

34-00255-03

VOID SHEET

TO: License Fee Management Branch  
FROM: RTI  
SUBJECT: VOIDED APPLICATION

Control Number: 321199  
Applicant: ABB Process Automation, Inc.  
Date Voided: 2/27/92  
Reason for Void: Not needed.

The amendment was to add a device to the  
distribution license not the mfg. license.  
Any fee should be returned.

J.P. Mad 2/27/91  
Signature Date

Attachment:  
Official Record Copy of  
Voided Action

FOR LFMB USE ONLY

Final Review of VOID Completed:

- Refund Authorized and processed
- No Refund Due
- Fee Exempt or Fee Not Required

Comments: \_\_\_\_\_

Log completed   
Processed by: SAC

9409270284 910227  
PDR ADOCK 03005610  
C PDR

ML  
30  
DH

(FOR LFMS USE)  
INFORMATION FROM LTS

BETWEEN:

License Fee Management Branch, ARM  
and  
Regional Licensing Sections

Program Code: 03211  
Status Code: 0  
Fee Category: 3A 3N 2C  
Exp. Date: 19940131  
Fee Comments: SER/NO WASTE 9/80 MEM

LICENSE FEE TRANSMITTAL

A. REGION III

1. APPLICATION ATTACHED

Applicant/Licensee: ABB PROCESS AUTOMATION, INC.  
Received Date: 910729  
Docket No.: 3005610  
Control No.: 321199  
License No.: 34-00255-03  
Action Type: Amendment

2. FEE ATTACHED

Amount: \$5,500.00  
Check No.: 038376

3. COMMENTS

See Control 321200

Signed  
Date

M. Moriarty  
7-31-91

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered )

1. Fee Category and Amount: \_\_\_\_\_

**FEE NOT REQUIRED**

2. Correct Fee Paid. Application may be processed for:

Amendment \_\_\_\_\_  
Renewal \_\_\_\_\_  
License \_\_\_\_\_

3. OTHER \_\_\_\_\_

Signed  
Date

M. Moriarty  
8/12/91



*Rec'd  
7/29/91*

July 23, 1991

Mr. Steven L. Baggett, Section Chief  
U.S. Nuclear Regulatory Commission  
Division of Industrial and Medical Nuclear Safety  
Washington, D.C. 20555

*030-05610  
030-05611*

Dear Mr. Baggett:

The enclosed materials pertain to device and source registrations for gauges produced and distributed by ABB Process Automation Inc. and listed in Byproduct Material Licenses 34-00255-03 and -06G. Three actions are requested based upon this material as follows:

- 1.) Safety evaluation, registration, and license amendment for a new device, TG-4, which is scheduled for initial distribution beginning in late September, 1991. A check for \$5,500 is enclosed for the application (\$3,300) and amendment (1,200) fees as specified in 10CFR170.31, Category 9A.
- 2.) Re-registering of devices currently being manufactured, as a result of updating information and consolidating models to conform to Regulatory Guide 10.10, in accordance with our meeting November 14, 1990 in Columbus, Ohio and your confirming letter (no date) later that month.
- 3.) Reclassifying twelve (12) previously registered sources and devices from "active" (NRC "100-series") to "inactive" (NRC "800-series") and removing three (3) additional sources and devices which are erroneously listed in our licenses. (Also, see separate letter requesting similar action for a portion of these in conjunction with negating USNRC 1991 annual fees which were invoiced for sources and devices no longer manufactured.)

In an effort to simplify the approach and reduce confusion regarding the voluminous information you have received from us over the past 35+ years and have on file for AccuRay (Brand name) devices and sources, we have decided it is best to change the model identification nomenclature and resubmit current information in accordance with the format of Regulatory Guide 10.10. We have defined two new device series -- "TG" for the transmission gauges and "BG" for the backscatter gauges. The TG devices that we currently expect to manufacture and distribute will fall into 5 categories (TG-1 through TG-5). Brochures with drawings and photographs of typical assemblies, frames, and scanners that might incorporate the TG-series devices are enclosed with this cover letter to assist the reviewer in visualizing their applications for industrial processes. These brochures are separate from the registration/re-registration application and are not intended to be part of it.

**FEE NOT REQUIRED**

*no need reg. fee SB - device evaluation only see 32120*

*REC'D*

**JUL 29 1991**

RECEIVED BY LFMS
Date <i>8/5/91</i>
ABB Process Automation
By <i>Misaw</i>
Date <i>8/12/91</i>

650 Ackerman Road  
P.O. Box 02650  
Columbus, Ohio 43202-1502

Telephone: 246675

Telex: 614261 2172

*321199*

S. Baggett  
7-23-91  
Page 2

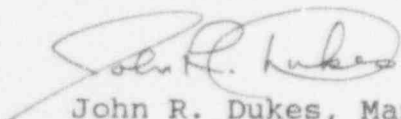
The BG series of devices currently has only one subcategory that is still active and will be submitted to you at a later date. The sealed sources which remain on our "active" list have previously been disclosed and are not part of this particular application for registration/re-registration. Additional information to update the source registrations will also be submitted at a later date.

Many of the devices and sources that we have declared to be "inactive" in item 3) above are in use in our customers' facilities and we will continue to provide radiological services such as the periodic radiological inspections and leak testing, maintenance, spare parts, refurbishing, and relocation. These services are typically provided at the customer's site by our field service organization. We will not be manufacturing or distributing any more of these devices or sources as new equipment.

A summary of the old models and the desired new models for registration and re-registration is attached to this letter to help clarify the status of all of the AccuRay devices and sources and the correlation between the old model numbers and the new model numbers.

Since this approach and format for registering devices is different than we used in the past we would like to meet with you or your assigned reviewer in the next couple of weeks to go over the submission in detail and answer any questions that might develop before we proceed with the balance of the re-registration process. We would particularly like to address the new TG-4 device so as to get it registered as soon as possible.

Sincerely,



John R. Dukes, Manager  
Nucleonics and Radiological Operations

Encl: ABB Device & Source Models List  
Letter to USNRC on negating selected FY 1991 fees  
ABB Brochures & Data Sheets  
Application for Radiation Safety Evaluation and Registration  
of Devices

91 JUN 30 12:32

[NRCREG03]JRD

ABB DEVICE & SOURCE MODELS

\*\*\*\*\* NEW MODELS \*\*\*\*\*

DEVICE MODELS

SOURCE MODELS

TG-xx SERIES

TG-1  
TG-2  
TG-3  
TG-4  
TG-5

S-11 Kr-85  
S-16 Am-241  
S-18 Sr-90  
S-20 Pm-147  
CLC.D1 Cm-244

BG-xx SERIES

BG-1

\*\*\*\*\* OLD MODELS \*\*\*\*\*

(CROSS REFERENCE)

OLD MODEL #  
(Model Nmbrs  
in Licenses)

Current  
Status

NEW MODEL I.D.

DEVICES

C-5 or C-5S	Inactive	--
C-7		TG-5
C-56	Error - Delete	--
I-5		BG-1
M-3 or M-3D		TG-2
M-3 or M-D	Error - Delete	--
O-2		TG-3
O-3	Inactive	--
O-5	Inactive	--
O-6	Inactive	--
O-7		TG-1
O-8 or O-8D	Inactive	--
U-2	Inactive	--
U-3 or U-3D	Inactive	--
U-4 or U-4D	Inactive	--
U-5	Inactive	--
U-6 or U-6D		TG-2
U-7 or U-7D		TG-1
U-8 or U-8D		TG-2

SOURCES

S-11	Kr-85		S-11
S-12	Sr-90	Inactive	--
S-13	Sr-90	Inactive	--
S-15	Sr-90	Inactive	--
S-16	Am-241		S-16
S-18	Sr-90		S-18
S-20	Pm-147		S-20
CLC.C1	Cm-244	Error - Delete	--
CLC.D1	Cm-244		CLC.D1



July 23, 1991

Mr. Steven L. Baggett, Section Chief  
 U.S. Nuclear Regulatory Commission  
 Division of Industrial and Medical Nuclear Safety  
 Washington, D.C. 20555

Subject: Device and Source Registrations

Dear Mr. Baggett:

We have received invoices from the USNRC for annual fees under the new 10CFR171 for a number of obsolete devices that are no longer manufactured by ABB Process Automation Inc. Several of the devices have not been produced in the past 10 years and are not even listed in our licenses (Byproduct Material Licenses 34-00255-03 and -06G).

Please move the following eleven (11) registered devices for which we received invoices to an "inactive" status:

Registry Number	Model	Type
NR0109D101U	DH-7	Density Gauge
NR0109D102G	LS-106	Level Gauge
NR0109D103G	C-5, C-5S	Tobacco Gauge
NR0109D107G	O-3	Wide-O (Ser E) Gauge
NR0109D108G	O-5	Wide-O (X-Head) Gauge
NR0109D109G	O-6	USP Gauge
NR0109D111B	O-8, O-8D	ISS Gauge
NR0109D112G	U-2	Cobra Head Gauge
NR0109D113B	U-3, U-3D	Large Mill Gauge
NR0109D114B	U-4, U-4D	Med/Small Mill Gauge
NR0109D115G	U-5	Box Head U-2 Gauge

We will not be manufacturing or distributing any new or used gauging systems with the above listed devices. However, a large number of these units remain in use in our customers' facilities in the U.S. and we will continue to support those customers by providing radiological services such as periodic radiological inspections and leak testing, maintenance, spare parts, refurbishing, and relocation. These services are typically provided at the customer's site by our field service organization. Such services may also be provided by other licensed organizations or by the customer's personnel if they are specifically licensed to do so.

ABB Process Automation

S. Baggett  
7/23/91  
Page -2-

This action is being requested before the August 9, 1991 deadline so as to negate the annual fees on these obsolete registrations.

Sincerely,

A handwritten signature in black ink, appearing to read "John R. Dukes", is written over a horizontal line. The signature is stylized and somewhat cursive.

John R. Dukes, Manager  
Nucleonics and Radiological Operations

cc: Don Stephens

[NRCREG04]JRD

AccuRay® Systems

# Radiation Safety Manual

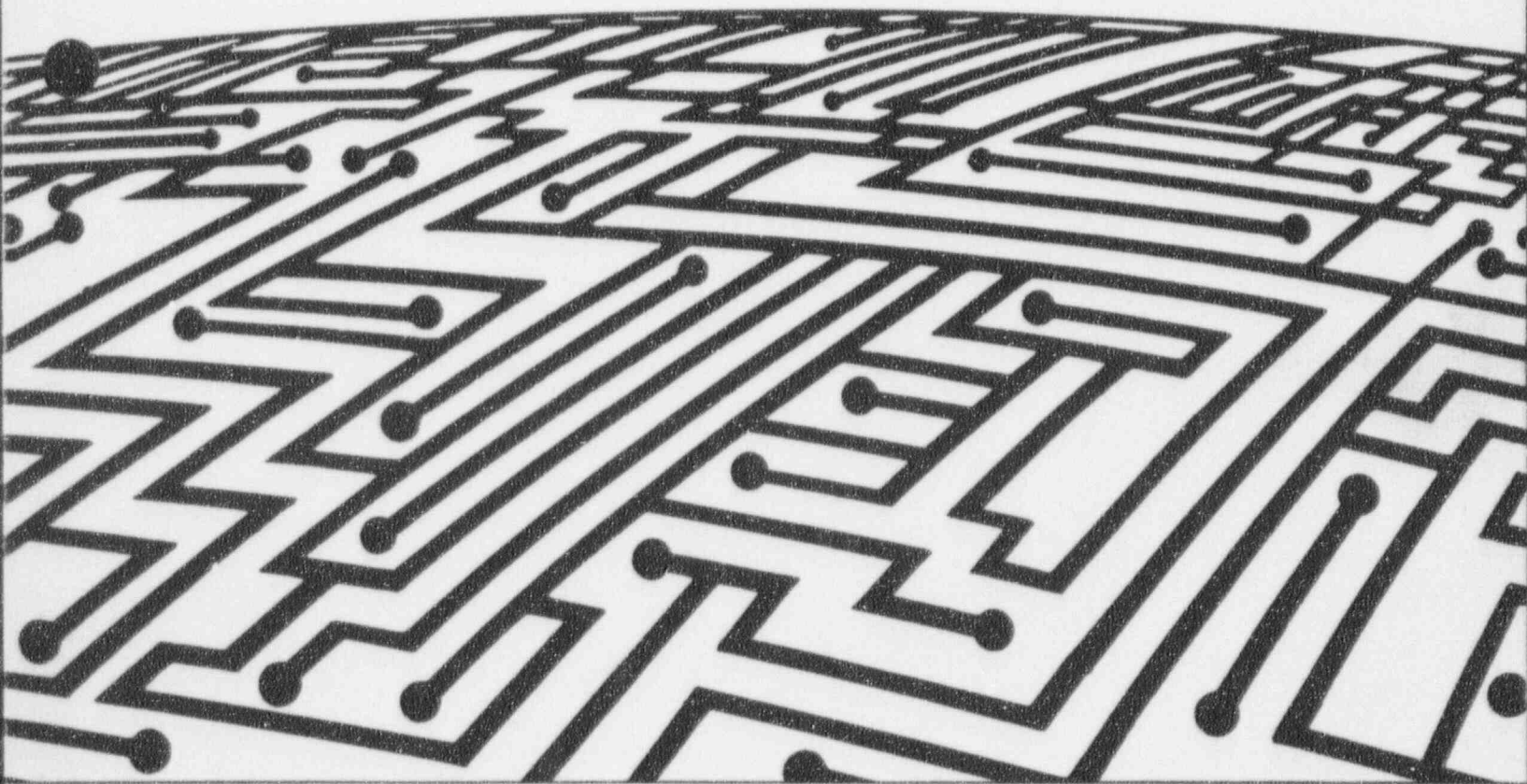


ABB Process Automation

**ABB**  
ASEA BROWN BOVERI

# Documentation Revision History

## Radiation Safety

Revision Level	Effective Date	Pages Changed by Revision	Pages Added by Revision	Pages Deleted by Revision
A	May, 1979	3-2, 3-3		
B	November, 1987	Entire Manual		

## ***PREFACE***

### **Radiation Safety**

This manual provides a description of radiation, radiation safety and the use of radiation by AccuRay sensors. It is for anyone who has contact with sensors that use radioactive material.

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# 1.0 OVERVIEW

## 1.1 OVERVIEW

Different types of AccuRay equipment use radiation as an energy source for measurement and control processes. The regular use of radiation in manufacturing is becoming more common.

Radiation sources emit forms of energy which penetrate matter. This ability to penetrate can be very useful for measurement in industrial processes. However, as with electricity, fire and chemicals, it is important to understand the possible hazards. As long as you use common sense and take the right precautions, you can use radiation with complete confidence and safety.

## 1.2 SUMMARY OF PRECAUTIONS

The following is a summary of precautions that should be followed:

1. Do not attempt to open the source housing. Someone trained and authorized by the appropriate regulatory agency must make repairs to this part of the sensor.
2. Do not place objects or any part of the body in the measurement beam between the source and detector housings. The only two exceptions are the material to be measured or a check sample.
3. A tag on the measurement head states a distance to keep from the source head. When the sensor is measuring, limit the amount of time you spend closer to the measurement head than stated on the tag. Any time you spend near the source should be absolutely necessary. See Section 3.0.
4. In case of a wreck or a fire involving the source housing, remain three meters (10 feet) away from the housing. Wait until someone properly trained can survey the area to be sure the shielding is still intact.

**NOTE:** Do not hesitate to rescue someone trapped near a source regardless of how close to the source you must be to do it. The radiation source used for measurement is so small that the injury from the exposed source would be much less serious than the injury that could result from a fire, explosion or mechanical wreck.

# 2.0 UNDERSTANDING RADIATION



## 2.1 WHAT IS RADIATION?

The term 'radiation' applies to several forms of energy emitted from sources all around us in our daily lives. Each type of radiation in nature has potential benefits and potential hazards. Both sunlight and the visible light you are using to view this page are forms of radiation. Usually, we think of sunlight as useful and harmless. Green plants use the energy from sunlight. This energy causes growth and supports life. This same sunlight, however, contains a type of radiation called ultraviolet radiation. Ultraviolet radiation can cause skin burns unless you take the type of protective care shown in Figure 2-1.



Figure 2-1 Taking Precautions to Prevent Sunburn

In general, radiation, refers to two kinds of energy:

1. Streams of energy composed of tiny, high speed particles
2. Bundles of electromagnetic energy, such as ultraviolet or X-ray, spontaneously released by atoms or generated by electronic devices.

Atoms are tiny building-block particles that make up our world. It takes billions of atoms just to make up the ink used in the period at the end of this sentence. Even smaller particles, with various names and descriptions, make up atoms. Not all types of atoms are perfectly stable. Some undergo sudden changes.

Similar sudden changes happen on a large scale on earth. The earth sometimes experiences sudden bursts of energy and matter that we see as an eruption of a volcano.

On a much smaller scale, individual atoms experience changes. These changes cause atoms to emit tiny high-speed particles or other forms of energy. Radiation is the term for both the high speed particles and energy. See Figure 2-2.

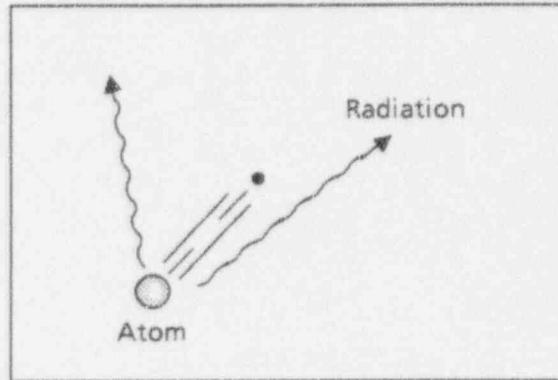


Figure 2-2 Radioactive Particle Leaving An Atom

## 2.2 WHY IS RADIATION USED IN MEASUREMENT?

### 2.2.1 How Radiation Is Used In Measurement

Matter absorbs all types of radiation. The amount of radiation that matter absorbs depends on the type of radiation and the density of the material. For example, glass easily transmits visible light. However, sea water partly transmits and partly absorbs visible light. Black asphalt pavement totally absorbs visible light.

Measurement using radiation in industry involves the following two principles that your doctor uses when taking a chest X-ray:

1. Less radiation passes through thick matter.
2. Less radiation passes through dense matter.

Manufacturers with a product made in a continuous process often need to know the thickness or density of a product without making contact with it. Examples of these products are paper, metal, plastic and rubber. A radiation source and detector can make this measurement. The radiation passes through the product to the detector on the other side. The detector receives different amounts of radiation due to the differences in the thickness or density of the product. See Figure 2-3. The detector produces an electrical signal which relates to the thickness or density of the product.

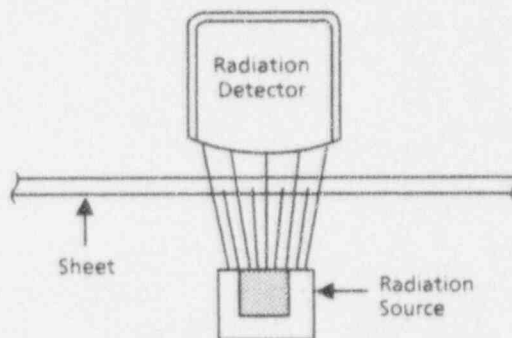


Figure 2-3 Radiation Source and Detector

The following are the two types of radiation most often used for measurement:

**Beta radiation**

Beta radiation consists of a stream of tiny particles (electrons) ejected from the atoms of the source material. The basis weight measurement of paper uses beta radiation.

**X-radiation**

X-rays are not particles, but rather, small energy bundles called photons more closely related to visible light than to particles. Sometimes X-radiation is also called gamma radiation or "bremsstrahlung." The measurement of the ash content of paper and the thickness of metal uses X-radiation.

### 2.2.2 Advantages Of Radiation Measurement

All radiation sensor processes have definite advantages over other measurement techniques:

- The measurement is very precise.
- The material can continue moving during measurement.
- There can be a very short interval between measurements.
- The measurement can be made at very high speeds. Measurements at high speeds mean that you can correct the process before more material is made.
- There is no physical contact with the material being tested.
- There is unusually long sensor life, excellent reliability, reasonable cost and minimal energy consumption.
- The measurement does not affect or alter the material in any way.

### 2.3 WHAT ARE THE HAZARDS OF RADIATION?

Radiation sources emit energy which has the power to harm living tissue. All radiation can do damage if the body receives a large enough quantity.

We are all aware that overexposure to sunlight can cause skin burns, blistering, exhaustion and illness. Yet people can function normally in bright sunlight if they take the right safety measures. Some of the well known safety measures are wearing protective clothing and keeping the total time of exposure low.

Besides sunlight, humans are exposed to many other sources of natural external radiation, in small amounts each day. Tiny amounts of radioactive materials exist in the air we breathe, the earth, the buildings around us, and in our bodies. In addition, the surface of the earth is constantly bombarded by a variety of radiation that originates in outer space. We are able to tolerate this exposure and be unaware of it just as we easily tolerate a walk in the sunlight. It is possible, however to experience too much radiation from a concentrated source.

Within certain limitations, the human body can repair itself from minor radiation damage. This would be similar to the body repairing itself from a bruise or a scrape. Knowing the limitations, you can create a safe working environment around radiation sources.

There are three kinds of radiation injury:

1. Localized effects to the surface of the body from exposure to less penetrating radiations. The common results of local radiation exposure include surface skin burns or slow-healing sores.
2. Radiation sickness (severe internal damage) from a massive exposure to penetrating radiation, such as with a severe X-ray overdose. Symptoms can be shock, nausea, vomiting and internal bleeding. Radiation sickness can cause death.
3. Radiation poisoning is illness caused by absorbing radioactive material into the body through breathing, swallowing, or absorption through the skin.

## 2.4 HOW DO YOU AVOID THE HAZARDS?

Three factors are important in supplying protection from radiation:

1. Time
2. Shielding
3. Distance.

We know that proper shielding (such as a hat and sunglasses) and limiting the amount of time in the sun prevents damage from sunlight.

These same principles of shielding and limiting exposure time apply to protection from all sources of radiation.

A rem is the basic unit of measurement for radiation absorbed by a human. The rem has a formal definition important to scientists, but it may be best understood by the chart in Figure 2-4.

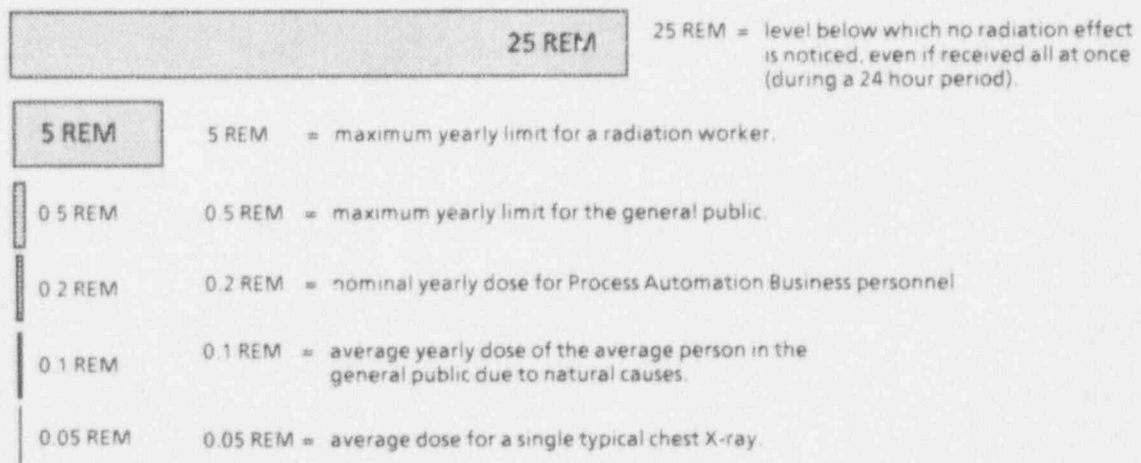


Figure 2-4 Human Radiation Dosage Chart

Keeping a certain distance from a beta or X-radiation source is also an effective way to reduce exposure. For example the radiation level is 25 times greater at one foot from a source than it is at five feet from the source.

The AccuRay sensor is designed to operate at radiation dosage levels no greater than those legally permissible for the general public. In practice, the dosage levels from a sensor probably do not exceed those from natural sources.

The maximum dose that a worker might receive from a sensor over a year is very small, 50 times smaller than the amount of radiation below which no effect is detected even if received all at once.

# 3.0 SAFETY FEATURES AND PRACTICES



### 3.1 WHAT ARE SAFETY FEATURES?

AccuRay systems are designed with safety as a strong concern, both in their construction and in normal inspection and operating procedures.

#### Containment

The radioactive material is encapsulated so that it is not released even if subjected to a severe industrial fire or accident. This eliminates radiation poisoning as a hazard. Prototypes of AccuRay source capsules have passed tests under industrial fire conditions.

#### Shielding

Several layers of shielded metal containment enclose the radiation source. The housing has a lock to prevent inadvertent access. An alarm system reacts in case of tampering or damage. During measurement a fairly small radiation beam passes through the substance. If a power failure occurs, or whenever the sensor is not measuring, a fail-safe shutter closes over the source to shut off the measuring beam. See Figure 3-1.

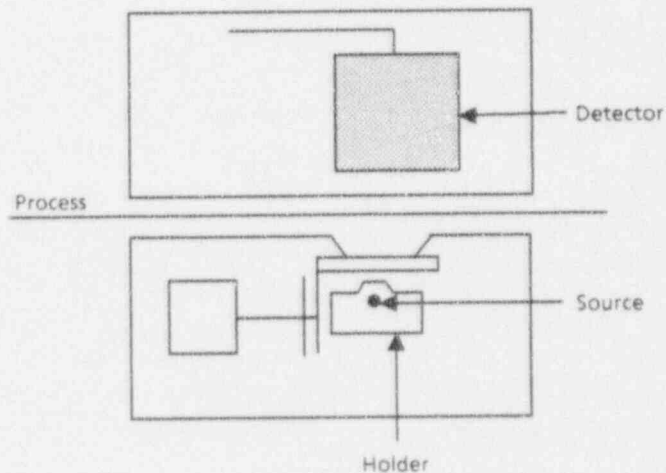


Figure 3-1 Source and Detector Showing Shutter Mechanism

### 3.2 WHAT ARE THE SAFETY PRACTICES?

There are three safety practices to follow:

1. Distance
2. Time
3. Unnecessary exposure. AccuRay equipment is thoroughly encapsulated and shielded.

A statement on the metal CAUTION tag attached to the measurement unit states:

"Do not continuously occupy the area within \_\_\_\_\_ feet of this unit."

Figure 3-2 shows the tag. The distance on the tag has a large safety margin. The average worker will spend very little time close to the radiation source during the scanning process. Service personnel check the area around the source for excess radiation during installation and every six months after installation. See Figure 3-2.

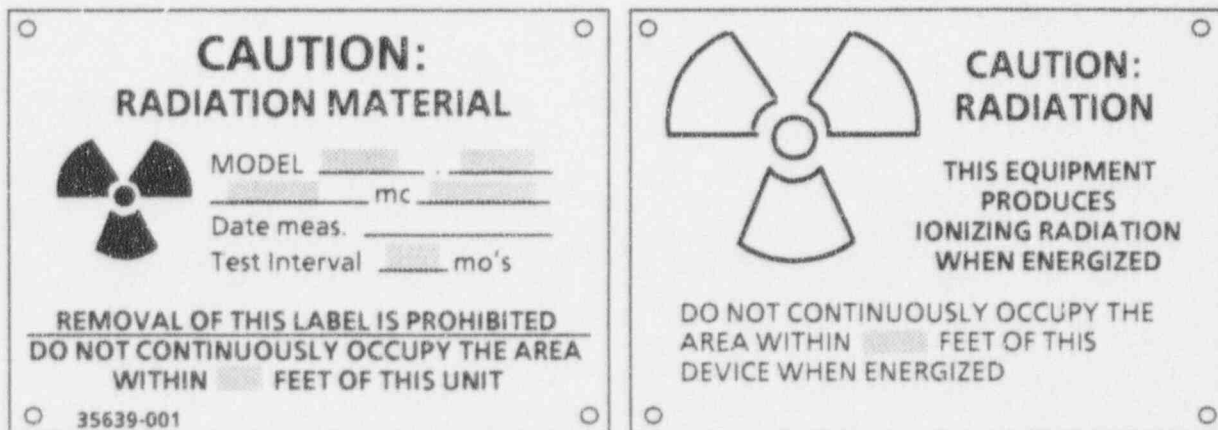


Figure 3-2 Radiation Safety Tag

Occasional work closer to the measurement head than specified on the warning tag distance will not result in a radiation dose of any health significance. However, if you do observe this distance, it will guarantee that the exposure level will be less than the level permitted by regulations for the general public.

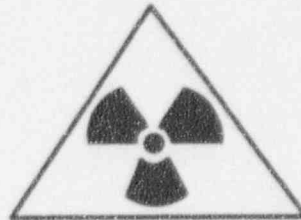
**NOTE:** A SUBSTANCE EXPOSED TO RADIATION DOES NOT BECOME RADIOACTIVE. For example the material being measured does not emit radiation after the scanning is over. Also the air surrounding the source does not become radioactive.

# GLOSSARY

## GLOSSARY

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Atoms	Atoms are small, basic particles, that make up all matter.
Beta Particle	A beta particle is a very small high speed particle (electron) spontaneously emitted from certain types of atoms. Atoms which emit beta particles are radioactive.
Sensor	This term refers to any measurement devices.
Radiation	Radiation is streams of energy, high-speed particles or bundles of electromagnetic energy (photons).
Radiation Injury	Radiation injury is localized and mostly surface skin injury due to an external radiation overdose.
Radiation Poisoning	Radiation poisoning is illness due to intake of radioactive material within the body.
Radiation Sickness	Radiation sickness is internal body damage due to large external radiation overdose of penetrating radiation.
Radioactive	Radioactive refers to any of a variety of types of atoms which are unstable and spontaneously emit radiation.
Rem	A rem is the basic unit used to measure the effect of radiation on humans.
Source	A source is a device or concentration of material which produces or emits radiation.
X-Ray	An X-ray is a very penetrating radiation composed of energy bundles (photons) related to visible light. The following is an example of the international symbol indicating presence of a radiation source.



# USER COMMENT FORM



## USER COMMENT FORM

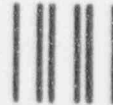
Manual Title \_\_\_\_\_ Part Number: \_\_\_\_\_

Mill Name: \_\_\_\_\_

Please check-mark the appropriate column	Strongly Disagree	Mildly Disagree	Disagree	Agree	Mildly Agree	Strongly Agree
The information is complete. The manual is missing information about:						
The information is correct. The incorrect information is:						
The information is easy to find. I had a hard time finding:						
The information is easy to read. The information which is hard to read is:						
This manual contains unneeded information. You can omit information about:						
The drawings helped me complete a specific task.						
The drawings helped me understand how the system works.						
This manual has a professional appearance.						
<b>Reviewer Information</b>	<b>Months 1-5</b>	<b>Months 6-12</b>	<b>Years 1-3</b>	<b>Years 3-5</b>	<b>Years 5-10</b>	<b>Years 10+</b>
I have worked with AccuRay Systems for:						

**Additional Comments:**

- Fold Here -



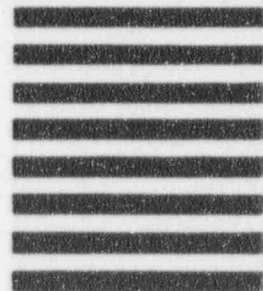
NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 886 COLUMBUS, OHIO

POSTAGE WILL BE PAID BY ADDRESSEE

AccuRay Corporation  
Technical Communications Dept.  
650 Ackerman Road  
P.O. Box 02248  
Columbus, Ohio 43202



Do Not Tear · Fold Here and Staple

APPENDIX F

OTHER DOCUMENTATION ACCOMPANYING THE DEVICE  
(Reference Section 3.9)

Contents:

- F-1 Cover page
- F-2 BF-55, Licensing of Radioactive Material, The General License
- F-3 BF-700, Gauge Installation Survey
- F-4 BF-898, Radiological Inspection Report



## LICENSING OF RADIOACTIVE MATERIAL THE GENERAL LICENSE

You must be licensed to possess the radioactive material in the sensor of your AccuRay measurement and control system. The attached reprint of excerpts from the Code of Federal Regulations contains important information about licensing. Read it carefully for complete understanding of the contents. Retain this information and all records of receipt, transfer, installation, tests and service pertaining to the radioactive material in a single permanent file.

According to Title 10, U.S. Code of Federal Regulations, Part 30, paragraph 30.31, "Licenses for byproduct material are of two types: General and Specific. Specific licenses are issued to named persons upon applications filed pursuant to the regulations in the part and Parts 32-35,39. General licenses are effective without the filing of applications with the Commission or the issuance of licensing documents to particular persons."

