capability of the Monitor.

Improved efficiency in rinse-tank operations can result in direct savings, depending on the reduction in water usage. Minimized parts rejection can result in further savings.

Specifications

Ranges — Conductance: from 0-0.2 to 0-200,000 μ mhos. Resistance: from 0-200,000 ohms to 0-20 megohms.

Readout — $3\frac{1}{2}$ digit, seven-segment, nominal $\frac{1}{2}$ -inch-high LED display

Limit of Error — Digital meter: $0.05\% \pm 1$ digit. Output: 0.3% of range

Stability — Better than 0.05% of range per month.

Humidity Effect — Negligible at 95% relative humidity over the ambient temperature range

Response Time — 1 second for 90% of step change.

Ambient Temperature — -10 to 50°C (14 to 122°F)

Ambient Temperature Effect — 0.04% of range per degree over the ambient temperature range.

Line-Voltage Effect — 0.005% of range per 1% change in line voltage.

Output — Isolated recorder outputs, 0-1 and 0-10 volts simultaneously; standard on all models.

Circuitry — Solid-state feedback-stabilized amplifier for drift-free operation; designed to minimize RFI effect.

Measuring Frequency — 75 Hz or 320 Hz. Higher frequency is used for high conductance ranges, to reduce polarization of electrodes.

Function Switch — Five-position. "Zero" reads zero on digital readout, "Check" measures internal precision resistors for calibration check. On the 7076-1, "Low", "Medium" and "High" select the conductivity ranges to measure the cell and compensator. On the 7076-5, "20 M", "2 M" and "200 K" select the resistance ranges to measure the cell and compensator.

Alarm/Control — Standard single alarm, for high or low deviation, with setter located on front panel. Set with screwdriver or coin to prevent accidental displacement. 0-20 scale with 40 divisions for easy alarm setting. Red and green lights indicate above and below set-point process conditions. Alarm is SPST, connected in failsafe alarm mode.

Contact Rating: 3 A on 120 V a-c or 28 V d-c; 1.5 A on 240 V a-c, inductive load.

Hysteresis (Deadband): 2% of full scale.

Repeatability: 0.25% of full scale.

Setting Accuracy: 1% of full scale.

Electrical Classification — General purpose, or — when hermetically sealed relays are specified — Class I, Division 2, Groups B, C and D.

Isolated Current Output — Provided by plug-in card with six field-selectable outputs. Outputs, with maximum load resistance at $\pm 10\%$ of nominal line voltage, are: 0-16 mA (1300 ohms); 4-20 mA (1000 ohms); 0-20 mA (1000 ohms); 5-25 mA (850 ohms); 0-40 mA (450 ohms); 10-50 mA (330 ohms).

Temperature Compensation — Automatic compensation is standard; fixed compensation is available.

Power Requirements — 100 V $\pm 10\%$, 120 V $\pm 10\%$, 220 V $\pm 10\%$, or 240 V $\pm 10\%$, 50-60 Hz, 14 VA.

Electrical Connections — Two $\frac{3}{4}$ " conduit openings in bottom of case; barrier terminal board inside.

Case — Gray, NEMA 3R and NEMA 12 corrosion-resistant, rain-resistant, outdoor, dust-proof Noryl[®] plastic case.

Dimensions FRONT PANEL: $9\frac{1}{8}$ " (w) \times $6\frac{1}{8}$ " (h) \times $\frac{3}{4}$ " (d) (244 \times 155 \times 19 mm). OVERALL DEPTH: $6\frac{1}{2}$ " (165 mm). PANEL CUTOUT: $8\frac{7}{8}$ " (w) \times $5\frac{3}{4}$ " (h) (225 \times 146 mm).

Weight — 5.5 lb (2.5 kg)

How to Order

Specify complete catalog number with appropriate suffixes:

A B C D E
7076-□-□-□-□-□-□

Suffix A. Type

Conductivity Monitor 1

Resistivity Monitor 5

Suffix B. Range

Conductivity Multi-Range 200

Resistivity Multi-Range 300

Suffix C. Power Requirements

100 V \pm 10%, 50-60 Hz 100

120 V \pm 10%, 50-60 Hz 120

220 V \pm 10%, 50-60 Hz 220

240 V \pm 10%, 50-60 Hz 240

Suffix D. Alarm and Current Output

Standard Alarm, General Purpose 001

Standard Alarm, Division 2 Rating* 031

Standard Alarm, General Purpose, 201

plus Isolated Current Output

Standard Alarm, Division 2 Rating, 231

plus Isolated Current Output*

Suffix E. Tagging

None 000

1 Metalcal Label, 15 Characters Max. 205

on Each of Two Lines (Specify Legend)

1 Linen Tag, 23 Characters Max. on 206

Each of Six Lines (Specify Legend)

1 Aluminum Tag, 15 Characters Max. 207

on One Line (Specify Legend)

1 Stainless Steel Tag, 25 Characters Max. 208

on Each of Three Lines (Specify Legend)

