

**MULTIPLE SOURCE
GAMMA CALIBRATOR
MODEL 1000**

EBERLINE INSTRUMENTS
DONALD MILLER - 312-697-0123
546 RANDALL ROAD
ELGIN, ILLINOIS 60120

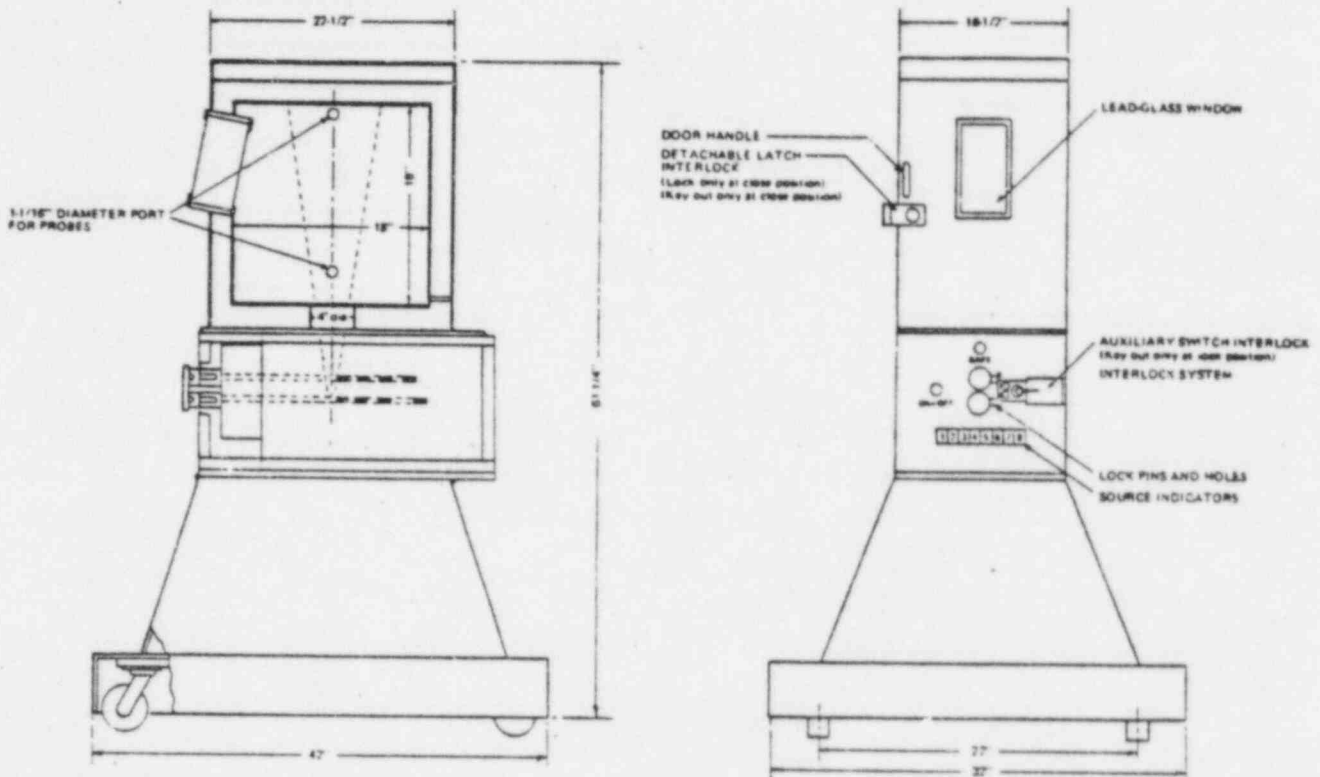
8508010324 850611
PDR FOIA
KOHNB5-256 PDR

EBERLINE INSTRUMENT CORPORATION
P.O. Box 2108 □ Santa Fe, New Mexico 87501 □ Phone: 505-982-1881 □ TWX: 910-985-0676

MODEL 1000

GENERAL

The Model 1000 Multiple Source Gamma Calibrator is designed to provide a beam of ionizing radiation internal to a self-contained source shield for the calibration of radiation detection instruments. The Calibrator is designed for beam utilization vertically upward. The Model 1000 consists basically of two source drawers which move through a cylindrical shield and an exposure chamber (lead safe) with lead-glass window; all mounted on a casted base. The sources are SAFE with the drawers in the IN position and EXPOSED when OUT: source transfer from the SAFE position is accomplished manually.



1. The Model 1000 is self-contained and meets all DoT-55 shipping requirements for shipment when loaded with Cesium-137.
2. Before shipment, the Instrument Calibrator is loaded with Cesium-137 which is double encapsulated in heliarc-welded, stainless steel capsules, IRL Source capsule, Model CS-2.
3. Provision is made for lifting the Instrument Calibrator by forklift.
4. Approximate dimensions are:
 - a. Height - 65 inches.
 - b. Width - 32 inches (base).
 - c. Length - 42 inches (base).
 - d. Weight: - 3,000 pounds.

MODEL 1000

- b. Notify Radiation Safety Officer.

OPERATION

The source is manually actuated to the EXPOSED position as follows:

1. Plug power cord into 115 VAC outlet. Depress ON-OFF breaker switch; SAFE light should illuminate.
2. Using provided key, open chamber door.
3. Place instrument to be calibrated above beam port using appropriate fixture. Direct light such that instrument meter scale is properly visible.
4. Close door and remove key.
5. Place key into source drawer lock and actuate; SAFE light should go out.
6. Pull out desired source drawer actuation rod until appropriate source indicator is illuminated.
7. The source is now EXPOSED.
8. Note the instrument reading. Instrument should read per instructions manual calibration procedures.
9. The source is returned to a SAFE position by pushing IN on the actuation rod.
10. The source drawers are locked into a SAFE position by the actuating key. Safe light should illuminate.
11. Remove key, open chamber door as above and adjust instrument per manufacturer's calibration instructions.
12. This cycle may be repeated as necessary or a new instrument placed in chamber.

CERTIFICATION

1. Source calibration information for the Cesium-137 sources at various cavity positions will be provided. Measurements are made using the Landsverk Electrometer Model L-64 Roentgen Meter or equal. A Source Leak Test Certificate is also provided.

2. Warranty Provisions: Eberline Instrument Corporation warrants the Model 1000 Multiple Source Gamma Calibrator, including sealed radioactive sources, to be free of defects of material and workmanship, and assumes responsibility for servicing or replacing the equipment which, under normal operating conditions, proves to be defective within one year of delivery. The service or replacement will be F.O.B. IRL, Plainsboro, New Jersey, at no charge. This warranty does not cover damage resulting from improper use or improper handling of the equipment and the warranty may be void if repair has been attempted by unqualified personnel.

3. Unauthorized tampering or modifying the Calibrator or removal of sources or source drawers from the Calibrator is prohibited.

INSTALLATION

1. The Model 1000 is shipped complete and ready to use, refer to operation instructions.
2. Two copies of operating instructions are provided with delivery of the Model 1000.

TECHNICAL MANUAL
MULTIPLE SOURCE GAMMA CALIBRATOR
MODEL 1000

Serial # 112

EBERLINE INSTRUMENT CORPORATION
Santa Fe, New Mexico

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SECTION I
CALIBRATOR DESCRIPTION

A. GENERAL

The Multiple Source Gamma Calibrator Model 1000 is a nuclear device designed to provide a self-contained, variable intensity beam of gamma radiation for the calibration of radiation detection instruments. It consists essentially of three parts:

1. A lead shielded compartment or safe for enclosing instruments to be calibrated.
2. A multiple source storage shield and radiation beaming device.
3. A castered platform which supports the calibration compartment and source shield at a convenient elevation.

When assembled, the device has a base dimension of 34" x 42" (86.3 x 106.7 cm) and stands approximately 65" (165.1 cm) high. Its gross weight is approximately 2965 (1344.9 Kg) pounds; 1460 (662.2 Kg) pounds in the safe, 1030 (467.2 Kg) pounds in the shield and source assembly, and 475 (215.4 Kg) pounds in the supporting components. Shipping weight is approximately 3100 (1406.1 Kg) pounds.