Licenses to possess radioactive material are controlled either by the U.S. Nuclear Regulatory Commission (USNRC) or by the equivalent authority (usually the Department of Health) of a State with which the Commission has signed an agreement (Agreement State). In any case, the regulations are quite similar except for the paragraph numbering. The following information is excerpted from Title 10 of the U.S. Code of Federal Regulations. You can get a copy of the equivalent Agreement State regulations by writing to the appropriate address on the attached list. If you have any questions, ask your ABB representative or call our Corporate Radiation Safety Officer at Columbus, Ohio, 614-261-2000.

### I. LICENSING

You are a general licensee. If the location at which you possess your AccuRay system is one of the states on the attached list, you are a general licensee of that state. Otherwise, you are a general licensee of the USNRC. This and the attached material is your general license. It is not necessary to make further application to any agency nor will a document be issued in your name. You may, however, be required to register your possession of radioactive material with your state. Again, your ABB representative can advise you of the proper procedure to follow.

"AccuRay" is the registered trademark of ABB Process Automation Inc.

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BF-55 (5-11-91)  
1/7

ABB Process Automation Inc.

## II. INSTALLATION, TESTING, SERVICING

Particular attention should be given to paragraphs 31.5(c)(2) and (3) of 10 CFR 31. The first requires that you have tests performed on the radioisotope sources and safety devices at intervals specified on the label. The second requires that such tests and installation, servicing, and removal from installation involving the radioactive material, its shielding or containment be performed by a person holding a specific license from the Commission or an Agreement State to perform such activities.

## III. DISPOSAL OR TRANSFER

Note that paragraph 31.5(c)(6) specifically prohibits the abandonment of the licensed part of the gauge. Conditions to permit the transfer of the byproduct material are outlined in paragraphs 31.5(c)(7), (8) and (9).

## IV. SERVICES

ABB Process Automation Inc. is licensed to perform all of the services referred to in the General License. These services are available under a number of different Service Agreements or may be obtained by issuance of an appropriate purchase order. Your ABB representative can advise you as to the specific arrangement most appropriate for your operation. In any case, upon completion of each such service, a documented report will be provided. Such reports should be kept by you in a permanent file along with this license.

USNRC GENERAL LICENSE

EXCERPTS FROM TITLE 10, CODE OF FEDERAL REGULATIONS

§ 31.5 Certain measuring, gauging or controlling devices.<sup>2</sup>

(a) A general license is hereby issued to commercial and industrial firms and research, educational and medical institutions, individuals in the conduct of their business, and Federal, State or local government agencies to acquire, receive, possess, use or transfer, in accordance with the provisions of paragraphs (b), (c) and (d) of this section, byproduct material contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.

(b) The general license in paragraph (a) of this section applies only to byproduct material contained in devices which have been manufactured or initially transferred and labeled in accordance with the specifications contained in a specific license issued pursuant to § 32.51 of this chapter or in accordance with the specifications contained in a specific license issued by an Agreement State which authorizes distribution of the devices to persons generally licensed by the Agreement State.

(c) Any person who acquires, receives, possesses, uses or transfers byproduct material in a device pursuant to the general license in paragraph (a) of this section:

(1) Shall assure that all labels affixed to the device at the time of receipt and bearing a statement that removal of the label is prohibited are maintained thereon and shall comply with all instructions and precautions provided by such labels;

(2) Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label; however:

(i) Devices containing only krypton need not be tested for leakage of radioactive material, and

(ii) Devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or

10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose;

(3) Shall assure that the tests required by paragraph (c)(2) of this section and other testing, installation, servicing, and removal from installation involving the radioactive materials, its shielding or containment, are performed:

(i) in accordance with the instructions provided by the labels; or

(ii) by a person holding a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State to perform such activities;

(4) Shall maintain records showing compliance with the requirements of paragraphs (c)(2) and (c)(3) of this section. The records must show the results of tests. The records also must show the dates of performance of, and the names of persons performing, testing, installing, servicing, and removing from the installation radioactive material and its shielding or containment. The licensee shall retain these records as follows:

(i) Each record of a test for leakage or radioactive material required by paragraph (c)(2) of this section must be retained for three years after the next required leak test is performed or until the sealed source is transferred or disposed of.

(ii) Each record of a test of the on-off mechanism and indicator required by paragraph (c)(2) of this section must be retained for three years after the next required test of the on-off mechanism and indicator is performed or until the sealed source is transferred or disposed of.

(iii) Each record that is required by paragraph (c)(3) of this section must be retained for three years from the date of the recorded event or until the device is transferred or disposed of.

(5) Upon the occurrence of a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie or more removable radioactive material, shall immediately suspend operation of the device until it has been repaired by the manufacturer or other person holding

a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the byproduct material contained in the device and, within 30 days, furnish to the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix D of Part 20 of this chapter, a report containing a brief description of the event and the remedial action taken;

(6) Shall not abandon the device containing byproduct material;

(7) Shall not export the device containing byproduct material except in accordance with Part 110 of this chapter;

(8) Except as provided in paragraph (c)(9) of this section, shall transfer or dispose of the device containing byproduct material only by transfer to a person holding a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State, to receive the device and within 30 days after transfer of a device to a specific licensee shall furnish to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, a report containing identification of the device by manufacturer's name and model number and the name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device;

(9) Shall transfer the device to another general licensee only:

(i) Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this section and any safety documents identified in the label of the device and within 30 days of the transfer, report to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, the manufacturer's name and model number of device transferred, the name and address of the transferee, and the name and/or position of an individual who may constitute a point of contact between the Commission and the transferee; or

<sup>2</sup> Persons possessing byproduct material in devices under the general license in § 31.5 before Jan. 15, 1975, may continue to possess, use or transfer that material in accordance with the requirements of § 31.5 in effect on Jan. 14, 1975.

(ii) Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by a general licensee.

(10) Shall comply with the provisions of §§ 20.402 and 20.403 of this chapter for reporting radiation incidents, theft or loss of licensed material, but shall be exempt from the other requirements of Parts 19, 20, and 21 of this chapter.

(d) The general license in paragraph (a) of this section does not authorize the manufacture or import of devices containing byproduct material.

#### § 31.12 Maintenance of records.

Each record required by this part must be legible throughout the retention period specified by each Commission regulation. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of producing a clear copy throughout the required retention period. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, specifications, must include all pertinent information such as letters, stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

#### § 20.402 Reports of theft or loss of licensed material.

(a)(1) Each licensee shall report to the Commission, by telephone, immediately after it determines that a loss or theft of licensed material has occurred in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

(2) Reports must be made as follows:

(i) Licensees having an installed Emergency Notification System shall make the reports to the NRC Operations Center in accordance with § 50.72 of this chapter.

(ii) All other licensees shall make reports to the Administrator of the appropriate NRC Regional Office listed in Appendix D of this part.

(b) Each licensee who makes a report under paragraph (a) of this section shall, within 30 days after learning of the loss or theft, make a report in writing to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555, with a copy to the appropriate NRC Regional Office listed in Appendix D of this part. The report shall include the following information:

(1) A description of the licensed material involved, including kind, quantity, chemical, and physical form;

(2) A description of the circumstances under which the loss or theft occurred;

(3) A statement of disposition or probable disposition of the licensed material involved;

(4) Radiation exposures to individuals, circumstances under which the exposures occurred, and the extent of possible hazard to persons in unrestricted areas;

(5) Actions which have been taken, or will be taken, to recover the material; and

(6) Procedures or measures which have been or will be adopted to prevent a recurrence of the loss or theft of licensed material.

(c) Subsequent to filing the written report the licensee shall also report any substantive additional information on the loss or theft which becomes available to the licensee, within 30 days after he learns of such information.

(d) Any report filed with the Commission pursuant to this section shall be so prepared that names of individuals who may have received exposure to radiation are stated in a separate part of the report.

#### § 20.403 Notifications of incidents.

(a) *Immediate notification.* Each licensee shall immediately report any events involving byproduct, source, or special nuclear material possessed by the licensee that may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more or radiation; or exposure of the feet, ankles, hands or forearms of any individual to 375 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II of this part; or

(3) A loss of one working week or more of the operation of any facilities affected; or

(4) Damage to property in excess of \$200,000.

(b) *Twenty-four hour notification.* Each licensee shall within 24 hours of discovery of the event, report any event involving licensed material possessed by the licensee that may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II of this part; or

(3) A loss of one day or more of the operation of any facilities affected; or

(4) Damage to property in excess of \$2,000.

(c) Any report filed with the Commission pursuant to this section shall be prepared so that names of individuals who have received exposure to radiation will be stated in a separate part of the report.

(d) Reports made by licensees in response to the requirements of this section must be made as follows:

(1) Licensees that have an installed Emergency Notification System shall make the reports required by paragraphs (a) and (b) of this section to the NRC Operations Center in accordance with § 50.72 of this chapter.

(2) All other licensees shall make the reports required by paragraphs (a) and (b) of this section by telephone to the NRC Operations Center<sup>1</sup> and by telegram, mailgram, or facsimile to the Administrator of the appropriate NRC Regional Office listed in Appendix D of this part.

<sup>1</sup> Commercial telephone number of the NRC Operations Center is (301) 951-0550.

§ 30.34 Terms and conditions of licenses.

(a) Each license issued pursuant to the regulations in this part and the regulations in Parts 31-35, shall be subject to all the provisions of the Act, now or hereafter in effect, and to all valid rules, regulations and orders of the Commission.

(b) No license issued or granted pursuant to the regulations in this part and Parts 31-35, nor any right under a license shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

(c) Each person licensed by the Commission pursuant to the regulations in this part and Parts 31-35, shall confine his possession and use of the byproduct material to the locations and purposes authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part and Parts 31-35, of this chapter shall carry with it the right to receive, acquire, own, and possess, byproduct material. Preparation for shipment and transport of byproduct material shall be in accordance with the provisions of Part 71 of this chapter.

(d) Each license issued pursuant to the regulations in this part and Parts 31-35, shall be deemed to contain the provisions set forth in section 183b-d., inclusive, of the Act, whether or not these provisions are expressly set forth in the license.

(e) The Commission may incorporate, in any license issued pursuant to the regulations in this part and Parts 31-35, at the time of issuance, or thereafter by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use and transfer of byproduct material as it deems appropriate or necessary in order to:

- (1) Promote the common defense and security;
- (2) Protect health or to minimize danger to life or property;
- (3) Protect restricted data;

(4) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(f) (Reserved) 48 FR 32324

(g) A licensee may prepare technetium-99m radiopharmaceuticals only with technetium-99m that contains less than 0.15 microcuries of molybdenum-99 per millicurie of technetium-99m. The licensee shall perform tests and retain the records required by § 35.204.

(h)(1) Each licensee shall notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code by or against:

- (i) The licensee;
- (ii) An entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or
- (iii) An affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee.

(2) This notification must indicate:  
(i) The bankruptcy court in which the petition for bankruptcy was filed;  
(ii) The date of the filing of the petition.

§ 30.51 Records.

(a) Each person who receives byproduct material pursuant to a license issued pursuant to the regulations in this part and Parts 31 through 35 of this chapter shall keep records showing the receipt, transfer, and disposal of the byproduct material as follows:

(1) The licensee shall retain each record of receipt of byproduct material as long as the material is possessed and for three years following transfer or disposal of the material.

(2) The licensee who transferred the material shall retain each record of transfer for three years after each transfer unless a specific requirement in another part of the regulations in this chapter dictates otherwise.

(3) The licensee who disposed of the material shall retain each record of disposal of byproduct material until the Commission terminates each license that authorizes disposal of the material.

(b) The licensee shall retain each record that is required by the regulations in this part and Parts 31 through 35 of this chapter or by license

condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, the record must be retained until the Commission terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(c)(1) Records which must be maintained pursuant to this part and Parts 31 through 35 of this chapter may be the original or a reproduced copy or microform if such reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, specifications, must include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

§ 30.52 Inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect byproduct material and the premises and facilities wherein byproduct material is used or stored.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

§ 30.53 Tests.

Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part and Parts 31-35 and 39 of this chapter, including tests of:

- (a) Byproduct material;
- (b) Facilities wherein byproduct material is utilized or stored;
- (c) Radiation detection and monitoring instruments; and
- (d) Other equipment and devices used in connection with the utilization or storage of byproduct material.

§ 30.61 Modification and revocation of licenses.

(a) The terms and conditions of each license issued pursuant to the regulations in this part and Parts 31 through 35 of this chapter shall be subject to amendment, revision or modification by reason of amendments to the Act, or by reason of rules, regulations and orders issued in accordance with the terms of the Act.

(b) Any license may be revoked, suspended or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and provisions of the Act or of any rule, regulation or order of the Commission.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

§ 30.62 Right to cause the withholding or recall of byproduct material.

The Commission may cause the withholding or recall of byproduct material from any licensee who is not equipped to observe or fails to observe such safety standards to protect health as may be established by the Commission, or who uses such materials in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefor or approved by the Commission.

§ 30.63 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or Title II of the Energy Reorganization Act of 1974, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule, regulation, or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any violation for which a license may be revoked under section 186 of the Act. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

APPENDIX D.—UNITED STATES NUCLEAR REGULATORY COMMISSION REGIONAL OFFICES

	Address	Telephone (24 hours)
Region I: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.	USNRC, 475 Alfordville Road, King of Prussia, PA 19406.	(215) 387-8000 (FTS) 346-5000
Region II: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, and West Virginia.	USNRC, 101 Marietta Street, NW, Suite 2900, Atlanta, GA 30323.	(404) 331-4503 (FTS) 242-4600
Region III: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.	USNRC, 799 Roosevelt Road, Glen Ellyn, IL 60137.	(708) 790-6500 (FTS) 388-6500
Region IV: Arkansas, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming.	USNRC, 611 Ryan Plaza Drive, Suite 1500, Arlington, TX 78011.	(817) 880-6100 (FTS) 728-6100
Region IV: Field Office	USNRC, Region IV Uranium Recovery Field Office, 730 Spruce Street, P.O. Box 25325, Denver, CO 80225.	(303) 236-2805 (FTS) 776-2805
Region V: Alaska, Arizona, California, Hawaii, Nevada, Oregon, Pacific Trust Territories, and Washington.	USNRC, 1450 Mans Lane, Suite 210, Walnut Creek, CA 94596.	(415) 943-3700 (FTS) 463-3700

AGREEMENT STATES

ALABAMA 205/242-5313

Bureau of Radiological Health  
Environmental Health Administration  
State Office Building, Room 314  
Montgomery, AL 36130

ARIZONA 602/255-4845

Arizona Radiation Regulatory Agency  
4814 South 40th St.  
Phoenix, AZ 85040

ARKANSAS 501/661-2142

Div. Rad. Control & Emergency Mgmt.  
Arkansas Department of Health  
4815 West Markham Slot 30  
Little Rock, AR 72205-3867

CALIFORNIA 916/445-0931

State Department of Health  
714 P St. Room 498  
Sacramento, CA 95814

COLORADO 303/331-8480

Radiation Control Division  
Colorado Dept. of Health  
4210 East 11th Ave.  
Denver, CO 80220

FLORIDA 904/487-1004

Office of Radiation Control (HSERM)  
Dept. of Health & Rehab. Services  
1317 Winewood Blvd.  
Tallahassee, FL 32399-0700

GEORGIA 404/894-7610

Radiological Health Section  
Department of Human Resources  
878 Peachtree St. NE Suite 600  
Atlanta, GA 30309

ILLINOIS 217/785-9900

Department of Nuclear Safety  
Division of Nuclear Materials  
1035 Outer Park Dr.  
Springfield, IL 62704

IOWA 515/281-3478

Bureau of Radiological Health  
Dept. of Public Health  
Lucas State Office Building  
Des Moines, IA 50319

KANSAS 913/862-9360

Bureau of Air Quality and  
Radiation Control  
Dept. of Health & Environment  
Building 740, Forbes Field  
Topeka, KS 66620

KENTUCKY 502/564-3700

Radiation Control Section  
Dept. of Health Services  
275 East Main St.  
Frankfort, KY 40621

LOUISIANA 504/925-4518

Radiation Protection Division  
P.O. Box 14690  
Baton Rouge, LA 70898-4690

MARYLAND 301/631-3300

Department of Environment  
Radiological Health Program  
2500 Broening Highway  
Baltimore, MD 21224

MISSISSIPPI 601/354-6657

Division of Radiological Health  
2423 North State St.  
P.O. Box 1700  
Jackson, MS 39205

NEBRASKA 402/471-2168

Division of Radiological Health  
State Department of Health  
301 Centennial Mall South  
P.O. Box 95007  
Lincoln, NE 68509

NEVADA 702/885-5394

Radiological Health Section  
Consumer Health Protection Services  
Room 103 Kinkead Bldg.  
Capitol Complex  
Carson City, NV 89710

NEW HAMPSHIRE 603/271-4588

N.H. Div. of Public Health Services  
Bureau of Radiological Health  
Health and Welfare Building  
6 Hazen Drive  
Concord, NH 03301-6527

NEW MEXICO 505/827-2948

Radiation Licensing & Registration Sec.  
Community Services Bureau/EID  
P.O. Box 968  
Santa Fe, NM 87504-0968

NEW YORK 718/797-7641

Division of Safety & Health  
1 Main St.  
Brooklyn, NY 11201

NORTH CAROLINA 919/571-4141

Division of Radiation Protection  
N.C. Dept. of Environment, Health  
& Natural Resources  
P.O. Box 27687  
Raleigh, NC 27611-7687

NORTH DAKOTA 701/224-2348

Div. of Environmental Engineering  
Radiological Health Program  
1200 Missouri Ave.  
Bismarck, ND 58501

OREGON 503/229-5797

Radiation Control Section  
Dept. of Human Resources  
1400 South West Fifth Ave.  
Portland, OR 97201

RHODE ISLAND 401/277-2438

Division of Occupational Health  
& Radiation Control  
R.I. Department of Health  
75 Davis St.  
Providence, RI 02908

SOUTH CAROLINA 803/734-4700

Bureau of Radiological Health  
State Dept. of Health  
& Environmental Control  
2600 Bull St.  
Columbia, SC 29201

TENNESSEE 615/741-7812

Division of Radiological Health  
Tenn. Dept. of Health & Environment  
150 Ninth Ave. North  
Nashville, TN 37219-5404

TEXAS 512/835-7000

Bureau of Radiation Control  
Texas Dept. of Health  
1100 West 49th St.  
Austin, TX 78756-3189

UTAH 801/533-6734

Bureau of Radiation Control  
State Dept. of Health  
298 North, 1460 West  
P.O. Box 16700-0700  
Salt Lake City, UT 84116

WASHINGTON 206/753-3459

Radiation Control Section  
Dept. of Social & Health Services  
Mail Stop LF-13  
Airdustrial Park  
Olympia, WA 98504



ASEA BROWN BOVERI

650 Ackerman Road  
Columbus, Ohio 43202

# Gauge Installation Survey

**ABB Process Automation Inc.**

Company:

Address:

Device Model:	Device Serial No.:	Source Serial No.:	Isotope:	Quantity: mCi
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Gauge (Bldg., Process, Location: Line, etc.)

Type of Installation (Initial, reinstallation, source change, etc.):

- The radiation field at 12 inches from the gauge or process bounds at locations which might be occupied by personnel while the gauge is measuring has been determined to be \_\_\_\_\_ mR/hr. The maximum distance at any time to \_\_\_\_\_ mR/hr is \_\_\_\_\_ feet; no continuously occupied work station should be established within this distance.
- Licensing of this unit is under one of the following categories. Additional instructions appearing on the gauge label are applicable. Consult your ABB Process Automation representative for further licensing information.
  - You are a General Licensee of the United States Nuclear Regulatory Commission and a copy of your General License (10 CFR 31, Sec. 31.5) is attached. This is your license and no further communication with the USNRC is required. However, your state may have supplemental regulations which require notification and/or registration.
  - You are a General Licensee of an Agreement State, i.e., your state has licensing jurisdiction over radioactive material rather than the USNRC. Your state regulations are similar to the attached USNRC excerpts. The actual regulations can be obtained from the office address shown on the last page of the attached form. Your state may have additional requirements for notification and/or registration.
  - You are a Specific Licensee of the USNRC or of an Agreement State. Receipt, possession, use and transfer of this device are governed by the conditions of your license number \_\_\_\_\_.
- If this gauge contains a shutter mechanism and indicators, they have been checked for proper operation. The radioactive source has been leak tested, if applicable. A report on that test will follow. You will be notified by our Service Department of the date on which the next leak test or shutter check should be performed to satisfy the requirements of the applicable regulations or of your license.
- IT IS A REQUIREMENT OF THE REGULATIONS THAT THIS DOCUMENT AND ANY OTHERS PERTAINING TO THE RECEIPT, TESTING, OR MOVEMENT OF THE RADIOACTIVE MATERIAL BE RETAINED. WE RECOMMEND THAT A FILE BE SET UP IMMEDIATELY FOR RETAINING ALL PERTINENT PAPERS, AND A SINGLE INDIVIDUAL BE DESIGNATED AS RESPONSIBLE FOR THE ADMINISTRATIVE CONTROL OF THIS UNIT.

**ABB Process Automation Inc.**

\_\_\_\_\_  
Customer's Signature

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Date

DISTRIBUTION White - Customer Yellow - Service Department Pink - Radiological Operations



ABB PROCESS AUTOMATION INC.  
 650 ACKERMAN ROAD  
 P.O. BOX 02650  
 COLUMBUS, OHIO 43202  
 TEL: 614-261-2000 TELEX: 246675  
 FAX: 614-261-2172

This is a report of the inspection made of your radioisotope device and should be retained in a permanent file along with all other records of licensing or registration, receipt, installation, servicing and transfer of your radioactive material. Your regulatory authority may wish to review this information. Check your license or local regulations carefully.

REPORT DATE:

LAB TEST DATE:

PERFORMED BY:

PLANT SITE:

Device Model	Device Serial Number	Source Serial Number	Isotope	Quan. (mCi)	Field Inspection Result				Lab Test Result
					Source	Shutter	Performed By	Date	

NOTES

1. NanoCurie = .001 microCurie ( $\mu\text{Ci}$ ) =  $10^{-6}$  milliCurie (mCi).
2. The entry "L" in the source column means less than 0.5 nanoCurie of removable contamination.
3. Any amount of detected activity greater than 0.5 nanoCurie is expressed in nanoCuries.
4. The entry "OK" in the shutter column means the shutter mechanism and indicators, if any, are operating properly, labeling is in proper condition, and the external radiation levels are consistent with those specified for the device. Discrepancies are detailed in appropriate notes.
5. The presence of 5 nanoCuries (.005  $\mu\text{Ci}$ ) or more of removable contamination is considered evidence that the source is leaking. Refer to your regulatory requirements regarding leakage or malfunction.

\_\_\_\_\_  
 CORPORATE RADIATION SAFETY OFFICER

APPLICATION FOR RADIATION SAFETY EVALUATION  
AND REGISTRATION OF DEVICE1.0 SUMMARY DATADate: July 23, 1991Applicant: ABB Process Automation, Inc.  
650 Ackerman Road  
P.O. Box 02248  
Columbus, Ohio 43202-1502Type: Manufacturer and distributorContact: Mr. Donald C. Stephens  
Radiation Safety Officer, and  
Supervisor of Radiological Operations  
Phone: (614)261-2000 (X2337)  
or  
Mr. John R. Dukes, Manager  
Nucleonics and Radiological Operations  
Phone: (614)261-2000 (X2448)Device Type: Beta or gamma transmission gaugeModel: "TG" Series (Transmission Gauges)Other Companies Involved: NoneRadioactive Sources Model Designations:

AccuRay &amp; supplier models S-11, S-16, S-18, S-20, CLC.D1

Radionuclides and Maximum Activity

Promethium-147	1000 millicuries (S-20)
Krypton-85	1500 millicuries (S-11)
Strontium-90	800 millicuries (S-18)
Curium-244	1000 millicuries (CLC.D1)
Americium-241	5000 millicuries (S-16)

Leak-Test Frequency: 6 months (Not required for Kr-85)Principle Use Codes: (D) & (E) Gamma & Beta Gauges

Devices are for distribution to users operating under either Specific Licenses or General Licenses.

Custom Device: NoCustom User: Not Applicable

## 2.0 SUMMARY DESCRIPTION (see drawing DC-128703-001, Appendix A)

This device is a nucleonic-based measurement sensor designed to gauge physical characteristics of processed materials such as the thickness, density, weight per unit area, weight per unit length, or composition of the measured materials. It generally consists of two heads or housings with a sealed radioisotope source in one housing and a radiation detector in the other housing. When measuring, the source and detector heads are mounted in a fixed geometrical relationship so that the emitted radiation beam passes through the measured material located between the two housings. These heads may be moved simultaneously over the measured material, maintaining precisely their geometrical relationship, or they may remain stationary as the material is being measured. As a special case, the source and detector housings may be combined into a single unit with the process to be measured passing through an opening in the housing located between the radiation source and the detector.

The device is to be installed at a fixed location. It may be incorporated directly into the user's manufacturing process machinery or it may be secured onto a frame or a scanner which is incorporated into the process machinery. It may also be mounted off the process line in a laboratory or similar location where it might be used to measure batch samples.

The dimensions and the materials of construction for the device vary depending upon the application, the amount of electronics and other hardware incorporated into the sensor package, and where and how the sensor heads are mounted for use. Dimensions for each of the two housings range from approximately 10x10x20 cm (4"x4"x8") to 25x25x50 cm (10"x10"x20"). The measuring gap between the heads may vary from 0.5 cm (1/4") to 10 cm (4") for beta radiation gauges and up to 50 cm (20") for collimated beam gamma gauges. When the two housings are combined into a single unit the dimensions of the head range from 9.2x14.9x19.7 cm (3.6"x5.9"x7.7") to 9.2x16.6x23.3 cm (3.6"x6.6"x9.2") and the process pass-through aperture is 2.5 cm or smaller.

From a health physics standpoint, the detector head serves as the primary barrier and provides shielding for the radiation measuring beam when the device is in the "ON" condition.

The source head assembly portion of the device is composed of four basic parts -- source, shielding, ON-OFF mechanism, and housing. The sealed source is secured into a source holder which provides primary shielding, except for the measuring beam. The source holder is attached, or integral, to the ON-OFF mechanism that provides for interruption of the measuring beam when the gauge is not in the measuring mode. The source, source holder, and ON-OFF mechanism are designed to remain together as an assembly and protect the source under accident conditions. This subassembly in AccuRay products is designed and fabricated to stay intact and protect the source under U.L. standard four hour fire test conditions (2000°F / 1093°C in 4 hours) wherever non-gaseous sources are

involved. The source housing provides an additional protected environment for the source, source holder, and ON-OFF mechanism and is lockable to prevent unauthorized access to the radioactive material. Secondary shielding is associated with the source housing as required for the radionuclide and activity involved.

All structural materials involved with retaining the source, source holder, and ON-OFF mechanism, as well as the source housing consist of high strength materials appropriate for the intended environments and having melting points above 1000°F/538°C such as titanium, steel, stainless steel, sintered tungsten, and aluminum. These materials may additionally be plated, coated, anodized or otherwise treated for added corrosion resistance and surface hardness. Methods of assembly and attachment include welding, bolting, and other high strength mechanical fasteners appropriate for the application and materials involved. These devices are often mounted in combination with one or more other nucleonic or non-nucleonic device to form a larger assembly of measuring devices which monitor more parameters of the measured material.

The source designs listed under Summary Data above and their ANSI N542 sealed source classifications are described in separate registrations. The source holder is a steel or tungsten alloy assembly which is secured with steel bolts. Dimensions for the source holder vary with the model of the source capsule, the radionuclide and activity, and the particular ON-OFF mechanism design to which it is attached. Lead filling is employed for additional shielding in some designs but the lead is never a structural element.

Different on-off mechanism designs are used in the device. All of the designs are either electrically or pneumatically operated and have a spring return so they are fail-safe if power is lost or intentionally removed. Either linear-action or rotary-action mechanisms may be employed to accomplish the "ON" or "OFF" condition. One or more electrical switches are operated directly by the moving mechanism parts to energize visual on-off indicators. The "CLOSED" indication is actuated only when the source is fully shielded. At all other times "OPEN" is indicated. On-off indicators are mounted near the device so they are visible to anyone working in the immediate vicinity. Other on-off indicators may be located throughout the associated signal processing, measurement, and control system (e.g. lights at the end of a frame or scanner, lights or video displays at operator monitoring and control stations, etc.).

External radiation levels depend upon the radioisotope and activity of the source, the dimensions of the device, the measuring gap, and shielding provided by the device, its mounting, and its surrounding mechanical environment. These are configured so that with the ON-OFF mechanism in the closed position, radiation levels measured external to the device do not exceed 200 uSv/hr and typically are less than 50 uSv/hr. The maximum intensity measured in the measuring gap with the source "OFF" is 500 uSv/hr. Radiation profiles using the maximum activity of each nuclide to be used are included in Appendix D and represent worst-case conditions. Typically, external radiation levels

will be less than illustrated because of added shielding, shielding and distance provided by adjacent sensors, other mechanical modules, the mounting assembly, and shrouds and covers.

An isometric projection sketch of the device showing the housings, source, source holder, and ON-OFF mechanism combinations and other safety information is attached in Appendix A (drawing DC-C-128703). (Brochures with drawings and photographs of typical assemblies, frames, and scanners which might incorporate the devices are attached to the cover letter -- they are not part of this application).

### 3.0 DETAILS OF CONSTRUCTION AND USE

#### 3.1 Conditions of Use

The device is used in a wide range of environmental conditions and hostile environments. Typical environments are those associated with measurement and control applications such as paper machines, metals rolling mills, plastics extrusion lines, fiberglass matt lines, tire fabric calendaring, and cigarette making machines. Each device is designed and constructed to withstand the temperature ranges, shock, and corrosive conditions that it is likely to be subjected to under normal circumstances of use as well as likely industrial accidents.

The device is typically an integral part of a much larger industrial measurement, control, and information system that monitors physical parameters of the materials being produced throughout the process and automatically controls the manufacturing process. It may be mounted inside the process machinery where it is not accessible, except when the line is shut down for maintenance. It may be mounted on a frame or scanner which is permanently installed into the process line and the device may then scan back and forth across the width of the process. The device might also be installed in a laboratory environment where it is used under ideal environmental conditions to measure batch samples. The proximity to personnel varies widely. Shielding, mounting assemblies, barriers, and controls are provided with each system to assure that radiation safety requirements are met and maintained. The expected useful life of the device is about 10 years. Through good maintenance programs, many devices are in continual use for much longer periods of time.

#### 3.2 Details of Construction

General Design Criteria: The devices are designed and the materials selected to provide assurance that:

1. The source housing will not melt at temperatures less than 1000° F (538° C) and that it meets the requirements for a Type A shipping container, as specified in 49CFR173.398(b).

2. The assembly of the sealed source, source holder, and ON-OFF mechanism will remain intact under industrial fire conditions represented by the Underwriters Laboratories' standard four hour fire (2000°F/1093°C). (The assembly is not expected to be operational after such test conditions.)
3. The ON-OFF mechanism will withstand 200,000 cycles of normal operation.
4. The sealed source, source holder, ON-OFF mechanism, and the source housing resist failure due to mechanical vibration, shock, and corrosive effects of the environment in which it is to function.

Specific Design Information: Annotated drawings are attached in Appendix B for each of the unit designs in this series. The basic details of construction are further described below.

TG-1 Unit Description --- see drawings DC-C-128679-000 and DC-C-126254-000 (TG-1 includes previous device models O-7, U-7, and U-7D)

\* Source models/max activity:

- S-11 / 37 GBq (1000 mCi) Kr-85
- S-16 / 185 GBq (5000 mCi) Am-241
- S-18 / 2.6 GBq (70 mCi) Sr-90
- S-20 / 37 GBq (1000 mCi) Pm-147
- CLC.D1 / 37 GBq (1000 mCi) Cm-244

- \* The sealed source is protected from abuse by the source holder (DC-126254), source holder adaptor (5), failsafe shutter (4), and source housing (1)(2)(3) assembly.
- \* The source/source holder/source holder adaptor/ shutter/source housing assembly provides the primary shielding to control the hazard from direct and scattered radiation when the shutter is closed (OFF). The detector housing, positioned opposite the source housing, provides the primary shielding for the measuring beam when the shutter is open (ON). Warning labels also indicate "Do not continuously occupy the area within (distance) of this device" -- the distance corresponding to 2.5 uSv/hr (0.25 mr/hr) for G.L. distributions or 6 uSv/hr (0.6 mr/hr) for S.L. distributions.
- \* Key locks securing both source housing side covers discourage unauthorized access to the sealed source.
- \* The measuring gap between the source housing and detector housing varies from 0.5 cm (1/4") to 10 cm (4") for beta emitting sealed sources (S-11, S-18, S- 20) and up to 50 cm (20") for gamma and bremsstrahlung sources (S-16, S-18, CLC.D1). The radiation measuring beam is typically inaccessible to personnel during use due to the presence of the measured material in the gap and the

hazards associated with the industrial process. ON-OFF indicators are visible to indicate the shutter position. Through various process and system interlocks, the shutter is normally closed when the device is not intentionally making measurements.