*Options 031 and 231 include alarms with hermetically sealed relays to meet Class I, Division 2, Groups B, C and D rating

Ranges and Temperature Compensators

Monitor				Cell and Temperature Compensator						
Range		Range Switch Position	Monitor Suffix "B"	Constant	Cell Constant Suffix**	Automatic Temperature Compensator***				
						Reference at 25 C	4973 Cells		4800, 4902, 4905, 4909 Cells	
							Range Suffix†	Temperature Range	Range Suffix†	Temperature Range
Conductance	0-0.2 μ mhos/cm 0-2.0 μ mhos/cm 0-20 μ mhos/cm	Low Medium High	200	0.01	001	0.055 μ mho	300	0-100 C	NA	NA
						0.1 μ mho	302	0-100 C	070	0-60 C
						0.5 μ mho	304	0-100 C	014	0-60 C
						2.0 μ mhos	306	0-100 C	071	0-60 C
	0-2 μ mhos/cm 0-20 μ mhos/cm 0-200 μ mhos/cm	Low Medium High	200	0.1	01	20 μ mhos	306	0-100 C	071	0-60 C
	0-20 μ mhos/cm 0-200 μ mhos/cm 0-2000 μ mhos/cm	Low Medium High	200	1.0	1	200 μ mhos	306	0-100 C	072	0-60 C
	0-200 μ mhos/cm 0-2000 μ mhos/cm 0-20,000 μ mhos/cm	Low Medium High	200	10.0	10	2000 μ mhos	306	0-100 C	072	0-60 C
Resistance	0-200 K ohms 0-2 megohms 0-20 megohms	200 K 2 M 20 M	300	0.01	001	18 megohms	300	0-100 C	NA	NA
						18 megohms	302	0-100 C	NA	NA
						2 megohms	304	0-100 C	014	0-60 C
						0.5 megohm	306	0-100 C	071	0-60 C

*Specify as Suffix B of Monitor catalog number

**Specify as Suffix A of conductivity-cell catalog number

***For a fixed temperature compensator, 8000 ohms at 25 C, order Part Number 411456

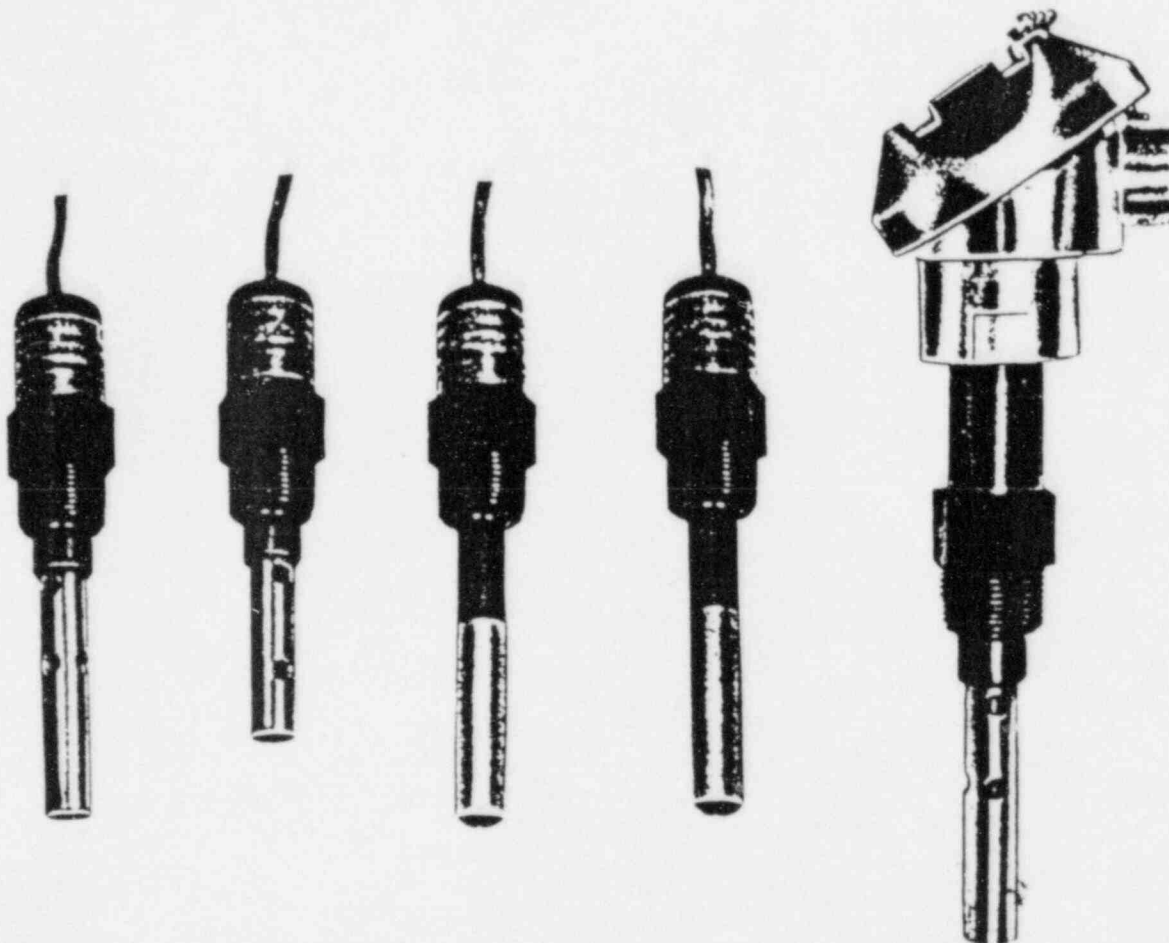
†Specify as temperature compensator suffix of conductivity cell



