30-21011 L 13018

NRC Form 313 I (12-81) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

1. APPLICATION FOR: (Check and/or complete as appropriate)

03121

	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
X	c. RENEWAL OF: LICENSE NUMBER 20-13018-03

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*

CHARLES T. MORGAN CO., INC.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

(617) 774-3215

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

STEPHEN LUNN

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

(617) 774-3215

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

500 MAPLE ST.
HATHORNE (DANVERS), MA 01937

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*

NO LICENSED MATERIAL WILL BE IN APPLICANTS POSSESSION.

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	NONE AT ABOVE APPLICANT LOCATION.	3/8/84 MARCH 4 I Brown
b.		
c.		

7. RADIATION PROTECTION OFFICER

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

3/23/84

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)			12685 ~~Application~~	
(2)	SEE ATTACHED DESCRIPTION		3/19/84 Brown	84
(3)				MAR 5
(4)				

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	SEE ATTACHED DESCRIPTION
(2)	
(3)	
(4)	

8408300063 840820
NMS LIC30
20-13018-03 PDR

"OFFICIAL RECORD COPY"

17119

NRC FORM 313 I (12-81)

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	NO STORAGE INVOLVED		
(2)			
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	SURVEY METER	WARRINGTON LABORATORES	2652	1	ALPHA, BETA, GAMMA	0-0.1 mR/h 0-100 mR/h
(2)						
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY
Warrington Laboratories, Inc.
7801 N. Lamar, D-111
Austin, Texas 78752 (6 months)

☐ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☐ (1) FILM BADGE ☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	NONE REQUIRED	☐ MONTHLY ☐ QUARTERLY ☐ OTHER (Specify): _____

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach anno*ated sketch(es) and description(s).

☐ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
☐ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED: NONE REQUIRED

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

Since all equipment demonstrated or serviced under this license is manufactured by Texas Nuclear, any disposal would be coordinated through Texas Nuclear's Austin, Texas plant.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

WARNING.–18 U.S.C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)*	b. CERTIFYING OFFICIAL *(Signature)* [signature]
	c. NAME *(Type or print)* Stephen O. Luna
(1) LICENSE FEE CATEGORY:	d. TITLE President
(2) LICENSE FEE ENCLOSED: $	e. DATE February 29, 1904

CHARLES T. MORGAN CO., INC.

500 MAPLE STREET • HATHORNE (DANVERS) MASS. 01937

(617) 774-3215 (617) 665-1995

Procedure: CTM-151

Radiation Safety Procedures

I. Source Head Delivery and Installation at Customer Plants.

A. Shipment

1. Shipment of Level, Density, Weigh Scale or Analyzer Systems are made directly from Texas Nuclear (Austin, TX) to the customer's facility. If a specific license is required, this is coordinated by Health Physics at Austin and completed by the customer before shipment can be made.

2. A responsible individual is designated to be the recipient of any keys associated with a lock or locks on the source head(s). Keys are always shipped separately to this individual (may be Radiation Safety Officer for the installation or other responsible individual).

B. Installation

1. No installation of the source head is permitted until one of the following persons has performed an initial radiation survey of the source head while still in its shipping container.

   a. Texas Nuclear - licensed individual

   b. C. T. Morgan Co. - licensed individual

   c. Customer - licensed individual (this applies usually to larger chemical or pulp/paper plants only)

2. Once the source head has been installed, the licensed individual surveys the head from all directions at a distance of one foot from the source head surface. This must be done twice (source open and source closed) and the data kept on file at the customer's facility.

II. Periodic Leak Testing

A. Texas Nuclear will supply test kit materials and source head drawings to the customer at prescribed intervals. The materials usually include swabs, a vial of pure water and a shipping container for return of the swabs to Texas Nuclear.

B. The user of the Texas Nuclear System is permitted to swab the source head himself following the instructions and drawings provided, or he may elect to have a C. T. Morgan Co. individual perform the swabbing operation.

C. When C. T. Morgan Co. swabs the source head, it is company policy to re-survey the source head at the same time to keep the customer files current for that source head.

D. Texas Nuclear analyzes the returned swabs at their Austin, Texas facility and supplies a report to the customer for his files.

III. Demonstration of Portable Analyzers

A. C. T. Morgan Co. may from time to time request that Texas Nuclear send demonstrators of their 9200 Series (General), 9266 Series (Alloys) or 9267 Series (Paper) Analysis Instruments. These are demonstrated within the six New England states for periods up to 2 to 3 weeks, then returned to Texas Nuclear's Austin plant.

B. Source sizes in demonstrators are small (50 millicuries or less) and are contained in sealed source heads. In operation the source is opened briefly either by a spring loaded manual trigger or by a microprocessor-controlled program. The source is usually closed even while the instrument is turned on. It only opens while a sample analysis is actually in progress.

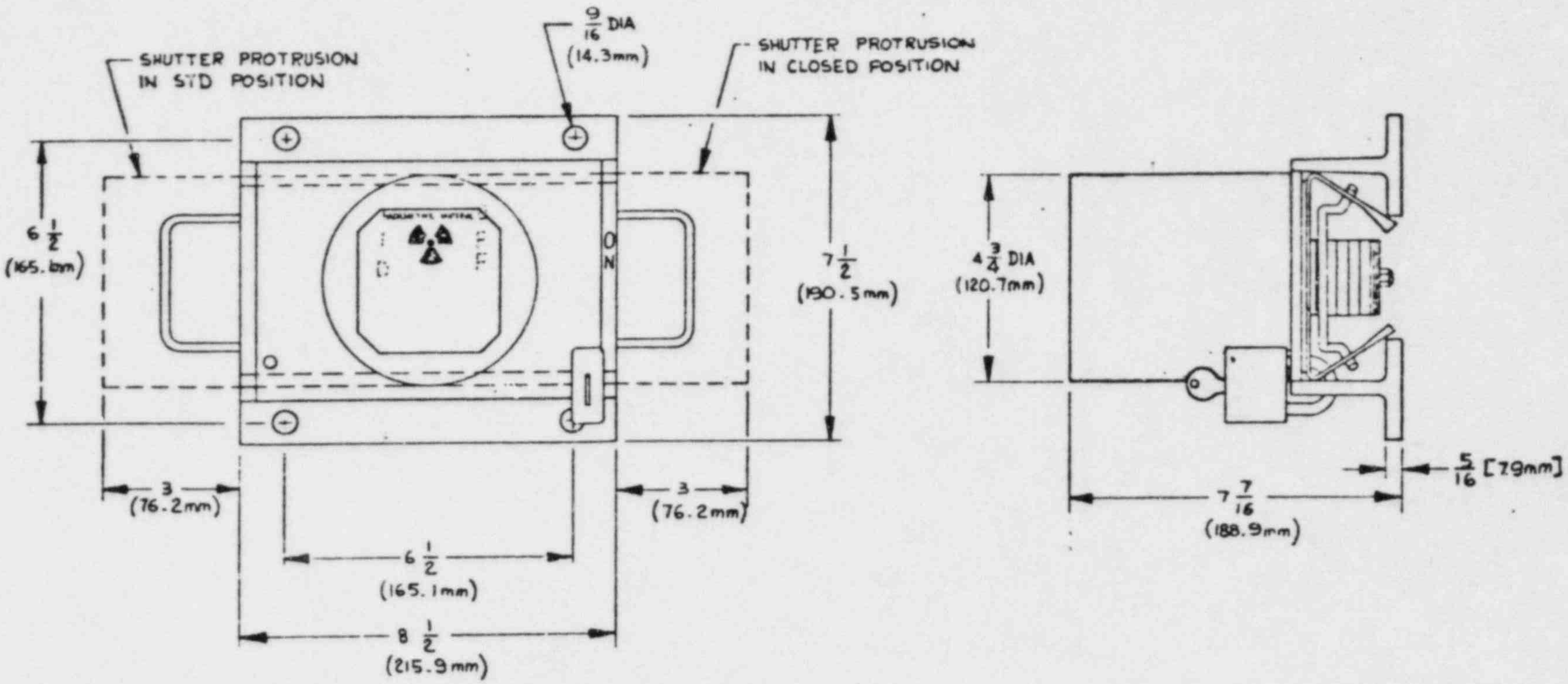
C. Demonstration units are shipped to and carried by C. T. Morgan Co. sales people in padded fiberglass cases. Manual lead shutters are provided with each unit in the event the source head should jam in in the open positon during analysis. In this event, the unit is to be returned to Texas Nuclear immediately witht the lead shutter in place. A copy of the source head configuration and safety pages from the instruction manual are attached.

Stephen O. Lunn
Radiation Safety Officer

9266 Source housing

0.5 millicuries

NOTES:
1. SHUTTER MAY BE LOCKED IN THE OPEN, CLOSED AND STANDARD POSITIONS.
2. MAXIMUM SOURCE LOADING 200 mCi Cs^{137}.
3. SOURCE HEAD WEIGHT IS 56 LBS 25.4 KILOGRAMS.