B. SOURCE SHIELD

The cylindrical source shield is a lead filled, carbon steel container, 12" (30.4 cm) in diameter x 24-21/32" (62.6 cm) in length. The shield is penetrated axially and horizontally from one end only by two cavities, each of which houses a movable source drawer. Each drawer contains up to four ¹³⁷Cs sources of varying gamma intensity. Both cavities pass perpendicularly through the axis of a radiation beam collimator which penetrates the shield halfway radially. This arrangement permits the incremental

Except when in use with detection probes, the two holes in the left side are closed with solid steel plugs and secured with padlocks.

Support for the safe is provided by a 2" (5.08 cm) x 3/16 (.4 cm) angle frame which bolts to both the safe and the base platform. The safe also rests on the top platform of the source shield but is not bolted thereto.

The instrument compartment door and the source drawers are secured by means of a single key, dual lock system. The common key is removable from the lock assembly only at such times as both the safe door and the source drawers are locked in the "SAFE" position.

SECTION II

RADIOLOGICAL SAFETY

A. GENERAL

Before being placed into service, the Model 1000 Multiple Source Gamma Calibrator should be introduced to plant radiological safety personnel for study of the mechanical characteristics, calibration procedures and associated radiation exposure hazards. Upon inspection it will be readily apparent that there are three areas of particular concern: the number of keys in circulation, calibration procedures requiring open ports in the instrument compartment, and equipment maintenance which requires removal of the source drawer lock assembly. Failure to administer precautionary measures in these regards could result in the exposure of operating personnel to relatively high levels of radiation. Therefore, the manufacturer of this equipment considers adherence to the following specific procedures necessary for safe operation.

B. RADIATION SAFETY PROCEDURES

1. Only trained and specifically authorized personnel should use this calibration equipment.
2. Keep only one key in circulation. The spare key should remain in the master key file to be issued exclusively to the Radiological Safety Officer upon written justification.
3. The use of the key to port padlocks should be administered by the Radiological Safety Officer.
4. Maintenance requiring removal of the front control panel necessitates strict safety officer attendance. The seals on the lock assembly should be broken prior to maintenance, and subsequently replaced by the

SECTION III
OPERATING PROCEDURES

The source is manually adjusted to the EXPOSED position as follows:

1. Plug power cord into 115 VAC outlet. Turn on toggle switch. SAFE light should illuminate.
2. Using provided key, open chamber door.

NOTE

Before proceeding, a lead plug (used for shipping purposes only) must be lifted and removed from the beam collimating hole. This is accomplished by removing socket head screws from retainer plate, removing retainer and then lifting out tapered lead plug by use of an eye screw (wood thread) inserted into the hole. Retain shipping plug, retainer plate and screws for future use.

3. Place instrument to be calibrated above beam port using appropriate fixture, direct light so that the instrument meter scale is clearly visible.
4. Close door and remove key.
5. Place key into source drawer lock and actuate. SAFE light should go out and EXPOSE light come on.
6. Pull out desired source drawer actuation rod until appropriate source indicator is illuminated.
7. The source is now EXPOSED.

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SECTION IV

WARRANTY

The manufacturer warrants the Model 1000 Multiple Source Gamma Calibrator, including sealed radioactive sources, to be free of defects of material and workmanship, and assumes responsibility for servicing or replacing the equipment which, under normal operating conditions, proves to be defective within one year of delivery. The service or replacement will be FOB IRL, Plainsboro, New Jersey, at no charge. This warranty does not cover damage resulting from improper use or improper handling of the equipment and the warranty may be void if repair has been attempted by unqualified personnel.

Unauthorized tampering, modification of the Calibrator or removal of source drawers from the Calibrator is prohibited.

IMPORTANT

In order to avoid damage to the source drawer pull rods by passing personnel or equipment, stanchions, rope and signs should be placed in front of the MSG Calibrator when in use. Such damage is serious and requires off-site repair service.

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SECTION V UNCRATING INSTRUCTIONS

CAUTION

In off-loading Multiple Source Gamma Calibrator from transport vehicle, use only a forklift truck having a capacity of 4,000 lbs. when in use with long forks. Weight distribution within the crate is such that it must be maintained in essentially an upright position at all times. Do not use hooks and cables.

The Model 1000 Multiple Source Gamma Calibrator is shipped on a heavy skid and within a plywood protective cover. Upon receiving the device and prior to uncrating, it should be placed near its permanent location and in an open area which is accessible to a forklift truck from three sides. Proceed as follows:

1. Remove top of crate and observe position of internal 2" x 4" supports.
2. Remove nails holding internal supports.
3. Remove sides of crate.
4. With the skid and device in an elevated position, remove bolts which secure the calibrator to the skid. (Rubber plugs for closing bolt holes are located within the instrument chamber.)
5. Lower both skid and calibrator.
6. Lift calibrator from skid, using long forks to assure that device is properly supported.

SECTION VI

CALIBRATION CHAMBER FITTINGS AND ACCESSORY EQUIPMENT LIST

The shielded chamber is equipped with instrument fixture support brackets, arranged at two inch increments of elevation and a magnetic base high intensity lamp. Additional accessories packed within the chamber are as follows:

- 1 - Magnetic base articulate mirror for viewing instrument dials.
- 1 - PIC-6A calibration fixture.
- 1 - E-520 calibration fixture.
- 1 - RAD OWL calibration fixture.
- 1 - Teletector calibration fixture.
- 1 - G-M probe support fixture.

SECTION VII

ELECTRICAL MAINTENANCE

A. LAMP, SWITCH AND SOCKET REPLACEMENT

Refer to parts listing here included. If control panel removal is required, refer to Section II, B, 4 and Section VII, B, 1.

B. SOURCE POSITION INDICATOR SWITCHES

It is expected that at infrequent intervals these devices consisting of micro switches and associated roller lever actuators will fail and require attention. Because of the difficulty of replacement and since position lights are not requisite to operational safety, it is suggested that corrective maintenance be postponed until two or more switches have failed. A simple pointer and mark system of indicating source position serves well in lieu of position lights.

Four position switches are associated with and mounted on each of two brass guide blocks which support source drawer pull rods in precise rotational and linear alignment relative to switch actuators. The guide blocks are permanently mounted on two inch centers to a common brass plate which bolts to the source shield.

NOTE

The guide block assembly does not serve the purpose of safety stop for source drawer withdrawal and may be safely removed from the shield for maintenance purposes.

Micro switches and actuators are attached in pairs to brass mounting brackets. Two brackets, each holding two switches, bolt to opposite sides

MODEL 1000

- b. Remove mounting bracket assembly by removing both machine screws.
- c. Remove switches and actuators from bracket and replace in pairs. Note rubber spacers or shims between switches and bracket. Replace in same order as new switches are installed.
- d. Return switch mounting bracket to guide block and observe action of rollers in grooves upon withdrawal of source pull rod.
- e. Put spring plunger in compression by adjusting both screws until switch actuators are in proper relationship to grooves. Slight forward and back adjustment can be achieved by independent screw adjustment. Also, if necessary, the pair-mounted switch bodies may be rotated relative to each other to achieve independent timing.
- f. Attach test meter to terminals and test on and off functions before replacing lead wires to lugs.

The replacement of source position switches as above described is difficult because of limited accessibility. On the other hand, this procedure involves less risk of damage to other switch assemblies and requires less follow-up adjustments than does an alternate procedure. The following alternate procedure which involves the removal of the entire guide block assembly may be used depending upon the patience and dexterity of the maintenance technician and upon the number of switches to be replaced.

3. Switch Replacement by Guide Block Assembly Removal

- a. Remove four bolts from the guide block plate and pull the assembly back over the ends of the source drawer pull rods. This will permit the removal of assembly, associated wiring, and the control panel to a convenient work area. Note location of shims.
- b. Remove mounting brackets and replace switches and actuators as previously described. Test.

NOTE (continued)

end of the switch up or down after loosening and subsequently tightening mounting screws. The achievement of proper on-off action of switches may at times require several adjustments of this type since there are no elevation adjustments on the mounting brackets. All devices with serial numbers larger than 104 have switch elevation adjustment screws as here described.

f. After observing proper action of all switches, reconnect leads, test, return control panel, lock assembly and mid-section shroud in reverse order of steps described in Section VI, B, 1, making sure that no wires are pinched between control panel or shroud and frame.

g. The adjustment of the lock assembly to assure smooth action is accomplished by trial and error. Secure tightly before sealing. Replace shims, if present, as removed.