LEEDS & NORTHRUP North Wales, Pa. 19454
A UNIT OF GENERAL SIGNAL

4973-Series Electrolytic Conductivity Cells

D2.2115-DS



4973 Cells: 0.01- and 0.1-constant, with titanium electrodes (left);
1- and 10-constant, with graphite electrodes and Teflon guards (center);
4973 Cell with Universal Junction-Box Head (right).

The 4973-Series Cells are ruggedly constructed for reliable, continuous measurements of electrolytic conductivity in industrial water processes at temperatures up to 150 C and pressures up to 250 psig.

They are applicable to such measurements as the effluents of distillation equipment, anionic, cationic, and mixed-bed ion exchangers, monitoring and controlling the washing of electronic components, plating rinse-tank control, boiler-water condensate, boiler hot-well measurements, and cooling-tower blowdown.

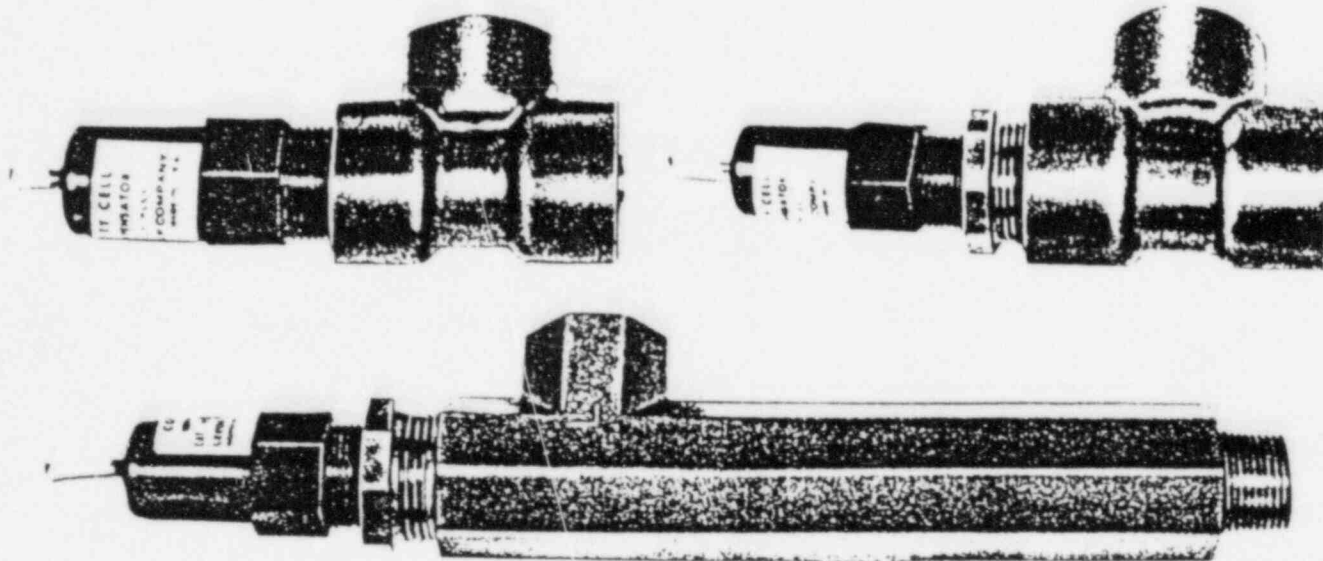
The cells feature PES (polyether sulfone) construction for high corrosion resistance, with electrodes of titanium (for 0.01 and 0.1 cell constants) or high-density carbon (for 1.0 and 10.0 cell constants).

The 4973 Cell can be equipped with an integral lead-wire cable either 7' (2.1 m) or 20' (6.1 m) long, or with

an Aluminum Universal Head for terminal connections mounted directly on the cell, with leadwire cable separately ordered.

For insertion applications, the $\frac{3}{4}$ " NPT male thread permits permanent installation in a pipe or tank; the cell can also be used as a laboratory dip-type for batch sampling.

For flow applications, the cell can be installed directly into a process stream, or used with a separately-ordered $\frac{3}{4}$ " pipe tee, or a 1" pipe tee and a 1"-to- $\frac{3}{4}$ " reducing bushing, in a by-pass stream. The cells have been designed to keep the electrodes and the temperature compensator immersed in the stream flow even when a reducing bushing is used, assuring that the cell will respond quickly and accurately to changes in both solution concentration and temperature.