CODE $x^{17}x^{13}$ - CA

THE CERTIFICATION OF THIS DRAWING IS VALID ONLY WHEN IT HAS BEEN PROPERLY SIGNED AND HAS HAD CHECK BLOCKS, HIB IDENTIFICATION INFORMATION AND APPLICABLE TAG NUMBERS FILLED IN. TEXAS NUCLEAR'S LIABILITY FOR THE CORRECTNESS OF THIS DRAWING IS LIMITED TO FURNISHING A CORRECTED DRAWING. THIS DRAWING IS NORMALLY SUPPLIED AS A 17" X 22" PRINT. REDUCED SIZE PRINTS AND OR PRINTS WHICH ARE INCLUDED AS AN INTEGRAL PORTION OF AN INSTRUCTION MANUAL MAY NOT BE UP TO DATE, AND SHOULD BE USED FOR GENERAL INFORMATION PURPOSES ONLY. THE INFORMATION CONTAINED ON THIS DRAWING IS PROPRIETARY AND IS INTENDED SOLELY TO INFORM THE INTENDED USER OF THE EQUIPMENT DESCRIBED HEREON.

CUSTOMER		DWN	ENGR
P O NO	S O NO	TOLERANCES UNLESS OTHERWISE SPECIFIED	
CERTIFICATION STAMP		MATERIAL	
SIGNED	DATE	FINISH	
TAG NOS		USED ON SG	MODEL NO 5190

Texas Nuclear Division — Ramsey Engineering Company — AUSTIN TEXAS

SOURCE HEAD, DENSITY
5 IN. LEAD, 200 mCi Cs^{137} MAX

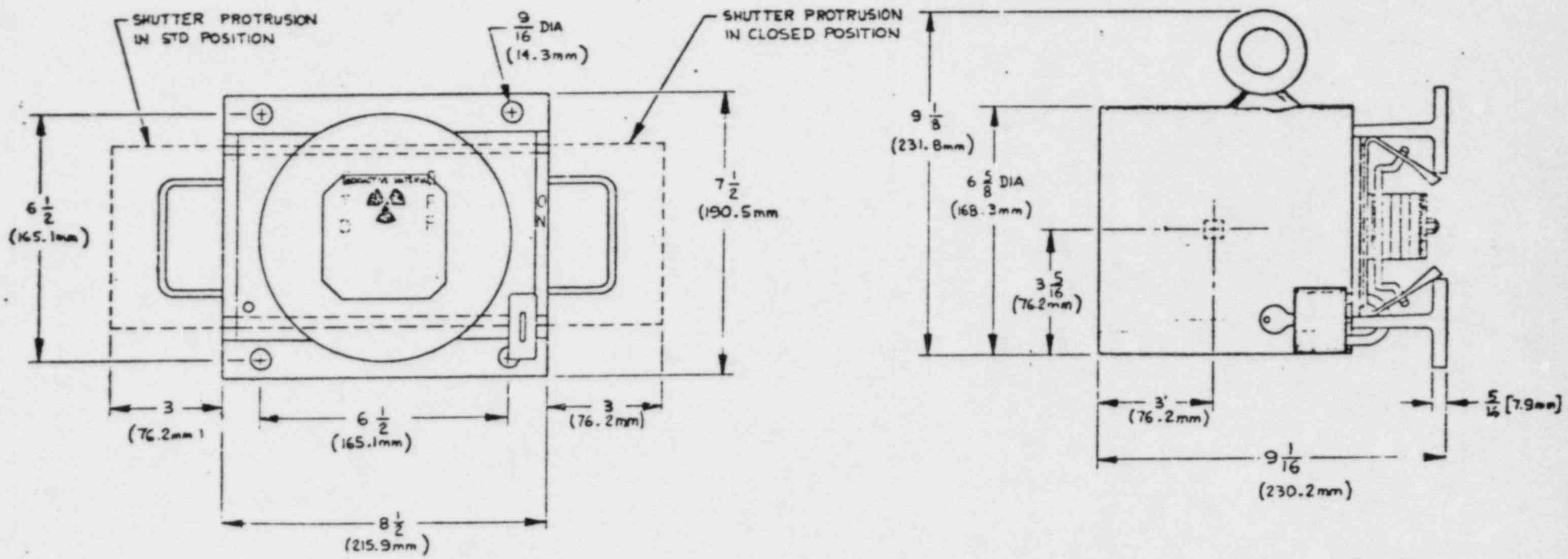
SCALE NTS

SIZE C | USE CODE DX | DRAWING NO. 850-85613M | E

DRAWING FORMAT C

850-85613M

NOTES:
1. SHUTTER MAY BE LOCKED IN THE OPEN, CLOSED AND STANDARD POSITIONS.
2. SOURCE HEAD WEIGHT 108 LBS (49 KILOGRAMS).