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SECTION VIII REPLACEABLE PARTS LIST

ITEM	USE	MANUFACTURER
1S X 1-T-H58 Micro Switch J X 25 Micro Switch Actuator	Source Position Indicator	Micro Switch A Division of Honeywell Freeport, Illinois 61032
Magnetic Base, Ball Joint Inspection Mirror #60015	Viewing Instrument Meter Face	Edmund Scientific Company 701 Edscorp Boulevard Barrington, N.J. 08007
Model 6484 Spotlight with #93 Bulb; Model 6400M Power Supply	Calibration Com- partment Illumina- tion	The Rexter Corporation 10-11 40th Avenue Long Island City, N.Y. 11101
Dialight Lamp Assembly #137-8836-0931-552; Lamp #NE2J	Source Position Read-Out	Federated Purchaser, Inc. 155 U. S. Route 22 Springfield, N.J.
Dialco #51-4001-0211-301 Dialco #51-4001-0212-301 Lamp Assemblies	"Safe" - "Expose" Indicator Lights	Federated Purchaser, Inc.
Vlier Ball Plunger - Part #B-54	Source Position Friction Stop	Vlier Engineering Corp. 2333 Valley Street Burbank, California 91505

SECTION IX
SOURCE CALIBRATION INFORMATION

All Multiple Source Gamma Calibrator sources are evaluated in their respective devices under normal conditions of use by the Multiple Source Gamma Calibrator manufacturer. Calibration curves which plot dose rate as a function of elevation in inches from the floor of the Multiple Source Gamma Calibrator instrument shield are included in the owners technical manual.

Dose rate data points, corrected for temperature and pressure are obtained by use of a dynamic capacitor-type electrometer and ionization probes covering the range of 10 mR/hr to 1000 R/hr. Certification of electrometer and probes calibration traceability to the National Bureau of Standards is also provided.

The manufacturer claims $\pm 6\%$ limit of error on Multiple Source Gamma Calibration data indicating dose rates in excess of 20 mR/hr. However, because of increased difficulty and diminished accuracy in evaluating low strength sources in the Multiple Source Gamma Calibrator using this system, the manufacturer places a $\pm 10\%$ limit of error on data indicating dose rates less than 20 mR/hr.

SECTION X
MECHANICAL MAINTENANCE

A. CABINET DOOR HINGES

Hinges have been pre-lubricated and are not expected to require frequent attention. Additionally, calibrators beyond Serial #104 are equipped with threaded holes in the hinge blocks for use with standard grease fittings during subsequent lubrication needs.

When hinge maintenance other than lubrication is required, care must be exercised in order to avoid damage and maintenance should proceed as follows:

1. Place 3/8" threaded eye bolt in plugged fitting in top of door.
2. Elevate and remove door by use of a hand-operated rope block so as not to exert undue stress. Door removal may be facilitated by rocking.
3. Captured hinge pins can be removed and all components cleaned and lubricated.
4. Replace door in reverse order of removal.
5. Replace plug in fitting after removal of eye bolt.

B. SOURCE SHIELD REMOVAL

Under unexpected circumstances which require return of the shield and source assembly to the manufacturer for repair, the shield is easily removable as follows:

1. Remove sheet metal shroud, control panel and electrical wiring as described in the electrical maintenance section of this manual.
2. Remove eight 3/8" bolts which secure the shielded instrument compartment to its supporting frame.

NOTE

The original bolts should be used during reassembly.
Bolt length must not exceed 3/4" should the original bolts need replacement.

DEVICE
SERIAL

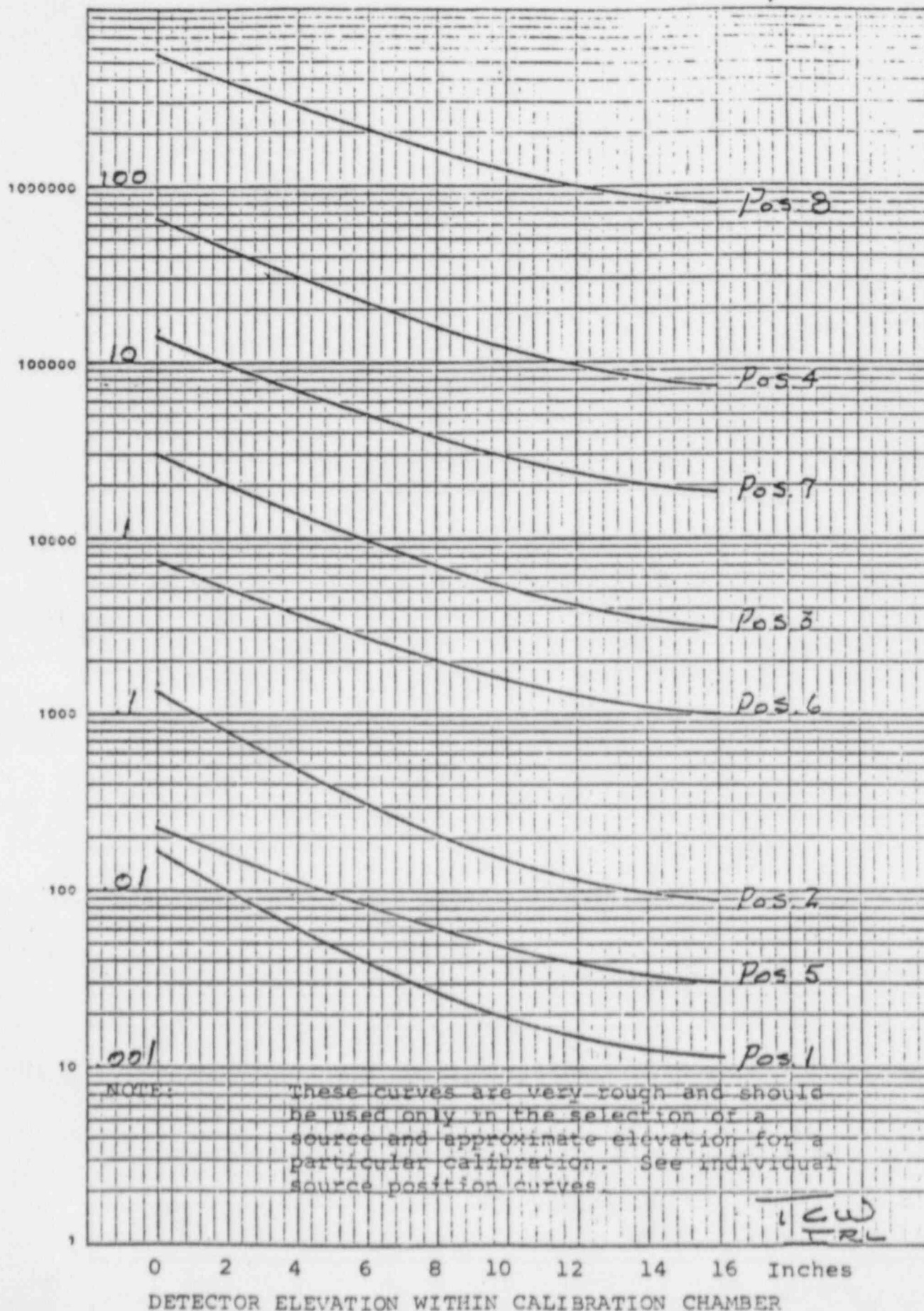
COMPOSITE OF SOURCE CALIBRATION
CURVES

112

MODEL MSGC 1000

DATE

3/20/75



CALIBRATION DATA

MSGC SERIAL NO.

112

CURIE CONTENT

28 uci

SOURCE POS. NO.