- \* The radioactive source is exposed only when the linear drive shutter blade (4) is opened (ON) to permit measurements. Otherwise the shutter is closed. This blade may be driven by either an electric or a pneumatic actuator which operates against a mechanical spring that otherwise holds the shutter blade closed (OFF). The failsafe shutter closes automatically when power is removed for any reason.
- \* An electrical switch which is coupled directly to the moving shutter parts actuates ON-OFF indicators in the associated measurement and control system. The indicators signal "OFF" (or Closed) when the shutter blade is fully closed. They indicate "ON" (or Open) when the shutter blade is not fully closed.

TG-2 Unit Description --- see drawings DC-C-128696-001 and DC-C-126254-000 (TG-2 includes previous device models M-3, M-3D, U-6, U-6D, U-8, U-8D)

- \* Source models/max activity:

- S-16 / 185 GBq (5000 mCi) Am-241
- S-18 / 11.1 GBq (300 mCi) Sr-90
- S-18 / 29.6 GBq (800 mCi) Sr-90 (Bremsstrahlung)
- CLC.D1 / 37 GBq (1000 mCi) Cm-244

- \* The sealed source is protected from abuse by the source holder (DC-126254), failsafe shutter (7)(8)(9), and source housing (1)(2)(3)(4)(5)(6) assembly.
- \* The source/source holder/shutter/source housing assembly provides the primary shielding to control the hazard from direct and scattered radiation when the shutter is closed (OFF). The detector housing, positioned opposite the source housing, provides the primary shielding for the measuring beam when the shutter is open (ON). Warning labels also indicate "Do not continuously occupy the area within (distance) of this device" -- the distance corresponding to 2.5 uSv/hr (0.25 mr/hr) for G.L. distributions or 6 uSv/hr (0.6 mr/hr) for S.L. distributions.
- \* Key locks securing the source housing side covers (or bottom cover) discourage unauthorized access to the sealed source.
- \* The measuring gap between the source housing and detector housing varies from 0.5 cm (1/4") to 10 cm (4") for beta emitting sealed sources (S-18) and up to 50 cm (20") for gamma and bremsstrahlung sources (S-16, S-18, CLC.D1). The radiation measuring beam is typically inaccessible to personnel during use due to the presence of the measured material in the gap and the hazards associated with

the industrial process. ON-OFF indicators are visible to indicate the shutter position. Through various process and system interlocks, the shutter is normally closed when the device is not intentionally making measurements.

- \* The radioactive source is exposed only when the linear drive shutter blade (7) is opened (ON) to permit measurements. Otherwise the shutter is closed. This blade may be driven by either an electric or a pneumatic actuator which operates against a mechanical spring that otherwise holds the shutter blade closed (OFF). The failsafe shutter closes automatically when power is removed for any reason.
- \* An electrical switch which is coupled directly to the moving shutter parts actuates ON-OFF indicators in the associated measurement and control system. The indicators signal "OFF" (or Closed) when the shutter blade is fully closed. They indicate "ON" (or Open) when the shutter blade is not fully closed.

TG-3 Unit Description --- see drawings DC-C-128702-001 and DC-C-126254-000 (TG-3 covers previous device model O-2)

- \* Source models/max activity:
  - S-11 / 55.5 GBq (1500 mCi) Kr-85
  - S-18 / 2.6 GBq (70 mCi) Sr-90
  - S-20 / 37 GBq (1000 mCi) Pm-147
- \* The sealed source is protected from abuse by the source holder (DC-126254), failsafe shutter (4)(5), and source housing (1)(2)(3) assembly.
- \* The source/source holder/shutter/source housing assembly provides the primary shielding to control the hazard from direct and scattered radiation when the shutter is closed (OFF). The detector housing, positioned opposite the source housing, provides the primary shielding for the measuring beam when the shutter is open (ON). Warning labels also indicate "Do not continuously occupy the area within (distance) of this device" -- the distance corresponding to 2.5 uSv/hr (0.25 mr/hr) for G.L. distributions or 6 uSv/hr (0.6 mr/hr) for S.L. distributions.
- \* Key lock securing the source housing bottom cover discourages unauthorized access to the sealed source.
- \* The measuring gap between the source housing and detector housing varies from 0.5 cm (1/4") to 10 cm (4") for the beta emitting sealed sources (S-11, S-18, S-20). The radiation measuring beam is typically inaccessible to personnel during use due to the presence of the measured material in the gap and the hazards associated with the industrial process. ON-OFF indicators are visible to indicate the shutter position. Through various process and system interlocks, the shutter is normally closed when the device is not intentionally making measurements.

- \* The radioactive source is exposed only when the linear drive shutter blade (4) is opened (ON) to permit measurements. Otherwise the shutter is closed. This blade may be driven by either an electric or a pneumatic actuator which operates against a mechanical spring that otherwise holds the shutter blade closed (OFF). The failsafe shutter closes automatically when power is removed for any reason.
- \* An electrical switch which is coupled directly to the moving shutter parts actuates ON-OFF indicators in the associated measurement and control system. The indicators signal "OFF" (or Closed) when the shutter blade is fully closed. They indicate "ON" (or Open) when the shutter blade is not fully closed.

TG-4 Unit Description --- see drawings DC-C-128698-001 and DC-C-128711-001 (TG-4 is new)

- \* Source models/max activity:
  - S-11 / 37 GBq (1000 mCi) Kr-85
  - S-16 / 185 GBq (5000 mCi) Am-241
  - S-18 / 2.6 GBq (70 mCi) Sr-90
  - S-20 / 37 GBq (1000 mCi) Pm-147
  - CLC.D1 / 37 GBq (1000 mCi) Cm-244
- \* The sealed source is protected from abuse by the source holder (DC-128711), failsafe source positioning mechanism (3)(4)(5), and source housing (1)(2) assembly.
- \* The source/source holder/source positioning mechanism/source housing assembly provides the primary shielding to control the hazard from direct and scattered radiation when the source positioning mechanism is OFF (closed). The detector housing, positioned opposite the source housing, provides the primary shielding for the measuring beam when the source positioning mechanism is ON (open). Warning labels also indicate "Do not continuously occupy the area within (distance) of this device" -- the distance corresponding to 2.5 uSv/hr (0.25 mr/hr) for G.L. distributions or 6 uSv/hr (0.6 mr/hr) for S.L. distributions.
- \* A key lock securing the top plate to the source housing enclosure discourages unauthorized access to the sealed source.
- \* The measuring gap between the source housing and detector housing varies from 0.5 cm (1/4") to 10 cm (4") for the beta emitting sealed sources (S-11, S-18, S-20) and up to 50 cm (20") for gamma and bremsstrahlung sources (S-16, S-18, CLC.D1). The radiation measuring beam is typically inaccessible to personnel during use due to the presence of the measured material in the gap and the hazards associated with the industrial process. ON-OFF indicators are visible to indicate the shutter position. Through various process and system interlocks, the shutter is normally closed when the device is not intentionally making measurements.

- \* The radioactive source is exposed only when the rotary source positioning mechanism (3)(4)(5) is opened (ON) to permit measurements. Otherwise the source is in the closed position. This rotating source positioning mechanism may be driven by either an electric or a pneumatic actuator which operates against a mechanical spring that otherwise holds the source closed (OFF). The failsafe mechanism closes automatically when power is removed for any reason.
- \* An electrical switch which is coupled directly to the moving source positioning mechanism parts actuates ON-OFF indicators in the associated measurement and control system. The indicators signal "OFF" (or Closed) when the source is fully shielded. They indicate "ON" (or Open) when the source is not fully shielded.

TG-5 Unit Description --- See drawing DC-A-128726-001  
(TG-5 covers previous device model C-7)

- \* Source Model/Max Activity:  
S-18 / 3.7 GBq (100 mCi) Sr-90
- \* This is a special case of the Transmission Gauge (TG) Series wherein the source housing and detector housing are combined into a single outer housing (1).
- \* The sealed source is protected from abuse by the base plate (2), shutter mechanism (3)(5), center block (4), and cover housing (1).
- \* The source/shutter/center block/base plate/cover assembly provides the radiation shielding to control the hazard from direct and scattered radiation.
- \* A key lock secures the cover in place so the unit cannot be disassembled thereby discouraging unauthorized access to the sealed source or removal from its installed location. The unit is mounted directly on an industrial production machine by fasteners (stanchions) which are only accessible when the locked cover is removed.
- \* The measuring gap consists of a tubular hole through the center block which guides the material to be measured and defines the passline. The dimensions of this opening vary, depending upon application, but will not exceed 2 cm diameter. The radiation measuring beam is inaccessible to personnel during use due the small passtube and the presence of the measured material. ON-OFF indicators are visible to indicate the shutter position. Through various process and system interlocks, the shutter is normally closed when the device is not intentionally making measurements.
- \* The radioactive source is exposed only when the linear drive shutter blade is opened (ON) to permit measurements. Otherwise the

shutter is closed. The shutter blade is driven by an electric solenoid which operates against a mechanical spring that otherwise holds the shutter blade closed (OFF). The failsafe shutter closes automatically when power is removed for any reason.

- \* An electrical switch which is coupled directly to the moving shutter parts actuates the ON-OFF indicators in the cover of the housing. The green OFF indicator is illuminated when the shutter blade is fully closed. The red ON indicator is illuminated when the shutter blade is not fully closed.

### 3.3 Labeling

Samples of some of the "Radiological Caution" and "Regulatory Conditions" labels are attached in Appendix C. As indicated in the subunit drawings, these labels are attached to the source holder and to the source housing. In addition, the sealed source is engraved or labeled with type and amount of radioactive material, date of measurement, and a unique serial number.

The "Regulatory Conditions" label and the "Caution Radioactive Material" label with model, quantity and isotope, date of measure, test interval, serial number, and distance specification are also affixed to the outer shrouds, carriage, frame, or mounting assembly containing the device for systems distributed to General Licensees so that they are clearly visible after the system is installed. (Only the caution label is used for systems distributed to Specific Licensees.)

The labels are fabricated in several forms and made from different materials which are designed to be highly durable. However, the environments in which the gauging systems operate are often dirty and harsh. The condition of all labels is determined during the periodic leak-test/radiological-inspection inspections performed by ABB field engineers, and they are cleaned or replaced as required. Appropriate labels are always stocked and available for sale to customers who make their own arrangements for these inspections.

### 3.4 Testing of Prototypes

Selected models of the ON-OFF mechanisms with their source holders attached have been tested for conformance with the general design criteria listed above by the Company and observed by Dr. Peter E. Korda of Korda and Associates, Ltd., Columbus, Ohio as follows:

Cycling of ON-OFF mechanisms and their ON-OFF indicator switches to failure;

Underwriters Laboratories four hour fire (2000°F/1093°C in 4 hours), followed by a six foot drop while incandescent, followed immediately by a quench in water at 68°F/20°C, followed by a fifteen foot drop on each of the three major axes.

In addition, other models of complete source housing assemblies have been tested by Underwriters Laboratories for the U.S. Atomic Energy Commission under Contract No. AT-(40-1)-3610.

The results of these exhaustive tests confirm that the design criteria are met in AccuRay devices. Engineering analysis and extrapolation based upon these tests and engineering data are used whenever new designs or modifications in designs are made. Every ON-OFF mechanism design is subjected to the 200,000 cycles of operation testing. We also have effective field experience feedback on the performance of all of the radiological features through our warranty replacement program and the periodic leak test/radiological inspection program.

These tests and the resulting device performance far exceed the conditions of use to which the devices are likely to be subjected.

### 3.5 Quality Control

These devices are distributed by ABB Process Automation, Inc. under authority of USNRC License No. 34-00255-06G. Quality control and assurance programs approved in that license apply.

### 3.6 Radiation Profiles

Isodistance radiation patterns are attached in Appendix D for each of the device designs in this series, using the maximum activity of each nuclide expected to be used in the device. These patterns were prepared using the procedure specified in ANSI N538, "Classification of Industrial Ionizing Radiation Gauging Devices", Section 7.3. The instruments used are covered in our USNRC licenses and are identified on the individual patterns.

Typically, external radiation levels accessible to operating personnel will be much less than illustrated by these patterns because lower activity sources may be used and the device is often incorporated into a larger assembly. Additional shielding and barriers are provided by adjacent sensors, other mechanical modules, the mounting assembly, added shielding, shrouds, and covers. (Also, see Section 2.0, regarding radiation levels with the shutter closed, and Section 3.7 for installation radiation specifications).

### 3.7 Installation

The measurement, control, and information systems containing these devices are typically installed at the user's site by ABB Process Automation. Our internal installation specifications require that radiation fields do not exceed 50 uSv/hr (5 mR/hr) beta-gamma 30 cm (12") beyond the bounds of the process equipment at locations which might be expected to be occupied by personnel when the gauge is measuring (shutter open). Device placement, natural barriers,

constructed barriers, automatic interlock systems or a combination of these may be utilized to meet the radiation limitations if required. Labels on the device, or the assembly containing the device, specify the distance to 2.5 uSv/hr (0.25 mR/hr) for G.L. devices or 6 uSv/hr (0.6 mR/hr) for S.L. devices when the ON-OFF mechanism is ON. These labels state: "Do not continuously occupy the area within (distance) of this device". A complete radiation survey is conducted, documented, and reviewed with the customer at each installation to assure specifications are met.

### 3.8 Radiological Safety Instructions

Radiological safety instructions are presented to the users of these devices in a number of different forms. Documentation includes the "AccuRay Systems Radiation Safety Manual", part number BC-S-8-019406-001, which is attached in Appendix E to this application. Radiological safety information and specific precautions are also contained in the other numerous manuals and documents which accompany the system where it would be logical to find such information.

As indicated in a previous section above, labels contain specific radiological information and warnings. Other documents accompanying the device which are listed in the next section below also provide radiological safety instructions.

All of these items are reviewed with the user in on-site training as part of the installation process. Training may be refreshed and reinforced during the periodic inspections and leak testing performed by our field service engineers. Additional training and refresher courses are available to the user upon request.

### 3.9 Documentation Accompanying the Device

In addition to the radiological safety instructions discussed in Section 3.8, samples of other radiation-safety-related documentation supplied with the device are attached in Appendix F as follows:

- \* Form BF-55, "Licensing of Radioactive Material, The General License"
- \* Form BF-700, "Gauge Installation Survey"
- \* Form BF-898, "Radiological Inspection Report"

These provide the user with licensing information, gauge installation survey results, and a certificate for the most recent leak test and safety features inspection. We also supply a copy of the "special form" certificate for sources that would not meet "Type A" requirements in normal form; and a copy of the documentation of the tests on the source shipping package demonstrating that it meets the requirements of a DOT Specification 7A package.

### 3.10 Servicing

Complete applications and engineering services are offered to all customers. Support is available 24 hours a day, 365 days a year through the ABB field service organization and the Corporate Radiological Emergency Committee. Clients have access to these services through a wide range of arrangements: dedicated ABB resident engineers working in their facility; regional field engineers and specialists who are on-call; and the Corporate continuously monitored telephone response lines. The full line of radiological services includes: pre-installation surveys; device installation; radiation survey at time of installation; maintenance and repair; periodic inspection and leak testing; source installation and replacement, temporary source storage and source disposal; relocation; training of operators and staff; emergency response; and radiological consulting.

### 3.11 Leak Testing

In accordance with USNRC requirements, the device is to be tested for possible leakage of radioactive material at intervals not to exceed 6 months. For devices that contain only gaseous sources (e.g. Kr-85) no leak test is required, but an annual shutter function test and safety features review needs to be performed.

### 3.12 Safety Analysis

The TG-series of devices are designed for General License distribution for use in industrial applications where they may be exposed to hostile environments. The radiation safety aspects follow or exceed the guidelines set by consensus standards: ANSI N538, "Classification of Industrial Ionizing Radiation Gauging Devices"; ANSI N542 and ISO 2919, "Sealed Radioactive Sources, Classification"; ISO 7205, "Radionuclide Gauges -- Gauges Designed for Permanent Installation"; and other guidelines. Safety analyses and many years of experience verify that the devices meet or exceed the requirements of 10CFR32.51(a)(2) whereby the designs provide reasonable assurance that:

- (i) the devices can be safely operated by persons not having training in radiological protection;
- (ii) under ordinary conditions of handling, storage and use of the devices, the byproduct material contained in a device will not be released or inadvertently removed from the device, and that it is unlikely that any person will receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in the table in 10CFR20.101(a); and
- (iii) under accident conditions (such as fire and explosion) associated with handling, storage and use of the devices, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column IV of the table in 10CFR32.24.

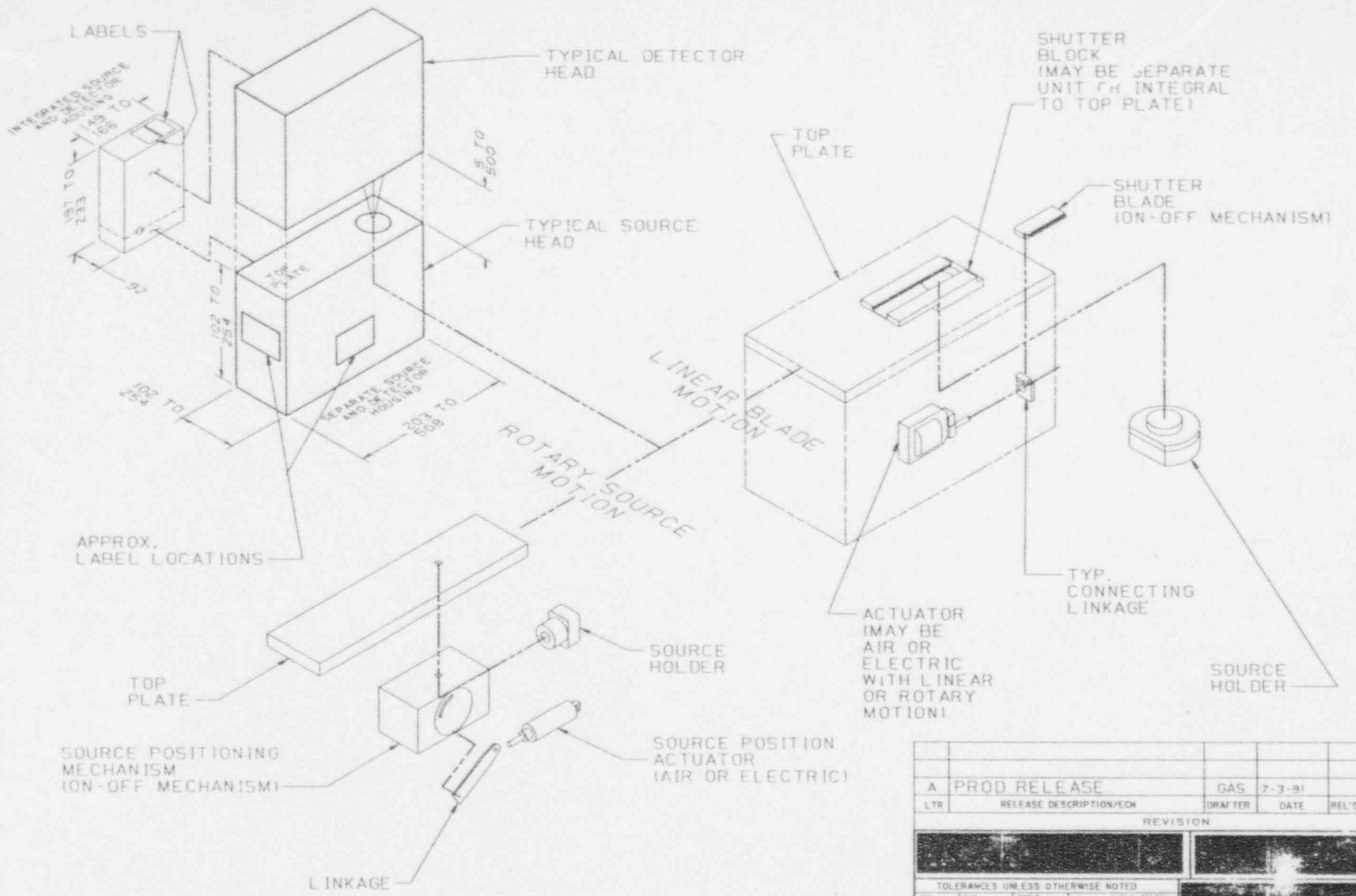
APPENDIX A

ISOMETRIC PROJECTION OF TG-SERIES DEVICES  
(Reference Section 2.0)

This drawing has been reduced from "D" size to "A" size to meet  
Regulatory Guide 10.10 style.


Contents:

- A-1 Cover page
- A-2 Drawing DC-D-128703-001, TG Series, Transmission Gauging Devices



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING-SEE SPS III, 8.6

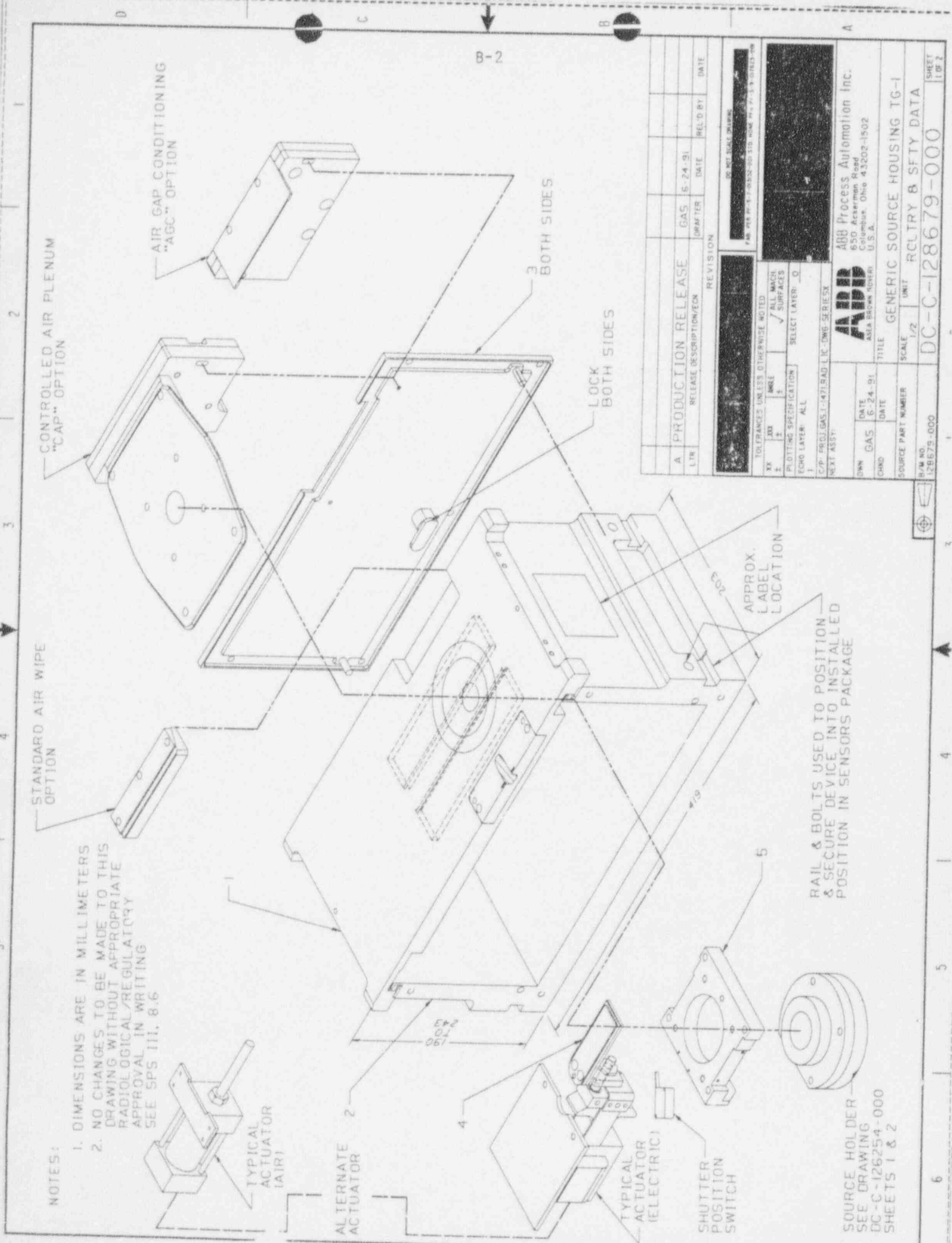
A		PROD RELEASE		GAS		7-3-91			
LTR	RELEASE DESCRIPTION/ECH			DRAFTER	DATE	REL'D BY	DATE		
REVISION									
TOLERANCES UNLESS OTHERWISE NOTED									
XX	XXX	ANGLE	ALL MACH SURFACES						
±	±	±							
PLOTING SPECIFICATION					SELECT LAYER				
ECHO LAYER									
C/P: PROJ GAS.1-1471.GENERIC-SOURCE-DWG-E									
NEXT ASSY:									
OWN	GAS	DATE	 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.						
CHWD		DATE	<b>TG SERIES</b> <b>TRANSMISSION GAUGING DEVICES</b>						
SOURCE PART NUMBER			SCALE	UNIT	RGULTRY & SFTY DATA				
R/W NO.			NONE		<b>DC-D-128703-001</b>				SHEET

APPENDIX BANNOTATED DRAWINGS FOR SPECIFIC DEVICES  
(Reference Section 3.2)

All drawings have been reduced from "C" size to "A" size to meet Regulatory Guide 10.10 style.

## Contents:

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B-5	TG-2 drawing, DC-C-128696-001,	sheet 2 of 2
B-6	TG-3 drawing, DC-C-128702-001,	sheet 1 of 2
B-7	TG-3 drawing, DC-C-128702-001,	sheet 2 of 2
B-8	TG-4 drawing, DC-C-128698-001,	sheet 1 of 2
B-9	TG-4 drawing, DC-C-128698-001,	sheet 2 of 2
B-10	TG-5 drawing, DC-C-128726-001,	sheet 1 of 2
B-11	TG-5 drawing, DC-C-128726-001,	sheet 2 of 2
B-12	Source holder drawing, DC-C-126254-000,	sheet 1 of 2
B-13	Source holder drawing, DC-C-126254-000,	sheet 2 of 2
B-14	Source holder drawing, DC-C-128711-001,	sheet 1 of 2
B-15	Source holder drawing, DC-C-128711-001,	sheet 2 of 2



NOTES:

1. DIMENSIONS ARE IN MILLIMETERS
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING SEE SPS III, 8.6


A		PRODUCTION RELEASE		GAS 5-24-91		DATE		DATE		DATE	
L/R		RELEASE DESCRIPTION/CHK		DRAFTER		REL'D BY		DATE		DATE	
XX		TOLERANCES UNLESS OTHERWISE NOTED		MMSE		SELECT LAYER: ALL		SELECT LAYER: 0		DATE	
Z		PLOT/ING SPECIFICATION		ALL		ALL		ALL		DATE	
ECHO LAYER: ALL		DATE		DATE		DATE		DATE		DATE	
C/P: FRI, GAS 1-14715AD L/R: DWG-SERIES X		DATE		DATE		DATE		DATE		DATE	
NEXT ASSY:		DATE		DATE		DATE		DATE		DATE	
DWN GAS 6-24-91		DATE		DATE		DATE		DATE		DATE	
CHND		DATE		DATE		DATE		DATE		DATE	
SOURCE PART NUMBER		SCALE		UNIT		RCLTRY		B SFTY DATA		SHEET	
128679-000		1/2		UNIT		RCLTRY		B SFTY DATA		1 OF 2	
R/M NO.		DC-C-128679-000		DC-C-128679-000		DC-C-128679-000		DC-C-128679-000		DC-C-128679-000	

SOURCE HOLDER  
SEE DRAWING  
DC-C-126254-000  
SHEETS 1 & 2

ITEM DESCRIPTION	ITEM NO.	MATERIAL THICKNESS	TYPICAL MATERIAL DESCRIPTION
SOURCE BASE PLATE	1	19.1	Fe STEEL, AISI CIII9 OR STAINLESS STEEL 316
SOURCE HEAD	2	6.4 MIN/31.8 MAX	Al or Fe ALUMINUM, 6061 OR ALMAG 35 OR STEEL AISI CIII9
SIDE COVERS	3	5.4	Al or Fe ALUMINUM, 6061-T651 OR STEEL AISI CIII9
SHUTTER BLADE	4	6.4 MIN	W or Fe HIGH DENSITY METAL, SINTERED TUNGSTEN (W) OR STAINLESS STEEL 316
SOURCE HOLDER ADAPTER	5	15.8 MIN	Fe STEEL, AISI C1018

NOTES:

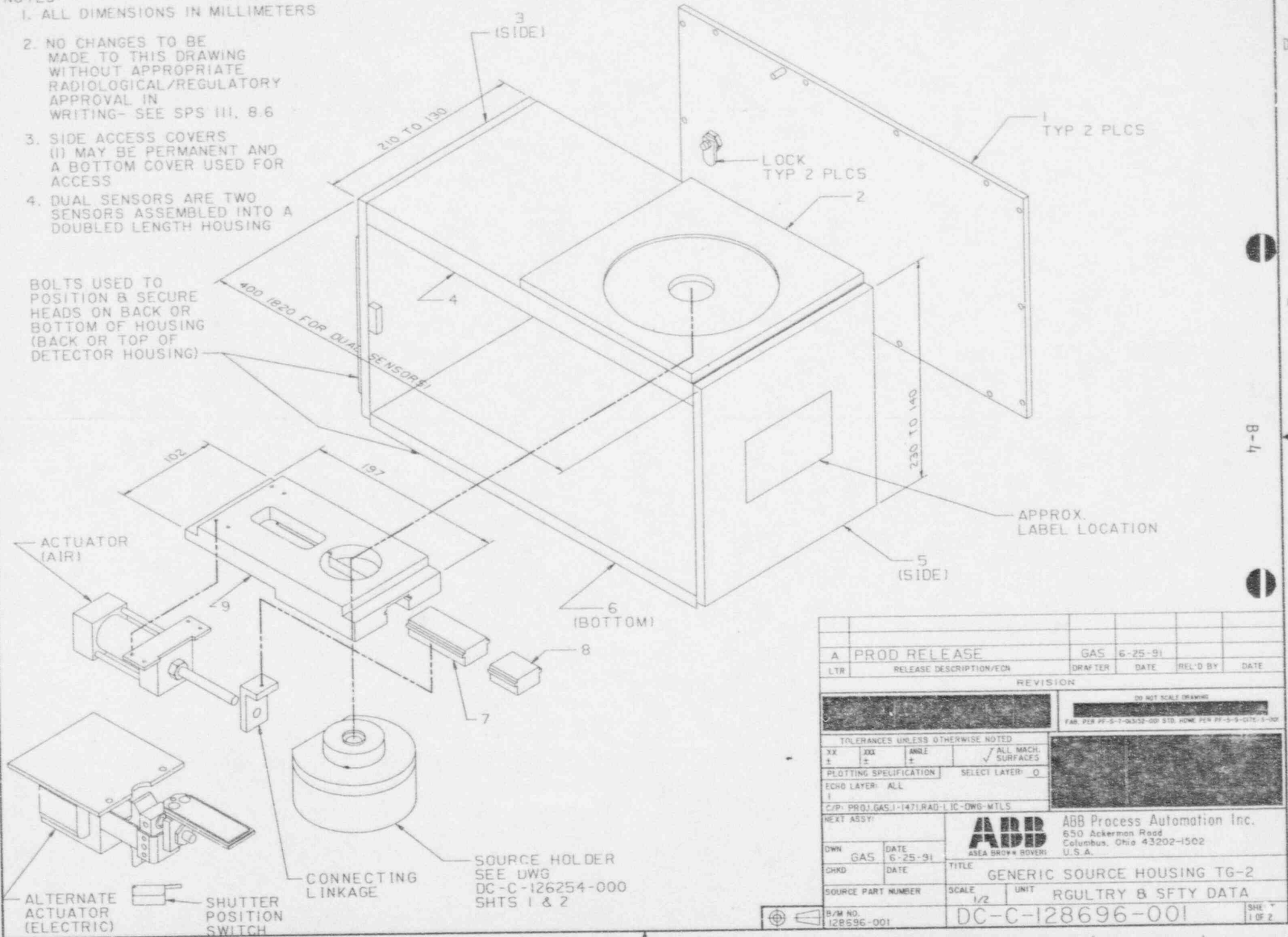
- 1 NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6.
- 2 DIMENSIONS ARE IN MILLIMETERS.