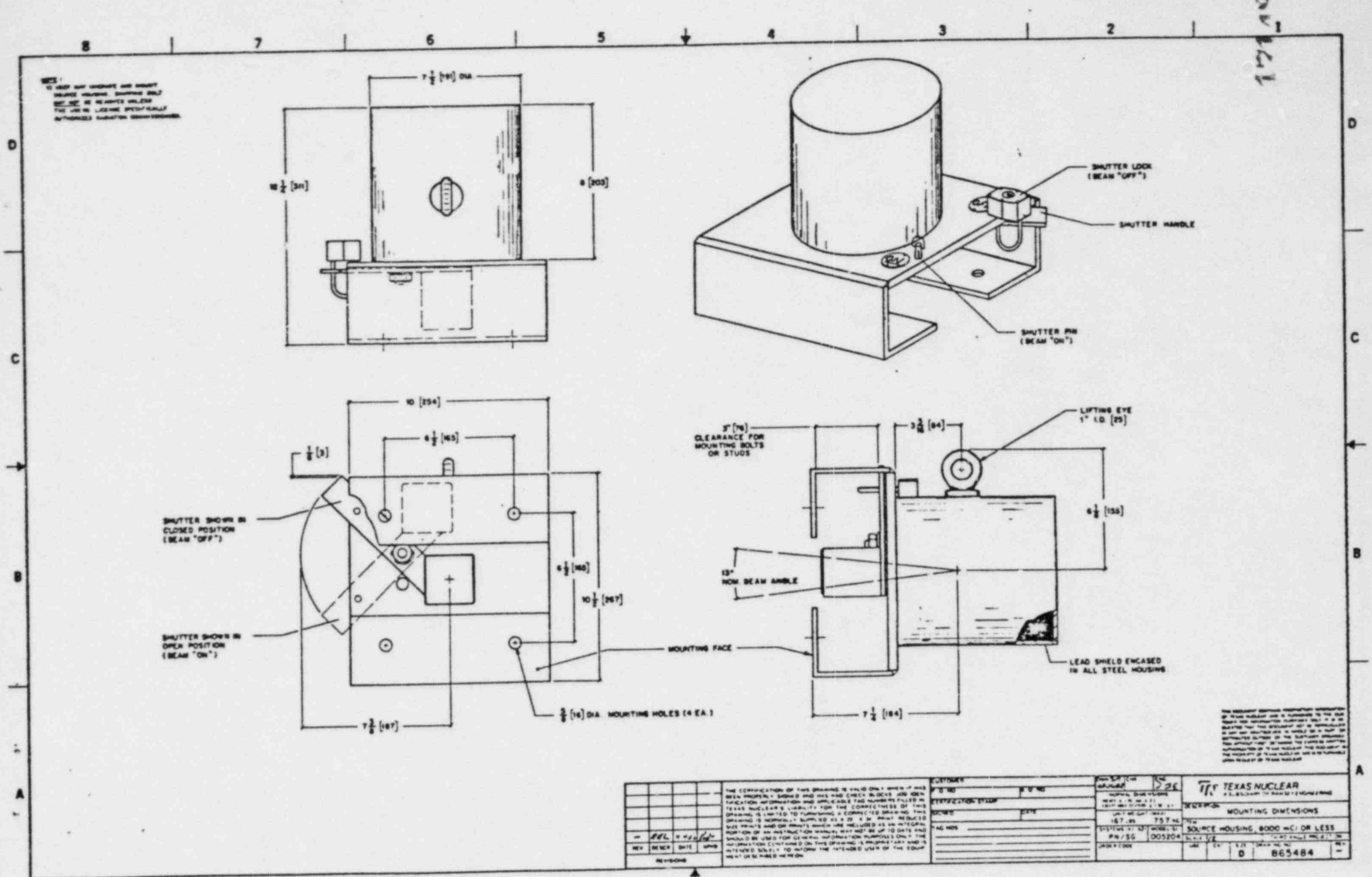


CODE X^{12} X^{13} - EA

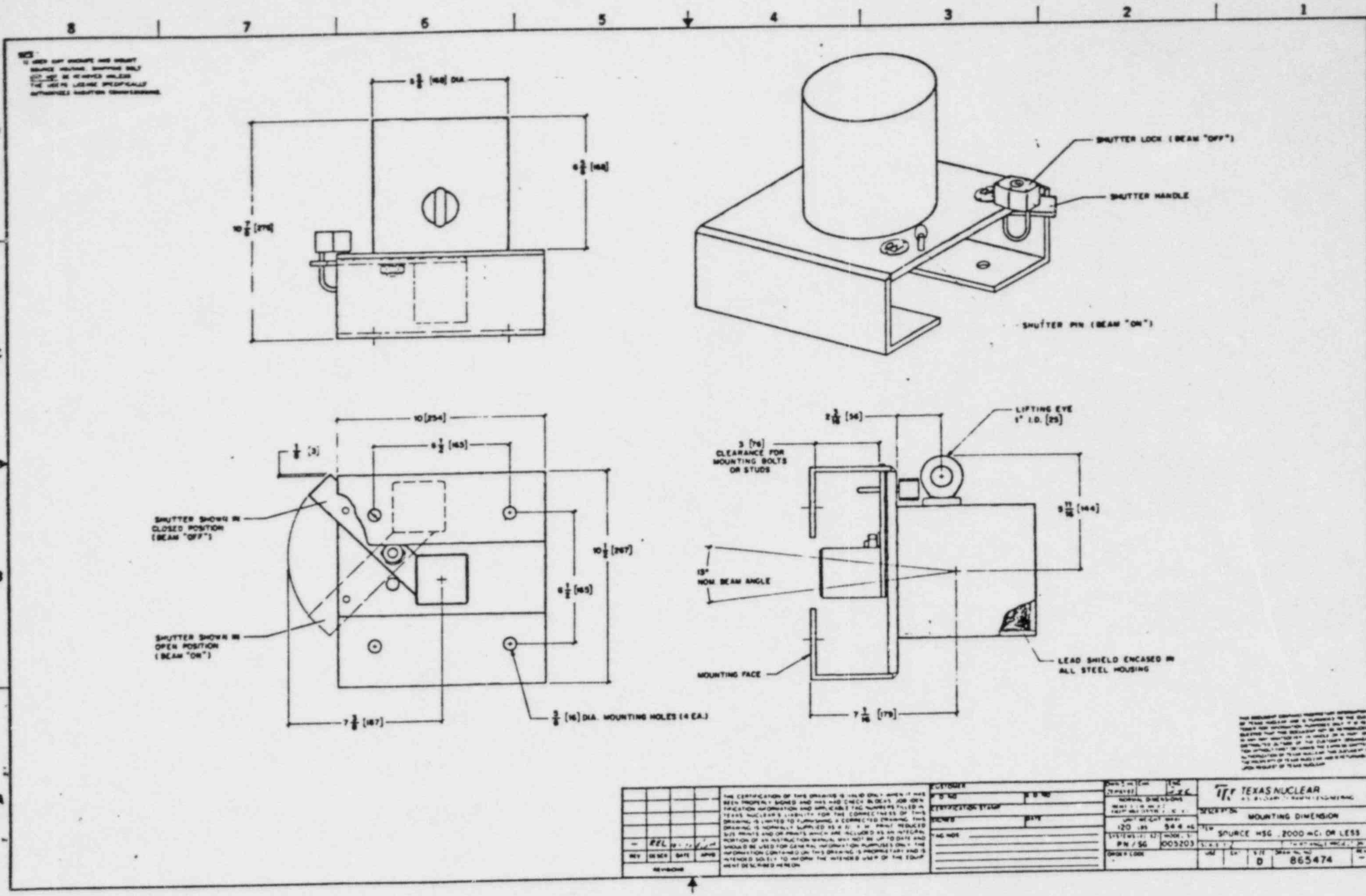
THE CERTIFICATION OF THIS DRAWING IS VALID ONLY WHEN IT HAS BEEN PROPERLY SIGNED AND HAS HAD CHECK BLOCKS, JOB IDENTIFICATION INFORMATION AND APPLICABLE TAG NUMBERS FILLED IN. TEXAS NUCLEAR'S LIABILITY FOR THE CORRECTNESS OF THIS DRAWING IS LIMITED TO FURNISHING A CORRECTED DRAWING. THIS DRAWING IS NORMALLY SUPPLIED AS A 17" X 22" PRINT. REDUCED SIZE PRINTS AND OR PRINTS WHICH ARE INCLUDED AS AN INTEGRAL PORTION OF AN INSTRUCTION MANUAL MAY NOT BE UP TO DATE AND SHOULD BE USED FOR GENERAL INFORMATION PURPOSES ONLY. THE INFORMATION CONTAINED ON THIS DRAWING IS PROPRIETARY AND IS INTENDED SOLELY TO INFORM THE INTENDED USER OF THE EQUIPMENT DESCRIBED HEREON.

CUSTOMER		DWN / CHK / DSGN	Texas Nuclear Division, Ramsey Engineering Company — AUSTIN TEXAS
P O NO	S O NO	TOLERANCES UNLESS OTHERWISE SPECIFIED	SOURCE HEAD, DENSITY 6 IN LEAD
CERTIFICATION STAMP		MATERIAL	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
SIGNED	DATE	FINISH	SCALE: NTS — DO NOT SCALE DRAWING
TAG NOS		USED ON: SG / MODEL NO: 5191	SIZE: C / USE CODE: DX / DRAWING NO: 850-85614M / REV: D

DRAWING FORMAT C

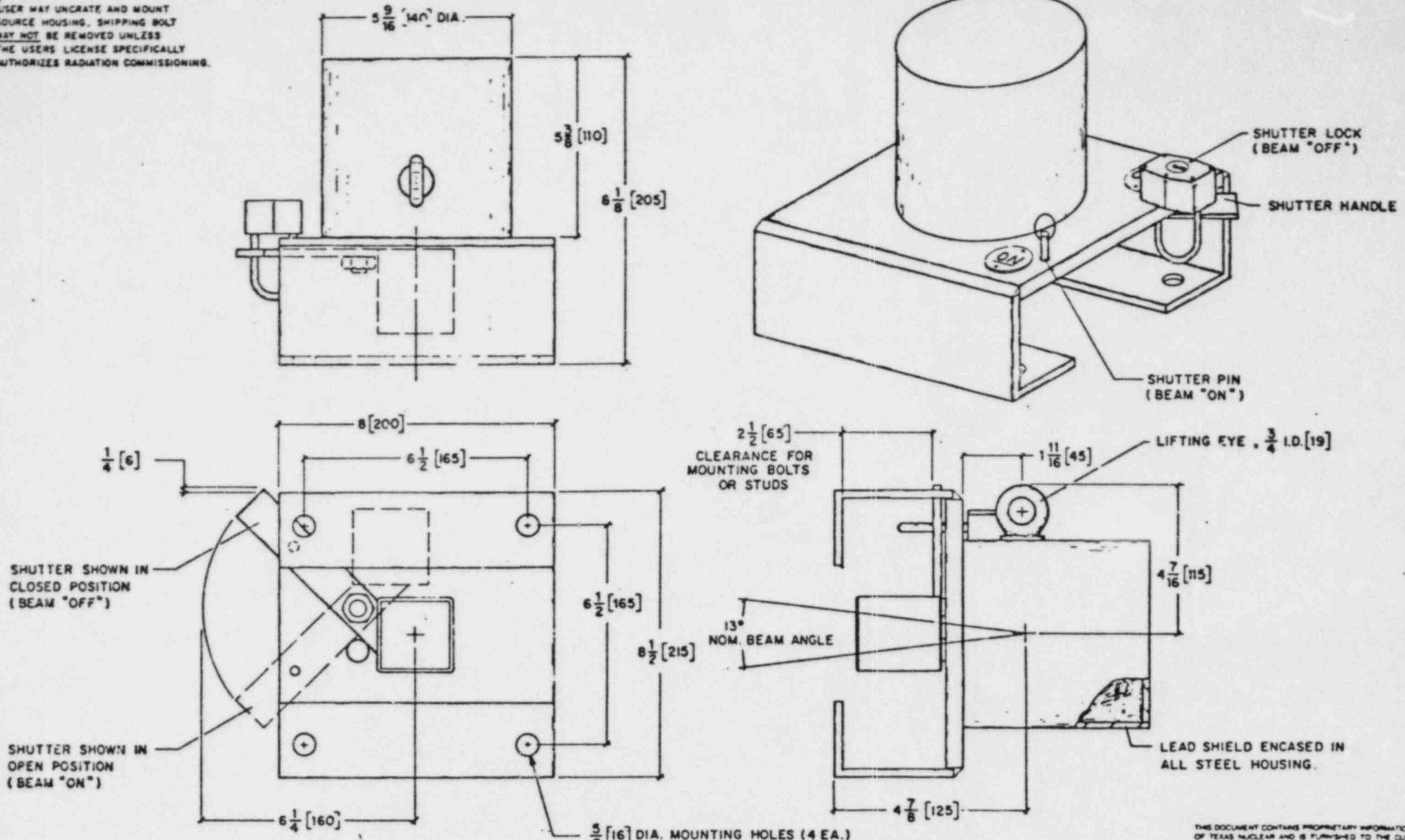


7 1/2 [191] DIA
12 1/4 [311]
8 [203]
SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
SHUTTER PIN (BEAM "ON")
10 [254]
6 1/2 [165]
1/8 [3]
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
6 1/2 [165]
10 1/2 [267]
7 3/8 [187]
5/8 [16] DIA. MOUNTING HOLES (4 EA.)
MOUNTING FACE
3" [76] CLEARANCE FOR MOUNTING BOLTS OR STUDS
3 5/16 [84]
LIFTING EYE 1" I.D. [25]
6 1/8 [155]
13° NOM BEAM ANGLE
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
7 1/4 [184]
TEXAS NUCLEAR
MOUNTING DIMENSIONS
SOURCE HOUSING, 8000 mCi OR LESS
167 lbs 75.7 kg
PN/SG
005204
D
865484



SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
SHUTTER PIN (BEAM "ON")
6 5/8 [168] DIA
6 5/8 [168]
10 7/8 [276]
10 [254]
6 1/2 [165]
1/8 [3]
10 1/2 [267]
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
7 3/8 [187]
5/8 [16] DIA. MOUNTING HOLES (4 EA.)
LIFTING EYE 1" I.D. [25]
2 3/16 [56]
3 [76] CLEARANCE FOR MOUNTING BOLTS OR STUDS
5 11/16 [144]
13° NOM. BEAM ANGLE
MOUNTING FACE
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
7 1/16 [179]
TEXAS NUCLEAR
MOUNTING DIMENSION
SOURCE HSG. 2000 mCi OR LESS
PN/SG
D
865474

NOTE:
1) USER MAY UNCRATE AND MOUNT SOURCE HOUSING. SHIPPING BOLT MAY NOT BE REMOVED UNLESS THE USERS LICENSE SPECIFICALLY AUTHORIZES RADIATION COMMISSIONING.