1

DRAWER

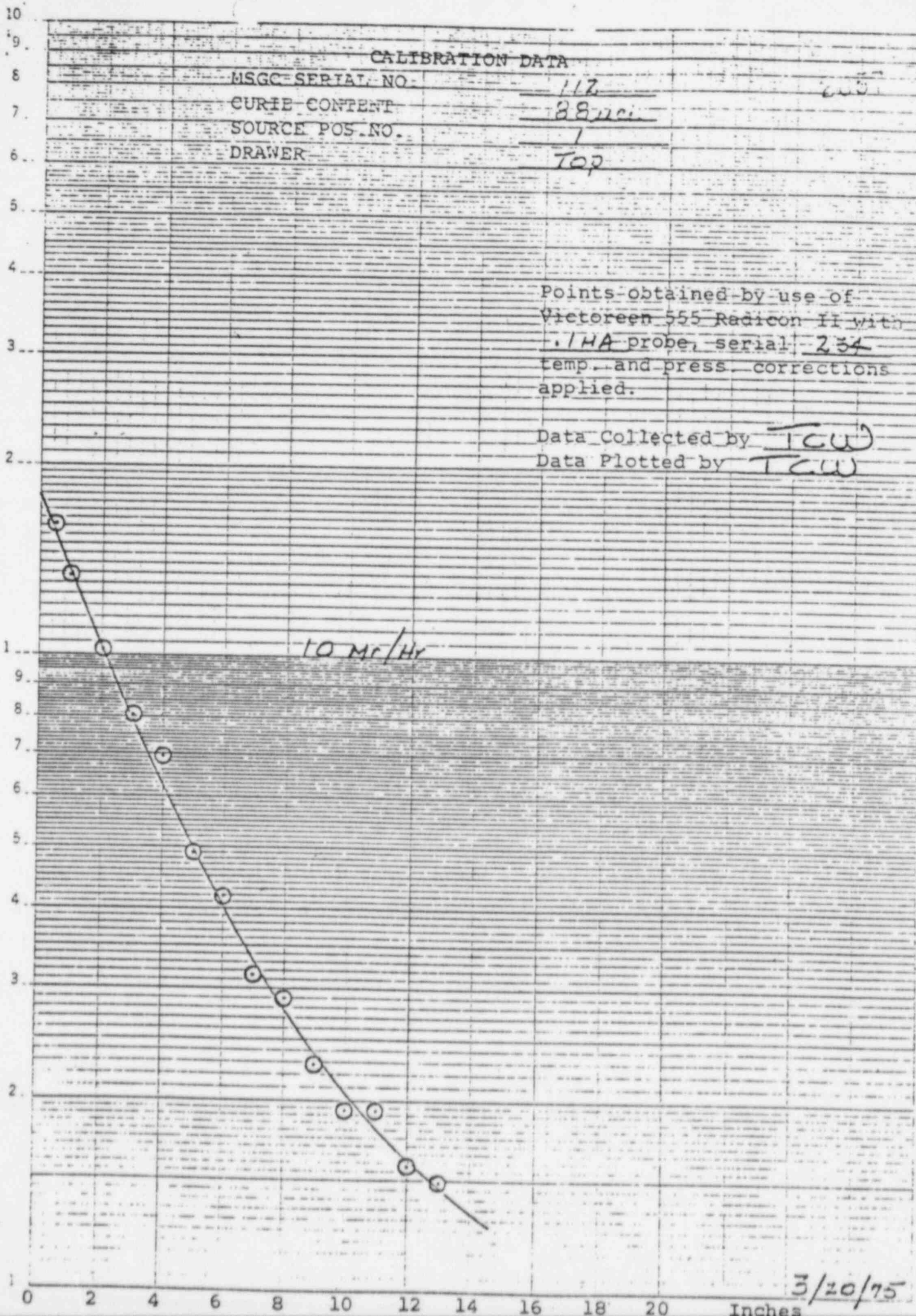
Top

Points obtained by use of
Victoreen 555 Radicon II with
.1HA probe, serial 234
temp. and press. corrections
applied.

Data Collected by TCW
Data Plotted by TCW

10 Mr/Hr

3/20/75



46 4970

16-3: SEMI-LOGARITHMIC • 7 INCHES X 10 DIVISIONS
RESISTANCE & CO. NEW YORK, N.Y.

CALIBRATION DATA

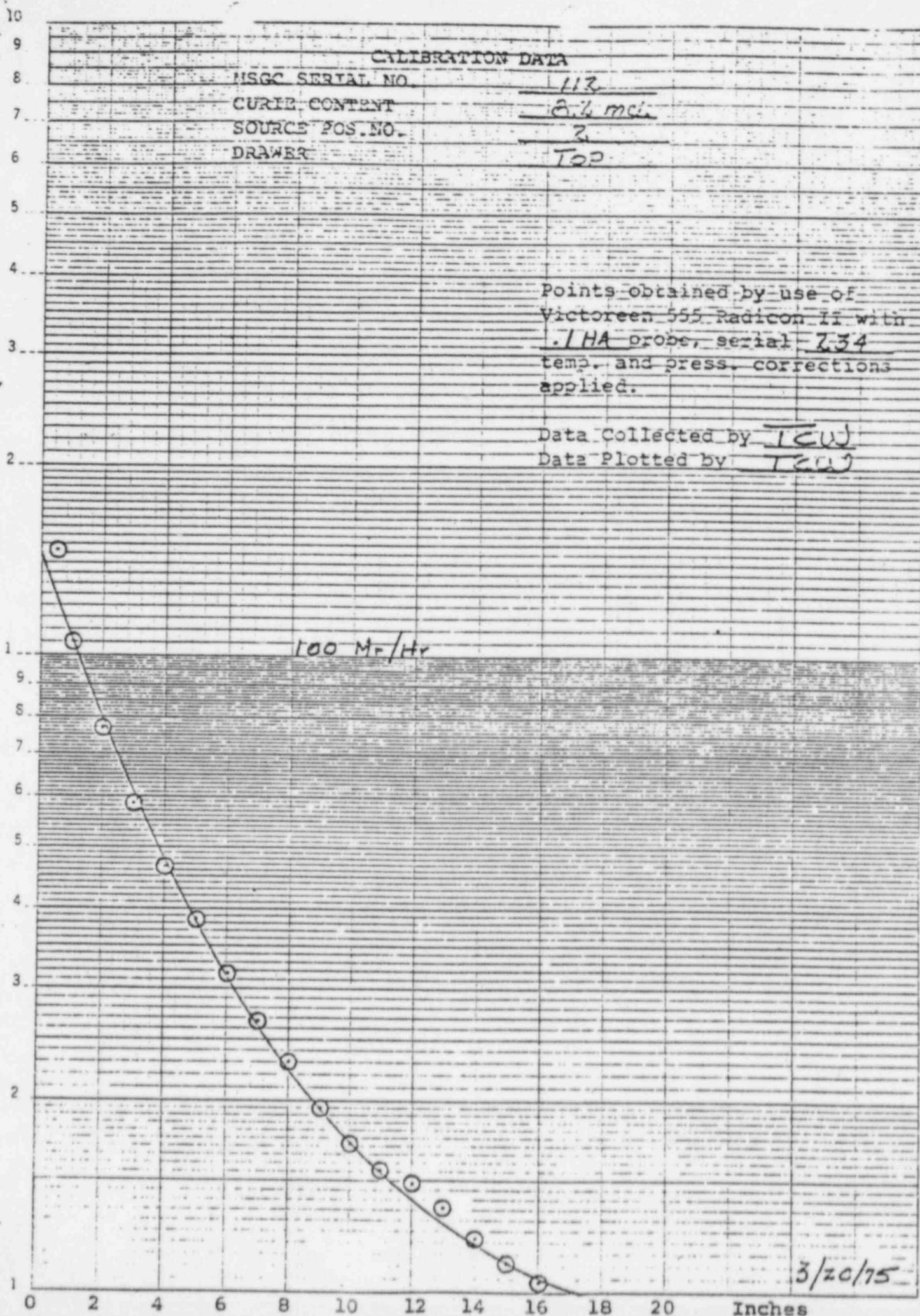
MSGC SERIAL NO. 112
 CURIE CONTENT 8.2 mci
 SOURCE POS. NO. 2
 DRAWER TOP

Points obtained by use of
 Victoreen 555 Radicon II with
 .1HA probe, serial 234
 temp. and press. corrections
 applied.

Data Collected by TCW
 Data Plotted by TCW

100 Mr/Hr

3/20/75



46 4970

SEMI-LOGARITHMIC *2 CYCLES X 70 DIVISIONS
 NEUFEL & ESSER CO. MADE IN U.S.A.