Top left: 4973 Cell inserted in standard $\frac{1}{4}$ " pipe tee. Top right: 4973 Cell with 020962 PVDC Reducing Bushing, inserted in standard 1" pipe tee. Bottom: 4973 Cell with 020962 Reducing Bushing mounted in 276127 PVDC Flow Chamber (PVDC fittings are limited to 100 C.)

Specifications

Function — Designed for insertion and flow applications.

Automatic Temperature Compensator — Supplied on all cells.

Cell Constant — 0.01, 0.1, 1.0 and 10 cm^{-1} .

Maximum Temperature Limit — 150 C (302 F) at rated pressure.

Maximum Pressure Limit — 250 psig (1724 kPa) at rated temperature.

Insertion — $\frac{1}{2}$ " NPT male thread for schedule 40 and 80 pipe.

Insertion Depth — $4\frac{1}{4}$ " (105 mm) from solution end of $\frac{1}{2}$ " NPT male thread.

Wetted Parts — Cell body: PES (polyether sulfone). Electrodes: 0.01 and 0.1 constant, titanium; 1.0 and 10.0 constant, high-density graphite with Teflon guard.

Electrical Connections — Integral PVC-covered, shielded 18 gauge 3-conductor cable, 7' (2.1 m) or 20' (6.1 m) long, as specified. If more than 20' are required, specify the Universal Junction-Box Head and the required length of B34059 Cable. (Head has $\frac{1}{2}$ " NPT conduit connection.) For a separate Junction Box, specify Part Number 316774, and appropriate length of B34059 Cable.

Weight — 0.1 lb (0.2 kg).

How to Order

Specify Catalog Number and appropriate suffixes from the table below.

4973-ABCD

	Description	Suffix
Suffix A Cell Constant	0.01	001
	0.1	01
	1.0	1
	10	10
Suffix B Automatic Temperature Compensator	Integral Automatic Temperature Compensator included. For suffix, see range listing for Monitor or Speedmax Recorder.	1
Suffix C Terminal Connection	Integral leadwire, 7' long.	7
	Integral leadwire, 20' long.	20
	Aluminum Universal Junction Box Head Mounted on Cell*	1
Suffix D Tagging	None	000
	1 Metal Label, 15 Characters Max. on Each of Two Lines (Specify Legend)	205
	1 Down Tag, 28 Characters Max. on Each of Six Lines (Specify Legend)	206
	1 Aluminum Tag, 15 Characters Max. on One Line (Specify Legend)	207
	1 Stainless Steel Tag, 24 Characters Max. on Each of Three Lines (Specify Legend)	208

* For use in conjunction with 20' leadwire, specify 20' Integral Automatic Junction Box Head. For use with 7' leadwire, specify 7' Integral Automatic Junction Box Head.



LEEDS & NORTHRUP North Wales, Pa. 15051

Sprinkler System

The irradiator is equipped with an automatic fire sprinkler system, as outlined on the attached drawing.

Also, we have a manual pool water recirculation system for fire protection. In the event a source rack jam should occur the sprinkler system would be used to prevent combustible product from smoldering or igniting.