REV	DESCR	DATE	APVD
—	REL		

REVISIONS

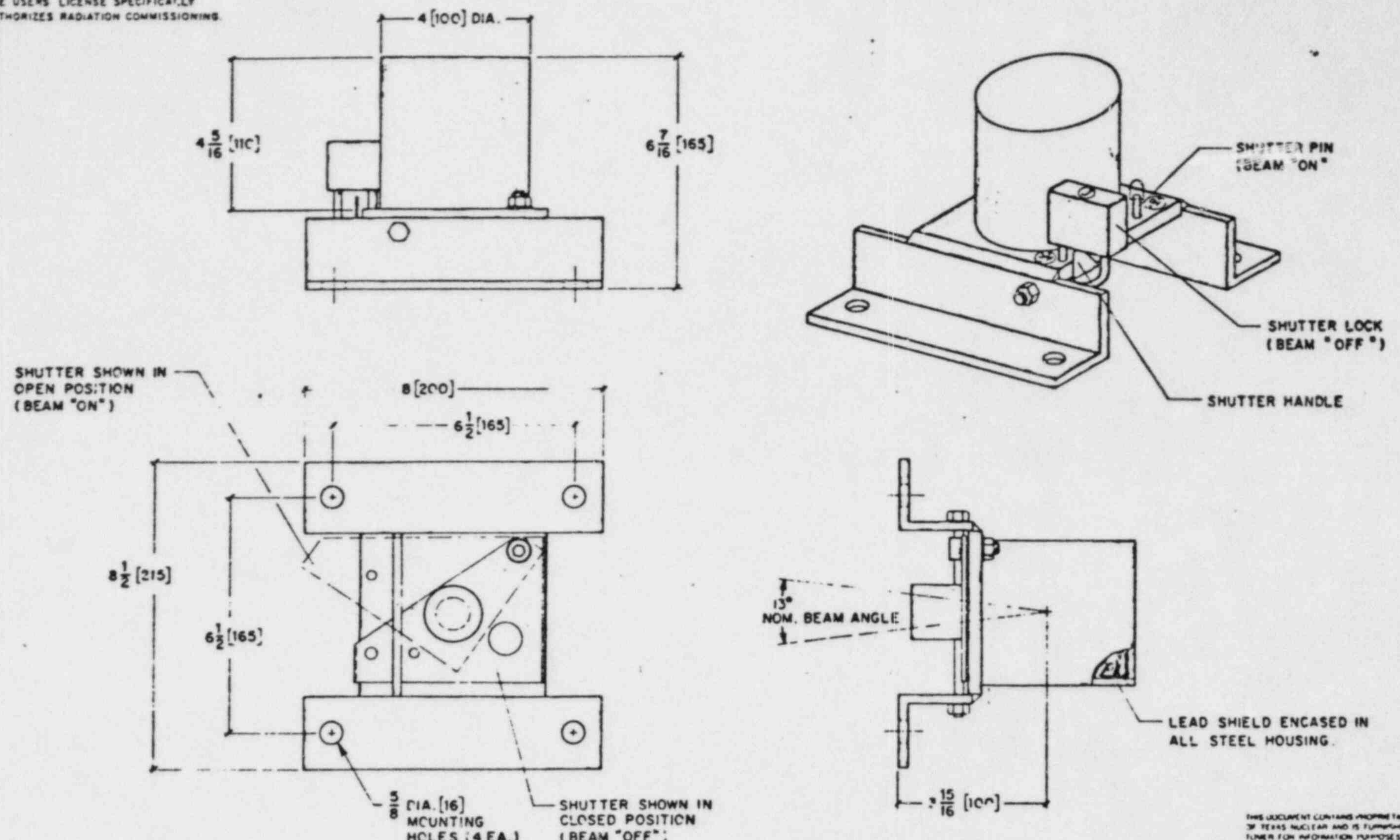
CUSTOMER
P O NO | S O NO
CERTIFICATION STAMP
SIGNED | DATE
TAG NOS

DWN SM 28AUG82 | CHK | ENG
NORMAL DIMENSIONS: INCHES ± 1/16 (mm ± 2) EXCEPT HOLE CENTERS ± 1/32 (± 1)
UNIT WEIGHT (MAX): 68 LBS. 30.8 KG
SYSTEMS (X1, X2): PN / SG | MODEL(S): 5202
ORDER CODE

TEXAS NUCLEAR
A SUBSIDIARY OF RAMSEY ENGINEERING

DESCRIPTION: MOUNTING DIMENSIONS
ITEM: SOURCE HOUSING, 500 mCi OR LESS
SCALE 1/2 | THIRD ANGLE PROJECTION
USE | CK'T | SIZE C | DRAWING NO 865463 | REV —

NOTE:
1) USER MAY UNCRATE AND MOUNT SOURCE HOUSING. SHIPPING BOLT MAY NOT BE REMOVED UNLESS THE USERS LICENSE SPECIFICALLY AUTHORIZES RADIATION COMMISSIONING.



REV	DESCR	DATE	APVD
–	REL		

REVISIONS

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CUSTOMER
P O NO | S O NO
CERTIFICATION STAMP
SIGNED | DATE
TAG NOS

DWN	CHK	ENG

NORMAL DIMENSIONS
INCHES ± 1/16 (mm ± 2)
EXCEPT HOLE CENTERS ± 1/32 (±1)