CALIBRATION DATA

MSGC SERIAL NO.

112

CURIE CONTENT

323 mci

SOURCE POS. NO.

3

DRAWER

Top

Points obtained by use of
Victoreen 555 Radicon II with
LHA probe, serial 231
temp. and press. corrections
applied.

Data Collected by TCW
Data Plotted by TCW

1 R./Hr

5/20/75

0 2 4 6 8 10 12 14 16 18 20 Inches

DETECTOR ELEVATION WITHIN CALIBRATION CHAMBER

46 4970

SEMI-LOG-ARITHMETIC #2 CYCLES X 70 DIVISIONS
NEUFEL & ESSEN CO. MADE IN U.S.A.

CALIBRATION DATA

MSGC SERIAL NO.

112

CURIE CONTENT

7.5ci

SOURCE POS. NO.

4

DRAWER

Tap

Points obtained by use of
Victoreen 555 Radicon II with
1HA probe, serial 281
temp. and press. corrections
applied.

Data Collected by TCW
Data Plotted by TCW

10 R/hr

3/20/75

Inches

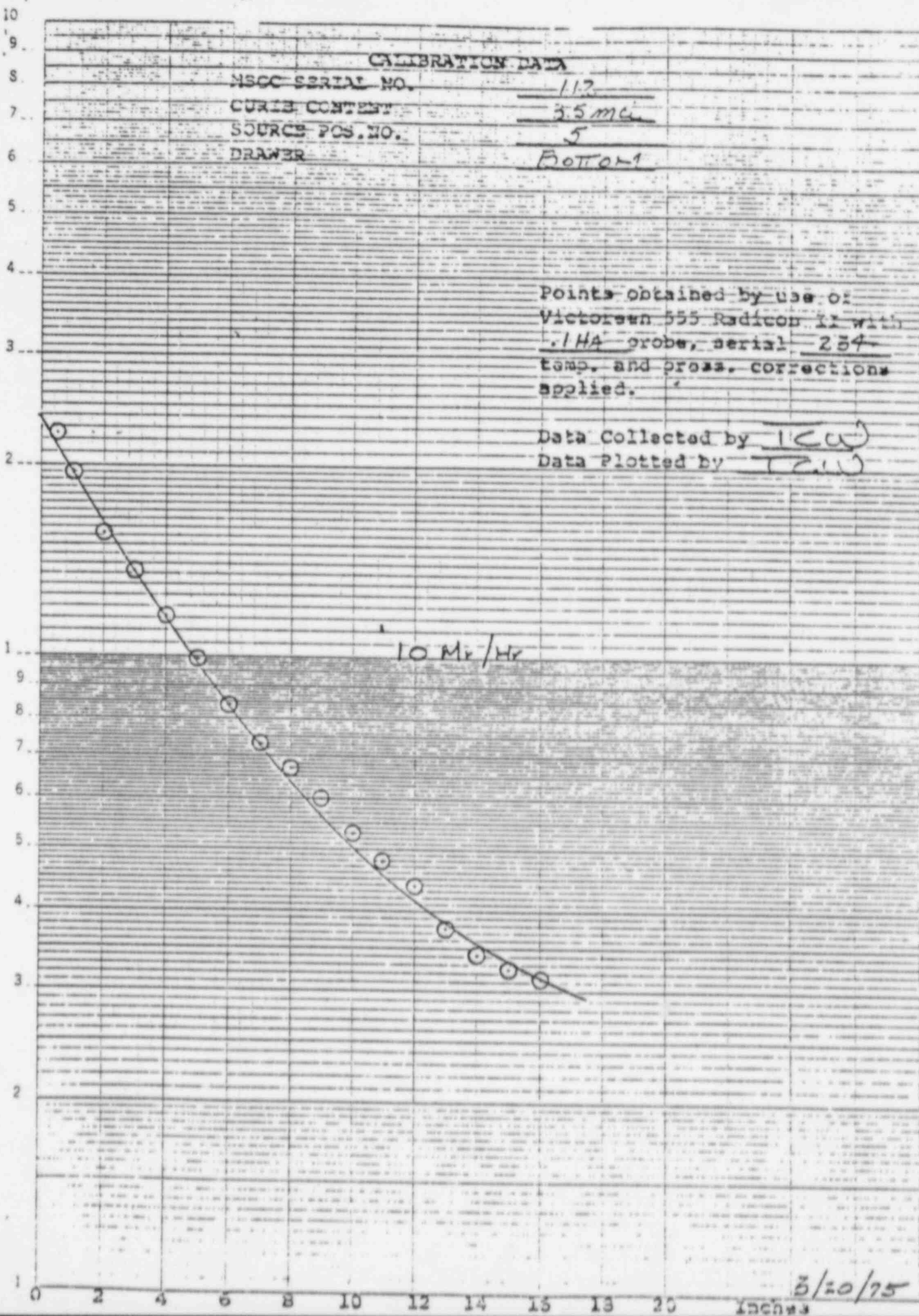
CALIBRATION DATA

NSCC SERIAL NO. 112
 CURIE CONTENT 3.5 mc
 SOURCE POS. NO. 5
 DRAWER Bottom

Points obtained by use of
 Victoreen 555 Radicon II with
 .1HA probe, serial 234
 temp. and press. corrections
 applied.

Data Collected by ICW
 Data Plotted by TZW

10 Mr/Hr



46 4970

SENTECH INDUSTRIES, INC. 30 DAY GUARANTEE
 NEWFALL & LUGER CO. 1974

3/20/75

46 4970

SEABALCON INSTRUMENTS • C. E. ALLEN • X. RAY DIVISION
NEW BRUNSWICK • NEW JERSEY

CALIBRATION DATA

MSGC SERIAL NO.

113

CURIE CONTENT

166 mci

SOURCE POS. NO.

6

DRAWER

BOTTOM

Points obtained by use of
Victoreen 555 Radicon II with
.1HA probe, serial 234
temp. and press. corrections
applied.

Data Collected by TCW
Data Plotted by TCW

100 Mr/Hr

3/20/75

0 2 4 6 8 10 12 14 16 18 20 Inches

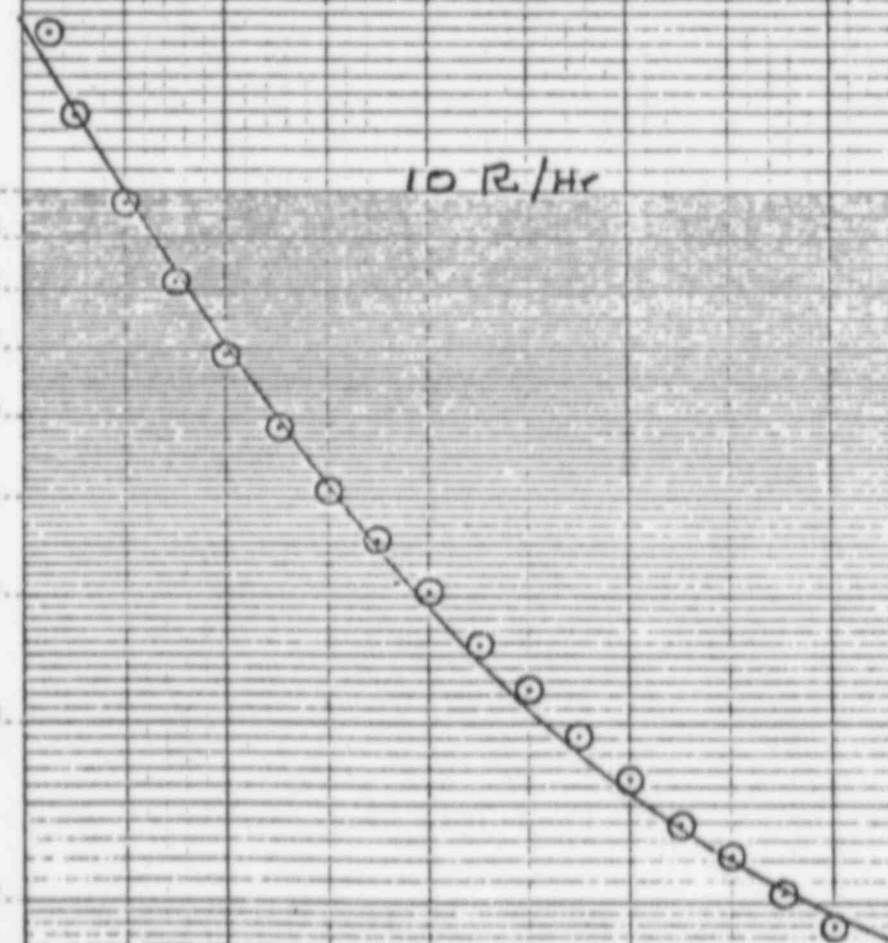
CALIBRATION DATA

MSGC SERIAL NO. 112
 CURIE CONTENT 3.1 C.
 SOURCE POS. NO. 7
 DRAWER BOTTOM

Points obtained by use of
 Victoreen 555 Radicon II with
1HA probe, serial 231
 temp. and press. corrections
 applied.