A		PRODUCTION RELEASE		GAS	6-24-91		
LTR	RELEASE DESCRIPTION/ECH	DRAFTER	DATE	REL'D BY	DATE		
REVISION							
[REDACTED]				DO NOT SCALE DRAWING FAB. PER PI 5-7-0352-001 STD HOME PLAN 17-5-9-01623-00			
TOLERANCES UNLESS OTHERWISE NOTED							
XX ±	XXX ±	ANGLE ±	✓ ALL MACH SURFACES				
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ GAS-1-1471.RAD-LIC-DWG-SERIESX							
NEXT ASSY:		 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.					
DWN	GAS	DATE	6-24-91	TITLE			
CHKD		DATE		GENERIC SOURCE HOUSING TG-1			
SOURCE PART NUMBER		SCALE	1/2	UNIT	RGLTRY & SFTY DATA		
B/W NO. 128679-000		DC-C-128679-000				SHEET 2 OF 2	

NOTES:

1. ALL DIMENSIONS IN MILLIMETERS
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING- SEE SPS III, 8.6
3. SIDE ACCESS COVERS (1) MAY BE PERMANENT AND A BOTTOM COVER USED FOR ACCESS
4. DUAL SENSORS ARE TWO SENSORS ASSEMBLED INTO A DOUBLED LENGTH HOUSING

BOLTS USED TO POSITION & SECURE HEADS ON BACK OR BOTTOM OF HOUSING (BACK OR TOP OF DETECTOR HOUSING)




A		PROD RELEASE		GAS		6-25-91	
LTR	RELEASE DESCRIPTION/ECH	DRAFTER	DATE	REL'D BY	DATE	REVISION	
						DO NOT SCALE DRAWING	
						FAB. PER PF-5-1-90352-000 STD. HOME. PER PF-5-9-9151-5-00	
TOLERANCES UNLESS OTHERWISE NOTED							
XX ±	XXX ±	ANGLE ±	✓ ALL MACH. SURFACES				
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ. GAS-1-1471.RAD-LIC-DWG-MTL5							
NEXT ASSY:		 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.					
OWN	GAS	DATE	6-25-91	TITLE	GENERIC SOURCE HOUSING TG-2		
CHKD		DATE		SCALE	1/2	UNIT	RGULTRY & SFTY DATA
SOURCE PART NUMBER		DC-C-128696-001		B/M NO.		128596-001	
				DC-C-128696-001		SHE. 1 OF 2	

ITEM DESCRIPTION	ITEM NO.	MATERIAL THICKNESS	TYPICAL MATERIAL DESCRIPTION
SIDE COVER	1	6.4	Fe STEEL AISI C1018
SOURCE HEAD PLATE	2	9.5	Fe STEEL AISI C1018
HOUSING(SIDES)	3,5	9.5	Fe STEEL AISI C1018
BASE PLATE	4	22.2	Fe STEEL AISI C1018
HOUSING(BOTTOM)	6	12.7	Fe STEEL AISI C1018
SHUTTER	7	6.4 MIN	W HIGH DENSITY METAL, SINTERED TUNGSTEN (W)
SHUTTER FILLER	8	6.4 MIN	W HIGH DENSITY METAL, SINTERED TUNGSTEN (W)
SHUTTER SLIDE	9	25.8 MIN	Fe STEEL AISI H117

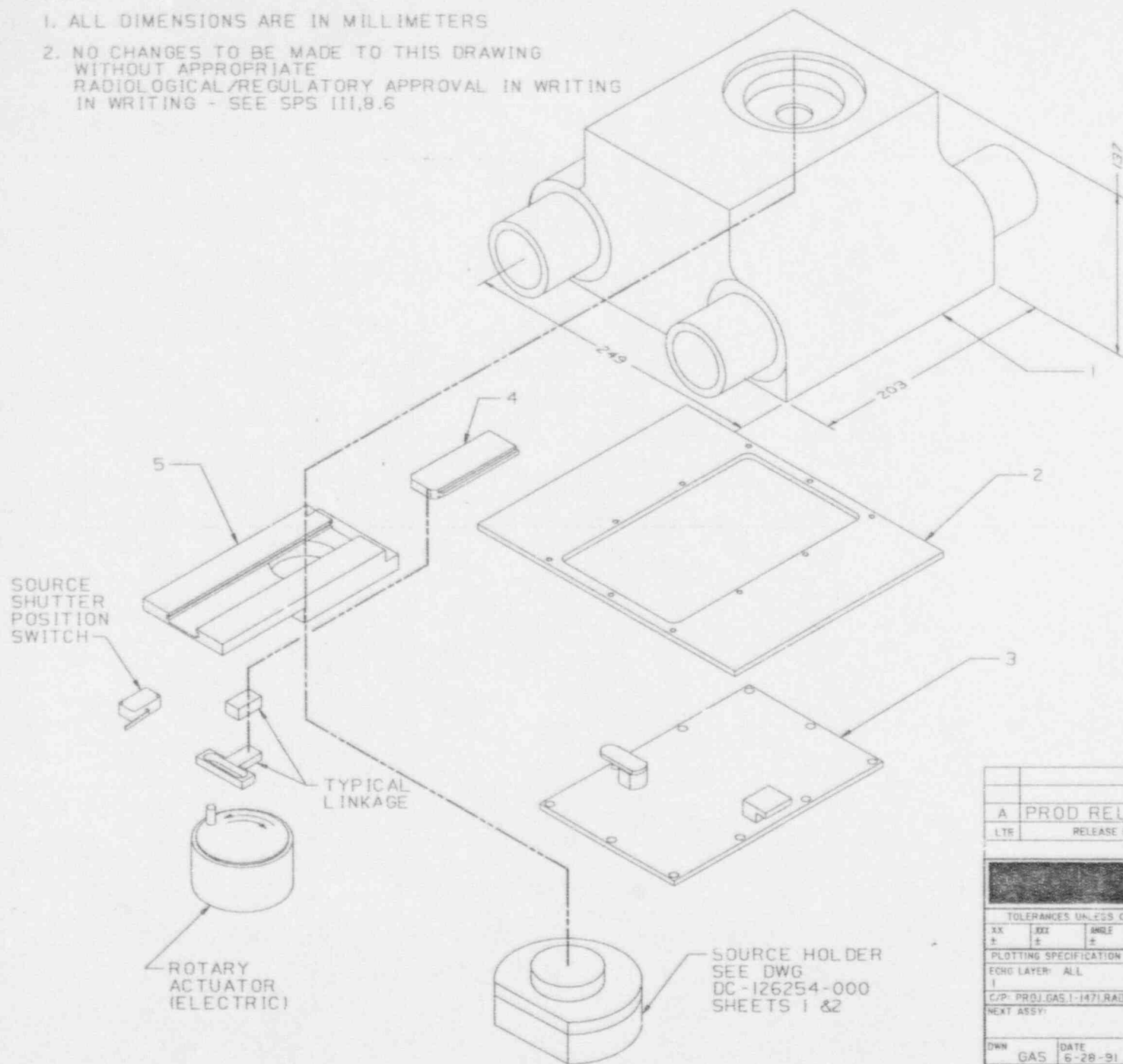
NOTES:


- NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6
- DIMENSIONS ARE IN MILLIMETERS

A		PROD RELEASE		GAS		8-25-91	
LTR	RELEASE DESCRIPTION/ECN			DRAFTER	DATE	REL'D BY	DATE
REVISION							
DO NOT SCALE DRAWING				FAB. PER ME 5-7-03152-001 STD. WORK PER PP 5-4-01613-009			
TOLERANCES UNLESS OTHERWISE NOTED							
XX	XXI	ANNE	✓ ALL MACH SURFACES				
+	+	+					
PLOTTING SPECIFICATION				SELF/T LAYER: 0			
ECHO LAYER: ALL							
C/P: PROJ GAS.1-1471.RAD.LIC-DWG-MTL5							
NEXT ASSY:				 <b>ABB</b> Process Automation Inc. 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.			
OWN	GAS	DATE	TITLE				
		6-25-91	GENERIC SOURCE HOUSING TG-2				
CHD		DATE	SOURCE PART NUMBER				
			SCALE	UNIT	RGULTRY & SFTY DATA		
			1/2		DC-C-128696-001		
B/M NO.		SHEET		2 OF 2			
128696-001							

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING IN WRITING - SEE SPS III.8.6



A		PROD RELEASE		GAS		6-28-91	
LTE	RELEASE DESCRIPTION/EON	DRAFTER	DATE	REL'D BY	DATE		
REVISION							
TOLERANCES UNLESS OTHERWISE NOTED							
XX	XXX	ANGLE	ALL MACH SURFACES				
+	±	±	✓				
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ GAS 1-1471RAD-LIC-DWG-MIN10							
NEXT ASSY:							
DWN		DATE		 <b>ABB</b> Process Automation Inc. 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.			
GAS		6-28-91					
CHRD		DATE		TITLE			
				GENERIC SOURCE HOUSING TG-3			
SOURCE PART NUMBER		SCALE	UNIT	RDLG CAL SURCE & DATA			
		1/2					
B/M NO.		128702-001		DC-C-128702-001			SHEET
							1 OF 2

ITEM DESCRIPTION	ITEM NO.	MATERIAL THICKNESS	TYPICAL MATERIAL DESCRIPTION
HOUSING	1	5.0	Al ALUMINUM ALLOY ALCOA 319 SAE 329
SOURCE HOUSING COVER	2	4.6	Al ALUM SHEET 2024
ACCESS PLATE	3	4.6	Al ALUM SHEET 2024
SHUTTER BLADE	4	6.4 MIN	W or Fe HIGH DENSITY METAL OR STEEL
SHUTTER SLIDE	5	9.5	Fe STEEL

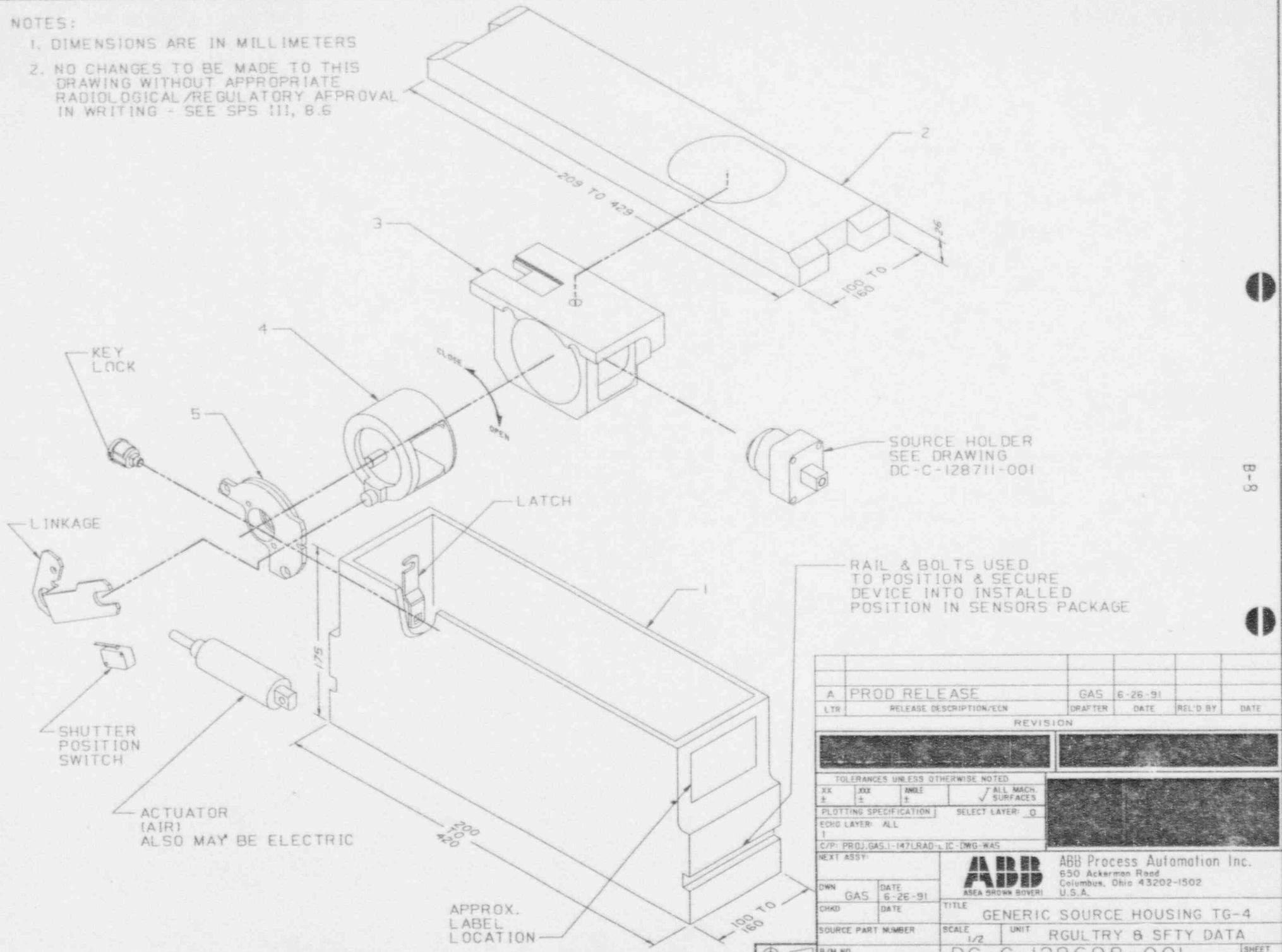
NOTES:

- NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6
- DIMENSIONS ARE IN MILLIMETERS

A		PROD RELEASE		GAS		6-28-91	
LTR	RELEASE DESCRIPTION/ECN	DRAFTER	DATE	REL'D BY	DATE		
REVISION							
TOLERANCES UNLESS OTHERWISE NOTED							
XX	XXX	ANGLE	✓ ALL MACH SURFACES				
±	±	±					
PLOTTING SPECIFICATION				SELECT LAYER: 0			
ECHO LAYER: ALL							
P.P. PROJ.GAS.1-1471.RAD-LIC-DWG-MINIQ							
NEXT ASSY:							
DWN		DATE		ABB Process Automation Inc.			
GAS		6-28-91		650 Ackerman Road			
CHRD		DATE		Columbus, Ohio 47202-1502			
				U.S.A.			
				TITLE			
				GENERIC SOURCE HOUSING TG-3			
SOURCE PART NUMBER		SCALE		UNIT			
		1/2		RDLG CAL SURCE & DATA			
B/M NO.		128702-001		DC-C-128702-001			
						SHEET	
						2 OF 2	

NOTES:

1. DIMENSIONS ARE IN MILLIMETERS
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6




RAIL & BOLTS USED TO POSITION & SECURE DEVICE INTO INSTALLED POSITION IN SENSORS PACKAGE

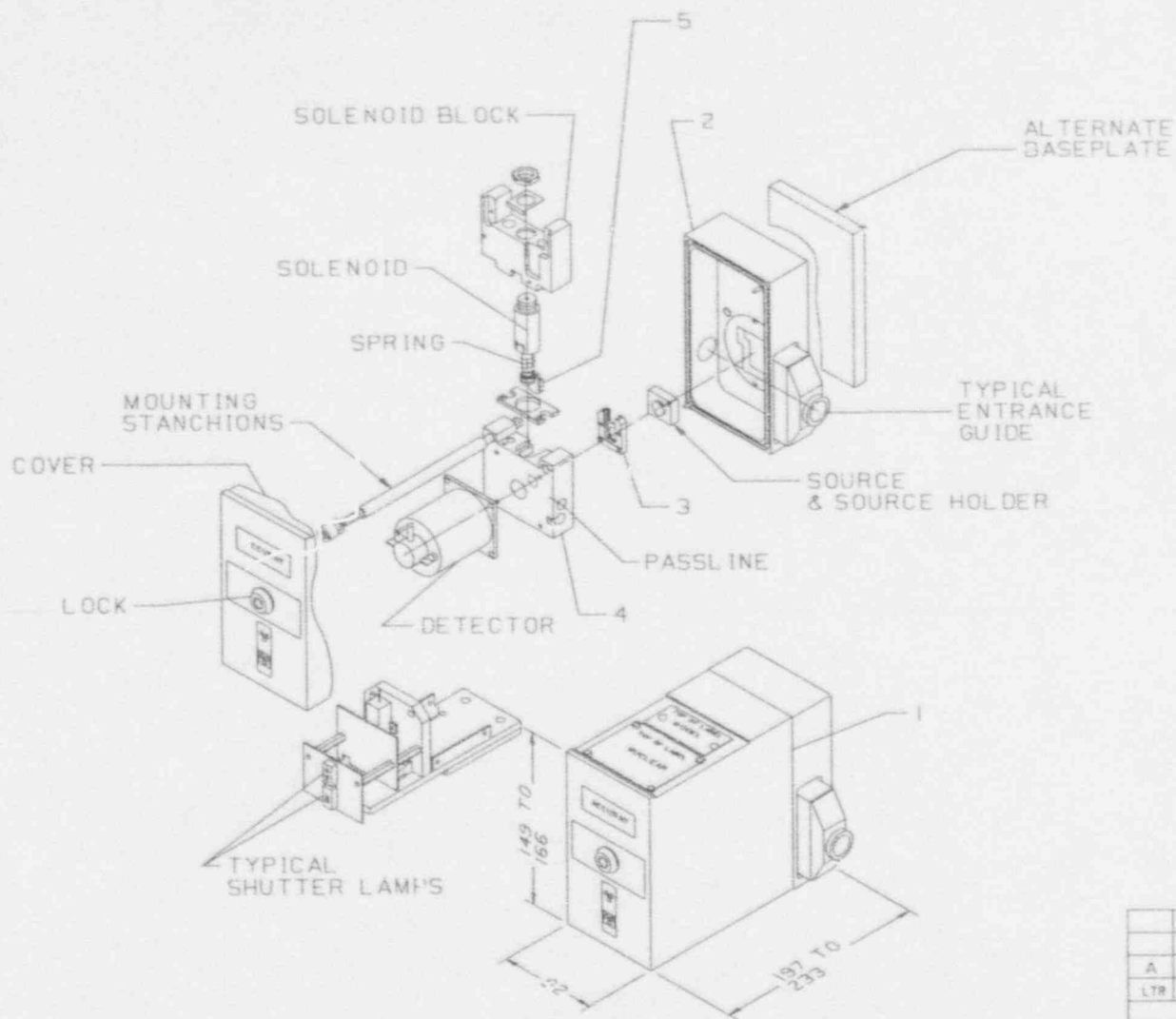
A		PROD RELEASE		GAS		6-26-91	
LTR	RELEASE DESCRIPTION/ECN	DRAFTER	DATE	REL'D BY	DATE	REVISION	
TOLERANCES UNLESS OTHERWISE NOTED		XX ±    XXX ±    ANGLE ±    ✓ ALL MACH. SURFACES					
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL		1					
C/P: PROJ. GAS. I-147LRAD-L IC-DWG-WAS		NEXT ASSY:					
OWN	GAS	DATE	<b>ABB</b> ABB Process Automation Inc. 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.				
CHKD	DATE	TITLE	GENERIC SOURCE HOUSING TG-4				
SOURCE PART NUMBER		SCALE	UNIT	RGULTRY & SFTY DATA			
B/M NO. 128698-001		SCALE 1/2	UNIT			DC-C-128698-001	
						SHEET 1 OF 2	

ITEM DESCRIPTION	ITEM NO.	MATERIAL THICKNESS	TYPICAL MATERIAL DESCRIPTION
ENCLOSURE	1	5.0 MIN.	Al ALUMINUM
TOP PLATE	2	25.4	Al ALUMINUM
HOUSING	3		Fe STEEL, AISI 4140 OR STAINLESS STEEL
ROTARY DRUM	4		Fe 303 STAINLESS STEEL
BEARING CAP	5		Fe 303 STAINLESS STEEL

NOTES:


- NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6
- DIMENSIONS ARE IN MILLIMETERS

A		PROD RELEASE		GAS	6-26-91			
LTR	RELEASE DESCRIPTION/ECN			DRAFTER	DATE	REL'D BY	DATE	
REVISION								
TOLERANCES UNLESS OTHERWISE NOTED								
XX ±	XXX ±	ANGLE ±		<input checked="" type="checkbox"/> ALL MACH. SURFACES				
PLOTting SPECIFICATION			SELECT LAYER: G					
ECHO LAYER: ALL								
C/P: PROJ.GAS.I-1471.RAD-LIC-DWG-WAS								
NEXT ASSY:								
DWN	GAS	DATE	6-26-91	 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.				
CHRD		DATE						
SOURCE PART NUMBER			SCALE	1/2	UNIT	RGULTRY & SFTY DATA		
B/M NO. 128698-001			DC-C-128698-001				SHEET 2 OF 2	



NOTES:


1. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT RADIOLOGICAL/REGULATORY APPROVAL IN WRITING, SEE SPS111, 8.6
2. DIMENSIONS ARE IN MILLIMETERS

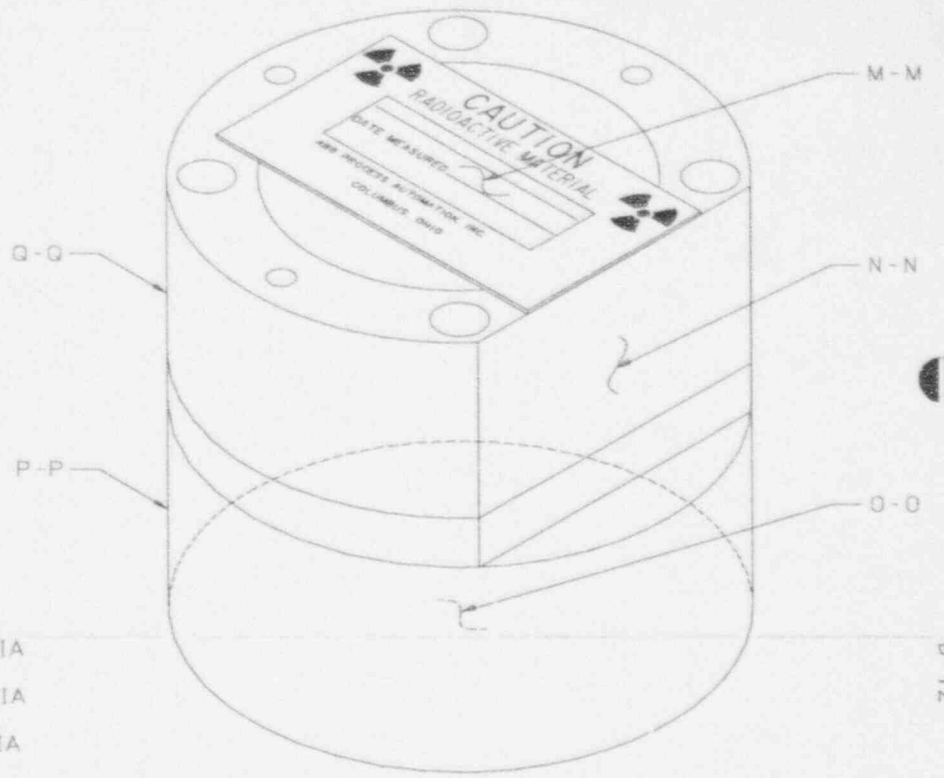
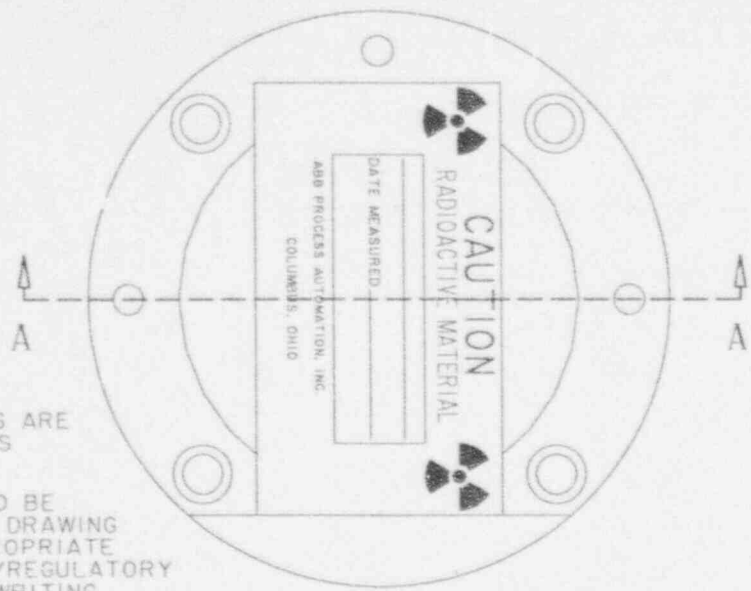
A		PROD RELEASE		GAS		7-10-91	
LTR	RELEASE DESCRIPTION/ECH	DRAFTER	DATE	REL'D BY	DATE	REVISION	
TOLERANCES UNLESS OTHERWISE NOTED XX .XX ± *    .XX ± *    .XX ± *    * ✓ ALL MACH. SURFACES							
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ: GAS-1-1471 RAD-1 IC-DWG-T08							
NEXT ASSY:		 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.					
OWN	GAS	DATE	TITLE				
CHKD		DATE	GENERIC SOURCE HOUSING 7G-5				
SOURCE PART NUMBER		SCALE	UNIT	RGULTRY & SFTY DATA			
B/M NO. 128726-001		DC-C-128726-001		SHEET		1 OF 2	

ITEM DESCRIPTION	ITEM NO.	MATERIAL THICKNESS	TYPICAL MATERIAL DESCRIPTION
ENCLOSURE	1	1.5 MIN	Al or Fe ALUMINUM OR STEEL
BASEPLATE	2	6.3 MIN	Al or Fe or W ALUMINUM OR STEEL OR HIGH DENSITY METAL, SINTERED TUNGSTEN
SHUTTER GUIDE	3	6.3	Fe STAINLESS STEEL
CENTER BLOCK	4	22.2 MIN	W HIGH DENSITY METAL, SINTERED TUNGSTEN
SHUTTER BLADE	5	1.5	Fe STAINLESS STEEL

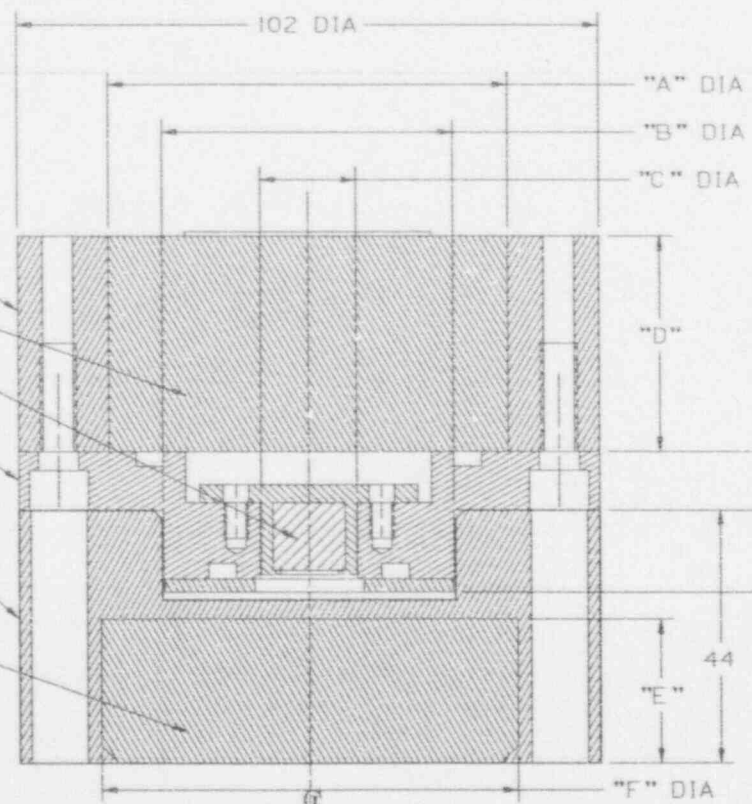
NOTES:

1. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6
2. DIMENSIONS ARE IN MILLIMETERS

A		PROD RELEASE		GAS		7-10-91	
LTR	RELEASE DESCRIPTION/ECN	DRAFTER	DATE	REL'D BY	DATE		
REVISION							
TOLERANCES UNLESS OTHERWISE NOTED							
XX ± *	XXX ± *	ANGLE ± *	* <input checked="" type="checkbox"/> ALL MACH SURFACES				
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ.GAS.I-1471.RAD-LIC-DWG-TOB							
NEXT ASSY:							
DWN		DATE		 <b>ABB Process Automation Inc</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.			
GAS		7-10-91					
CHKD		DATE		TITLE			
				GENERIC SOURCE HOUSING TG-5			
SOURCE PART NUMBER		SCALE		UNIT			
		.3		RGULTRY & SFTY DATA			
B/M No. 128726-001		DC-C-128726-001				SHEET 2 OF 2	



- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS
  2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING SEE SPS III, 8.6



SOURCE HOLDER

HEALTH SHIELD:  
PRESENT FOR SHIPPING OR STORAGE.  
REMOVED FOR INSTALLATION OF HOLDER IN HOUSING

SECTION A-A

B CLARIFICATION		GAS 7-3-91	
A PRODUCTION RELEASED		DCD	
LTR	RELEASE DESCRIPTION/ECN	DRAFTER	DATE
REVISION			
DO NOT SCALE DRAWING			
FAB. PER PF-6-7-0530-001 STD. HOME PER PF-5-9-01763-000			
TOLERANCES UNLESS OTHERWISE NOTED			
XX	XXX	MMSE	* ALL MACH. SURFACES
± *	± *	± *	
PLOTting SPECIFICATION		SELECT LAYER: 0	
ECHO LAYER: ALL			
C/P: PROJ DCD 49200.GENERIC-SRC-SHIELD			
NEXT ASSY:			
OWN	DATE	TITLE	
DCD	7-03-91	SOURCE HOLDER & HEALTH SHIELD	
CHKD	DATE	SCALE	UNIT
		3/2	REGULATORY & SAFETY DATA
SOURCE PART NUMBER		REGULATORY & SAFETY DATA	
B/M NO. 126254-000		DC-C-126254-000	
			SHEET 1 OF 2

SOURCE	3	Kr85 250	Kr85 1000	Sr90 16	Sr90 70	Sr90 300	Sr90 800	Pm147 1000	Am241 1000	Am241 3000	Cm244 1000
SHELL-HOLDER BACK	1	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$	Fe $\triangle_3$
SHIELD-HOLDER BACK	2	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	N/A $\triangle_9$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$
HOLDER	4	Fe $\triangle_4$	W $\triangle_7$	Fe $\triangle_4$	Fe $\triangle_4$	W $\triangle_7$	W $\triangle_7$	Fe $\triangle_5$	Fe $\triangle_5$	Fe $\triangle_5$	Fe $\triangle_5$
SHELL-HEALTH SHIELD	5	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$	Fe $\triangle_4$
SHIELD-HEALTH SHIELD	6	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	Pb $\triangle_6$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$

DIMENSIONS MM	A	65	65	65	65	65	65	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$
	B	51	51	51	51	51	51	60	60	60	60
	C	17	17	17	17	17	17	33	33	33	33
	D	25	25	25	25	38	38	14	14	14	14
	E	25	25	25	25	25	25	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$
	F	73	73	73	73	73	73	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$	N/A $\triangle_8$

SURFACE RADIATION EXPOSURE RATE MR/HR (VICTOREEN 491.30MG/CM <sup>2</sup> )	M-M	3.7	25	0.8	1.1	2.0	24	BG *	0.8	2.6	2.1
	N-N	26	20	3.5	14	12	23	BG *	0.4	1.4	1.3
	O-O	1.2	7	2.1	7.6	25	43	BG *	0.3	0.4	1.3
	P-P	10	17	2.7	8.0	25	44	BG *	0.3	0.7	1.1
	Q-Q	11	7	1.7	5.6	8.0	10	BG *	0.2	0.7	1.1

\* BACKGROUND

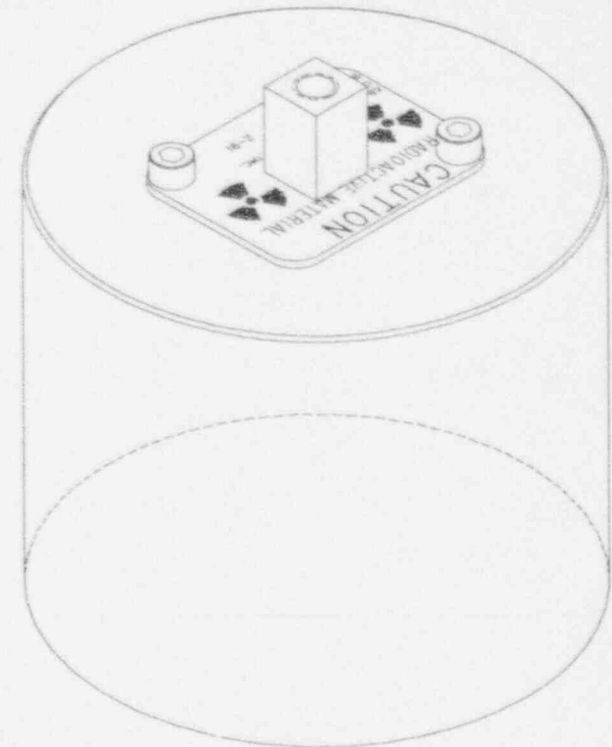
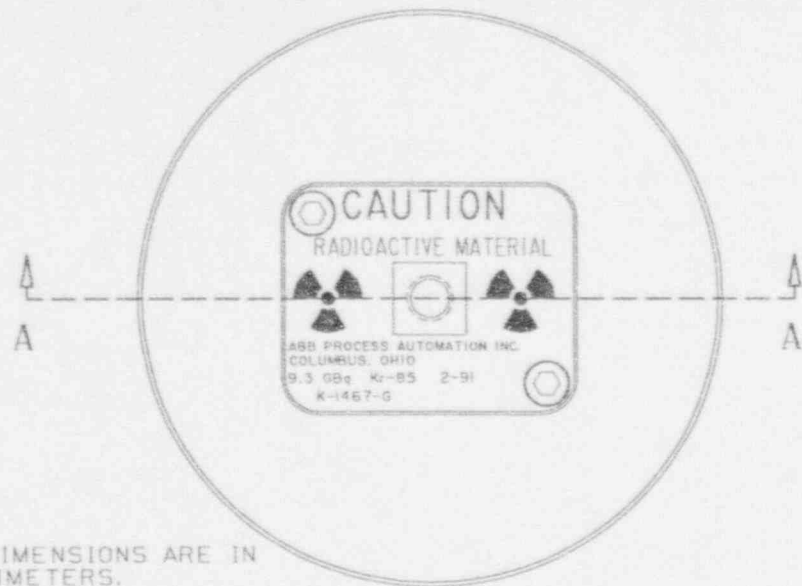
NOTES:

- NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6.
- DIMENSIONS ARE IN MILLIMETERS.