UNIT WEIGHT (MAX): 28 LBS 12.7 KG

SYSTEMS: PN/SG | MODEL: 5200

ORDER CODE

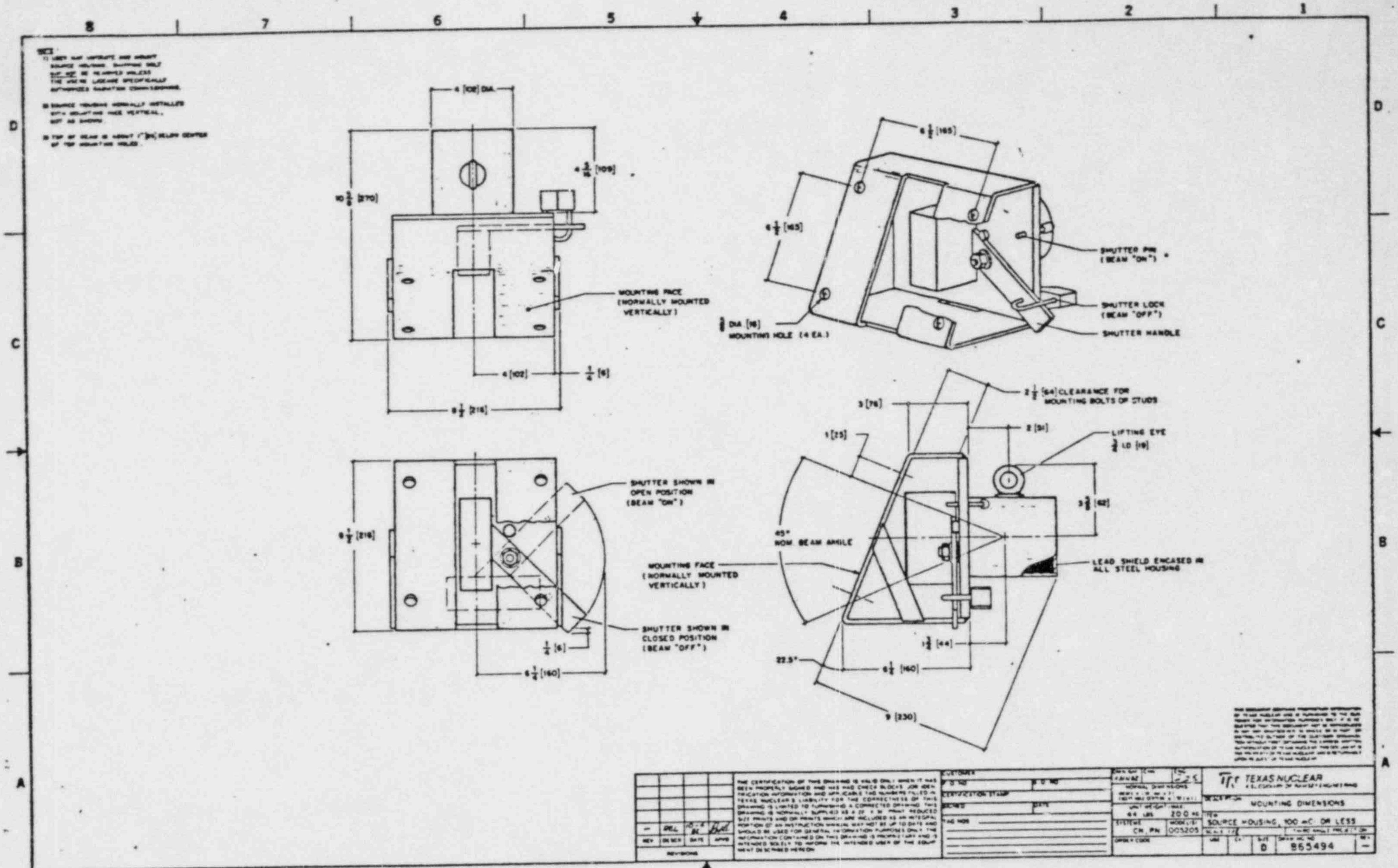
TEXAS NUCLEAR
A SUBSIDIARY OF RAMSEY ENGINEERING

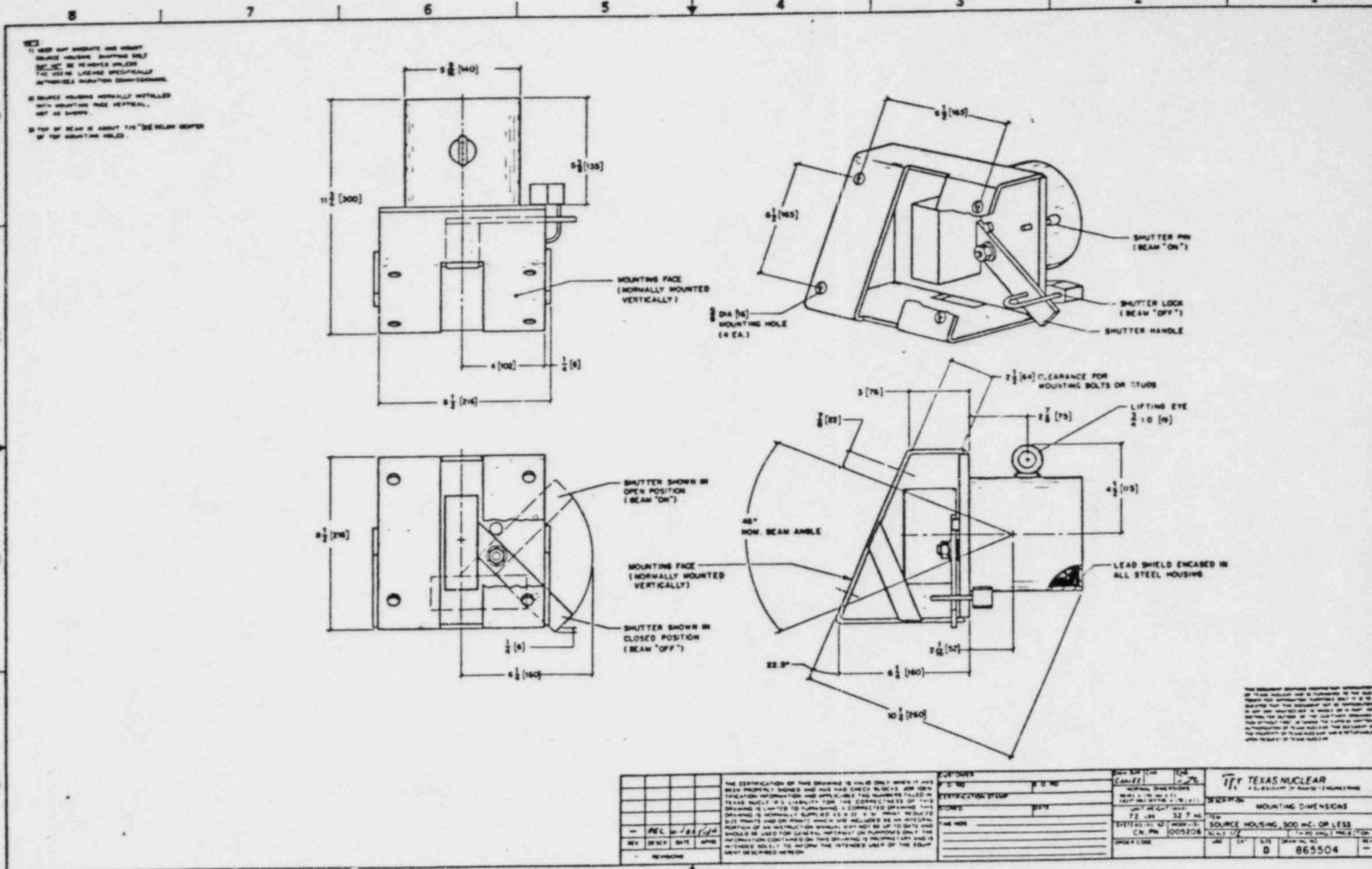
DESCRIPTION: MOUNTING DIMENSIONS

ITEM: SOURCE HOUSING, 100 mCi OR LESS

SCALE 1/2 | THIRD ANGLE PROJECTION

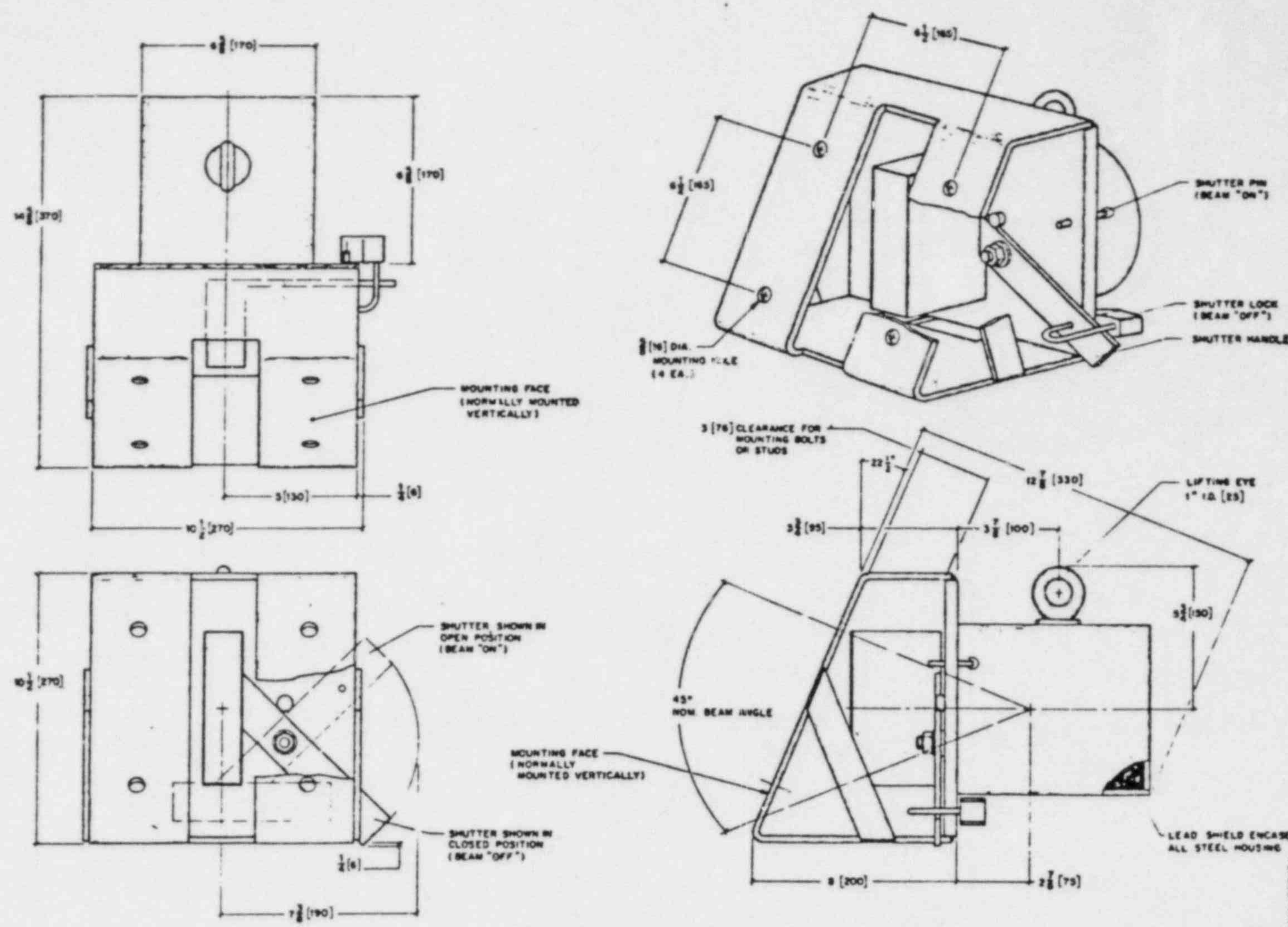
USE	CAT	SIZE	DRAWING NO	REV
		C	6C4563	-