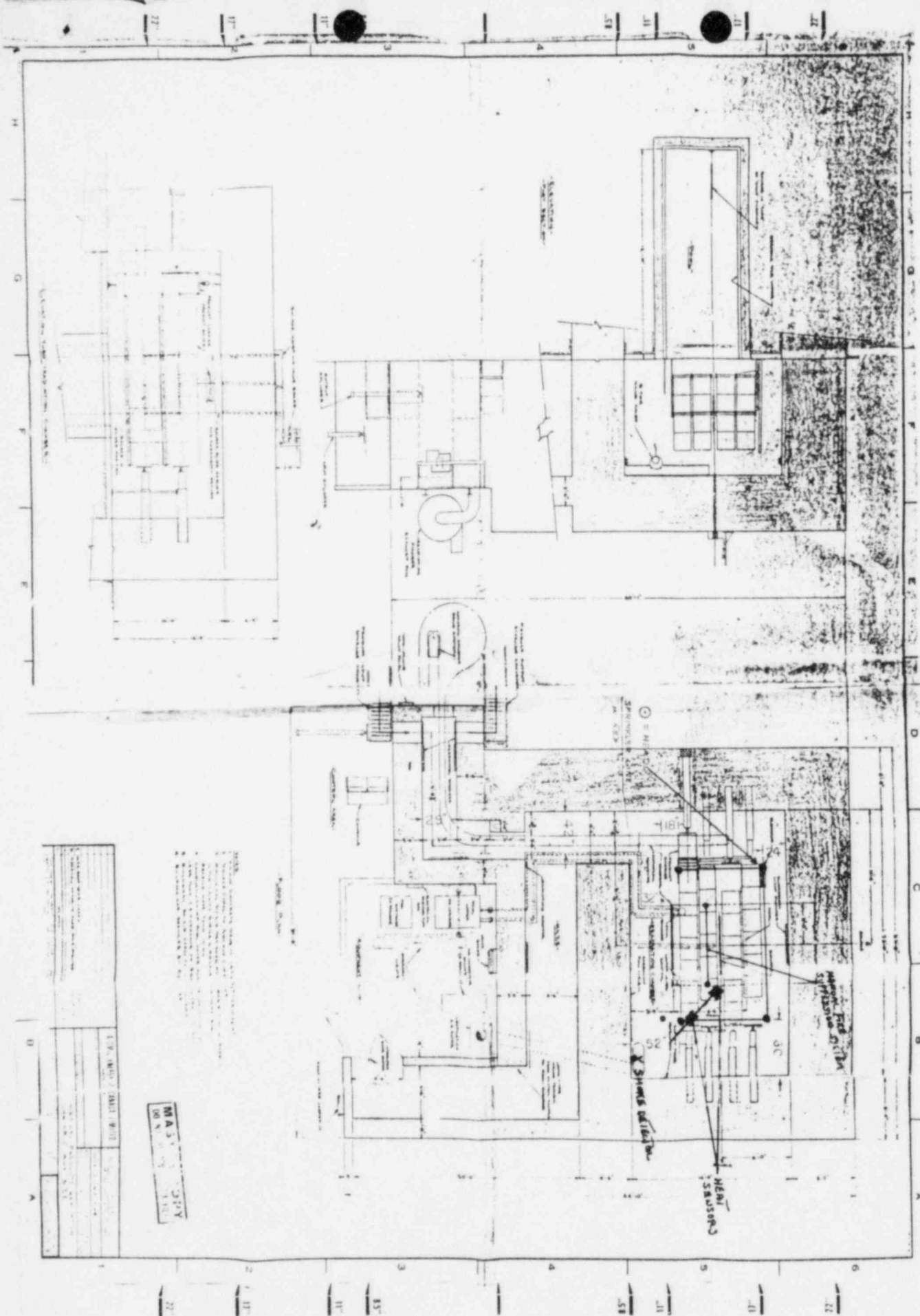
The pool water is circulated through a self-priming pump, through a solenoid valve, through a particulate filtration system and is then directed through two (2) sprinkler heads.

Smoke Detectors

Smoke detector is located in equipment room. A copper pipe runs from inside the maze (near the exhaust port), through the detector, into the exhaust duct in the equipment room. The exhaust pulls the smoke through the pipe, into the detector. Reference attached drawing.

Heat Sensors

There are two heat sensors attached to ceiling inside irradiator. Reference attached drawing.



9.5

There is located at the product exit portal, two DL2 monitors. If radioactivity is measured the monitors will sound an alarm condition as well as illuminate a pilot light on the console. The source will automatically be lowered to a safe condition. All mechanics will stop.

ITEM 10.1

The maze entrance door is located in the control room office. The control room door is kept locked at all times. The only personnel who have keys to the control room are the responsible individuals/users with the exception of one person, Richard Crook, Manager, Bacteriologist and Sterilization Services. This prevents anyone from attempting to open the maze door and/or access to the console and/or equipment room. At no time can an operator open the maze door until the correct procedure has been carried out.

There is a key attached, (by a chain), to a hand held survey meter. This ensures the operator carries the survey meter with him. There is a check source to insure meter is functioning prior to opening the maze door.

Personnel are issued a radiation badge. Radiation badges are changed on a monthly basis. All personnel are required to wear their badge prior to entering the irradiator.

Maintenance is performed by a responsible individual/user. If the situation occurs where a maintenance person is summoned to perform maintenance he shall be issued a pocket dosimeter and be accompanied by a responsible individual/user. The time in, time out, pocket dosimeter number, name, reading of badge prior to entry and reading of badge upon exiting are logged in the quest logbook.

10.3

Leak Testing

Two DL2 monitors have been placed directly behind the resin filter unit. The DL2 monitors provide continuous monitoring. If radioactivity is detected an audible alarm will sound. A pilot light will illuminate on console indicating same.

OPERATING AND INSTALLATION
INSTRUCTIONS

D/L 2 MONITOR
CATALOGUE NO. L119

EDITION NO. 4, MARCH 1980

STORES CODE 2M002426



ATOMIC ENERGY OF CANADA LIMITED,
COMMERCIAL PRODUCTS,
OTTAWA, CANADA.

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GENERAL DESCRIPTION

The D/L 2 Monitor System is designed to give a visual indication of the presence of gamma radiation and to sound an audible alarm when the radiation level reaches the preset alarm level. Typical uses are as an area monitor or as a monitor for specific pieces of equipment in an irradiation facility.

Two red light-emitting diodes (LED's) on the front face give a visual indication that the monitor is functioning properly. An LED with a clear lens is constantly on when power is supplied to the monitor. An LED with a red lens produces occasional "flickers" from the normal background radiation.