MATERIAL DESCRIPTION:

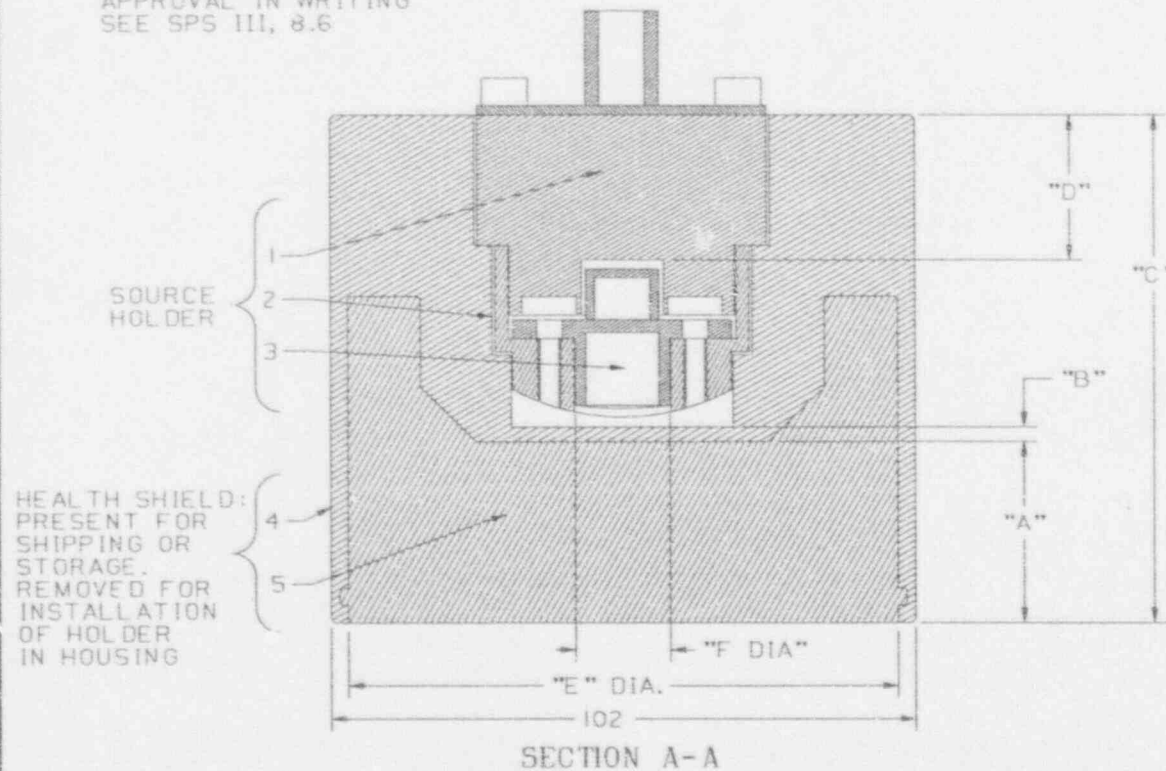
- $\triangle_3$  Fe PAB PART NO. US-S-012879-004 STAINLESS STEEL, ALLOY TYPE 303
- $\triangle_4$  Fe PAB PART NO. UU-S-017969-001 STEEL, AISI 12L14
- $\triangle_5$  Fe PAB PART NO. UU-S-011386-003 STEEL, AISI C1040, C1045 OR C1141
- $\triangle_6$  Pb PAB PART NO. UX-S-011405-001 LEAD ALLOY (Pb) WITH 2-3% ANTIMONY (Sb)
- $\triangle_7$  W PAB PART NO. UX-S-UX0037-002 HIGH DENSITY METAL, SINTERED TUNGSTEN (W)
- $\triangle_8$  N/A NOT APPLICABLE (NO CUTOUT FOR LEAD FILL).


B CLARIFICATION		GAS		7-3-91	
A PRODUCTION RELEASED		DCD			
LTR	RELEASE DESCRIPTION/ECN	DRAFTER	DATE	REL'D BY	DATE
REVISION					
TOLERANCES UNLESS OTHERWISE NOTED			DO NOT SCALE DRAWING		
XX	XXX	ANNE	FAB. PER PF-3-7-0630-001 STD. HOME PER PF-3-9-01762-00		
±*	±*	±*			
PLOTING SPECIFICATION			SELECT LAYER: 0		
ECNO LAYER: ALL					
C/P: PRGJ.DCD.49200.GENERIC-SRC-SHIELD					
NEXT ASSY:					
OWN	DATE	ABB Process Automation, Inc.			
DCD	7-03-91	650 Ackerman Road			
CHD	DATE	Columbus, Ohio 43202-1502			
TITLE		U.S.A.			
SOURCE PART NUMBER		SOURCE HOLDER & HEALTH SHIELD			
SCALE		REGULATORY & SAFETY DATA			
3/2		UNIT			
B/M NO.		DC-C-126254-000			
126254-000		SHEET			
		2 OF 2			



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING SEE SPS III, 8.6



A		PROD RELEASE		GAS		7-09-91	
LTR	RELEASE DESCRIPTION/ECN			DRAFTER	DATE	REL'D BY	F. *6
REVISION							
TOLERANCES UNLESS OTHERWISE NOTED				ALL MACH SURFACES			
XX ±*	XXY ±*	ANGLE ±*	* ✓ ALL MACH SURFACES				
PLOTTING SPECIFICATION		SELECT LAYER: 0					
ECHO LAYER: ALL							
C/P: PROJ.GAS.1-1471.WAS-SRC-SHIELD							
NEXT ASSY:				 <b>ABB Process Automation Inc.</b> 650 Ackerman Road Columbus, Ohio 43202-1502 U.S.A.			
DWN	GAS	DATE	7-09-91	TITLE			
CHKD		DATE		SOURCE HOLDER & HEALTH SHIELD			
SOURCE PART NUMBER		SCALE	1.5:1	UNIT	REGULATORY & SAFETY DATA		
B/W NO. 128711-001		DC-C-128711-001				SHEET 1 OF 2	

SOURCE	3	Kr85 250	Kr85 1000	Sr90 16	Sr90 70	Pml47 1000	Cm244 1000
SHIELD-HOLDER BACK	1	W $\triangle 5$	W $\triangle 5$	W $\triangle 5$	W $\triangle 5$	Fe $\triangle 3$	Fe $\triangle 3$
HOLDER	2	W $\triangle 5$	W $\triangle 5$	W $\triangle 5$	W $\triangle 5$	Fe $\triangle 3$	Fe $\triangle 3$
SHELL-HEALTH SHIELD	4	Fe $\triangle 3$	Fe $\triangle 3$	Fe $\triangle 3$	Fe $\triangle 3$	Fe $\triangle 3$	Fe $\triangle 3$
SHIELD-HEALTH SHIELD	5	Pb $\triangle 4$	Pb $\triangle 4$	Pb $\triangle 4$	Pb $\triangle 4$	N/A $\triangle 6$	N/A $\triangle 6$

DIMENSIONS MM	A	32	32	32	32	N/A $\triangle 6$	N/A $\triangle 6$
	B	3	3	3	3	6	6
	C	89	89	89	89	45	45
	D	25	25	25	25	22	22
	E	96	96	96	96	N/A $\triangle 6$	N/A $\triangle 6$
	F	17	17	17	17	24	24

NOTES:

- NO CHANGES TO BE MADE TO THIS DRAWING WITHOUT APPROPRIATE RADIOLOGICAL/REGULATORY APPROVAL IN WRITING - SEE SPS III, 8.6.
- DIMENSIONS ARE IN MILLIMETERS.

MATERIAL DESCRIPTION:

- $\triangle 3$  Fe PAB PART NO. US-S-012879-004 STAINLESS STEEL, ALLOY TYPE 303
- $\triangle 4$  Pb PAB PART NO. UX-S-011405-001 LEAD ALLOY (Pb) WITH 2-3% ANTIMONY (Sb)
- $\triangle 5$  W PAB PART NO. UX-S-UX0037-000 HIGH DENSITY METAL, SINTERED TUNGSTEN (W)
- $\triangle 6$  N/A NOT APPLICABLE (NO CUTOUT FOR LEAD FILL).

A		PROD RELEASE		GAS		7-09-91	
LTR	RELEASE DESCRIPTION/ECH			DRAFTER	DATE	REL'D BY	DATE
REVISION							
TOLERANCES UNLESS OTHERWISE NOTED							
XX	XXX	ANGLE	* <input checked="" type="checkbox"/> ALL MACH. SURFACES				
± *	± *	± *					
PLOTTING SPECIFICATION				SELECT LAYER: 0			
ECHO LAYER: ALL							
C/P: PROJ.GAS.1-1471.WAS-5RC-SHIELD							
NEXT ASSY:							
DWN	GAS	DATE	TITLE				
		7-09-91	SOURCE HOLDER & HEALTH SHIELD				
CHKD		DATE	SCALE				
			FULL UNIT REGULATORY & SAFETY DATA				
SOURCE PART NUMBER			SCALE			UNIT	
			FULL			REGULATORY & SAFETY DATA	
B/M NO.		DC-C-128711-001				SHEET	
12B711-001						2 OF 2	

B-15



A

APPENDIX C

SAMPLE RADIATION LABELS  
(Reference Section 3.3)

<b>CAUTION</b> RADIOACTIVE MATERIAL	
	MODEL _____
	DATE MEAS. _____
	TEST INTERVAL _____
REMOVAL OF THIS LABEL IS PROHIBITED	
DO NOT CONTINUOUSLY OCCUPY THE	
AREA WITHIN _____ OF THIS DEVICE	
035639-000	

<p>REGULATORY CONDITIONS</p> <p>THE RECEIPT, POSSESSION, USE, AND TRANSFER OF THIS DEVICE ARE SUBJECT TO A GENERAL LICENSE OR THE EQUIVALENT AND THE REGULATIONS OF THE U.S. NRC OR A STATE WITH WHICH THE NRC HAS ENTERED INTO AN AGREEMENT FOR THE EXERCISE OF REGULATORY AUTHORITY.</p> <p>ABANDONMENT OR DISPOSAL PROHIBITED UNLESS TRANSFERRED TO PERSONS SPECIFICALLY LICENSED BY NRC OR AN AGREEMENT STATE.</p> <p>OPERATION PROHIBITED IF THERE IS AN INDICATION OF FAILURE OF, OR DAMAGE TO, CONTAINMENT OF RADIOACTIVE MATERIAL. INSTALLATION, DISMANTLING, RELOCATION, REPAIR OR TESTING SHALL BE PERFORMED BY PERSONS SPECIFICALLY LICENSED BY NRC OR AN AGREEMENT STATE.</p> <p>DEVICE SHALL BE TESTED FOR LEAKAGE OF RADIOACTIVE MATERIAL AND PROPER FUNCTIONING OF THE ON-OFF MECHANISM, AND INDICATOR, IF ANY, AT INTERVALS SPECIFIED ON THE ATTACHED YELLOW LABEL.</p> <p>35715-001 REMOVAL OF THIS LABEL IS PROHIBITED</p>
--

	<b>CAUTION</b> RADIOACTIVE MATERIAL	
DATE MEASURED _____		
ABB PROCESS AUTOMATION INC.		
COLUMBUS, OHIO		
060782-001-E		

APPENDIX DISODISTANCE RADIATION PATTERNS  
(Reference Section 3.6)

## Contents:

D-1	Cover page
D-2	TG-1, S-11, 37 GBq Kr-85
D-3	TG-1/TG-2, S-16, 185 GBq Am-241
D-4	TG-1, S-18, 2.6 GBq Sr-90
D-5	TG-1, S-20, 37 GBq Pm-147
D-6	TG-1, CLC.D1, 37 GBq Cm-244
D-7	TG-2, S-18, 11.1 GBq Sr-90
D-8	TG-2, S-18, 29.6 GBq Sr-90 (Bremsstrahlung)
D-9	TG-2, CLC.D1, 37 GBq Cm-244
D-10	TG-3, S-11, 55.5 GBq Kr-85
D-11	TG-3, S-18, 2.6 GBq Sr-90
D-12	TG-3, S-20, 37 GBq Pm-147
D-13	TG-4, S-11, 37 GBq Kr-85
D-14	TG-4, S-11, 37 GBq Kr-85 (3 module head pkg)
D-15	TG-4, S-16, 185 GBq Am-241
D-16	TG-4, S-18, 2.6 GBq Sr-90 (3 module head pkg)
D-17	TG-4, S-20, 37 GBq Pm-147
D-18	TG-4, CLC.D1, 37 GBq Cm-244
D-19	TG-5, S-18, 3.7 GBq Sr-90

ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 07/LK5/212	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-1	Sensor / Frame LK5-07BH	Gap 13 mm	Safety Classification ANSI-	
Source S.N. K-1000-H [RADPAT01]-31	Source Model S-11	Source P.N. 12112-004	Qty / Isotope 37 GBq / Kr-85	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

SOURCE "ON" / ["OFF"]

(uSv/hr)

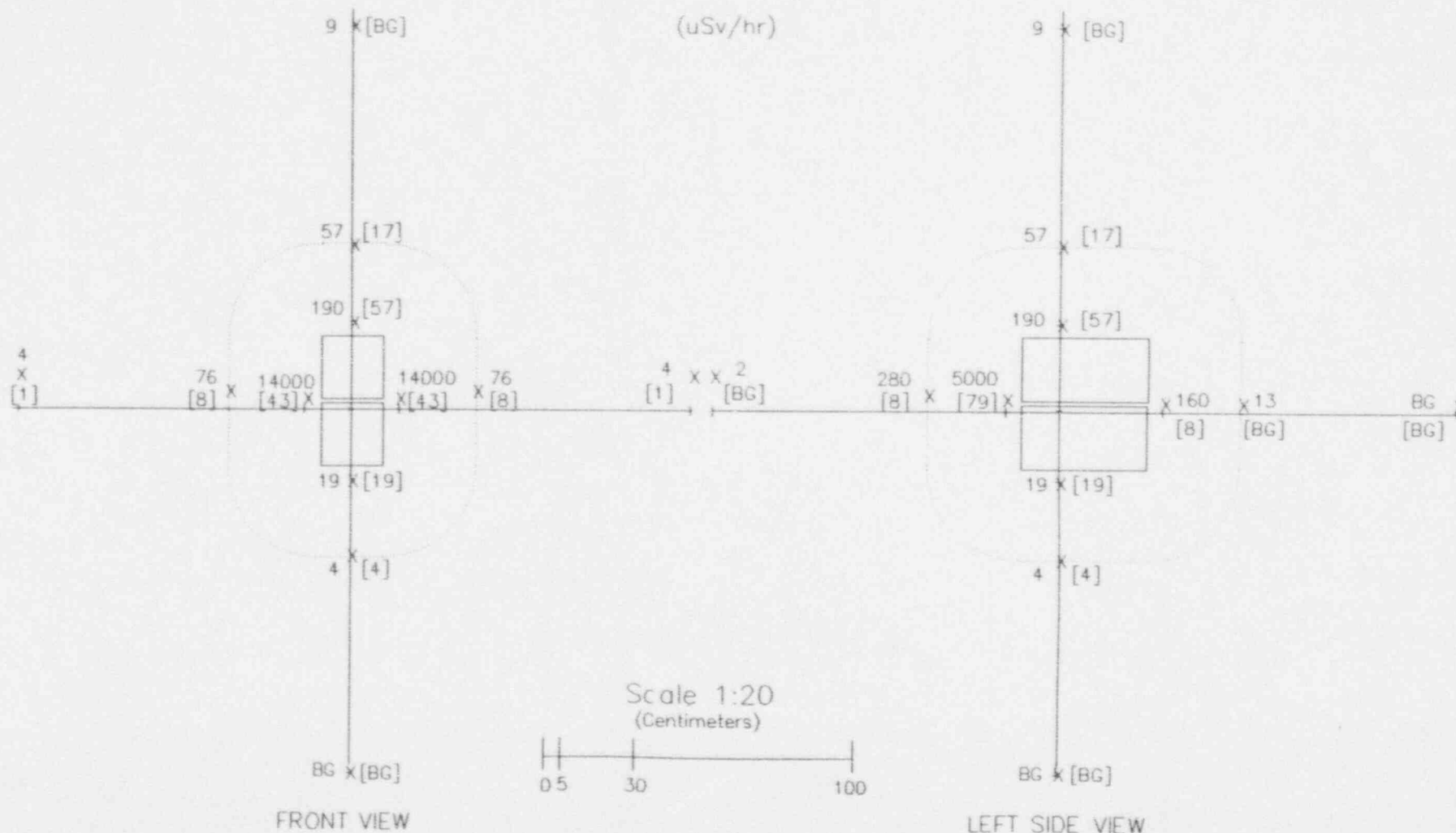




ABB PROCESS AUTOMATION INC.

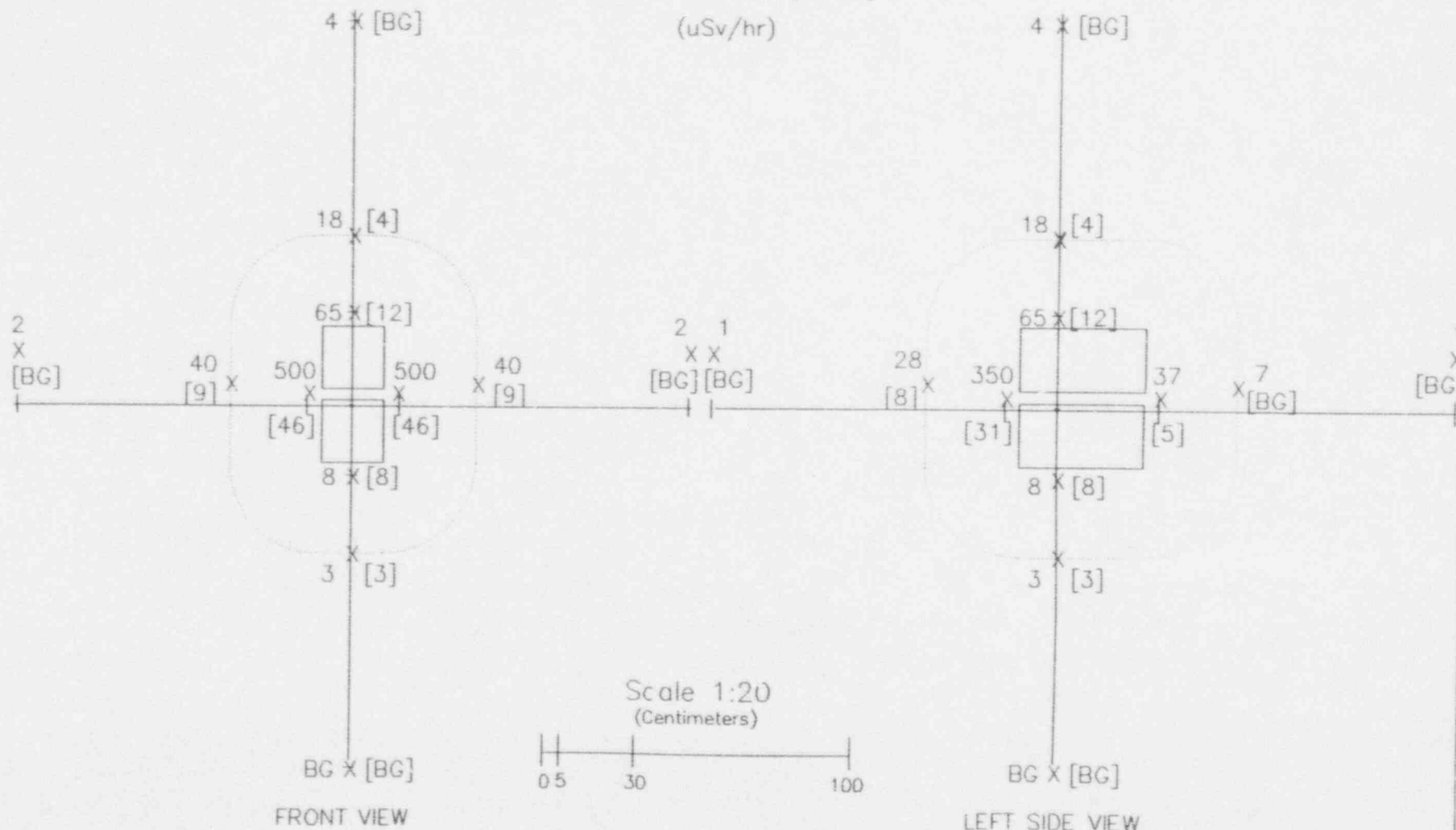
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 07/LS1/212	Customer / Address USNRC Registration Information			J.O.		
Device S.N.	Device Model TG-1	Sensor / Frame TLS1-U6BH	Gap 38 mm	Safety Classification ANSI-		
Source S.N. S-1382-T [RADPAT01]-33	Source Model S-18	Source P.N. 12125-001	Qty / Isotope 2.6 GBq Sr-90	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538	

SOURCE "ON" / ["OFF"]

(uSv/hr)



7-4

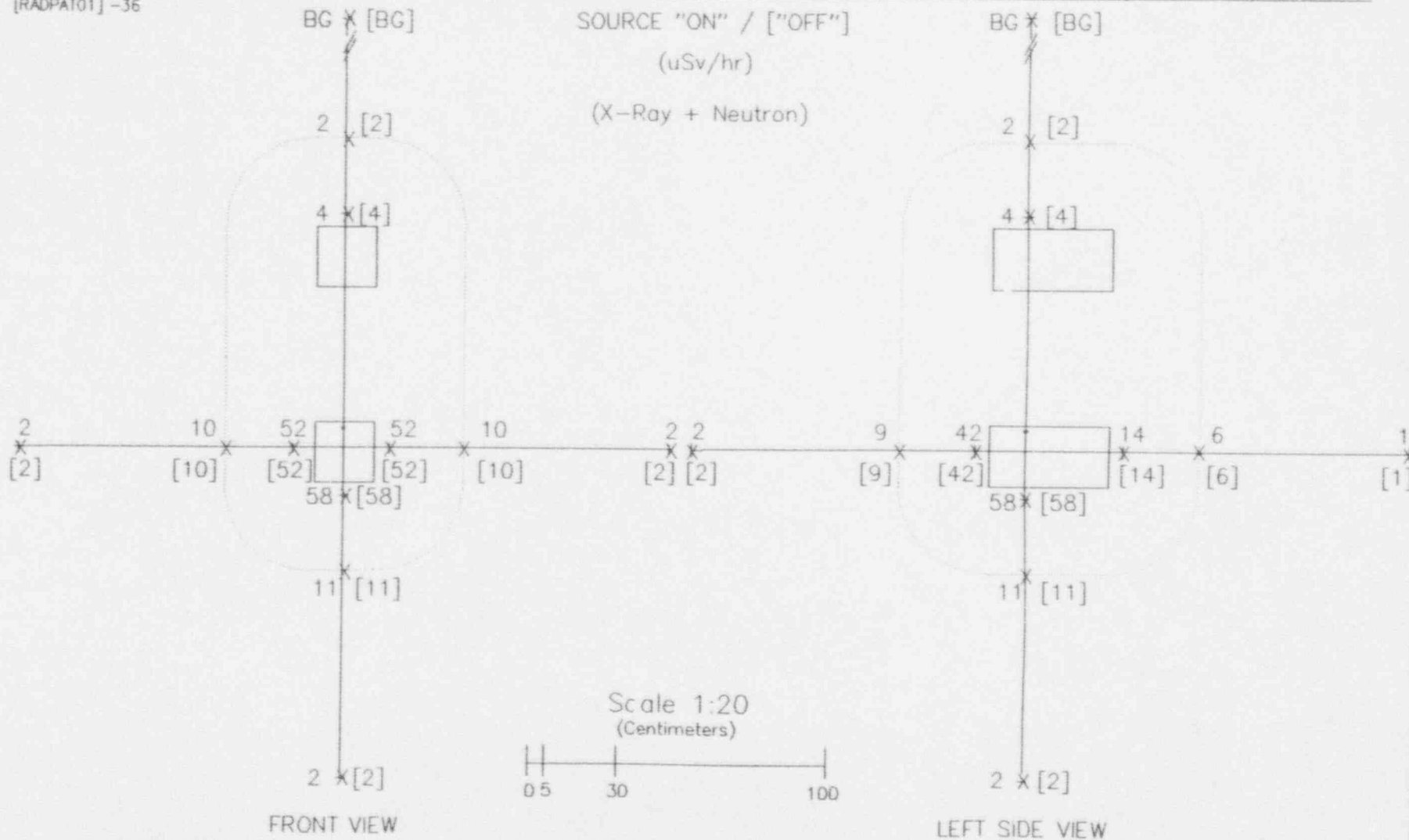


ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. U7/TCM/212	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-1	Sensor / Frame TMC1-U7BH	Gap 460 mm	Safety Classification ANSI-	
Source S.N. [RADPAT01]-36	Source Model CLC.D1	Source P.N. 12136-002	Qty / Isotope 37 GBq Cm-244	Instrument VICTOREEN V-488-A (Neutrons)	Method Per ANSI N538



D-6







ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. U6/TCM/212	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-2	Sensor / Frame TMCM1-U6BH	Gap 460 mm	Safety Classification ANSI-	
Source S.N. [RADPAT01] -37	Source Model CLC.D1	Source P.N. 12136-002	Qty / Isotope 37 GBq Cm-244	Instrument VICTOREEN V-488-A (Neutrons)	Method Per ANSI N538

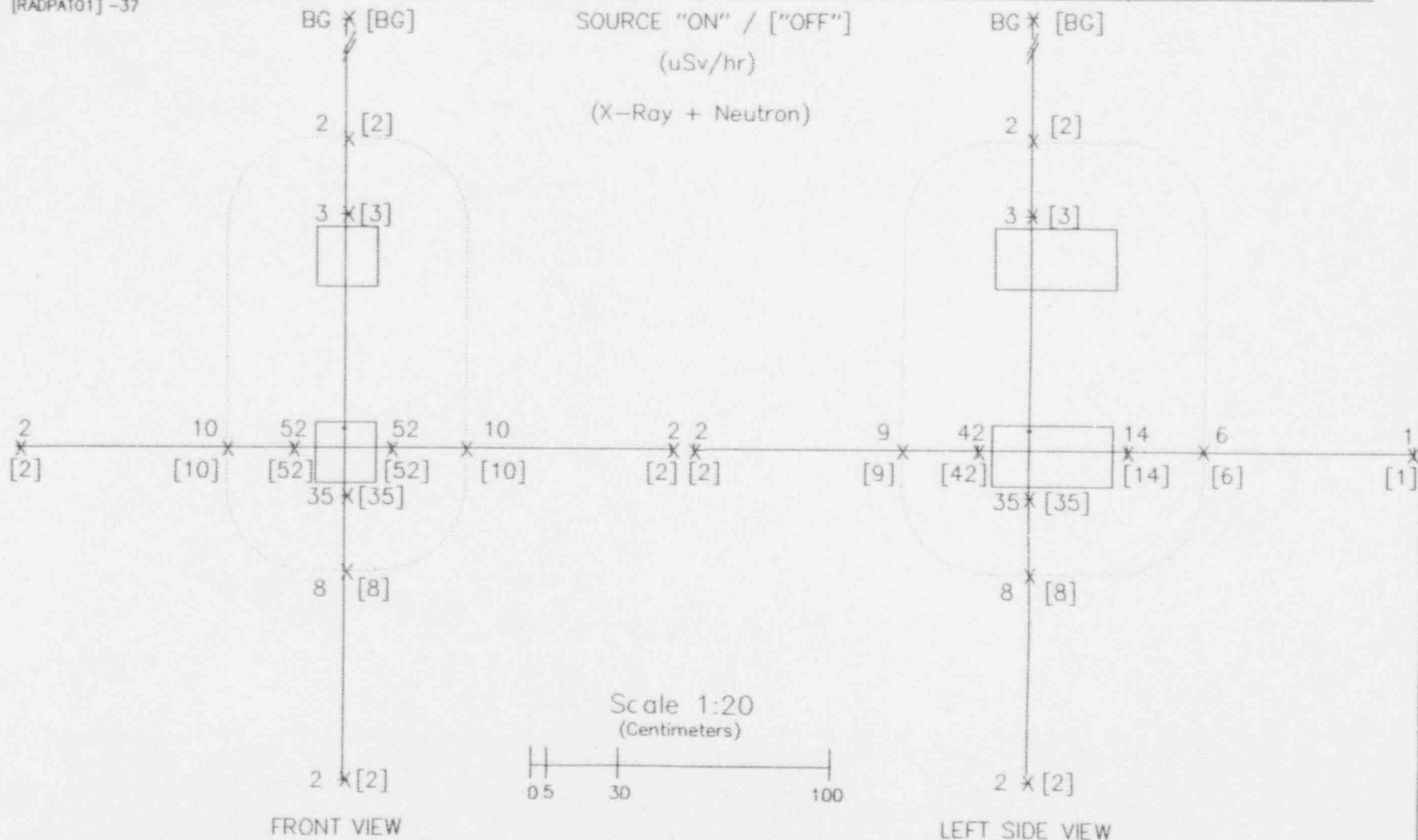


ABB PROCESS AUTOMATION INC.