4 [102] DIA.
4 5/16 [109]
10 5/8 [270]
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
4 [102]
1/4 [6]
8 1/2 [216]
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
1/4 [6]
6 1/4 [160]
6 1/2 [165]
6 1/2 [165]
5/8 DIA [16] MOUNTING HOLE (4 EA.)
SHUTTER PIN (BEAM "ON")
SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
2 1/2 [64] CLEARANCE FOR MOUNTING BOLTS OF STUDS
3 [76]
1 [25]
2 [51]
LIFTING EYE 3/4 I.D. [19]
3 5/8 [92]
45° NOM. BEAM ANGLE
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
1 3/4 [44]
6 1/4 [160]
22.5°
9 [230]
TEXAS NUCLEAR
MOUNTING DIMENSIONS
SOURCE HOUSING, 100 mCi OR LESS
D
865494



MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
5 1/2 [140]
5 3/8 [135]
11 3/4 [300]
4 [102]
1/4 [6]
8 1/2 [216]
6 1/2 [165]
SHUTTER PIN (BEAM "ON")
SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
5/8 DIA [16] MOUNTING HOLE (4 EA.)
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
6 1/4 [160]
2 1/2 [64] CLEARANCE FOR MOUNTING BOLTS OR STUDS
3 [76]
7/8 [22]
2 7/8 [73]
LIFTING EYE 3/4 I.D. [19]
4 1/2 [115]
46° NOM. BEAM ANGLE
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
22.5°
10 1/4 [260]
TEXAS NUCLEAR
MOUNTING DIMENSIONS
SOURCE HOUSING, 500 MC. OR LESS
D
865504

NOTES:
1) USER MAY UNCRATE AND MOUNT SOURCE HOUSING. SHIPPING BOLT "MAY NOT" BE REMOVED UNLESS THE USER'S LICENSE SPECIFICALLY AUTHORIZES RADIATION COMMISSIONING.
2) SOURCE HOUSING NORMALLY INSTALLED WITH MOUNTING FACE VERTICAL, NOT AS SHOWN.
3) TOP OF BEAM IS ABOUT EVEN W/ CENTER OF TOP MOUNTING HOLES.



6 3/4 [170]
14 5/8 [370]
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
5 [130]
1/4 [6]
10 1/2 [270]
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
1/4 [6]
7 3/8 [190]
6 1/2 [165]
SHUTTER PIN (BEAM "ON")
SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
5/8 [16] DIA. MOUNTING HOLE (4 EA.)
3 [76] CLEARANCE FOR MOUNTING BOLTS OR STUDS
22 1/2°
12 7/8 [330]
LIFTING EYE 1" I.D. [25]
3 3/4 [95]
3 7/8 [100]
5 1/8 [130]
45° NOM. BEAM ANGLE
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
8 [200]
2 7/8 [75]

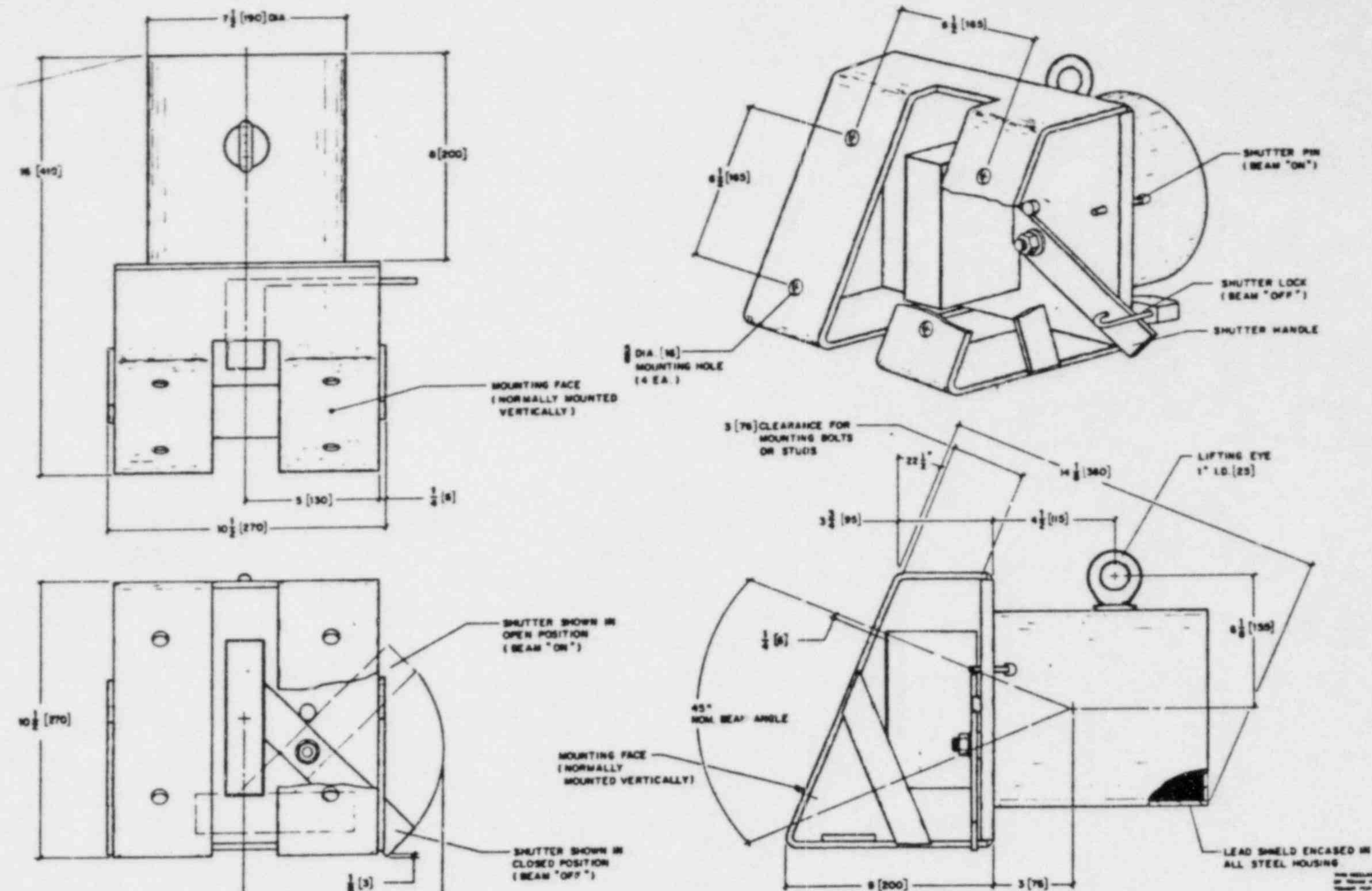
TEXAS NUCLEAR

MOUNTING DIMENSION

SOURCE HOUSING, 2000 mCi OR LESS

UNIT WEIGHT	150 LBS / 68.0 KG
CN. PN	005207
SIZE	D
DWG NO.	865514
REV	—

NOTE:
1) USER MAY [illegible] SOURCE HOUSING. SHUTTER BOLT MAY NOT BE REMOVED UNLESS THE USER'S LICENSE SPECIFICALLY AUTHORIZES RADIATION [illegible].
2) SOURCE HOUSING NORMALLY INSTALLED WITH MOUNTING FACE VERTICAL, NOT AS SHOWN.
3) TOP OF BEAM IS ABOUT 1/4" [6] ABOVE CENTER OF TOP MOUNTING HOLES.



7 1/2 [190] DIA
16 [410]
8 [200]
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
5 [130]
1/4 [6]
10 1/2 [270]
SHUTTER SHOWN IN OPEN POSITION (BEAM "ON")
SHUTTER SHOWN IN CLOSED POSITION (BEAM "OFF")
1/8 [3]
7 1/2 [190]
6 1/2 [165]
SHUTTER PIN (BEAM "ON")
SHUTTER LOCK (BEAM "OFF")
SHUTTER HANDLE
5/8 DIA [16] MOUNTING HOLE (4 EA.)
3 [76] CLEARANCE FOR MOUNTING BOLTS OR STUDS
22 1/2°
14 1/8 [360]
LIFTING EYE 1" I.D. [25]
3 3/4 [95]
4 1/2 [115]
5 1/4 [135]
1/4 [6]
45° NOM. BEAM ANGLE
MOUNTING FACE (NORMALLY MOUNTED VERTICALLY)
LEAD SHIELD ENCASED IN ALL STEEL HOUSING
8 [200]
3 [76]

REV	DESCR	DATE	APVD
—	REL		

REVISIONS

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DATE
TAG NOS.

TEXAS NUCLEAR
A SUBSIDIARY OF RAMSEY ENGINEERING

NOMINAL DIMENSIONS

UNIT WEIGHT (MAX): 190 LBS. 86.2 KG.