If the radiation level increases, the LED with the red lens will flicker more rapidly. At the preset alarm level an audible horn sounds and an auxiliary relay closes a set of contacts. These contacts can be used to control an associated system for "shutting down" the irradiator or the specific piece of equipment being monitored.

SPECIFICATIONS

1. Visual Sensitivity - Visual indication of background radiation down to 0.01 mR/h.
2. Alarm Level - Can be set for 0.5 mR/h and higher.
3. Power Requirements - 100-130 VAC, 50/60 Hz.
4. Case Dimensions - 21.5 cm wide x 13 cm high x 9 cm deep (8-1/2 in x 5 in x 3-1/2 in).
5. Auxiliary Relay Contacts - 15 watts capacity.

COMPONENTS

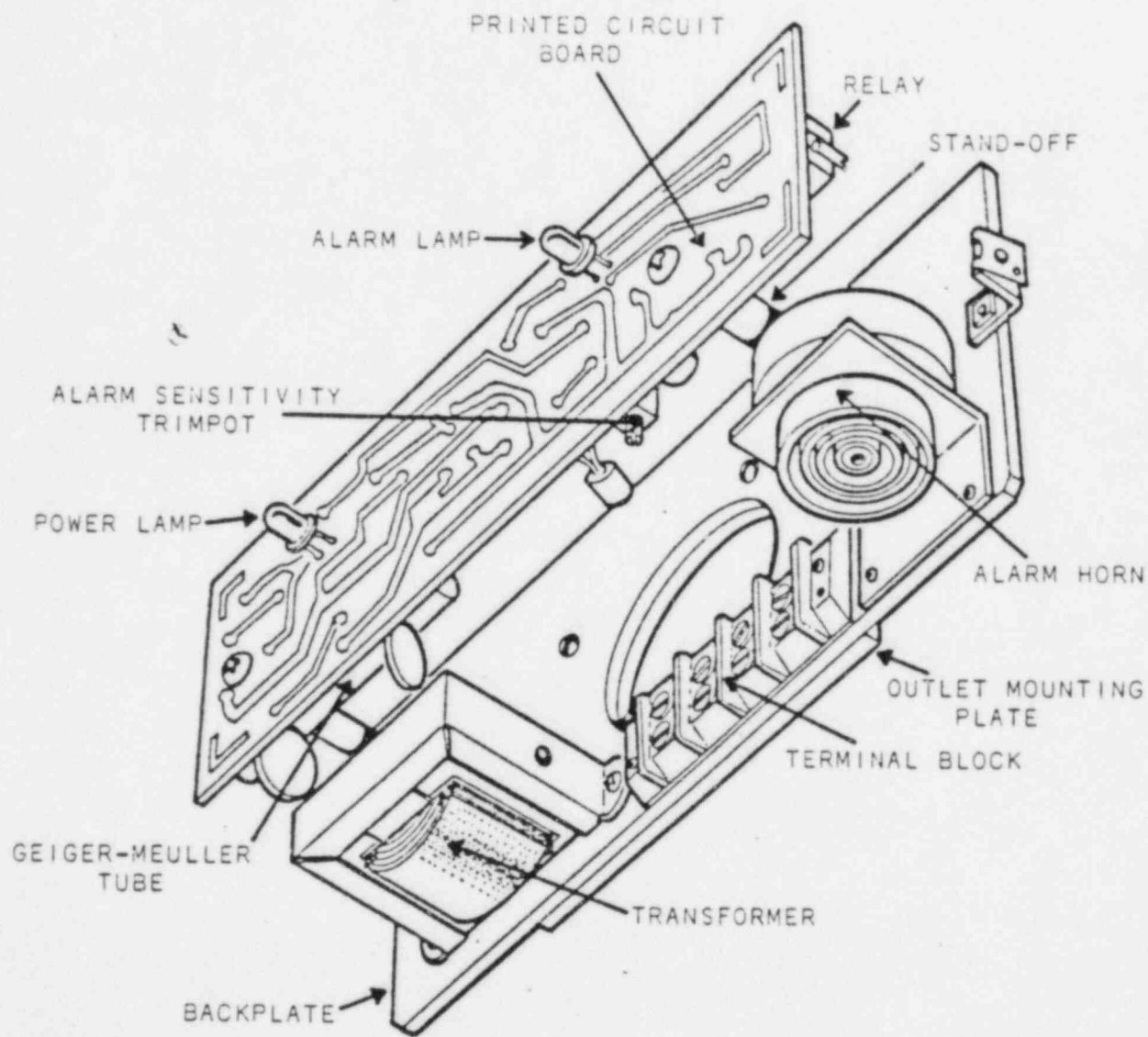
Refer to Figure 1.

Transformer

1. Provides a 12 VAC supply.
2. Provides isolation from the 115 VAC line.

Power Lamp

Indicates that the D/L 2 Monitor is ON.



REF B105207-024/A

Fig. 1. Component Location

Alarm Lamp

Provides a visual indication of gamma radiation levels.