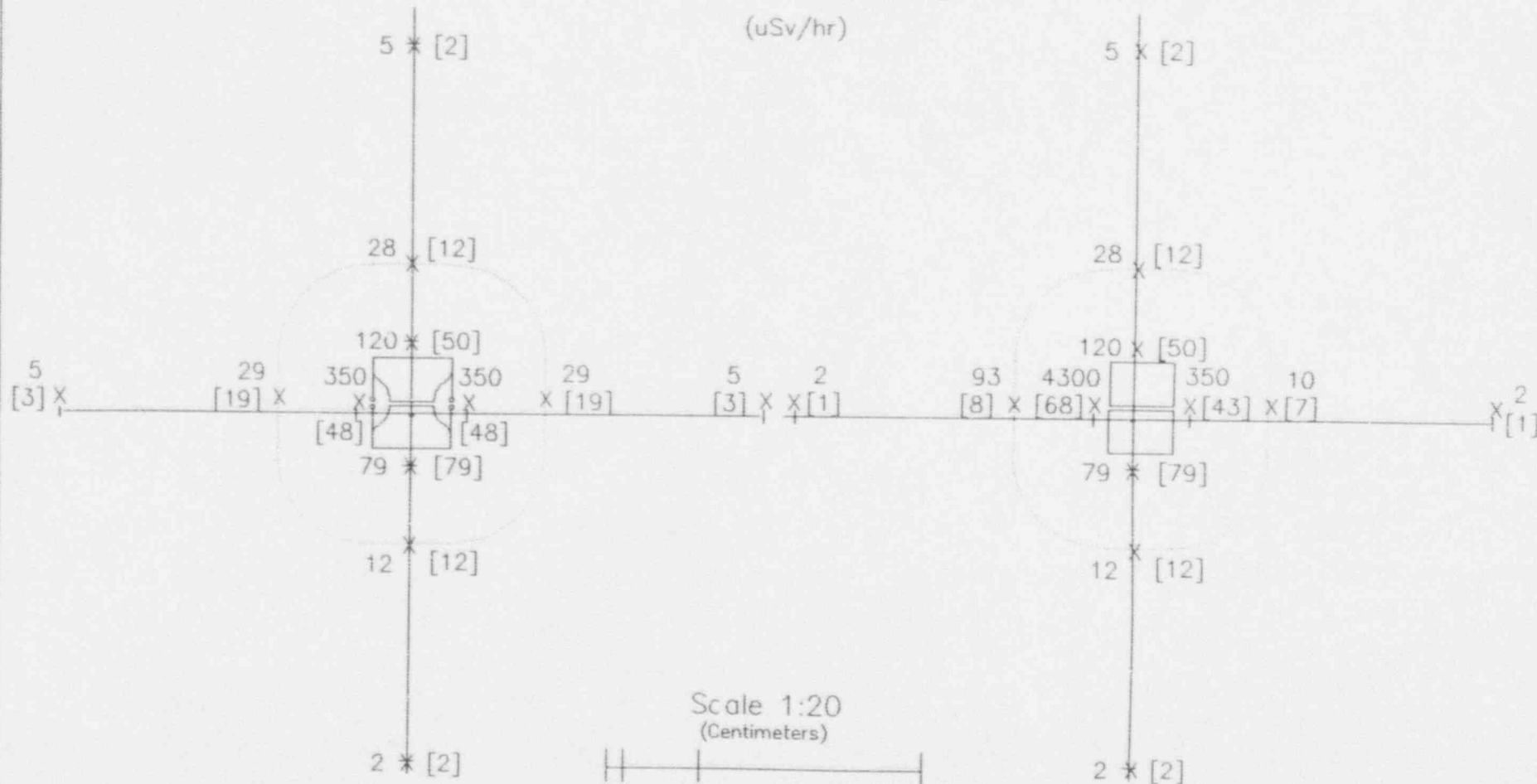
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 02/LK4/13	Customer / Address USNRC Registration information			J.O.	
Device S.N.	Device Model TG-3	Sensor / Frame TLK4-MO2BH	Gap 13 mm	Safety Classification ANSI-	
Source S.N. K-1317-T [RADPAT01]-21	Source Model S-11	Source P.N. 12137-001	Qty / Isotope 55.5 GBq Kr-85	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

SOURCE "ON" / ["OFF"]

(uSv/hr)



FRONT VIEW

LEFT SIDE VIEW

ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 02/TM2/38	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-3	Sensor / Frame TM2-MO2BH	Gap 38 mm	Safety Classification ANSI-	
Source S.N. S-1392-t	Source Model S-18	Source P.N. 12125-001	Qty / Isotope 2.6 GBq Sr-90	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

[RADPAT01] -22

SOURCE "ON" / ["OFF"]

(uSv/hr)

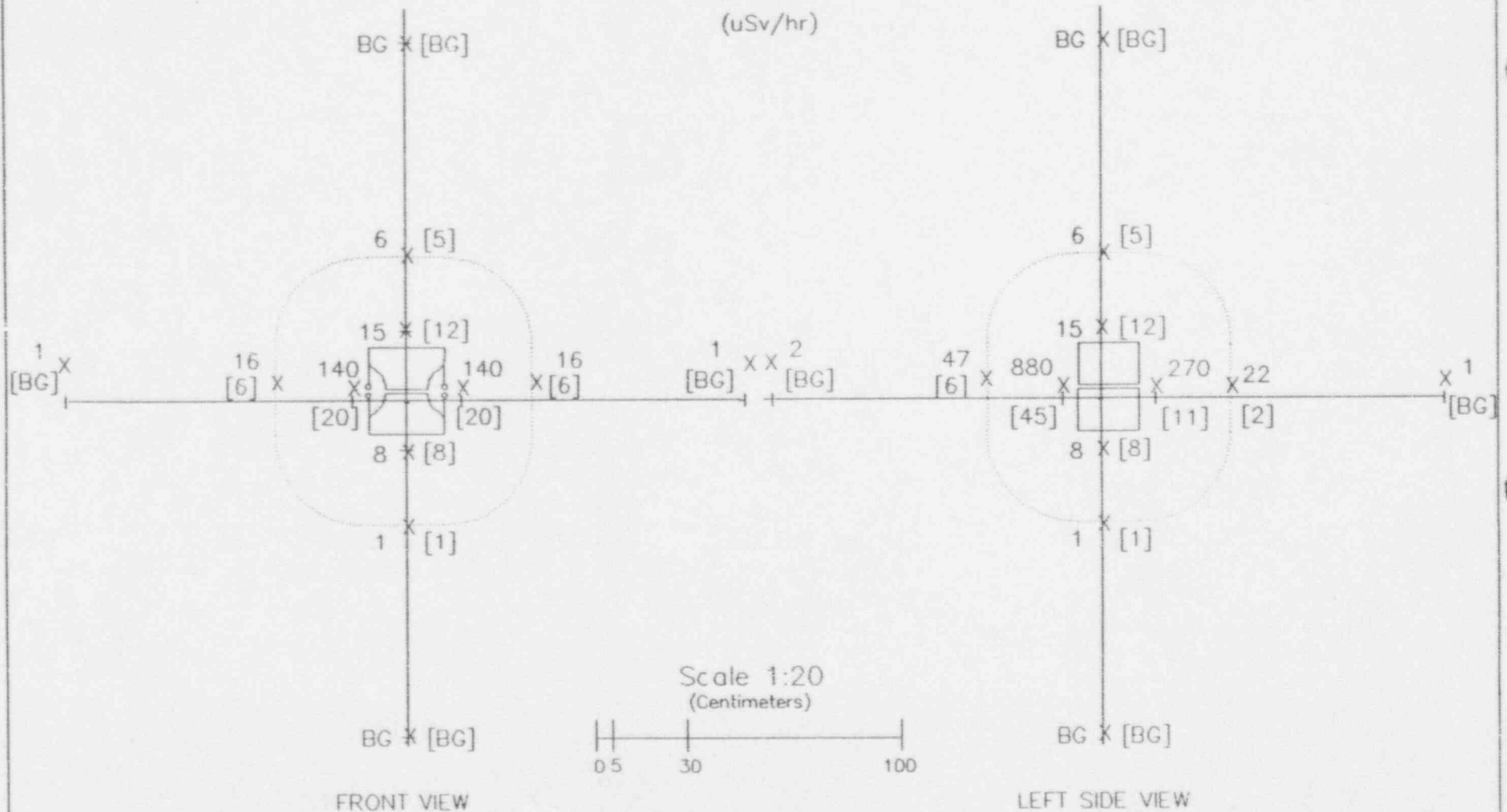


ABB PROCESS AUTOMATION INC.

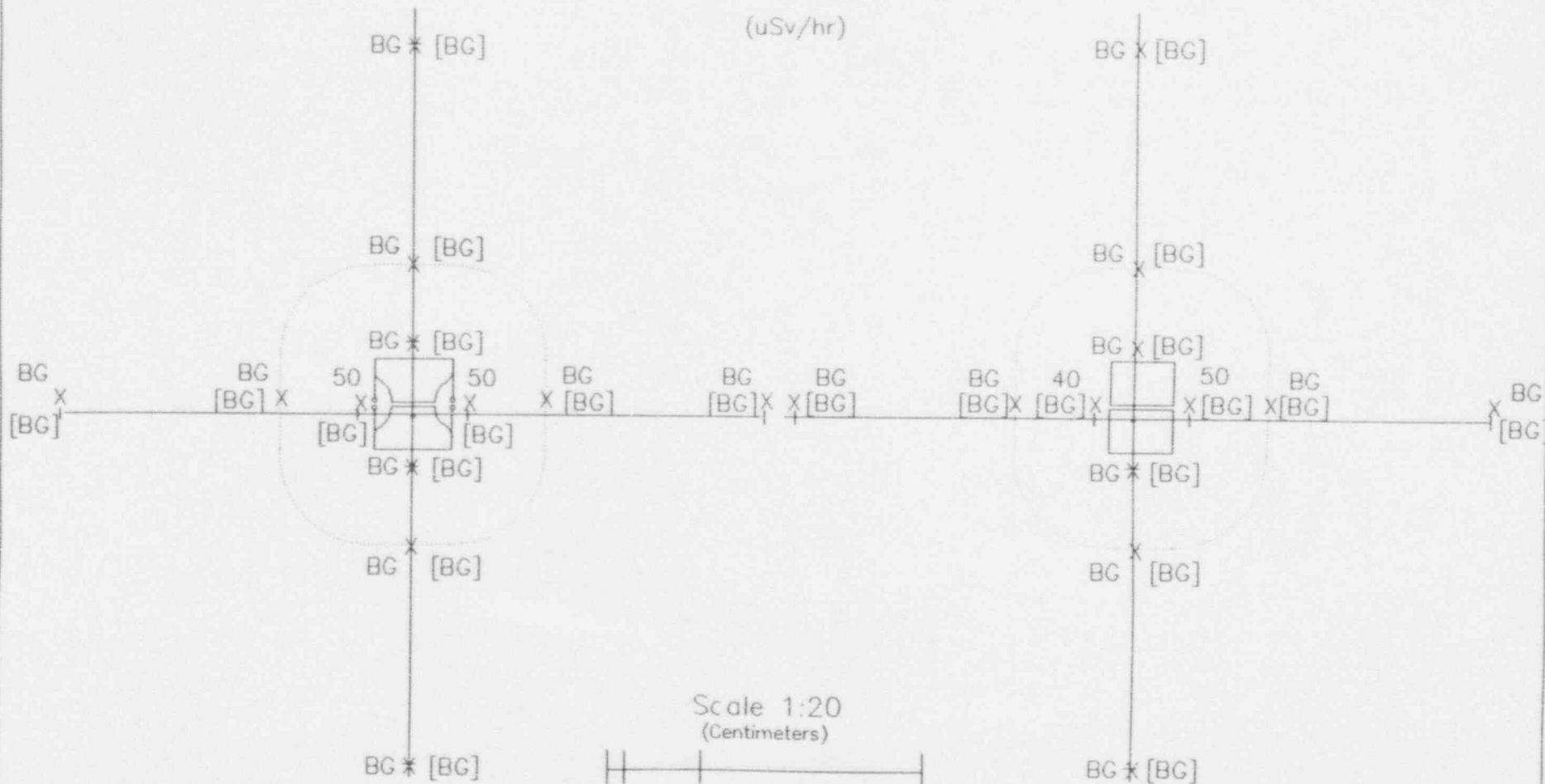
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 02/LP1/212	Customer / Address USNRC Registration Information		J.O.	
Device S.N.	Device Model TG-3	Sensor / Frame TLP1-MO2BH	Gap 13 mm	Safety Classification ANSI-
Source S.N. P-276-A [RADPAT01] -23	Source Model S-20	Source P.N. 12139-001	Qty / Isotope 37 GBq Pm-147	Instrument RAM-A 6-0001R Ser 430-787
				Method Per ANSI N538

SOURCE "ON" / ["OFF"]

(uSv/hr)



FRONT VIEW

LEFT SIDE VIEW

ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 09/LK5/11	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-4	Sensor / Frame TLK5/09BH	Gap 13 mm	Safety Classification ANSI-	
Source S.N. K-1002-H [RADPAT01] -42	Source Model S-11	Source P.N. 12112-004	Qty / Isotope 37 GBq Kr-85	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

SOURCE "ON" / ["OFF"]

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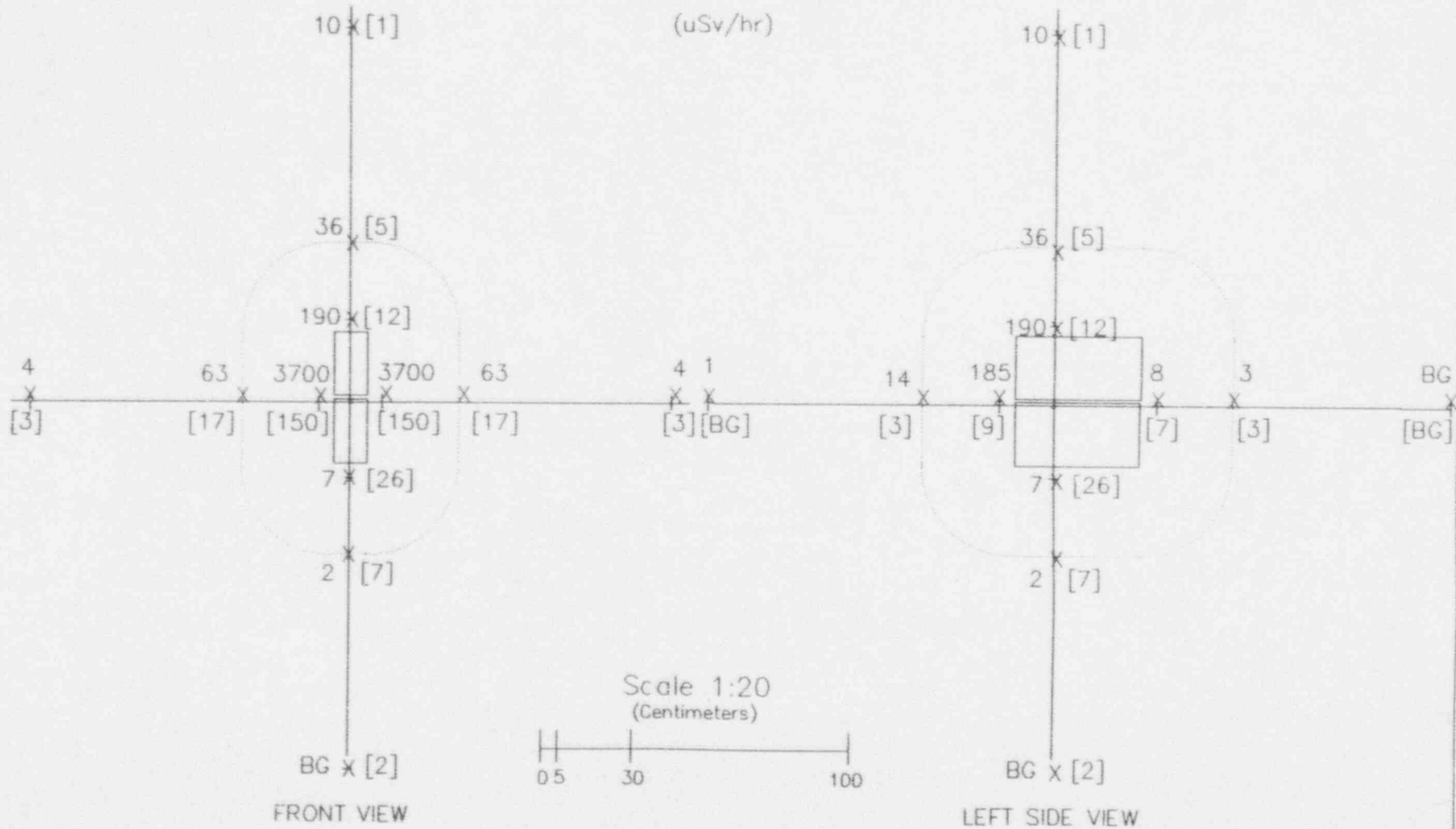


ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. 09/LK5/11	Customer / Address USNRC Registration Information			J.O.	
Device S.N.	Device Model TG-4	Sensor / Frame TLK5/09BH	Gap 13 mm	Safety Classification ANSI-	
Source S.N. K-1002-H [RADPAT01] -46	Source Model S-11	Source P.N. 12112-004	Qty / Isotope 37 GBq Kr-85	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

SOURCE "ON" / ["OFF"]

(uSv/hr)

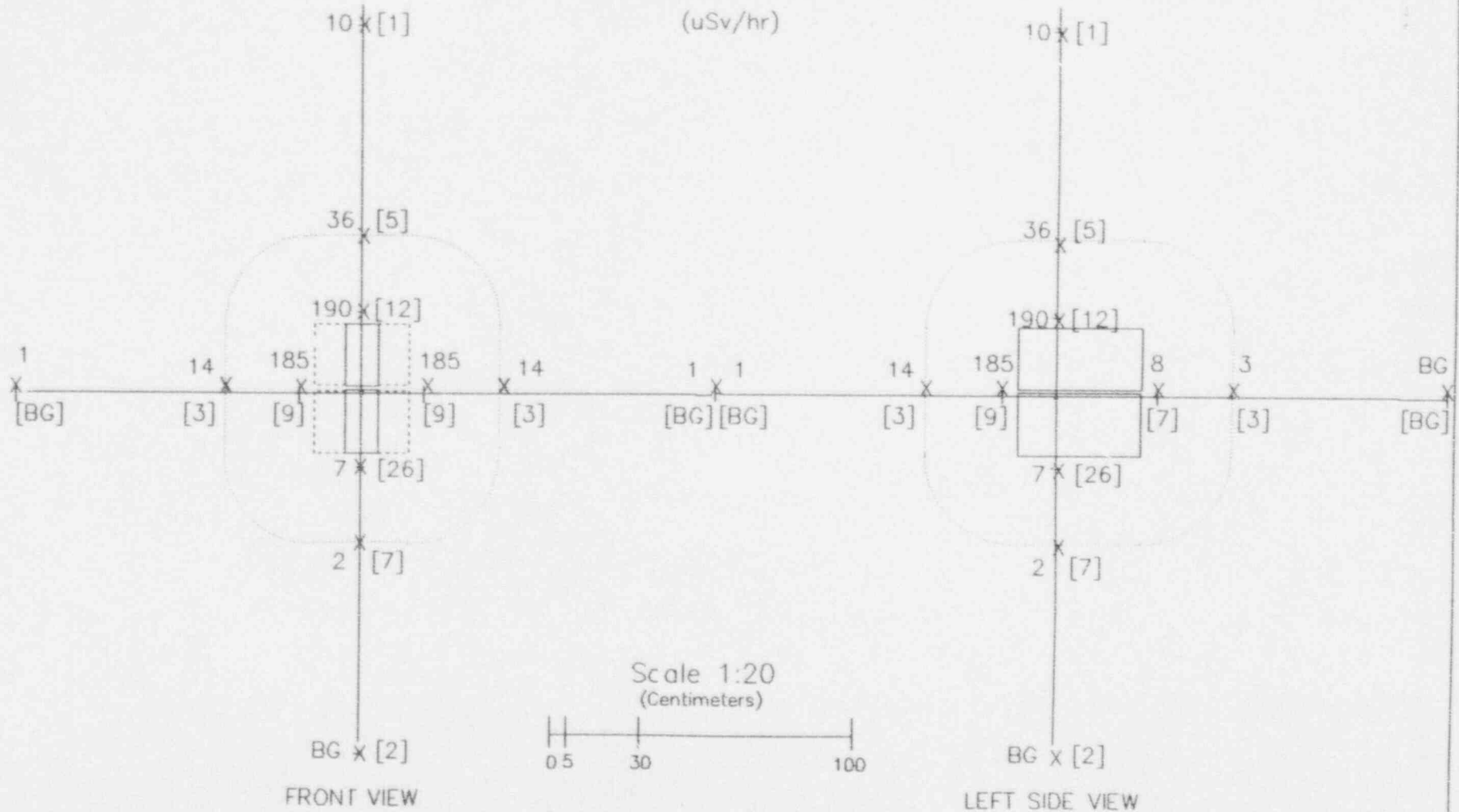


ABB PROCESS AUTOMATION INC.

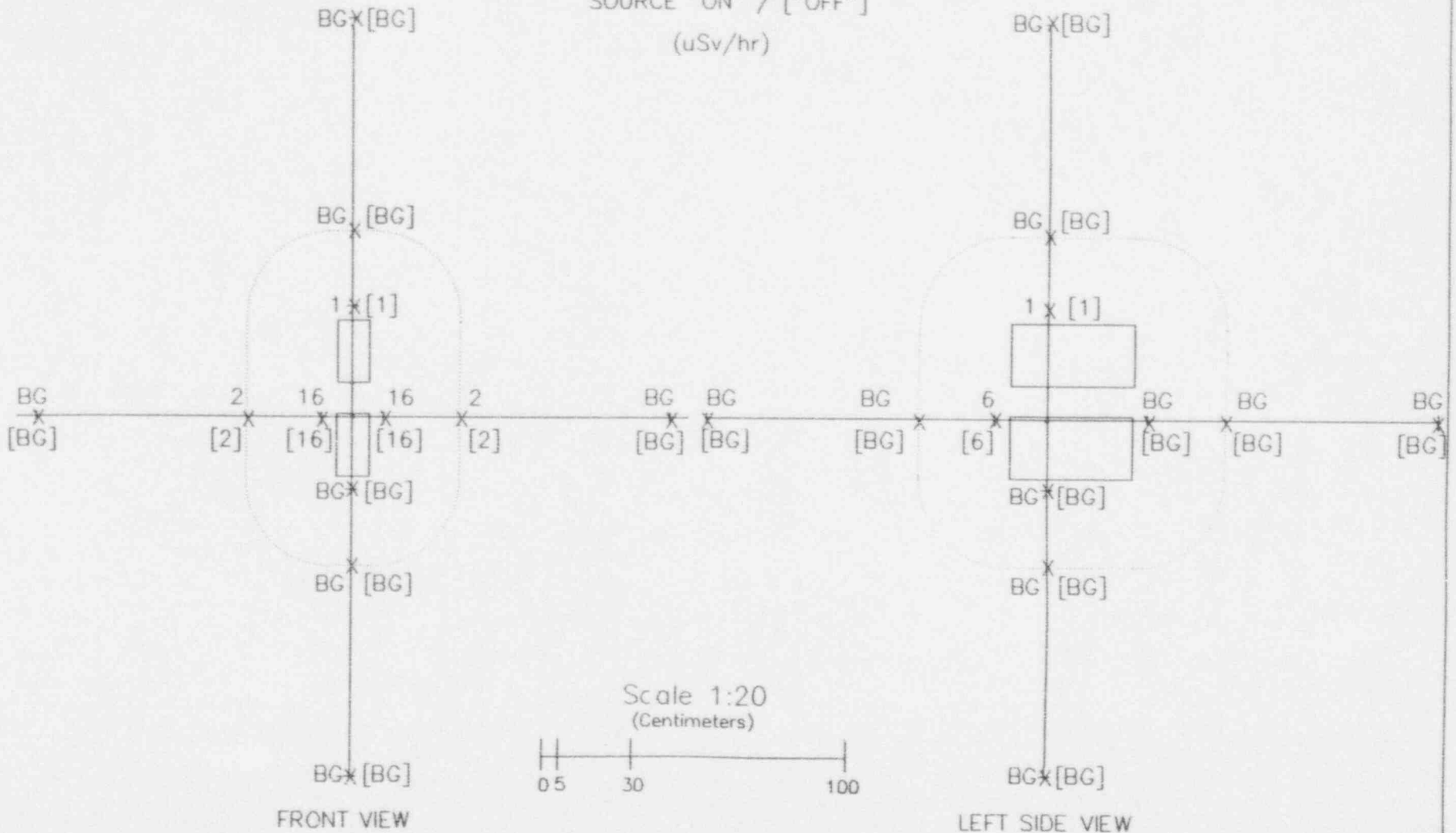
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No.	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-4	Sensor / Frame	Gap 102 mm	Safety Classification ANSI-	
Source S.N. AM-5003	Source Model S-16	Source P.N. 10098-003	Qty / Isotope 185 GBq Am-241	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

[RADPAT01] -44

SOURCE "ON" / ["OFF"]  
(uSv/hr)



# RADIATION PROFILE

ABB PROCESS AUTOMATION INC.

COLUMBUS, OHIO 43202

File No.	Customer / Address		USNRC Registration Information		Safety Classification	
	J.O.					
Device S.N.	Device Model	Sensor / Frame	Gap			
	IG-4	TM2/SP700	38 mm	ANSI-		
Source S.N.	Source Model	Source P.N.	Qty / Isotope	Instrument	Ser	Method
S-1260-T	S-18	12125-001	2.6 GBq Sr-90	RAM-A	6-0001R	430-787
[RAUPAT01]-45						Per ANSI N538

SOURCE "ON" / ["OFF"]  
(uSv/hr)

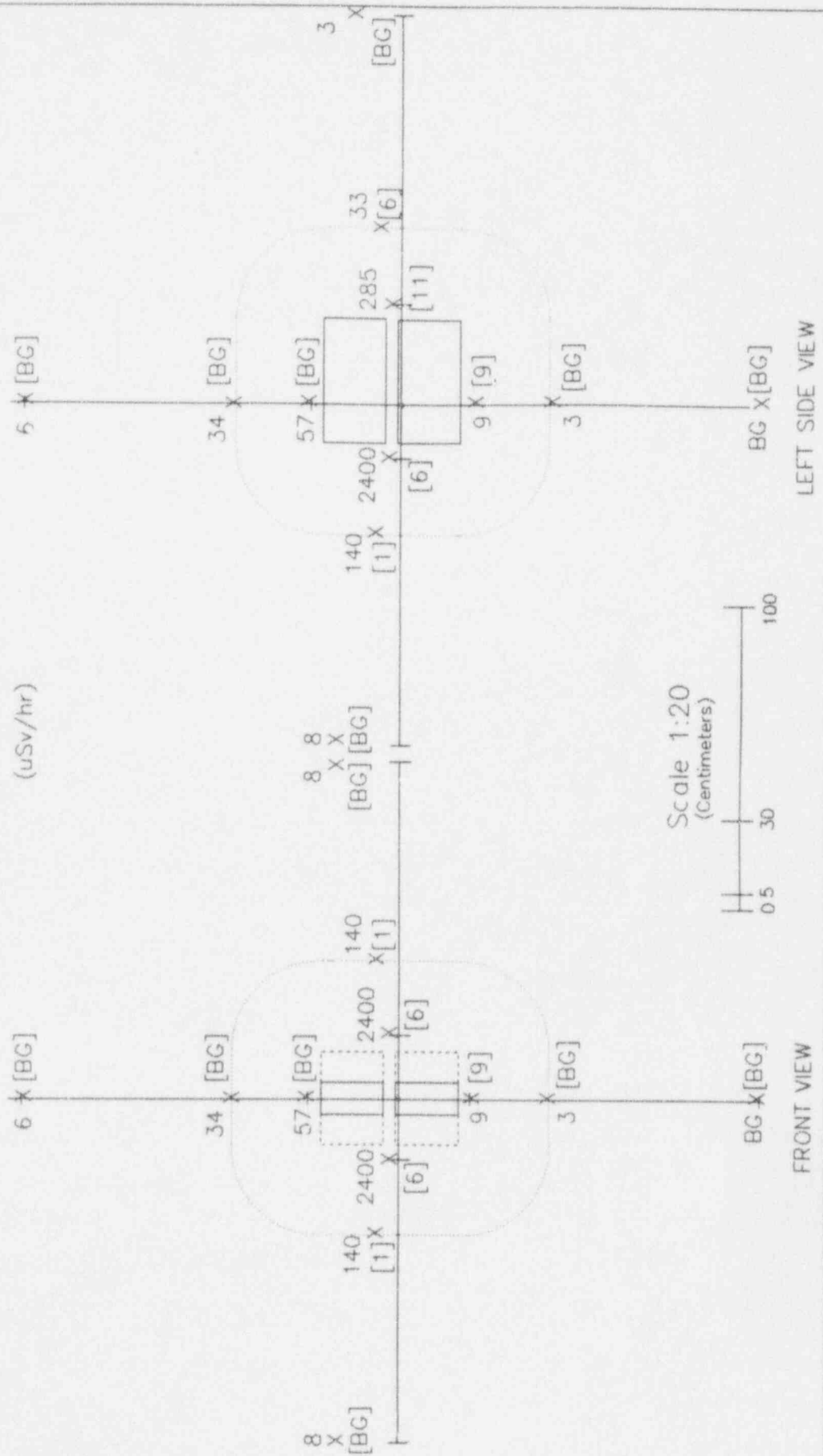


ABB PROCESS AUTOMATION INC.

# RADIATION PROFILE

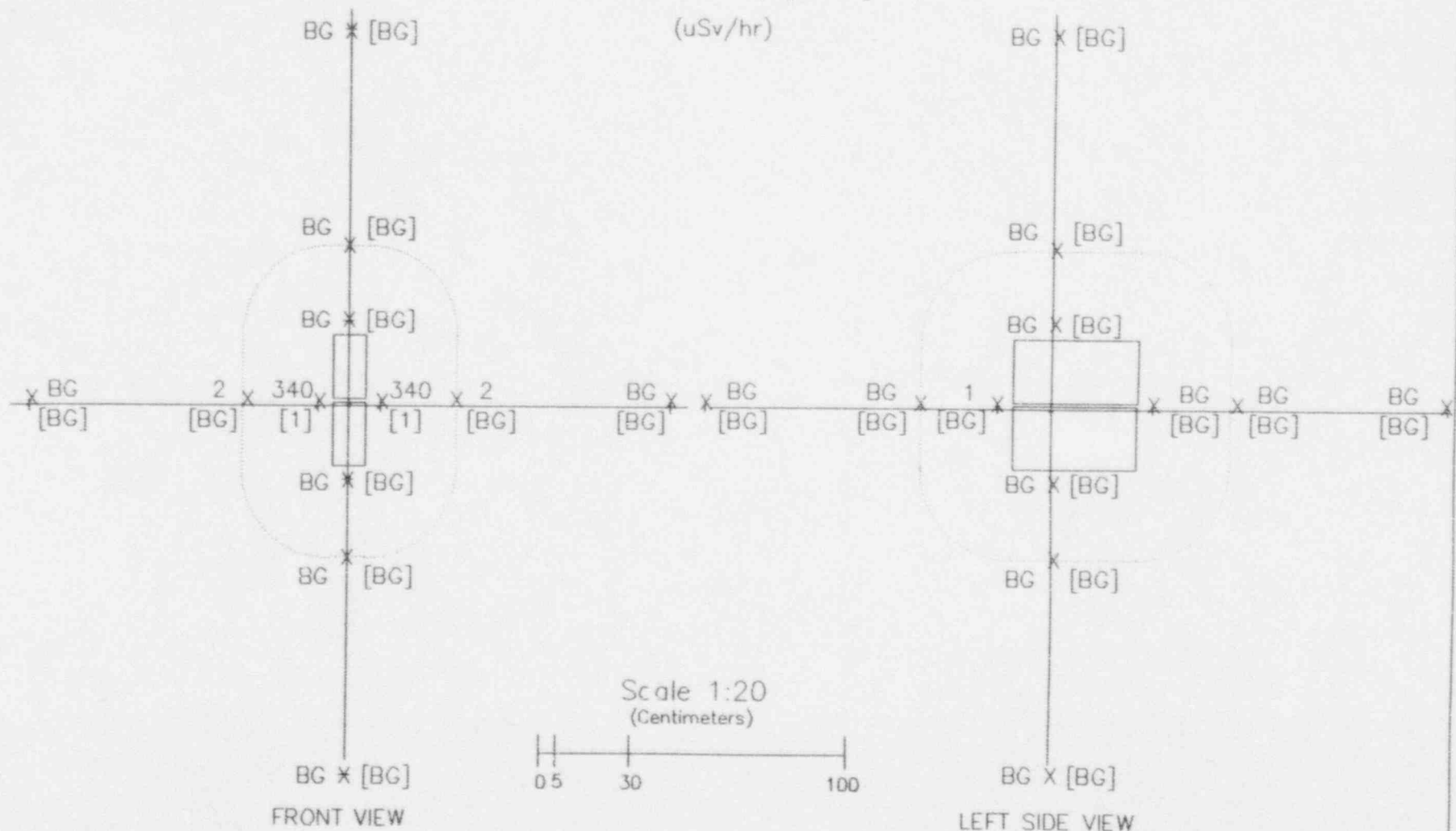
COLUMBUS, OHIO 43202

File No. 09/LP1/11	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-4	Sensor / Frame	Gap 13 mm	Safety Classification ANSI-	
Source S.N. P-267-A	Source Model S-20	Source P.N. 12139-001	Qty / Isotope 37 GBq Pm-147	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538

[RADPAT01] -#1

SOURCE "ON" / ["OFF"]

(uSv/hr)



0-17

ABB PROCESS AUTOMATION INC.