Data Collected by ICW
 Data Plotted by ICW

10 R/hr



3/20/75

Inches

CALIBRATION DATA

MSGC SERIAL NO. 112
 CURIE CONTENT 132 Ci
 SOURCE POS. NO. 8
 DRAWER BOTTOM

Points obtained by use of
 Victoreen 555 Radicon II with
1 HA probe, serial 231
 temp. and press. corrections
 applied.

Data Collected by TCW
 Data Plotted by TCW

100 R/hr

0 2 4 6 8 10 12 14 16 18 20 Inches

3/10/75

46 4970

K&E SEMI-LOGARITHMIC #2 CYCLES X 70 DIVISIONS
 NEUFEL & ESSER CO. MADE IN U.S.A.



March 31, 1975

CERTIFICATE OF INSPECTION

This certifies that the following sealed radioactive source(s) have been leak tested at Industrial Reactor Laboratories on date(s) indicated, the results of which indicate less than $0.005 (5.0 \times 10^{-3})$ microcuries of removable contamination per source:

<i>Pos. No.</i>	Source Serial	Test Date	Isotope	Curies	Test Method	Removable Contamination (microcuries)
1	422	12/12/74	Cs-137	88 uci	See Comment 1	<.005 uci
2	407	"	"	8.2 mci	" " "	" "
3	393	"	"	322 mci	" " "	" "
4	254	"	"	7.5 ci	" " "	" "
5	410	"	"	3.5 mci	" " "	" "
6	399	"	"	166 mci	" " "	" "
7	386	"	"	3.1 ci	" " "	" "
8	253	"	"	132 ci	" " "	" "

DISPOSITION:

The Dow Chemical Company
Midland Michigan 48640

Attn: Mr. Gordon Engdahl, HP
COMMENTS:

1. Test Method - cyclic bailing H_2O immersion as a group
2. Wipe test on pull rods 3/31/75 - less than 100 dpm

W. M. Feig
Radiation Safety Officer

MULTIPLE SOURCE GAMMA CALIBRATOR
MODEL 1000

March 25, 1975

KIRK KEY INTERLOCK SYSTEM

Device Serial: 112

Sold to: The Dow Chemical Company

Midland, Michigan 48640

Is equipped with Kirk System Key Serial Number: RE 11505

ITE Order No. 45-78864

Replacement keys or lock service may be obtained from:

ITE Imperial Corporation
Kirk Key Interlock Div.
Greensburg, Pa.

COPIES:

ITE Imperial
Owners Tech. Manual
MSGC Serialized File

TCW/an

INDUSTRIAL REACTOR LABORATORIES, INC.
Plainsboro, New JerseyREQUEST TO ~~(SECURED)~~
(DISPOSE OF) RADIOISOTOPE

No. 20439

Job No.

Distribution: White: Health Physics
Pink: Requestor
Yellow: To Accompany ShipmentHEALTH PHYSICS MUST BE NOTIFIED AT TIME OF RADIOISOTOPE HANDLING FOR APPROVAL
BELOW

NAME OF REQUESTOR: T. C. Weeks DATE: 3/31/75

RADIOISOTOPE & AMOUNT (mc, mc, c): Cs-137, 143.0998 Ci.

SOURCE OF RADIOISOTOPE (if IRL, give isotope #) CEA

TO BE LOCATED: Dow Chemical Co., Midland Michigan

LICENSE NUMBER OF RECIPIENT: 21-00265-06

DESCRIPTION OF STORAGE OF SHIPPING CONTAINER:

FORM OF TRANSPORTATION: Common Carrier

DESCRIPTION OF MATERIAL (Physical or Chemical Form, Impurities, etc.):

Doubly S₈ encapsulated Cs137 clPROPOSED USE OF MATERIAL (Brief description of experiment): Mod. 1000
MSGC, Calibration of radiation detection instruments.

INTENSITY OF RADIATION UNSHIELDED

On MAY 1974 at NA
this material measured 473.4 R/hr
at 12 inches.

SIGNATURE OF RECIPIENT:

Group or
Company

RADIATION LEVELS FROM CONTAINER

NA mrem/hr at surface of
inner container.
<0.35 mrem/hr at accessible
surface of shipping container.
<0.2 Units (mrem/hr at one meter
from accessible surface).
<100 dpm/100 cm² on surface of con-
tainer.

Required Signatures

Function

Date

Signature

Radioisotopes Comm. Representative	General Approval	4/2/75	[Signature]
Health Physics Representative	Survey Approval	4/5/75	[Signature]
Secretary, Radioisotopes Committee	Inventory	4/7/75	[Signature]

CALIBRATION CERTIFICATION

We hereby certify that the instruments have been calibrated on the dates shown inside and are in accordance with the specifications set forth for these models by THE VICTOREEN INSTRUMENT DIVISION. Radiation calibrations are traceable to the National Bureau of Standards.

CUSTOMER INSPECTION

This instrument should be examined and tested as soon as received by the purchaser or owner. Claims for damage, if any, should be filed at once with the carrier. Instruments returned to VICTOREEN for repair, calibration or any other reason should be accompanied by the RETURNED GOODS FORM provided in the instruction manual.

*Please Read Instruction Manual Carefully
Before Operating This Instrument*

CALIBRATION REPORT

To: Industrial Rector Lab. Inc., Plainboro, N.J. Date: JAN 23 1974
 Register # 009291 Serial # 240 Model # 555 Radcom II

X-RAY TECHNIQUE
 (Moderately Filtered X-Rays)

Technique	KVCP	Total Filtration		Kev Eff.	hvl	
		mm Al	mm Cu		mm Cu	mm Al
H	60	4	0	32	0.09	2.8
I	76	4	0	34.5	0.11	3.4
J**	100	5	0	42	0.20	5.1
K	150	5	0.25	64	0.66	10
L	200	5	0.5	84	1.3	13
M**	250	5	1.0	111	2.2	16
M ¹	250	5	3.2	140	3.2	18
Cs137*	—	—	—	660	—	—
Co 60*	—	—	—	1250	—	—

Correction factors for these techniques are obtained by intercomparison with instruments whose calibrations are traceable to the U.S. National Bureau of Standards and are accurate to within $\pm 3\%$.

Model and Serial No.	Correction Factor (multiplier) for Technique				
	Cs137	Co60	()	()	()
555-0.1HA #234	0.96 _e	0.98 _e			
555-1HA #231	0.98 _e	0.97 _e			

*Standard Calibration Points for High Energy Chambers and Probes, no extra charge.

**Standard Calibration Points, no extra charge on new or repair instruments.

Calibrated By: L. J.
 (X-Ray Lab.)

Form: 9064A-1-63

Model No.	Serial No.	Date Calibrated	Calibration Technique	Recommended Date For Recalibration
555 Radcon II	740	JAN 23 1974	CS137 0060	
555-0.1HA	231			
555-1HA	234			

Register No. 009291

L.D.

Calibration Lab.