SYSTEMS: CN, PN — MODEL(S): 005208

DESCRIPTION: MOUNTING DIMENSIONS

ITEM: SOURCE HEAD, 8000 mCi OR LESS

SCALE: 1/2 — THIRD ANGLE PROJECTION

ORDER CODE

SIZE: D — DRAWING NO: 865524 — REV: —

TEXAS NUCLEAR MODELS 9266 & 9267

6. RADIATION SAFETY PRECAUTIONS

The Alloy Analyzer uses radioisotope sources which emit x-radiation. Although the radiation intensity is low by comparison, for example, to that from an x-ray tube system, it is not negligible and certain precautions must be taken to ensure safe operation. The need for caution must be emphasized all the more because the instrument is portable and easy to use: Many operators of varied experience will use it for a wide variety of applications. This section of the manual is therefore extremely important. ALL RECOMMENDATIONS and INSTRUCTIONS must be UNDERSTOOD and OBSERVED by ALL OPERATORS so that there will be NO RISK of RADIATION EXPOSURE to ANY PERSONNEL.

The Radiation Sources.

Three distinct radioisotope sources are used for various purposes in the Model 9266 Alloy Analyzer. These are located in the probe unit of the instrument. The sources, their nominal radioactivity and half-life are as follows.

Source	Acitivity	Half-Life
Americium-241 (^{241}Am)	0.5 microcuries	470 years
Iron-55 (^{55}Fe)	45 millicuries	2.7 years
Cadmium-109 (^{109}Cd)	5 millicuries	1.3 years

The first mentioned source is incorporated in the detector and is used only to stabilize the system. Due to its very low radioactivity, comparable in fact to that used in many domestic smoke alarms, and its location deep within the probe, this source poses no radiation hazard. It should also be noted that:

> The detector must only be serviced, replaced or disposed of by Texas Nuclear authorized personnel.

The two primary sources, Fe-55 and Cd-109, are located beneath the measurement aperture within the steel "snout" or "muzzle" section of the probe. Radiation is emitted through the aperture when the sources are exposed, one at a time, to generate fluorescent x-rays in the metal under test. The more significant activity and output of these sources require that the probe be HANDLED WITH CARE. In

normal instrument operation, when the measurement window is covered by a sample there is no hazard. If PRECAUTIONS ARE IGNORED however there could result an APPRECIABLE RADIATION DOSE - mainly to the SKIN and EYES.

It will be noticed that the two primary sources have comparatively short half-lives. As each source decays the remaining activity decreases by 1% approximately every week for Cd-109 and every 2 weeks for Fe-55. Measurement times are automatically increased in proportion to source decay so that in terms of potential exposure, the need for caution always remains the same. We therefore emphasize:

OPERATOR PRECAUTIONS

- All operators must have a working knowledge of the instrument operation before putting it to extended use.

- When either of the two shutter indicators are in the ON position, x-rays radiate from the aperture. When both indicators are OFF, the external radiation level is negligible. After every operation always look at the yellow shutter indicators to make sure that both sources are OFF.

- Do not operate the instrument without a sample in place over the aperture.

- If the sample is small and does not fully cover the aperture, do not look into the uncovered portion of the window; do not hold a small sample in place using the fingers.

- For routine application to small samples in the benchtop mode, erect a plastic or glass shield between the probe and the operator. Alternatively, wear a pair of normal goggles or safety glasses.

- Never aim the probe at another person.

- If a source shutter fails to close properly - i.e. one of the indicators does not show OFF and/or and error message ERR 09 is displayed - keep the

aperture covered with a full size sample and call Texas Nuclear (512-836-0801) as soon as possible.

Remember: Even though the unit is electronically turned off, a faulty shutter may be left in a partially open condition.

- If a shutter problem exists, do not leave the instrument unattended. Apply the EMERGENCY SHUTTER over the aperture and put the probe in the carrying case or some other secure place.

- Do not try to examine the shutters by looking through the aperture window.

- If any damage is suspected to the probe; to the cable; or to the aperture window return the complete instrument to Texas Nuclear for inspection.

- Do not attempt to disassemble any part of the probe without express authorization from Texas Nuclear.

In addition to the above, users should also take whatever steps seem appropriate to keep the instrument operating reliably and thus prevent a malfunction which might lead to a hazardous situation.

For example,

- Always make sure that the probe and sample arrangement is steady and secure during measurement.

- Be careful of sharp objects and hot surfaces that might damage the window or cable.

- If the instrument is used routinely on the bench with the probe in the upright position, provide a more solid base support so that it will not tip or get knocked over.

- If one is working up a ladder or on scaffolding, anchor the unit temporarily so that it cannot fall to the ground.

- Keep the probe dry.

- Always report any instrument malfunction no matter how infrequent or trivial it may seem to be.

These then are the major recommendations to follow for safe instrument operation. Texas Nuclear also has incorporated many safeguards in the design of the instrument and for completeness these are now described.

SAFETY PROVISIONS IN THE INSTRUMENT DESIGN

As for any system containing radioactive sources and in particular one that is portable, the following provisions have been made with regard to radiation protection and safety in operation.

a) All radioactive materials are permanently sealed within high strength capsules which have undergone tests to be certified as satisfactory for industrial use.

b) The source capsules are firmly mounted within the instrument and further protected against physical damage by the probe design.

c) Radiations emitted by the sources are stopped by an efficient shutter device at all times except during a measurement cycle.

d) Only one source at a time can be exposed during measurement and the operator is alerted to the fact by several visible and audible signals.

e) Shutter actuation requires special instructions to be entered via the keyboard and even then, it will only proceed if an automatic control-check proves to be satisfactory.

f) The radiation field from each source is spatially restricted and, in normal use, it is totally confined by the sample to the immediate vicinity of the probe.

Source Capsule Design

The radioactive material contained in each primary source is electroplated onto a metal substrate and sealed inside a tungsten alloy capsule of special design and tested integrity. The capsule is cylindrical in shape with a narrow rectangular slot running longitudinally along one side of the mid-section. A sealed-in beryllium window covers the active deposit at the base of the slot. The narrow width of the slot , 0.06 inch (0.15 cm), helps to protect the otherwise vulnerable window and limits the spatial divergence of the emergent x-ray beam. The capule is further protected by a tubular tungsten alloy shutter which, except for a similar longitudinal slot, completely envelops the capusle. The shutter rotates around the capsule to expose the source aperture. In the closed (relaxed) position the shutter essentially stops all the source radiation.

The source capsule-shutter assemblies are mounted securely, one on each side of the measurement aperture, inside the stainless steel snout-like projection of the probe unit. Their location, under the rim of the steel enclosure provides added protection against impact damage. The integrity of the capsule-shutter assembly has been tested according to standards recommended for industrial radioisotope x-ray devices. (ANSI Standard N542 "Classification of Sealed Radioactive Sources".)

Specifically the conditions of test are as follows:

TEMPERATURE	$-40^{\circ}C$ (20 min) to $+180^{\circ}C$ (1 hr)
EXTERNAL PRESSURE	3/4 to 300 lb/sq. in. abs.
IMPACT	1.8 oz. (50 g) hammer blow from 3 ft. (1 m) and free fall to steel plate from 5 ft. (10 times)
VIBRATION	30 min. 25-30 Hz @ 5 G peak amp; 50-90 Hz @ 0.025" amp. peak to peak; and 90-500 Hz @ 10 G.

PUNCTURE	1/8" dia. (3mm) pin strike (equivalent to 6 ft. (2 m) drop by source onto pin)

Shutter Operation Safeguards

The shutter can only be opened in response to a programmed measurement sequence. If the sequence is properly carried out, according to the given instructions, there is no radiation hazard.

The operator is alerted to the opening of the shutter by an audible signal followed by the appearance of an asterisk (*) in the upper portion of the display. Two position indicators are also visible on the side of the probe. Shutter closure is also indicated by an audible signal, the asterisk disappears and the display will show either the results of the measurement or some other meaningful message. Any malfunction of the shutter mechanism which might prevent orderly operation and control of the instrument is brought to the attention of the operator by an error message on the display together with a distinct audible alarm. This safeguard feature is further described below.

Shutter actuation will only proceed and be terminated in a normal manner provided that

a) At the start and end of the measurement both shutters are fully closed, and

b) during measurement the operating shutter is clearly recognized as being fully open while the other is recognized as being fully closed.

If any of these conditions are not satisfied, both shutters will be closed and an error message will be displayed.

Position information on the shutters is obtained from four microswitches which are mechanically interrupted by the motion of the shutter actuators. All switches are monitored continuously through the measurement cycle. At the start of measurement the two upper switches should be closed and the two lower switches should be open. As each shutter is actuated, the corresponding switches change state. If

because of mechanical or electrical malfunction any switch does not show its proper status, the shutter drive mechanism will close the sources in a prescribed way. In the process of closing the shutters the program checks all four switches in a special sequence which is designed to distinguish a permanent switch failure as opposed to a temporary condition. Permanent failure will cause an ERR 09 message in the display and the unit will automatically turn-off at the next keystroke. A temporary condition will given an ERR 19 display and the user can continue operation.