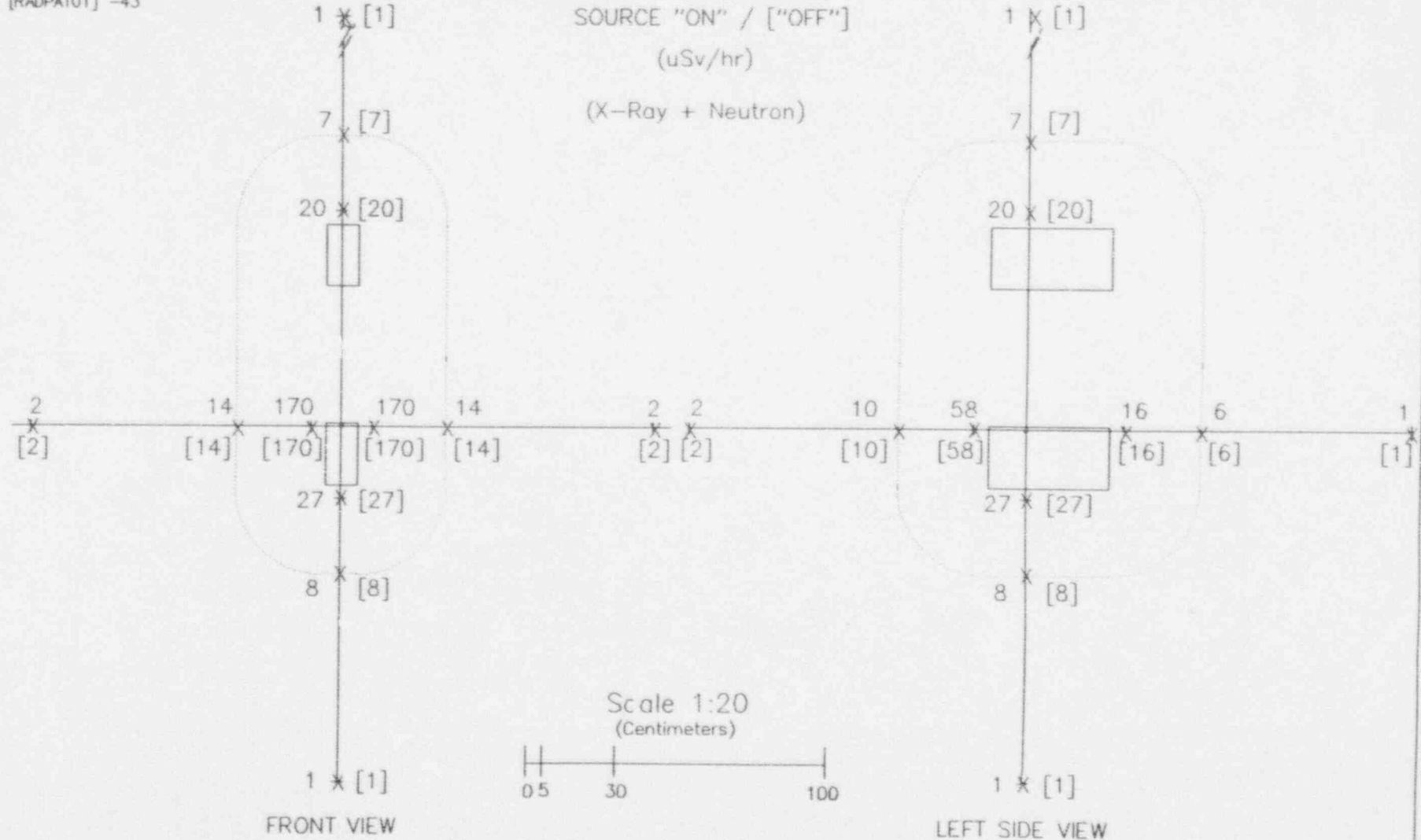
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No.	Customer / Address USNRC Registration Information				J.O.
Device S.N.	Device Model TG-4	Sensor / Frame	Gap 460 mm	Safety Classification ANSI-	
Source S.N.	Source Model CLC.D1	Source P.N. 12136-002	Qty / Isotope 37 GBq Cm-244	Instrument VICTOREEN V-488-A (Neutrons)	Method Per ANSI N538

[RADPAT01] -43

SOURCE "ON" / ["OFF"]  
(uSv/hr)  
(X-Ray + Neutron)



D-18

ABB PROCESS AUTOMATION INC.

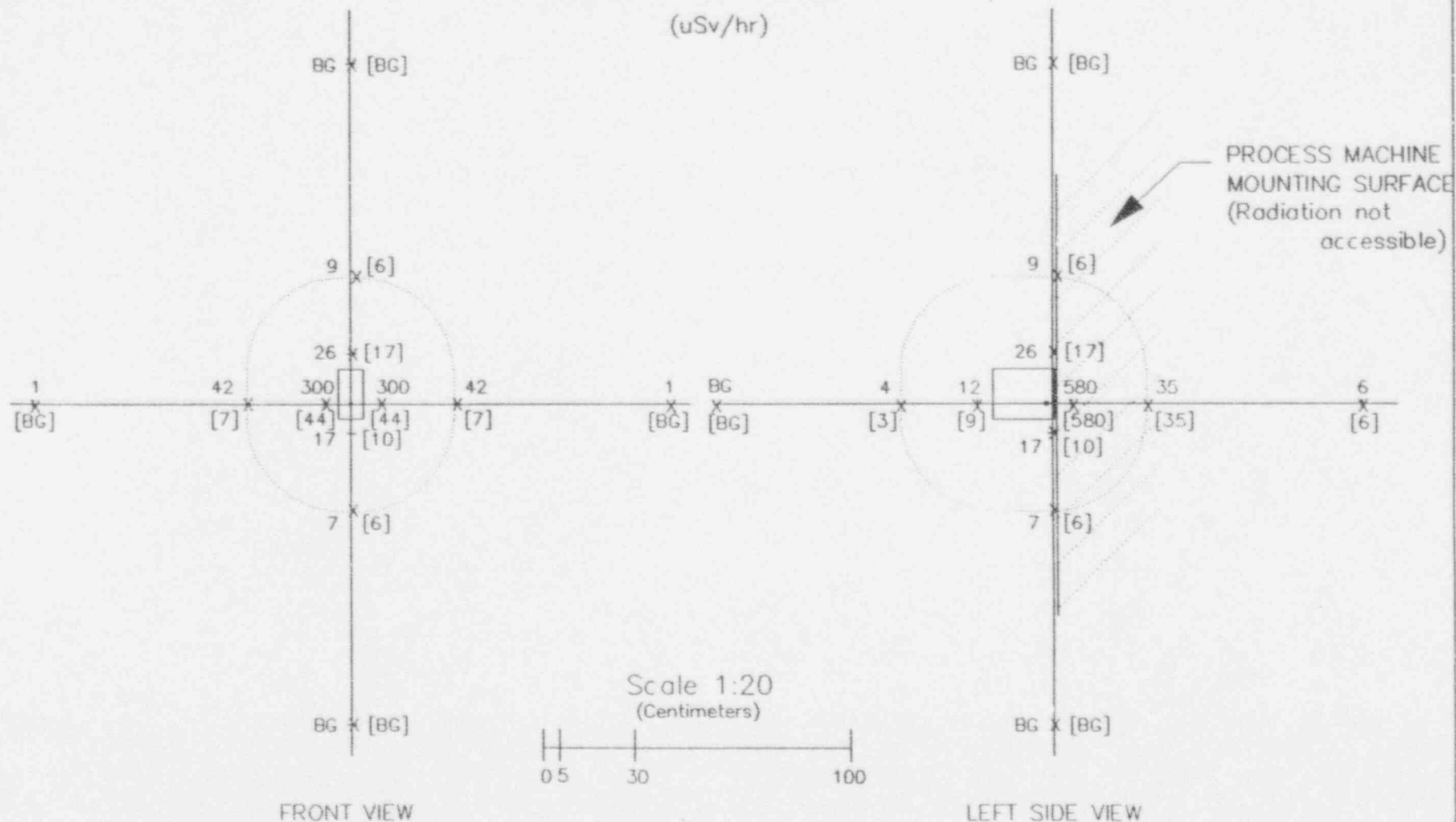
# RADIATION PROFILE

COLUMBUS, OHIO 43202

File No. C7/ /9	Customer / Address USNRC Registration Information			J.O.	
Device S.N.	Device Model TG-5	Sensor / Frame	Gap 9 mm	Safety Classification ANSI-	
Source S.N. S-2043-C	Source Model S-18	Source P.N. 12126-001	Qty / Isotope 3.7 GBq / Sr-90	Instrument RAM-A 6-0001R Ser 430-787	Method Per ANSI N538
[RADPAT01]-51					

SOURCE "ON" / ["OFF"]

(uSv/hr)

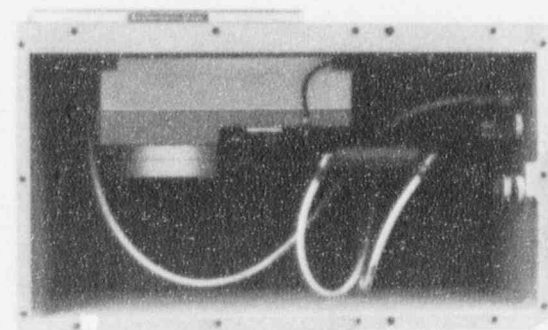
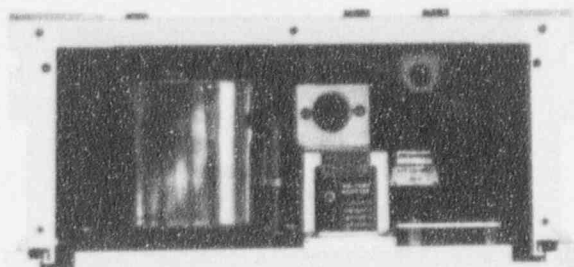


APPENDIX E

ACCURAY SYSTEMS RADIATION SAFETY MANUAL  
(Reference Section 3.8)

Contents:

- E-1 Cover page
- E-2 ABB Manual, BC-S-8-019406-001



## FEATURES

Bi-directional Frame Standardization maintains system accuracy even when the heads become misaligned due to outside force exerted on the scanning frame. Frame standardization is easily implemented by the operator at the Operator Station.

A Source Decay Model compensates for the slow, predictable decay of the nucleonic source by accurately calculating the strength of the source at any point in the system's life. This ensures measurement accuracy over the life of the sensor.

All Point Standardization is accomplished through proprietary firmware algorithms which accurately describe the relationship between fiberglass weight and the ion chamber output. Dirt on the sensor window is measured during off-sheet standardization and "subtracted" from subsequent process measurements.

Linear response and sensor stability permit pre-installation and permanent factory calibration, with typically no need for dynamic correlations.

Self-diagnostics are run during each standardization and the results are stored in memory. Results are available in printout form for easy diagnosis of sensor problems.

Standard check samples allow quick verification of sensor accuracy.

An Air Wipe ensures that loose fiberglass, or other contaminants are kept out of the measurement gap.

## SPECIFICATIONS

Accuracy of  $\pm 0.3\%$  of weight output, typical average deviation between sensor reading and check samples.  $\pm 0.5\%$  of weight output, typical average deviation between sensor reading and sample lab weights.

Typically measures weight shifts as small as 2.4 gsm (0.0005 lbs/sq ft).

Source: 500 mCi nucleonic x-ray emitter

Air Gap: 15.2 cm (6 in.), 25.4 cm (10 in.), or 35.6 cm (14 in.)

Measurement Range: 200, to 10,000 gsm (0.04 to 2.01 lbs/sq ft)

## EXECUTIVE SUMMARY

The MicroTec family of sensors provides precision measurement of fiberglass products. The Nucleonic X-ray Weight Sensor features a proprietary design which ensures ultra-stable radiation detection and an extremely high signal-to-noise ratio.

## DESCRIPTION

This sensor has a nucleonic source of X-ray photons and a large ionization chamber. This design is proven to produce extremely accurate weight measurements, even in the "hostile" environment of the plant.

Signal processing is carried out entirely in the AccuRay MICRO system's computer, permitting accurate measurement over the entire process range without operator assistance.

Automatic standardization, air wipes and direct dirt measurement minimize the effects of contaminants on the sensor heads. Permanent calibration of the sensor heads at the factory usually eliminates the need to perform field calibration when a head is replaced.

# ABB AccuRay<sup>®</sup> Nucleonic Thickness Sensors

## Features

**Drift-free, non-contacting measurement**

**Individual calibration for each alloy or grade**

**Application matched sensors**

**Superior measurement accuracy**

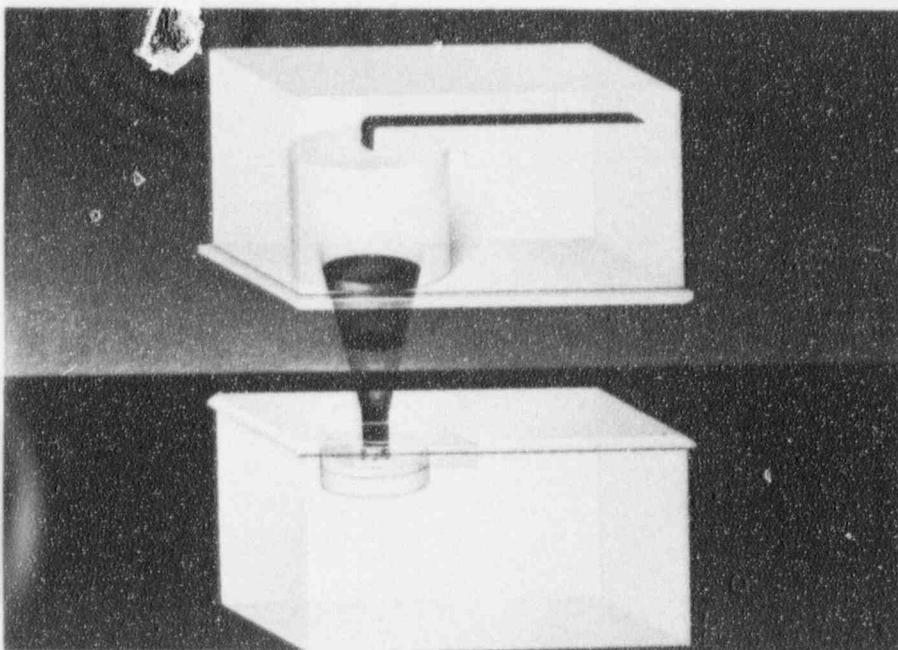
**High signal-to-noise ratio**

**Fast speed of response**

**Automatic compensation for sensor window contamination by foreign material (dirt)**

**Permanent full-range calibration, linearization and standardization**

**Source decay compensation**



## Product Description

Today's sensors must provide accurate, drift-free measurements of product thickness. This is accomplished by the ABB AccuRay<sup>®</sup> family of advanced conical beam geometry sensors that feature superior resolution, composition insensitivity, and permanent calibration.

ABB AccuRay thickness sensors are compact, rugged units which incorporate unique high efficiency sealed nucleonic sources in combination with spectrally-matched detectors, to obtain the highest performance available today. The high efficiency sources contain high specific activity Sr-90 or Am-241, with negligible internal energy loss. The ionization chamber detectors are custom designed and manufactured by ABB.

The conical beam geometries have large solid angles to make maximum use of the radiation energy emitted from the sealed sources. This achieves the high performance required for accurate measurements. Advanced and proprietary developments have been incorporated. Unique signal processing and standardization techniques virtually eliminate the sensor's sensitivity to dirt accumulations on the measurement windows.

The stability and insensitivity to extraneous variables permit permanent sensor calibration and simple field recalibration, if necessary, following a cobble. Each sensor measures on a single, linear calibration curve over the entire process range of the system. Verification is simplified by using only single-point calibration verifications and static, reference sample repeatability checks. Included are extensive on-line sensor diagnostics, to provide maximum operator simplicity and confidence in accu-

rate measurements.

These distinct features translate directly into superior sensor performance with unique results that can be measured in a significant Return On Investment.

## Specifications

Although every process and application is unique, these specifications are based on a typical operation. This assumes sampling and testing techniques that are sufficiently precise to demonstrate the inherent accuracy of the ABB AccuRay sensor.

Each of the following specifications results from sensor testing using high-precision samples and ABB defined testing procedures.

**ABB**  
**ASEA BROWN BOVERI**

## NUCLEONIC SENSORS

Product Number		SG5582 AG5582	SG5983 AG5983	SG5584 AG5584	SG5984 AG5984
Sensor		TM-5 (Beta)	TM-5 High Speed (Beta)	THAM-2 (Gamma)	THAM-2 High Speed (Gamma)
Source		70 mCi Sr-90	300 mCi Sr-90	1 Curie Am-241	3 Curies Am-241
Time Constant <sup>6</sup>		70 msec	20 msec	50 msec	20 msec
Free Air Gap		1.875 inches (47.6 mm)		11.125 inches <sup>4</sup> (282.6 mm)	
Thickness Range	For aluminum and its alloys	2 to 70 mils (0.05 to 1.75 mm)		60 to 1500 mils <sup>1</sup> (1.55 to 39 mm)	
	For carbon and stainless steels	0.5 to 25 mils (0.015 to 0.64 mm)		5 to 200 mils (0.13 to 5.00 mm)	
Accuracy <sup>3</sup>	For aluminum and its alloys	$\pm 0.1\%$ or $\pm 0.02$ mils <sup>2</sup> ( $\pm 0.0005$ mm)		$\pm 0.1\%$	
	For carbon and stainless steels	$\pm 0.1\%$ or $\pm 0.005$ mils <sup>2</sup> ( $\pm 0.00013$ mm)		$\pm 0.1\%$	
Sensitivity to Extraneous Variables	Metal Composition	Negligible after alloy calibration			
	Operating Temperature	None. Sensor is designed for reliable operation at temperatures normally encountered in common metals applications.			
	Passline Change	Design and tuning of source-detector compensates for 0.25" (6.3 mm) passline change.	Negligible. Design and tuning of source-detector compensates for normal variations in passline.		
	Foreign Material Buildup	Negligible. Air wipe and standardization of gauge compensates for effect on measurement of oil, water, and dirt deposit on source-detector "windows."			
Stability	$\pm 0.05\%$ of nominal thickness value over 2 hours without standardization				
Resolution	Less than 0.1% of thickness with one second averaging <sup>5</sup>				
Repeatability <sup>3</sup>	Less than $\pm 0.1\%$ or $\pm$ sensor resolution <sup>2</sup>				

- Notes:**
1. Upper range of THAM-2 geometry for aluminum is application dependent
  2. Whichever is greater
  3. For static conditions, for two standard deviations (95% confidence interval)
  4. Custom air gaps up to 17.125 inches (435.0 mm) available
  5. Application dependent specification. Most common applications specification listed.
  6. 1 RC time constant (time to exhibit 63% of a step change)



Printed in U.S.A.

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ABB Process Automation Inc.  
Metals Business Unit  
650 Ackerman Road  
Columbus, Ohio 43202, USA  
Telephone: +1 614 261-2000  
Telecopier: +1 614 261-2172

# Weight Measurement Unit

## AccuRay 7000 MicroPlus System

### Tobacco Automation Systems

#### EXECUTIVE SUMMARY

The Weight Measurement Unit is the most accurate and reliable weight sensor available to the tobacco industry. The sensor's advanced design and sophisticated digital signal processing ensure accurate measurements for reliable on-machine classification and process control for both cigarette and filter making.

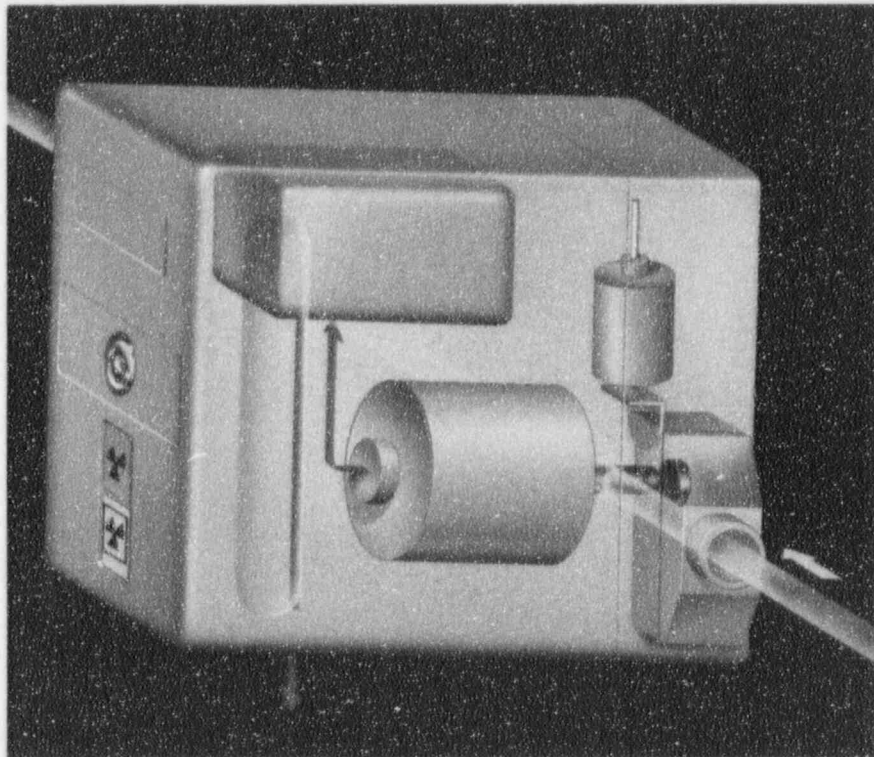
#### DESCRIPTION

Today's high-speed machines require precise measurement of the cigarette and filter rod to maximize quality and minimize costs. The Weight Measurement Unit utilizes beta measurement technology for fast, highly accurate measurement of cigarette or filter rod weight.

Superior features of the Weight Measurement Unit include advanced measurement geometry, a fast-response ionization chamber and maximum measurement stability through electronics that alleviate the need for internal temperature compensation.

Installed before the continuous knife-cut device, the Weight Measurement Unit measures weight at 24 points along the length of each cigarette or filter rod. These measurements are recorded for each rod at speeds of 12,000 rods per minute.

High-speed digital signal processing ensures the fastest, most accurate measurement for effective classification and control of cigarette or filter rod weights. This signal processing greatly increases the speed and accuracy at which the AccuRay 7000 MicroPlus can classify and reject defective rods.



A true calibration curve is used to determine weight, thus eliminating errors inherent in conventional straight-line approximations. This precise logarithmic calibration curve is calculated each time standardization is performed or the Specification Weight is changed.

The Weight Measurement Unit can be easily and cost-effectively added to all existing 7000-series measurement and control systems.

#### FEATURES

- Fast, accurate digital signal processing.
- Calculation of tobacco or filter weight at 24 points along the length of a single rod.
- Ability to process at a speed of 12,000 rods per minute.
- Advanced Measurement Geometry
- Fast-response ionization chamber
- Advanced electronics that alleviate the need for internal temperature compensation.
- An integrated air bearing for improved rod stabilization
- Effective, compact design that alleviates costly installation, alignment and routine maintenance adjustments
- Improved analog-to-digital signal processing to increase overall system performance.
- One-piece cast cover with flush-mounted indicators and keylock entry to increase resistance to environmental contamination.
- Removable pass tubes for inspection at the machine.

# AccuRay<sup>®</sup> 1190<sup>™</sup>

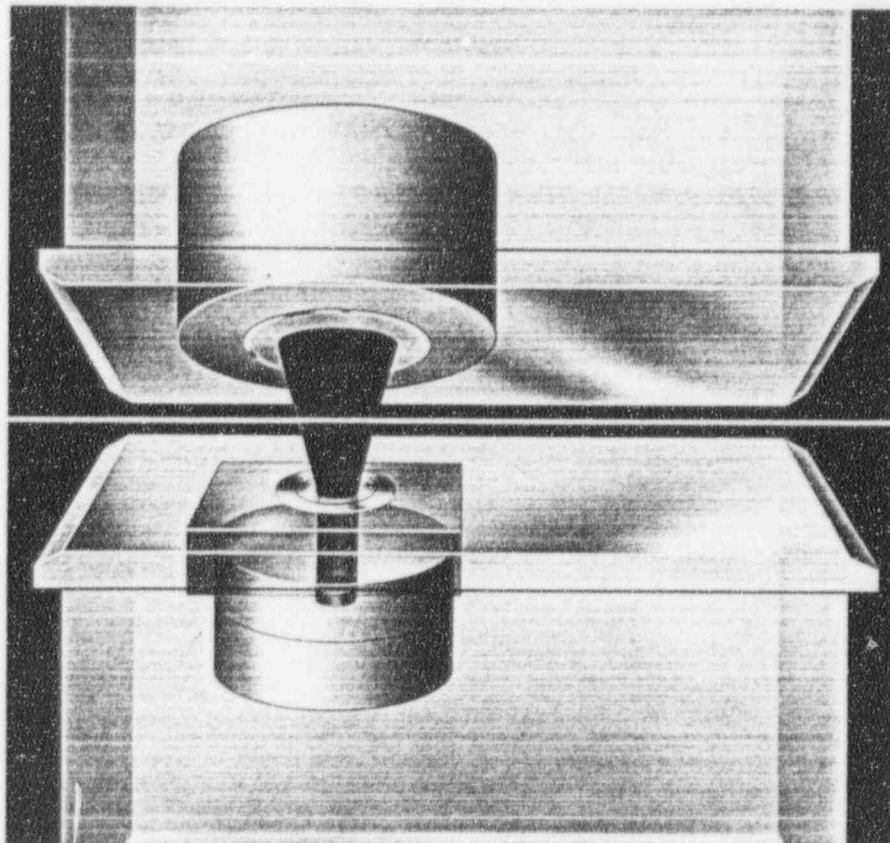
## Basis Weight Sensors

Feature No. 4210/4211/4215

### Executive Summary

Today's demands for cross-machine control and higher resolution require noiseless, responsive measurements to provide the most accurate profile data. The AccuRay family of advanced, application-matched basis weight sensors provides superior process resolution, high speed of response, advanced signal processing, and high signal-to-noise ratios to achieve the most accurate measurement possible. Pre-calibrated at the factory, AccuRay Basis Weight Sensors can be measuring accurately at the time of installation.

ABB Process Automation has been the technology leader in nucleonic basis weight measurement and control for 40 years. The pulp and paper industry has been a primary focus of ABB's team of measurement physicists.



### Description

The AccuRay family of application-matched basis weight sensors incorporates many advanced features not available with other basis weight sensors.

Each AccuRay Basis Weight Sensor features high-efficiency sealed nucleonic sources combined with spectrally matched detectors to obtain the highest signal-to-noise ratios for precise measurement and control. The high-efficiency gaseous (enriched Kr-85) source capsules are welded titanium for maximum corrosion resistance. These sensors are designed for sub-atmospheric pressures so as to experience negligible internal energy losses. The promethium source is double-encapsulated corrosion-resistant titanium, and all seals are welded. This

advanced source design makes it the most secure device of its kind in the industry.

The state-of-the-art ionization chamber detectors are custom-designed and manufactured by ABB to optimize spectral response, detection efficiency and speed of response. In addition, proprietary developments have been incorporated to make the basis weight sensor's geometry inherently insensitive to mechanical deflection of the sensor heads, passline variations and composition of the process being measured.

The nucleonic sensor geometries — conical-beam and fan-beam — have large solid angles to maximize utilization of the beta energy emitted from the sealed sources. Nuclear noise is minimized, allowing the sensor to achieve the high signal-to-noise

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ratios required for the most accurate measurement.

Standardization techniques unique to ABB ensure long-term sensor performance. The All-Point Standardization feature separates the variables and automatically corrects for electronic drift, source decay and dirt build-up on the sensor windows that would otherwise affect measurement accuracy. This total compensation ensures that all points on the calibration curve are accurate, not just two, three or five points as with competitive basis weight sensors.

The stability and insensitivity to extraneous variables permit permanent sensor calibration and simple calibration transfer. AccuRay Sensors are completely interchangeable without recalibration. Each sensor measures on a single, linear curve over the entire process measurement range. Verification is simplified by using only single-point calibration and static reference sample repeatability checks. Extensive on-line diagnostics provide maximum operator simplicity and confidence in the measurements.

AccuRay Basis Weight Sensors are compact, modular units which are aligned with other sensors in the scanner to assure same-spot, machine-direction measurement for optimum cross-machine control. Because the sensors do not have to scan off the edge of the sheet, the process measurement time is maximized.

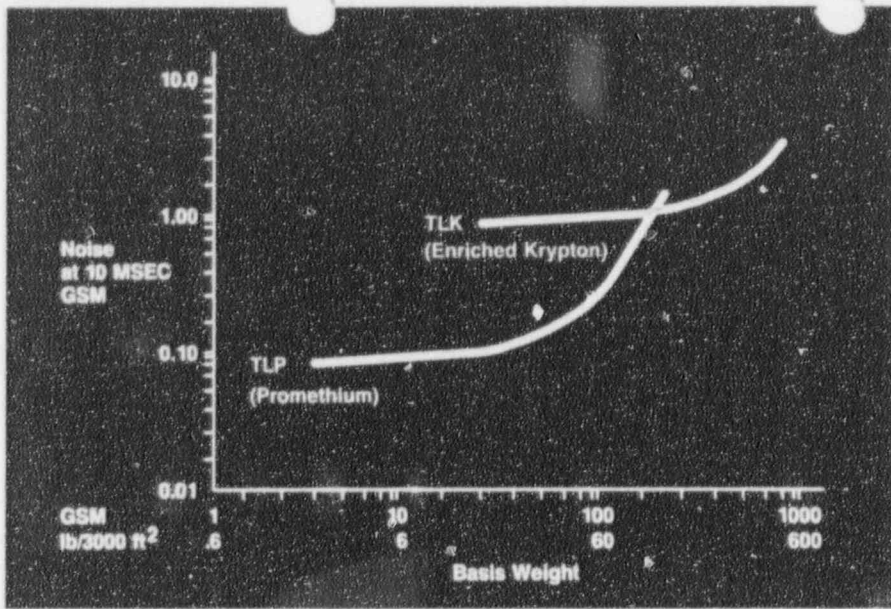
Advanced features such as Air Gap Conditioning, Air Gap Temperature Correction, and Controlled Air Plenum further enhance the measurement performance of the AccuRay Basis Weight Sensors.

#### **Installation and Engineering Services**

To ensure quick delivery and start-up of AccuRay Basis Weight Sensors, ABB Process Automation offers a full range of services. These include outlining customer specifications, installing each product, ensuring optimum performance from every system, and providing expert project management through acceptance.

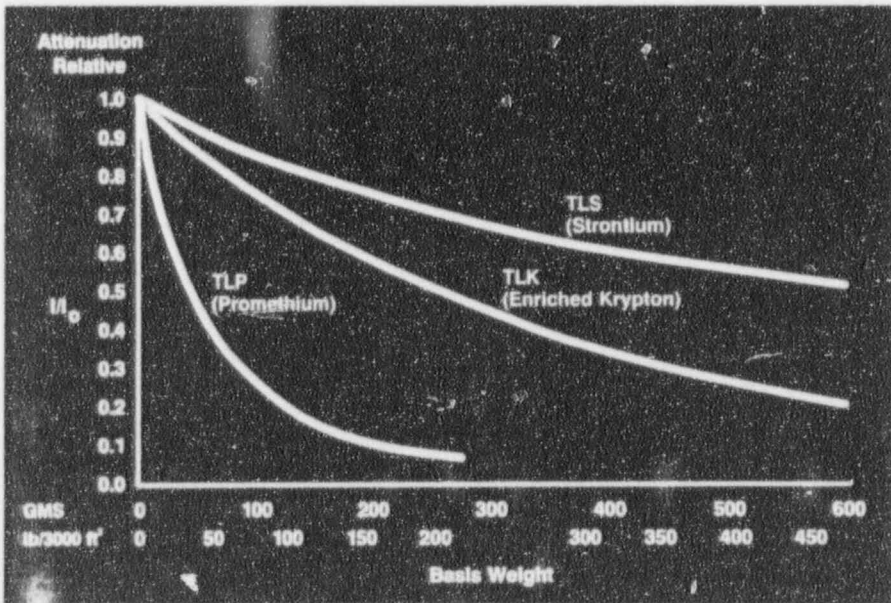
#### **Features**

- Application-matched family of advanced basis weight sensors for measuring all grades, from light-weight tissue and newsprint to heavy board.
  - Custom-designed and manufactured ionization chambers provide superior measurement characteristics, stability, efficiency and high speed of response.
  - Small measuring area and high signal-to-noise ratios provide detailed streak resolution in a single scan.
  - Fan beam "streak" geometry options for tighter cross-directional streak and edge-of-sheet measurement.
  - 100% on-sheet measuring time between standardization cycles provides an uninterrupted product picture.
  - Advanced geometries provide insensitivity to X, Y and Z deflections, passline variations and composition changes in the process.
  - Smart on-line diagnostics verify measurement integrity.
  - Factory pre-calibrated for accurate process measurement at time of installation.
  - Permanent factory calibration ensures single, linear measurement range for long-term accuracy.
  - Air Temperature Correction eliminates air column errors.
  - Air Profile Correction provides fine tuning for scanner misalignments and environmental errors.
  - Air Gap Conditioning establishes a stable temperature environment in the measuring gap to ensure continuous measurement performance.
  - All-Point Standardization provides automatic compensation for electronic drift, source decay and dirt build-up on the measurement windows.
  - No static-to-dynamic shift. Completely interchangeable sensors provide static accuracy verification with permanent reference check samples.
- Signal is processed to provide actual linear measurement — not approximation between measurement points.
  - Substrate independent calibration transfer and in-line measurements optimize coat weight measurement and control accuracy.
  - Ease of verification and operation promotes operator confidence.
  - Machine-direction sensor alignment for precise cross-machine control.
  - Meets AccuRay Sensor quality standards to ensure long-term customer satisfaction.
  - AccuRay EVERGREEN Technology™ commitment allows for new features and additions while protecting initial investment.
  - Supported by ABB's worldwide network of service professionals.