Geiger-Meuller Tube

Monitors the gamma radiation and produces output pulses at a frequency that is proportional to the radiation level.

Alarm Horn

Produces a high-frequency "shrill" sound should the alarm level of gamma radiation be reached.

Relay

The relay contacts close in an alarm condition.

Alarm Sensitivity Trimpot

Provides a means of adjusting the alarm level of the MONITOR for gamma radiation. Clockwise rotation increases the sensitivity.

Terminal Block

1. Provides for easy connection to 115 VAC.
2. Auxiliary relay contacts are also available at this terminal block.

THEORY OF OPERATION (Refer to AECL Drawing A14233.)

The radiation level is monitored by a Geiger-Meuller tube which produces output pulses at a frequency proportional to the radiation level. These pulses are then processed by a Transducer Detector to produce a non-symmetrical square-wave output having an "on-time" proportional to the frequency of the pulses from the Geiger-Meuller tube.

The output of the transducer detector drives the red ALARM lamp (LED). This output also feeds an R-C integrator having a relatively "long" time constant. Therefore, the DC output voltage from the R-C integrator is consequently proportional to the radiation level.

The output of this R-C integrator goes to a COMPARATOR whose reference voltage is set by the ALARM SENSITIVITY trimpot.

If the radiation level should increase to the alarm setting, the COMPARATOR (along with transistor Q1) will "actuate" the audible alarm and de-energize the relay coil causing the relay contacts to close.

SENSITIVITY ADJUSTMENT

The sensitivity of the D/L 2 Monitor should be adjusted with maximum background radiation (with the source in the raised or "ON" position).

To adjust the alarm level to 0.5 mR/h above background, place a 10 microcurie Cs 137 (or equivalent) check source on the top edge of the backing plate 3 cm in from the left hand side. The monitor should just continuously alarm. Slowly adjust the sensitivity trimpot to achieve this condition. Clockwise rotation of the trimpot increases the sensitivity.

PERIODIC CHECKING OF THE MONITOR

The D/L 2 Monitor should be checked once a month.

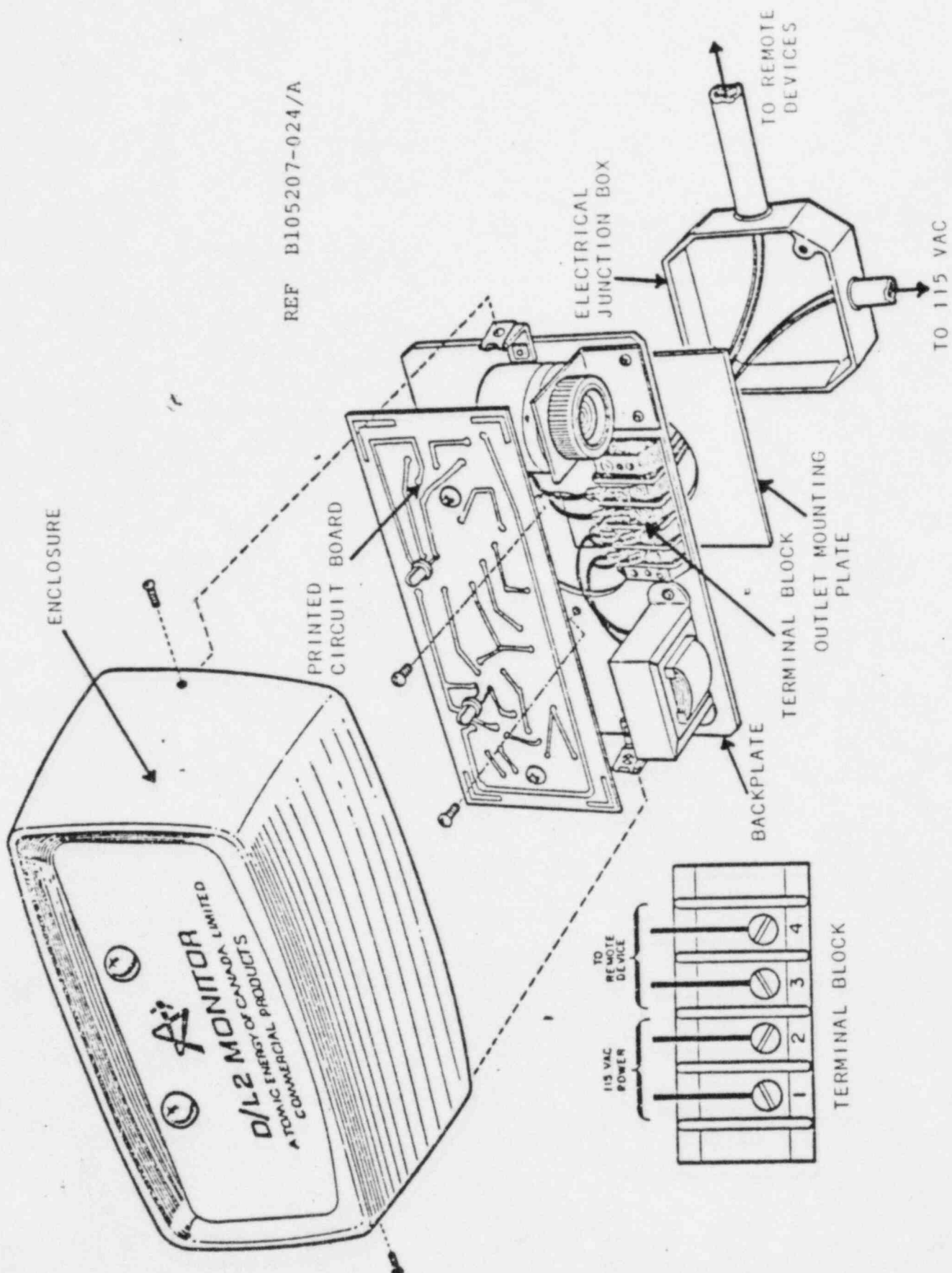
With the monitor powered and the irradiation source in the raised or "ON" position, place a 10 microcurie Cs 137 (or equivalent) check source on top of the monitor cover just to the left of the 'power' light. Within 5 seconds the alarm should sound and initiate any function which is integrated with the auxiliary contacts. If the alarm does not sound, the sensitivity should be re-adjusted as described in 'Sensitivity Adjustment'.