The distinction between the two error conditions is made primarily for diagnostic purposes. It is not meant to imply that one situation is potentially more, or less serious than the other. In either case, Texas Nuclear should be notified. The operator also should always verify the shutter position indicators on the probe in the event of an ERR 09 or an ERR 19 display. The shut down sequence that precedes an ERR 09, is designed to compensate for a failure in any or all of the switches and to leave the shutters in the closed position. Depending on the circumstances however one shutter might be left partially open. In this case the aperture should be covered and the shutter closed manually by pushing upward on the yellow indicator. A partially open shutter can be closed with relatively light pressure: A fully opened shutter will be more difficult to close. If necessary, cover the aperture with the emergency shutter as described below.

The probe cable should never be disconnected during measurement since this might leave one of the shutters open. Similarly if the cable is damaged severely during measurement a shutter might be left open. In an emergency case the self-adhesive lead foil, provided with each unit, should be applied immediately over the measurement window. If the cable is damaged to the extent that the instrument cannot be operated reliably, the complete system must be returned to Texas Nuclear for repair.

Aperture Window

The probe aperture is covered with thin but fairly strong plastic window which serves as a dust cover and must be intact at all times. It is possible however to puncture the window with a sharp edge or blister it with a hot sample. If any damage is incurred Texas Nuclear should be notified immediately. The probe may have to be returned to Texas Nuclear for repair. IMPORTANT: The window should

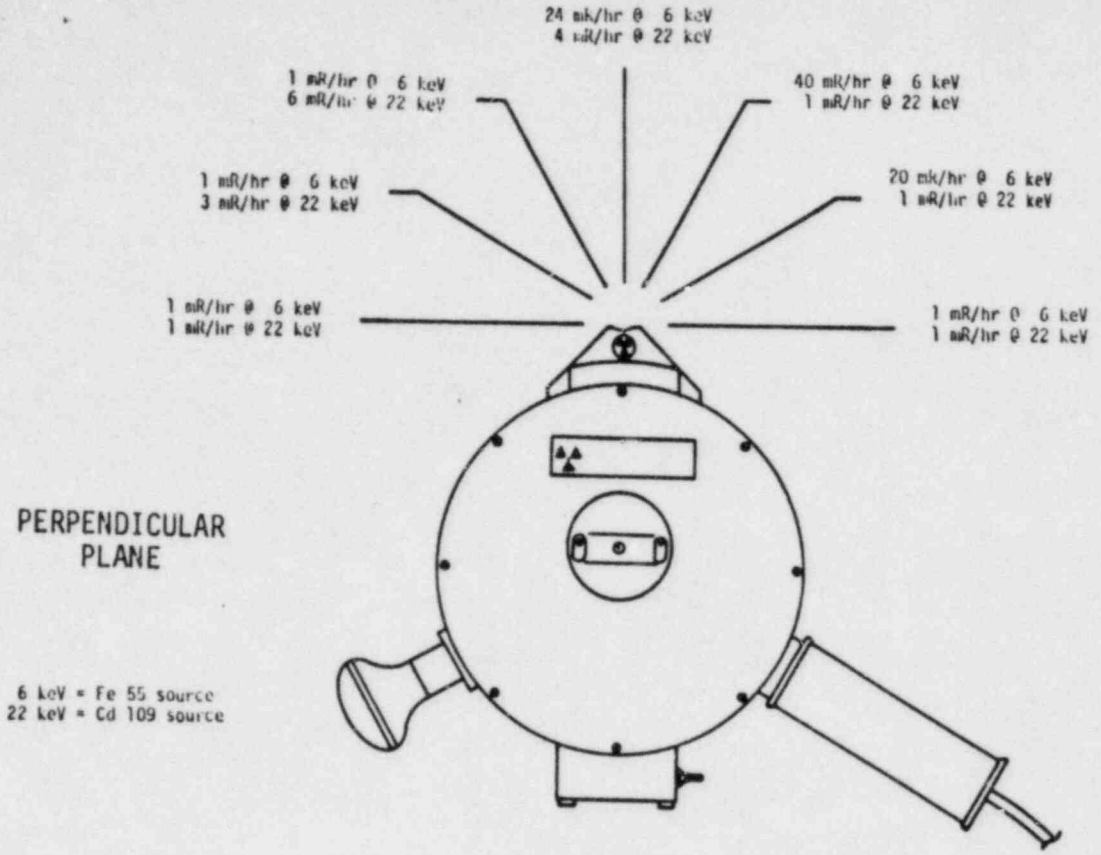
only be inspected when the shutters are fully closed as verified by the indicators on the side of the probe.

Radiation Details

When the source shutters are closed, the external radiation level is very low and less than 1.5 mR/hr everywhere around the probe It is also less than 1.5 mR/hr when the sources are open provided that the window is covered by a full size sample in contact with the aperture. With no sample in place however, the open-source radiation level is not negligible, especially in the measurement zone close to the window. The instrument should never be operated without a sample, and if the window is only partially covered, as for example by a small size sample, caution must be exercised to prevent unnecessary exposure. On no account should a sample be held in place by hand or the operator look into the aperture during measurement. For routine application under these circumstances, the use of safety glasses is highly recommended.

Some results of radiation surveys around the probe with the sources open are shown in Figure 6.1. These data represent specifically air dose rates, measured at 12 inches (30 cm) from the window in two planes; a Model 2592 Cutie Pie, end window, ionization chamber was used. The intensity is seen to vary appreciably with angle in the perpendicular plane due to the collimation effect of the source capsule. The radiation level is negligible in the space behind the plane of the measurement window.

It is important to note that the data is based on measured air dose rate. For low energy x-rays which are readily attenuated by clothing and epidermal tissue the effective dose rate to living tissue is diminished. In the case of Fe-55 radiation for example, the attenuation factor might be as much as several orders of magnitude. This safety margin does not apply however to the unprotected eye. Normal safety glasses on the other hand provide attenuation factors of 200 and 2 respectively for Fe-55 and Cd-109 radiation respectively: Their use should be encouraged. It should also be stressed that the reported dose rates are at a distance of 12 inches (30 cm). The radiation intensity varies approximately as the inverse square of the distance. Thus, at 6 inches (15 cm) it is four times greater. Always keep a distance of more than 12 inches away from a partially covered window.



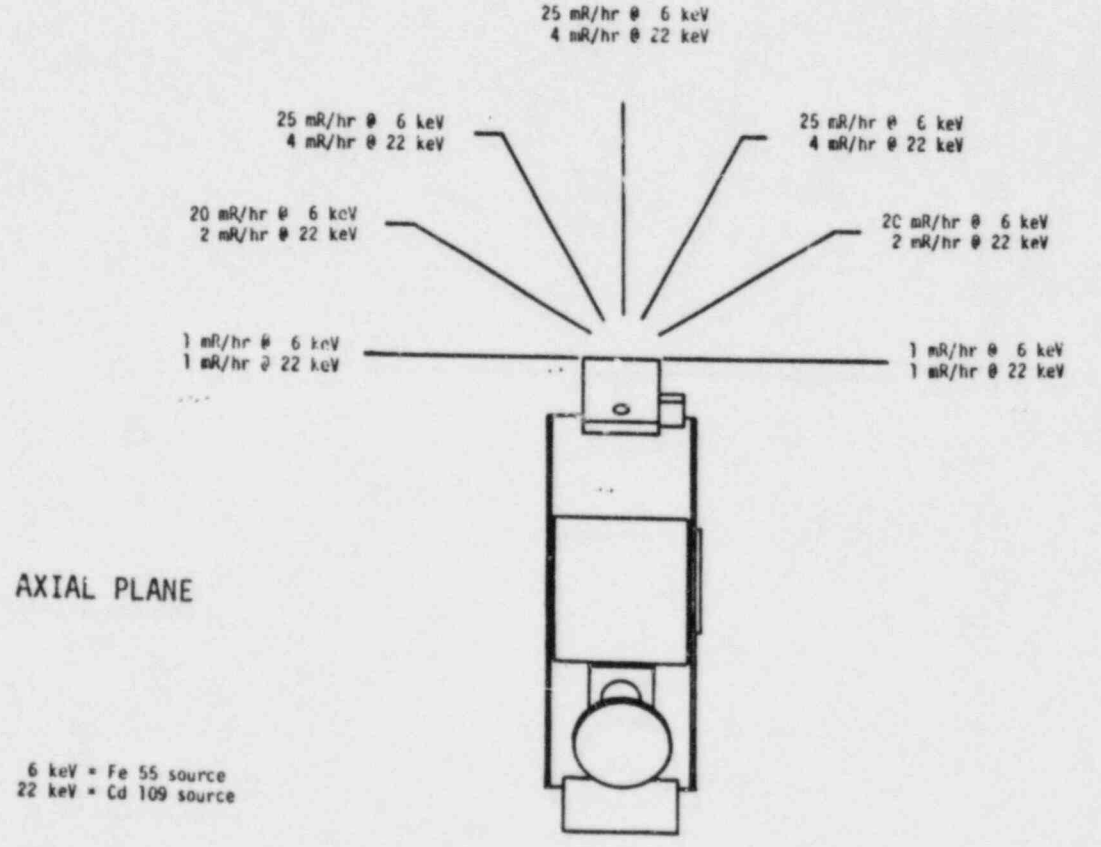


Figure 6.1 Open Source Air Dose Rates @ 12 in. (30cm) With No Sample In Place