VICTOREEN INSTRUMENT DIVISION
10101 WOODLAND AVENUE * CLEVELAND, OHIO 44104

RADI IN BONE - ROENTGENS IN AIR, FROM TABLE 1

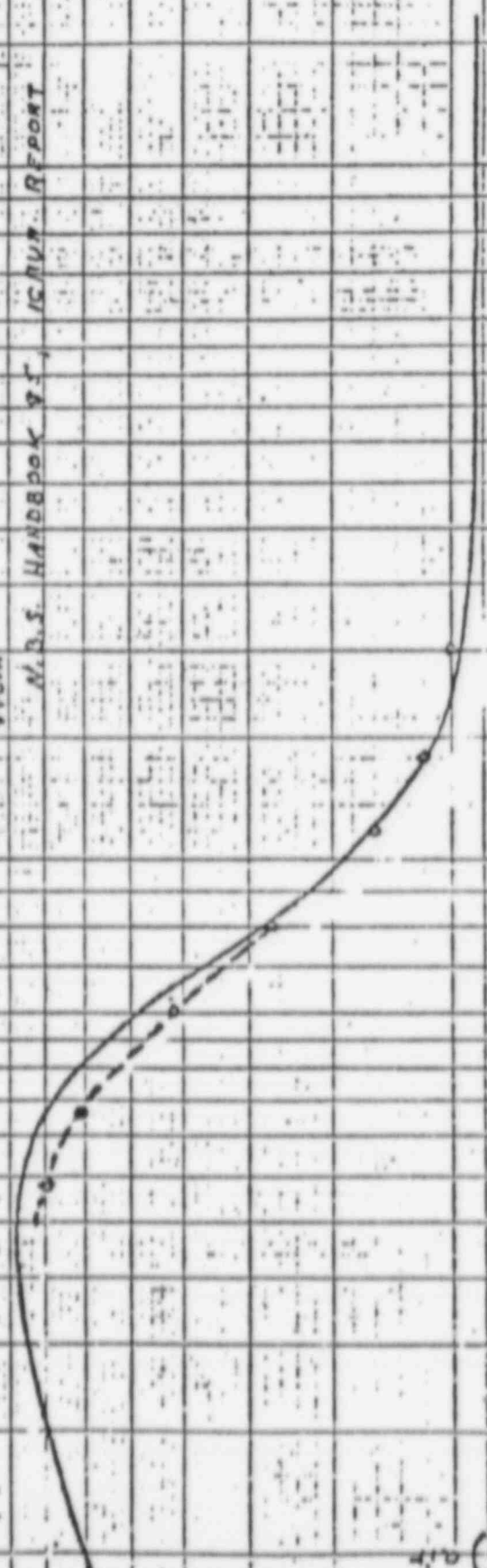
W. W. Y-RAY SPECTRA,

FIG. 1A1 b

N.B.S. HANDBOOK 95, ICNRP REPORT

BONE

from

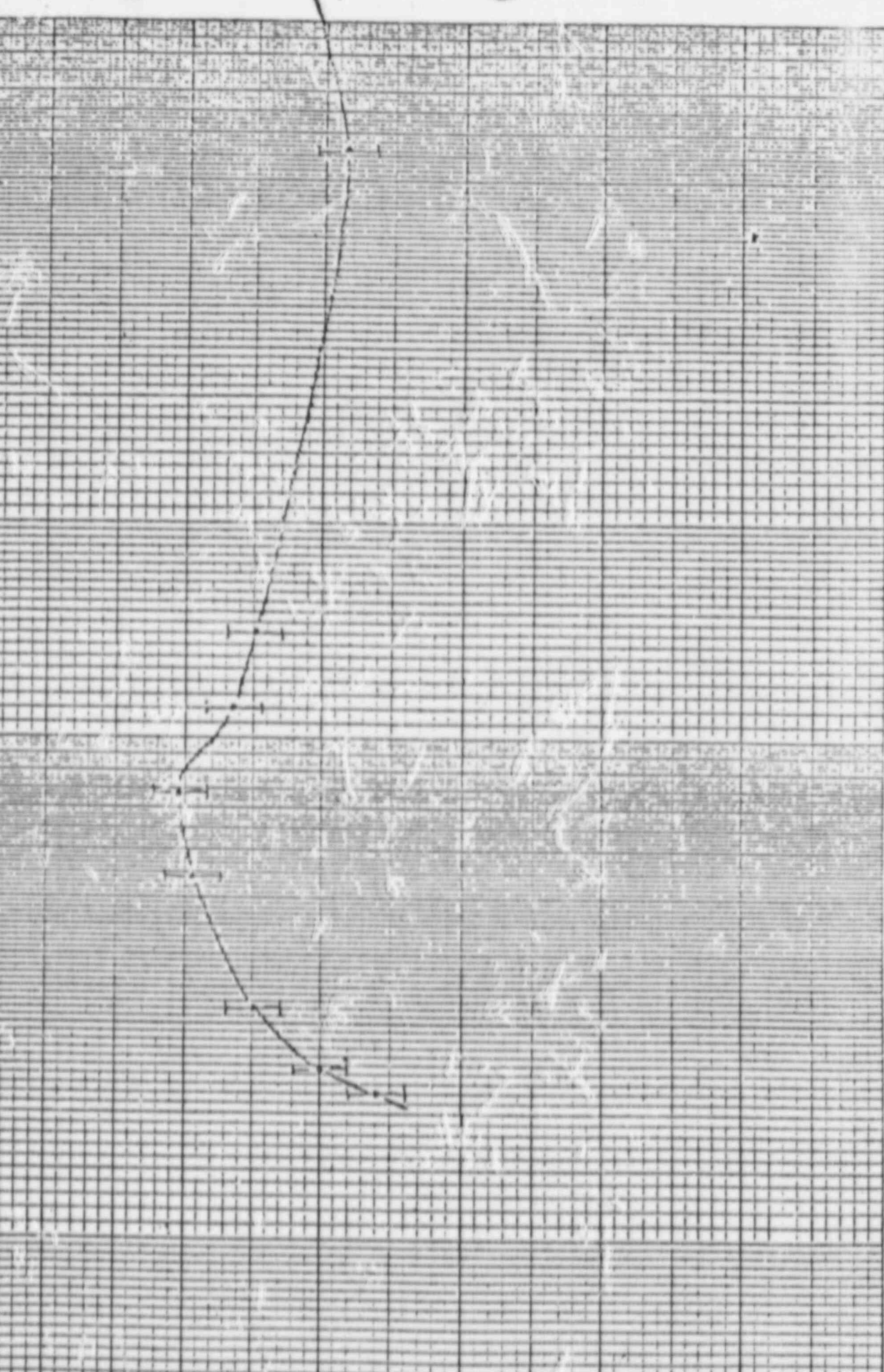


PHOTON ENERGY (keV)