INSTALLATION INSTRUCTIONS (Refer to Figure 2.)

The D/L 2 Monitor is designed for wall mounting and should only be located where the background radiation is relatively "low"; otherwise the electronic components could be damaged.

Mounting

1. Remove the cover from the backplate.
2. Remove the square mounting plate from the backplate.
3. Drill and countersink holes in the mounting plate to suit the mounting holes in the electrical junction box, keeping the two existing holes horizontally below the centerline.



REF B105207-024/A

MOUNTING DETAILS
FIGURE 2

4. Bring wires through the access hole in the mounting plate and secure the plate to the electrical junction box using flat head screws.
5. Secure the D/L 2 to the mounting plate with the two screws provided.
6. Connect the wires to the terminal block as shown in Figure 2.
7. Adjust the alarm level as described under Sensitivity Adjustment.
8. Re-assemble the cover to the backplate.

PROCEDURE FOR DL2 MONITORS LOCATED AT RESIN FILTER UNIT

1. If an alarm condition occurs check with survey meter noting reading on meter.
2. If meter does not indicate radioactivity, reset alarm condition. An adjustment may be necessary to monitors.
3. If meter does drive upward note reading on meter. Contact a responsible individual who in turn will contact Atomic Energy of Canada, Limited.
4. Secure area.

PROCEDURE FOR ENTERING IRRADIATOR

1. Push "monitor test" button switch. When the switch is activated an alarm condition is induced into the ratemeter circuit to verify that the meter circuit is functioning properly.
2. Check source down pilot to insure it is illuminated.
3. Check "OK to enter" pilot light to ensure it is illuminated.
4. Proceed to maze door with survey meter.
5. Turn survey meter selector switch to Battery Check.
6. Turn survey meter selector switch to 1.
7. Place survey meter under check source, (Key Switch). Meter should drive upward indicating meter is functioning.
8. Insert key into keyswitch to open maze door.
9. Disconnect the chain stretched across aisle. This prevents air from reaching the source hoist.

5/21/85

TELEPHONE OR VERBAL CONVERSATION RECORD

TIME

☐ A.M.
☐ P.M.

☐ INCOMING CALL

☐ OUTGOING CALL

☐ VISIT

PERSON CALLING

Jack Davis

OFFICE/ADDRESS

PHONE NUMBER

EXTENSION

PERSON CALLED

Tony Piniat

OFFICE/ADDRESS

B&D Corp Safety

PHONE NUMBER

EXTENSION

201-967-3633

CONVERSATION

SUBJECT

Renewal of Irradiator Lic. (Pool)

SUMMARY

Will send addendum to include:

- 1) Not irradiating Explosives, flammables or corrosives OK
- 2) If they are tentatively Bypassing Fail Safe Alarm for maintenance if Bypass - then Administrative Procedures.
- 3) Procedures to change resin bed by conductivity levels OK
- 4) Item 10.5 (L/T) change to monitor Resin Bed - Alarm
 - a) Item 9 - typo - 0.0054 Ci
 - b) Since of 0.054 Ci to monitor xcpm.
- 5) Descrite
 - a) Heat & Smoke sensing devices to detect combustion OK
 - b) Spillables OK
 - c) all personnel to wear Film Badges OK
 - d) radiation survey before entering OK
 - e) detector at exit portal OK
- 6) Organization structure.
- 7) It provide generic ^{minimum} training, experience, testing will give generic authorized user on license.

Discussed "Physical Presence" on License ...

REFERRED TO:

ACTION REQUESTED

"OFFICIAL RECORD COPY"

ML10

☐ ADVISE ME OF ACTION TAKEN.

INITIALS

DATE

ACTION TAKEN

INITIALS

DATE