(Rn/p)_{air}

10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10

5055-11 VA EMERGENCY RESPONSE
1000 CHANGING VAL THICKNESS = 470 KGS



0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
8.50
9.00
9.50
10.00

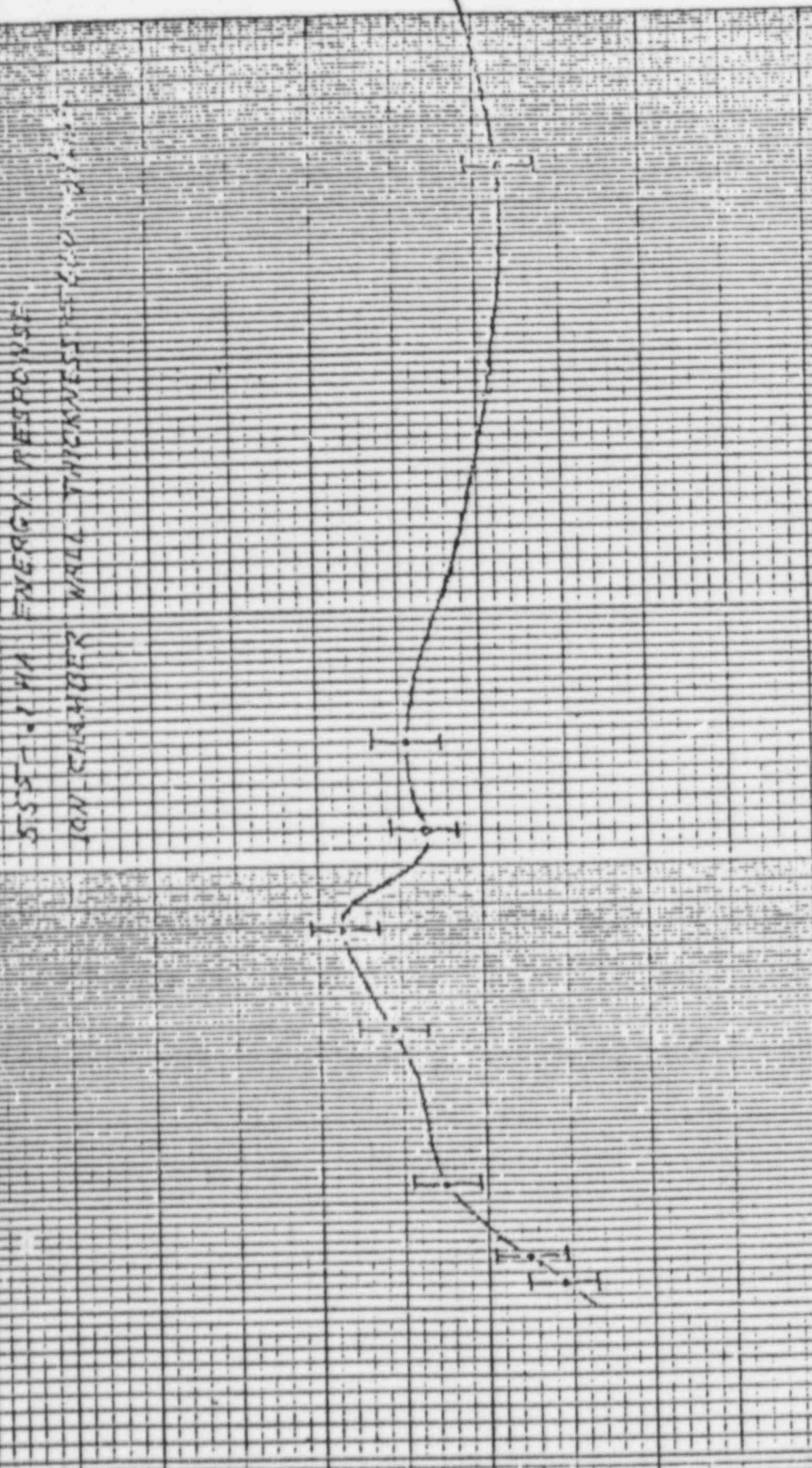
ACTUAL

ST-57-1.14 ENERGY RESPONSE

ION CHAMBER WALL THICKNESS (CM)

10
9
8
7
6
5
4
3
2

1
2
3
4
5
6
7
8
9
10



ACTUAL

AIR DENSITY CORRECTION TABLE

This instrument is calibrated in International Roentgens corrected to 0°C when used at 22°C and 760 mm mercury (Hg) barometric pressure. For temperatures other than 22°C and pressures other than 760 mm Hg, multiply the scale reading by the factor obtained from the following table.

Inches	mm.	F. 60.8 C. 16	64.4 18	68.0 20	71.6 22	75.2 24	78.8 26	82.4 28	86.0 30	89.6 32	93.2 34	96.8 36	100.4 38	104.0 40
19.68	500	1.489	1.499	1.509	1.520	1.530	1.541	1.551	1.561	1.571	1.582	1.592	1.602	1.613
20.08	510	1.460	1.469	1.479	1.490	1.499	1.510	1.520	1.530	1.540	1.551	1.561	1.571	1.581
20.47	520	1.431	1.441	1.451	1.461	1.471	1.481	1.491	1.500	1.510	1.520	1.530	1.540	1.550
20.87	530	1.405	1.414	1.424	1.434	1.444	1.453	1.463	1.473	1.482	1.492	1.502	1.512	1.521
21.26	540	1.378	1.388	1.397	1.407	1.416	1.426	1.435	1.445	1.454	1.464	1.474	1.483	1.493
21.65	550	1.354	1.363	1.373	1.382	1.391	1.401	1.410	1.419	1.429	1.438	1.448	1.457	1.466
22.05	560	1.329	1.337	1.348	1.357	1.366	1.375	1.384	1.394	1.403	1.412	1.421	1.431	1.439
22.44	570	1.306	1.315	1.324	1.333	1.342	1.351	1.360	1.369	1.378	1.387	1.396	1.405	1.414
22.83	580	1.283	1.292	1.301	1.310	1.319	1.328	1.337	1.345	1.354	1.363	1.372	1.381	1.389
23.23	590	1.262	1.270	1.279	1.288	1.297	1.305	1.314	1.323	1.331	1.340	1.349	1.358	1.366
23.62	600	1.241	1.249	1.258	1.267	1.275	1.284	1.293	1.301	1.309	1.318	1.327	1.336	1.344
24.02	610	1.220	1.229	1.237	1.246	1.254	1.263	1.271	1.279	1.288	1.297	1.305	1.314	1.322
24.41	620	1.200	1.208	1.217	1.225	1.233	1.242	1.249	1.258	1.266	1.275	1.283	1.292	1.299
24.80	630	1.181	1.189	1.198	1.206	1.214	1.222	1.230	1.239	1.247	1.255	1.263	1.271	1.279
25.20	640	1.164	1.171	1.180	1.188	1.196	1.204	1.212	1.220	1.228	1.236	1.244	1.252	1.260
25.59	650	1.145	1.153	1.161	1.169	1.177	1.185	1.193	1.201	1.208	1.216	1.224	1.232	1.240
25.98	660	1.127	1.135	1.143	1.151	1.159	1.167	1.174	1.182	1.189	1.198	1.206	1.213	1.221
26.38	670	1.111	1.119	1.126	1.134	1.142	1.149	1.157	1.165	1.172	1.180	1.188	1.195	1.203
26.77	680	1.095	1.103	1.110	1.118	1.125	1.133	1.141	1.148	1.156	1.163	1.171	1.179	1.186
27.16	690	1.078	1.086	1.093	1.101	1.108	1.116	1.123	1.131	1.138	1.146	1.153	1.161	1.168
27.56	700	1.064	1.071	1.079	1.086	1.093	1.101	1.108	1.115	1.123	1.130	1.137	1.145	1.152
27.95	710	1.048	1.055	1.063	1.070	1.077	1.084	1.092	1.098	1.106	1.113	1.121	1.128	1.135
28.35	720	1.033	1.041	1.048	1.055	1.062	1.069	1.076	1.083	1.091	1.098	1.105	1.112	1.119
28.54	725	1.027	1.034	1.041	1.048	1.055	1.062	1.069	1.076	1.083	1.091	1.098	1.105	1.112
28.74	730	1.019	1.027	1.034	1.041	1.048	1.055	1.062	1.069	1.076	1.083	1.090	1.097	1.105
28.94	735	1.013	1.019	1.027	1.034	1.041	1.048	1.055	1.062	1.069	1.076	1.083	1.090	1.097
29.13	740	1.006	1.013	1.020	1.027	1.034	1.041	1.048	1.055	1.062	1.069	1.075	1.082	1.089
29.33	745	.999	1.006	1.013	1.020	1.027	1.034	1.040	1.048	1.054	1.061	1.068	1.075	1.082
29.53	750	.992	.999	1.006	1.013	1.020	1.027	1.033	1.040	1.047	1.054	1.061	1.068	1.075
29.72	755	.986	.993	1.000	1.007	1.014	1.021	1.027	1.034	1.041	1.048	1.055	1.062	1.068
29.92	760	.980	.986	.993	1.000	1.007	1.014	1.020	1.027	1.034	1.041	1.047	1.054	1.061
30.12	765	.972	.979	.986	.993	.999	1.006	1.013	1.020	1.026	1.033	1.040	1.047	1.054
30.31	770	.967	.973	.980	.987	.994	1.000	1.007	1.014	1.020	1.027	1.034	1.041	1.047
30.51	775	.961	.968	.974	.981	.987	.994	1.001	1.007	1.014	1.021	1.027	1.034	1.041
30.71	780	.954	.961	.967	.974	.980	.987	.994	1.000	1.007	1.014	1.020	1.027	1.033
30.90	785	.948	.955	.961	.968	.974	.981	.988	.994	1.001	1.007	1.014	1.021	1.027
31.10	790	.942	.949	.955	.962	.968	.975	.981	.988	.994	1.001	1.008	1.014	1.021