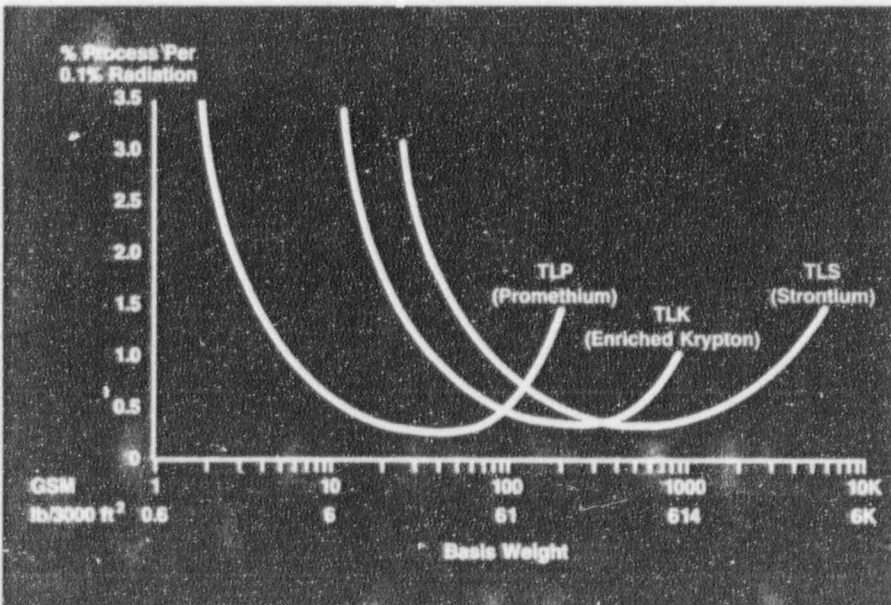
### Sensor Noise

Sensor noise is minimized with Promethium (TLP) basis weight measurement, resulting in the finest possible resolution of lightweight processes.



### Calibration Curves

All-Point Standardization retains the base standard calibration curves to ensure long-term measurement performance.



### Process Resolution Curves

AccuRay Sensors are designed to match customer applications. This graph shows which AccuRay Basis Weight Sensor will provide the most accurate measurement for certain product weights.

## Specifications

Specifications are quoted for installations on AccuRay Measurement Platforms and typical process environments and applications. These specifications assume sampling and testing techniques that are sufficiently precise to demonstrate inherent sensor accuracy. Recognizing that every process and application is unique, ABB Process Automation draws on its extensive measurement knowledge and paper industry application experience to provide custom solutions for sensor performance, as well as consulting on environmental and process-related challenges.

AccuRay Sensors are supported by a worldwide network of service professionals. ABB resources at local, divisional, and corporate levels ensure that systems are operating to quality standards. Unique customer needs are met through on-site surveys, application studies and specification efforts by field specialists, combined with product analysis by home office physicists.

### Accuracy

Typically  $\pm 0.25\%$  (2-sigma) of basis weight or  $0.15 \text{ g/m}^2$ , ( $0.05 \text{ g/m}^2$  for TLP-1), whichever is greater. This assumes sampling errors and laboratory processing errors are negligible\*.

### Stability

Typically less than  $\pm 0.05\%$  of zero basis weight signal.

### Repeatability

$\pm 0.2\%$  (2-sigma) of weight output or  $0.12 \text{ g/m}^2$  ( $0.06 \text{ g/m}^2$  for TLP-1), whichever is greater, on standard reference samples.

### Resolution

Less than 0.1% of weight over entire measurement range with one second averaging. Typically 0.1% of weight per individual 0.0625 second reading\*.

### Environment

Ambient temperature up to  $21^\circ\text{C}$  ( $250^\circ\text{F}$ ).

Humidity up to 95% R.H., non-condensing.

Detailed description of testing, performance criteria and boundaries are defined in ASTP-11.

\*Sensor accuracy, repeatability and resolution depend upon the actual basis weight. Refer to process resolution curves.

## Measurement Range

### AccuRay Family of Application-Matched Basis Weight Measurement

Feature #:	4210-T	4210-5	4210-8	4211	4215-1	4215-2
Type:	TLK-Tissue	TLK-5	TLK-8	T	TLP-1	TLP-2
Measurement Range:	8-1050	8-1050	15-800	50-4900	5-180	5-180
	$\text{g/m}^2$	$\text{g/m}^2$	$\text{g/m}^2$	$\text{g/m}^2$	$\text{g/m}^2$	$\text{g/m}^2$
	5-645	5-645	9-490	30-3000	3-110	3-110
	$\text{lb/3000ft}^2$	$\text{lb/3000ft}^2$	$\text{lb/3000ft}^2$	$\text{lb/3000ft}^2$	$\text{lb/3000ft}^2$	$\text{lb/3000ft}^2$
Advanced Features:	AGC	ATC	ATC		AGC	AGC
	ATC				ATC	ATC
	CAP				CAP	CAP
Air Gap:	6.4mm	13mm	13mm	38mm	6.4mm	6.4mm
Effective Measuring Area:	25mm	25mm	25mm	25mm	25mm	10mm*
Source:	250-1000mc Kr-85			70mc Sr-90	1000mc Pm147	
Detector:	Custom Ionization Chambers					

\*Fan beam geometry

## Advanced Basis Weight Sensor Features

### Air Gap Conditioning (Feature No. 4285)

Air Gap Conditioning (AGC) provides a stable environment for accurate nucleonic-based basis weight measurement by injecting a curtain of heated air into the sensor measuring gap. This eliminates possible measurement errors due to air density changes while the sensor is scanning, and when it travels off-sheet for standardization and process interruptions.

Air Gap Conditioning uses curie-point semiconductor ceramic heaters to heat clean, pressurized air. The air fills the measuring gap above and below the sheet, replacing uncontrolled air around the sheet and in the surrounding environment. Setpoint temperature controllers maintain the temperature at a constant level. Air Gap Conditioning also effectively eliminates dirt accumulation on sensor windows.

The proprietary honeycomb ceramic heaters have no moving parts, providing high reliability in the harsh and dusty paper machine environment. In addition, the ceramic heaters are self-regulating, heating only to a specified temperature. This feature, along with the setpoint temperature controllers, eliminates risks associated with conventional hot-wire heating elements.

*The Controlled Air Plenum, Air Gap Conditioning, and Air Gap Temperature Correction prevent dirt build-up on the measurement windows and negate the effects of temperature in extreme environments.*

### Air Gap Temperature Correction

Air Gap Temperature Correction (AIC) compensates the basis weight measurement for air column density changes that occur in and between the source and detector heads. Four representative temperatures in the total air column are measured with fast response thermistors and combined proportionally to provide consistent air gap temperature correction.

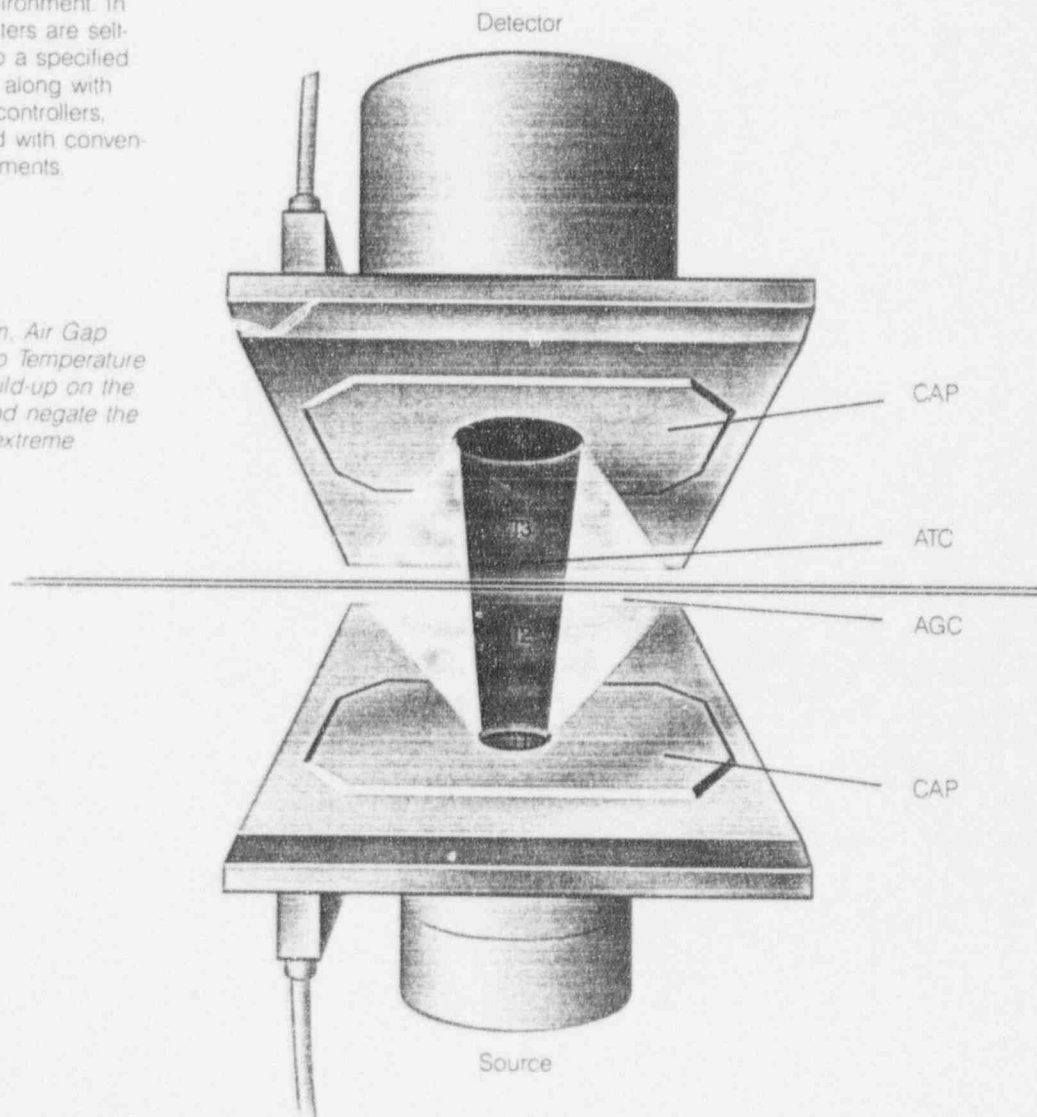
Four measurements are taken to achieve the most accurate compensation for true weight measurement. Even with internal air column temperature control, changes in the external gap temperatures will occur due to radiant heating or cooling from the process, causing short-term fluctuations in internal air columns.

Each thermistor features a predictive model based on its application-related response time. This modeling helps determine actual air column temperature instantaneously, independent of thermistor response time. This determined temperature is the same as what the basis weight sensor sees.

### Controlled Air Plenum (Feature No. 4286)

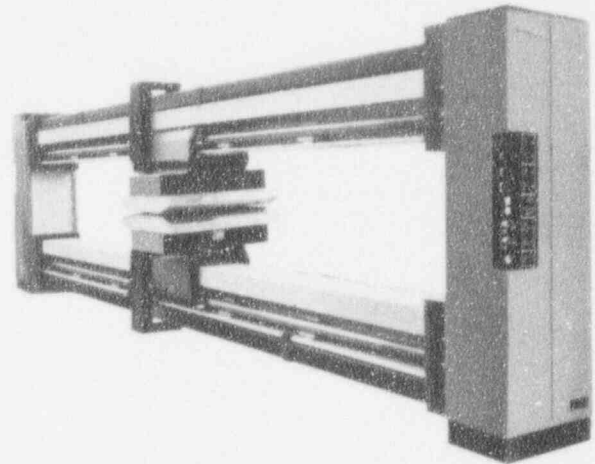
The Controlled Air Plenum (CAP) forces a temperature-controlled plenum of air to flow from both the top and bottom of the sensor. Used in conjunction with Air Gap Conditioning, this heated air is directed at high speeds through plates to keep the sensor windows clean, even in harsh environments such as tissue and toweling applications. The overall effect is enhanced basis weight measurement in adverse environments.

The air plenum over the source and detector windows maintains a pressure barrier, keeping the process and associated dirt and dust from contacting the windows. In addition, the controlled air flow provides improved temperature stability — resulting in improved basis weight measurement performance.



**GENERAL DESCRIPTION**

The modular design provides in-line measurement of multiple process variables including weight, moisture, caliper, opacity, and ash. The scanner is capable of single point or scanning measurements. Heavy-duty steel construction, precision machined keyways and dowel pins, and patented automatic standardization of the tensed tubes ensure accurate alignment of the scanner and sensors during operation. Individual sensors can be removed easily for off-machine servicing.


**FEATURES**

Solid-state drive system is insensitive to variations in load, line voltage, and ambient temperature.

Extensive self-diagnostics are provided for frame drive, control, and sensors.

Permanent alignment of sensor package is built-in.

Sensor package is retractable into off-sheet position.

High-speed emergency withdrawals are initiated manually or automatically.

Serial data link to the Programmable Microcomputer Module.

Sensor package cable is contained within the I-beam construction.

All surfaces are primed and painted with polyurethane-base paint for corrosion resistance.

Thermal articulation subsystem maintains tube alignment during ambient temperature variations.

**SPECIFICATIONS**

Scan speed is adjustable up to 0.3 m/s (12.5 in./sec.).

Fits sheet trim widths of up to 10.7 m (420 in.).

51-mm (2-in.) diameter stainless steel tubes, tensed for straightness, support and guide sensor packages.

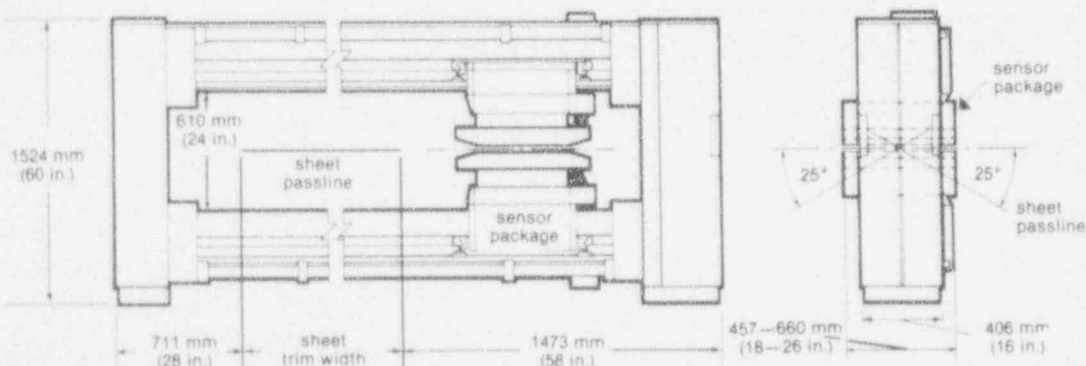
Scanner can carry 136-kg (300-lb.) sensor package across the web.

Sheet passlines beyond 25° from horizontal are available, but require change of vertical dimension.

Sensor positioning is reproducible to within 6 mm (0.25 in.).

Steel I-beams: 254 x 254 mm (10 x 10 in.).

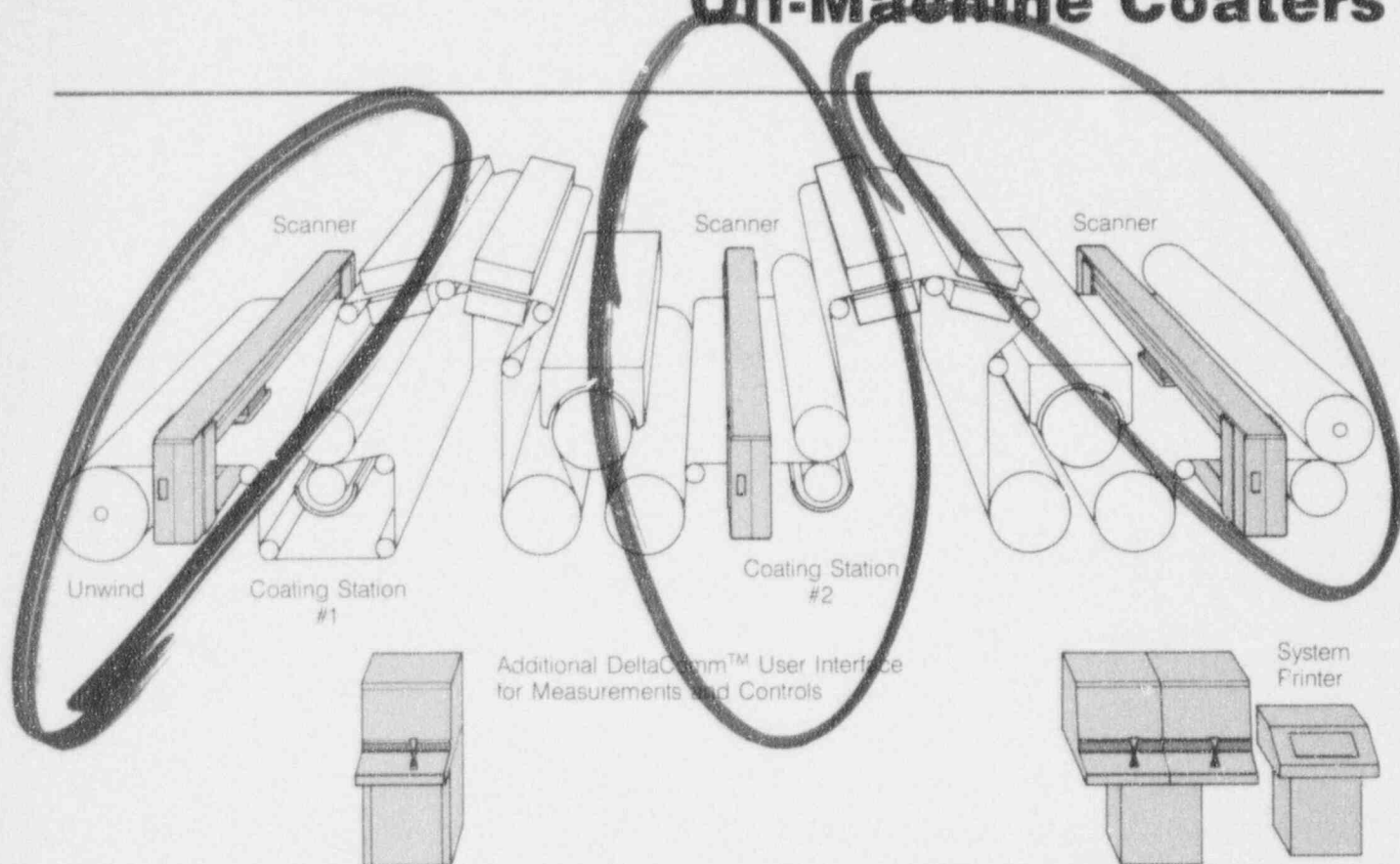
Weight: 680 kg (1500 lbs.) plus 56.7 kg (125 lbs.) per meter.





1180 MICRO

# 1180 MICRO for Off-Machine Coaters



Dual Console DeltaComm™ User Interface, with the Minicomputer and Programmable Microprocessor Modules, lets the user view two displays simultaneously

## Control Features Available with AccuRay 1180 MICRO™

1. Coat Weight Control
2. Digital Moisture Control
3. Scan Independent Control
4. Model Reference Control
5. Coordinated Speed Change
6. Speed Optimization Control
7. Start-Up Control
8. Profile Manager™/Moisture

## The AccuRay Family of MICROSCAN™ Sensors Includes:

1. Basis Weight Sensor
2. Moisture Sensor
3. Ash Sensor
4. Caliper Sensor
5. Opacity Sensor
6. Color Sensor
7. Smoothness Sensor
8. Sheet-Width Sensor
9. Reel Hardness Sensor
10. Gloss Sensor
11. Formation Sensor
12. Brightness Sensor



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Specifications subject to change

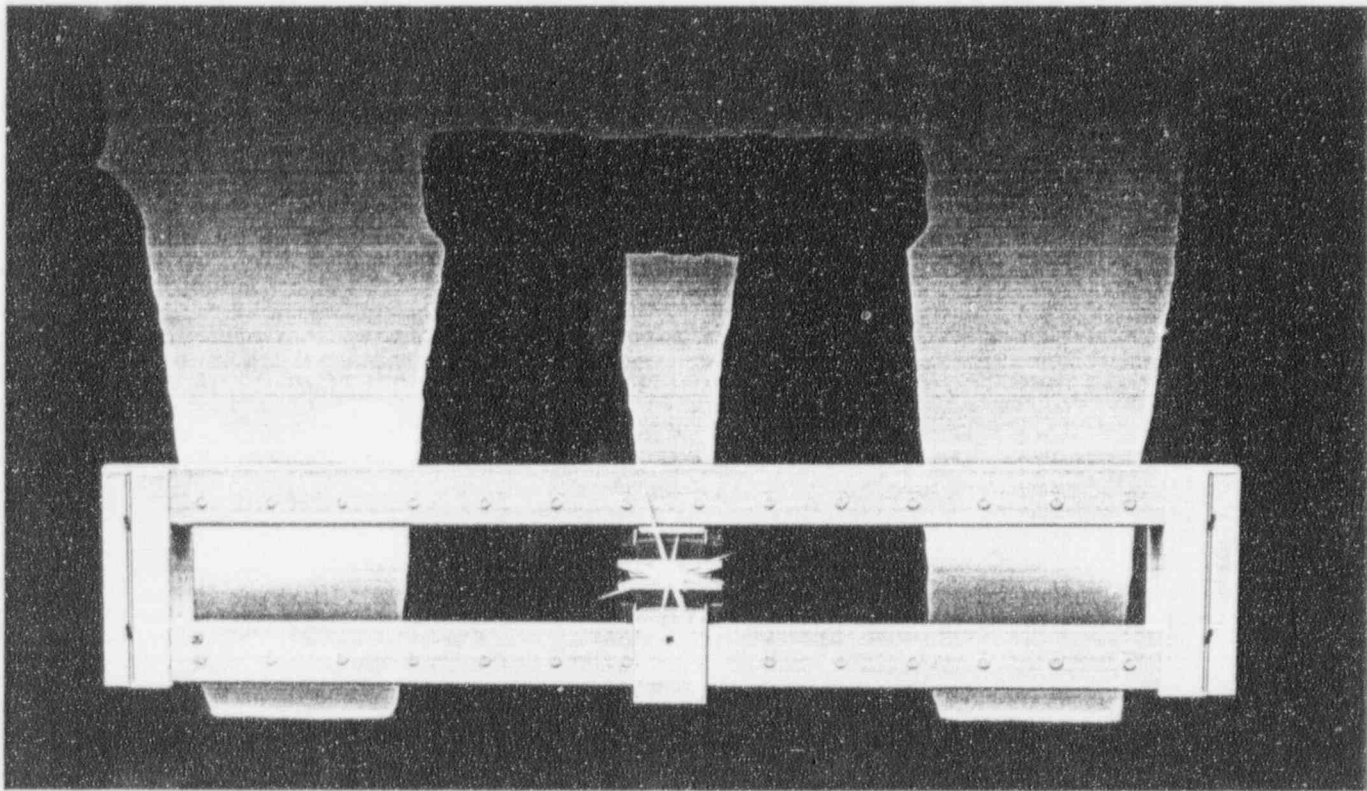
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# 3118

AccuRay<sup>®</sup> 1180 MicroPlus<sup>™</sup>

## MICROSCAN<sup>™</sup> Measurement Platform



### Executive Summary

The MICROSCAN Measurement Platform provides a solid foundation for AccuRay sensors to achieve the superior measurement required for modern papermaking.

Measurement Platform features a superior "A"-section design for stability, accuracy and reliability in the most adverse conditions. In addition, Measurement Platform can be quickly installed and easily and cost-effectively maintained and serviced.

### Description

The modular MICROSCAN Measurement Platform is an integral part of the AccuRay 1180 MICRO<sup>™</sup> and 1180 MicroPlus systems and provides on-line scanning or single-point measurement of multiple process variables. It can carry a multi-sensor package across the widest sheets and accommodate pass-line angles up to 45 degrees.

The unique "A" section box-beam construction provides superior vertical, horizontal and torsional rigidity required for precision alignment of sensor source and detector across wide-trim paper machines. The exterior of Measurement Platform has no openings, exposed cables, covers or hardware, and is

protected by three layers of advanced-technology coatings. All electronics and moving parts reside in a clean, sealed environment.

The measurement carriage rides on polished, solid steel tracks 25 mm (1") in diameter, that are permanently laser-aligned at the factory. Traversing speed of the sensor is adjustable to match the process or machine, and sensor positioning is accurate to within 1 mm.

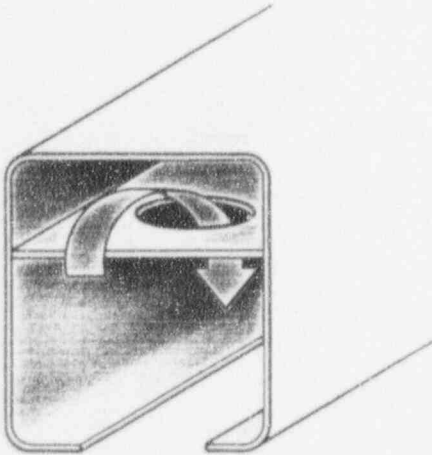
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## Features

### Built strong for accurate measurement.

- "A"-section box-beam construction provides vertical strength 2.2 times stronger, horizontal strength 8 times stronger, and torsional (twisting) strength 168 times stronger than traditional "I"-beam designs.
- Beams formed from a single sheet of 10 mm (3/8") plate. A ventilated steel stiffener plate facilitates air flow and equalizes internal temperatures.

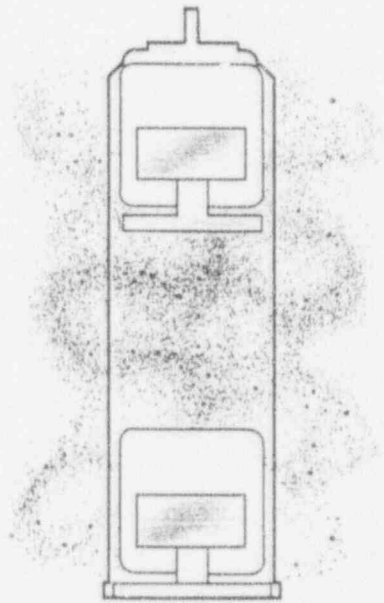


- Box-construction end columns attached by welding around the beam on both sides, to further improve beam rigidity.
- Large sensor carriage to better accommodate additional sensors and extreme passline angles.
- The entire structure is stress-relieved or "aged" prior to alignment, to simulate years of on-machine use. This ensures that factory alignment is accurate and permanent, even after shipping, machine vibrations, and daily use.
- Carriage tracks permanently laser-aligned at the factory, to within 50 microns (0.002"). This provides steady, accurate travel of the sensor heads.
- A resolver accurately positions sensor heads to within 1 mm.

- Exceeds accuracy requirements for modern cross-machine control applications.
- Designed to accommodate multiple sensors to improve system utilization.
- Sensors positioned in a straight line within the measurement head, to always measure the same point.

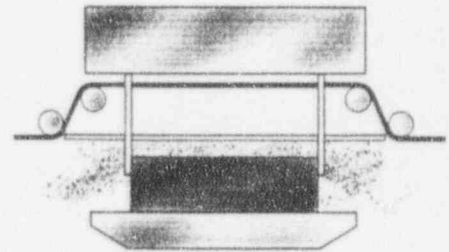
### Designed to perform day after day, in the harshest environments

- Smooth exterior design with no external openings, covers, or exposed hardware or cables.
- All corners rounded to prevent dirt build-up.
- Upper and lower beams have "seam" side down to prevent material falling in.



- Externally protected with advanced coatings that resist chemical agents and actively counter corrosion. Includes a cold zinc undercoating, red oxide primer, and high-gloss urethane exterior coating.
- All bearing surfaces and electronic components in a sealed interior to protect against dirt, water, temperature and chemicals.
- "A"-section internally pressurized with clean air. Air flow aids temperature stabilization.

- End doors constructed of molded, reinforced fiberglass for strength and light weight. Doors sealed against water and air and allow internal pressurization.
- Quick-release recessed latches and detect-action hinges allow easy access to end sections.
- Membrane control panels conveniently located at both ends of the platform feature accurate response, easy-to-understand symbols and light-emitting diodes. Prevents dirt and water from reaching internal components.
- Unique sealing design features proprietary tape to prevent dirt from entering the clean interior. Makes Measurement Platform airtight and allows for internal pressurization.



- Wrap-around bottom carriage constructed of double-wall aluminum with stiffeners for rigidity and protection of cables. Prominently displays source warning lights.
- Carriage tracks are solid 25 mm (1") steel bars. These have excellent corrosion resistance and the same thermal expansion coefficient as the rest of the structure.
- Carriage and sealing-belt wheels composed of a long-lasting proprietary polymer for a smooth, precise ride.
- Maintenance-free, brushless, three-phase AC drive motors and high reliability drive electronics. Power converted from single-phase to three-phase in drive electronics.
- Low-friction carriage wheels and vertical utility distribution design allow motors to virtually "idle" while scanning, to extend motor life.

- Helical gear reducer connects motor to drive shaft. In case of power failure, heads can be manually retracted. No clutch required.
- Drive belts are stretch and wear resistant.
- Torque is electronically controlled for safe limiting of forces on the heads, without a worm gear or clutch.
- In case of process upsets, sensors can be quickly retracted using keypad, operator station, or sheet break detectors.
- Electronic components meet or exceed MIL SPEC 883B.

**Easier and less costly to install, maintain and service.**

- Only system that can be diagnosed and maintained while the process is running. All key components (wheels, cables, drive belts, seals, electronics) can be reached through a unique end-column access system.
- Measurement heads easily separated for maintenance and cleaning, and re-engaged with high precision.
- Quick release latch allows access to sensor heads.
- Easy to install due to rigidity and permanent factory alignment.
- Entire sensor package retractable into off-sheet position for easy threading.
- A diagnostic module with connectors in the end sections, permits checking of all incoming and outgoing signals.
- Pre-connectorized cables for easy installation.

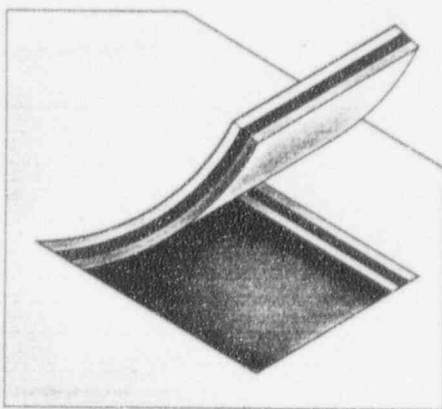
**Specifications**

**Structure**

Welded, closed-beam construction of 10 mm (3/8") steel plate. Outside beam cross-section 405 x 355 mm (16" x 14").

**Coating**

Steel pre-treated per SSPC-SP10 and zinc coated. Red oxide primer and high solids polyurethane topcoat.



**Weight**

595 kg + 266 kg per meter mounting hole distance (1313 lbs. plus 179 lbs. per foot).

**Length**

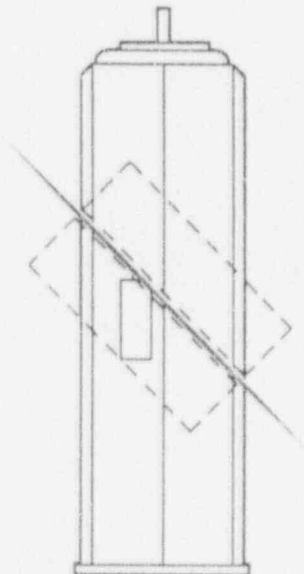
Standard up to 12 meters (472"). Longer upon request.

**Traversing**

50 mm (2") wide drive belts. Brushless three-phase motor, 0.2 KW, AC, variable frequency inverter control system.

**Passline**

0-25° standard end column, 0-45° extended end column



**Way System**

Polished, solid steel bars, 25 mm (1") in diameter. Factory laser-aligned to ± 50 microns (± 0.002").

**Sealing System**

Airtight construction. Required air pressurization 6-20 mm (0.25-0.75") of water, using 100-150 mm (4-6") duct. Air purge unit available upon request.

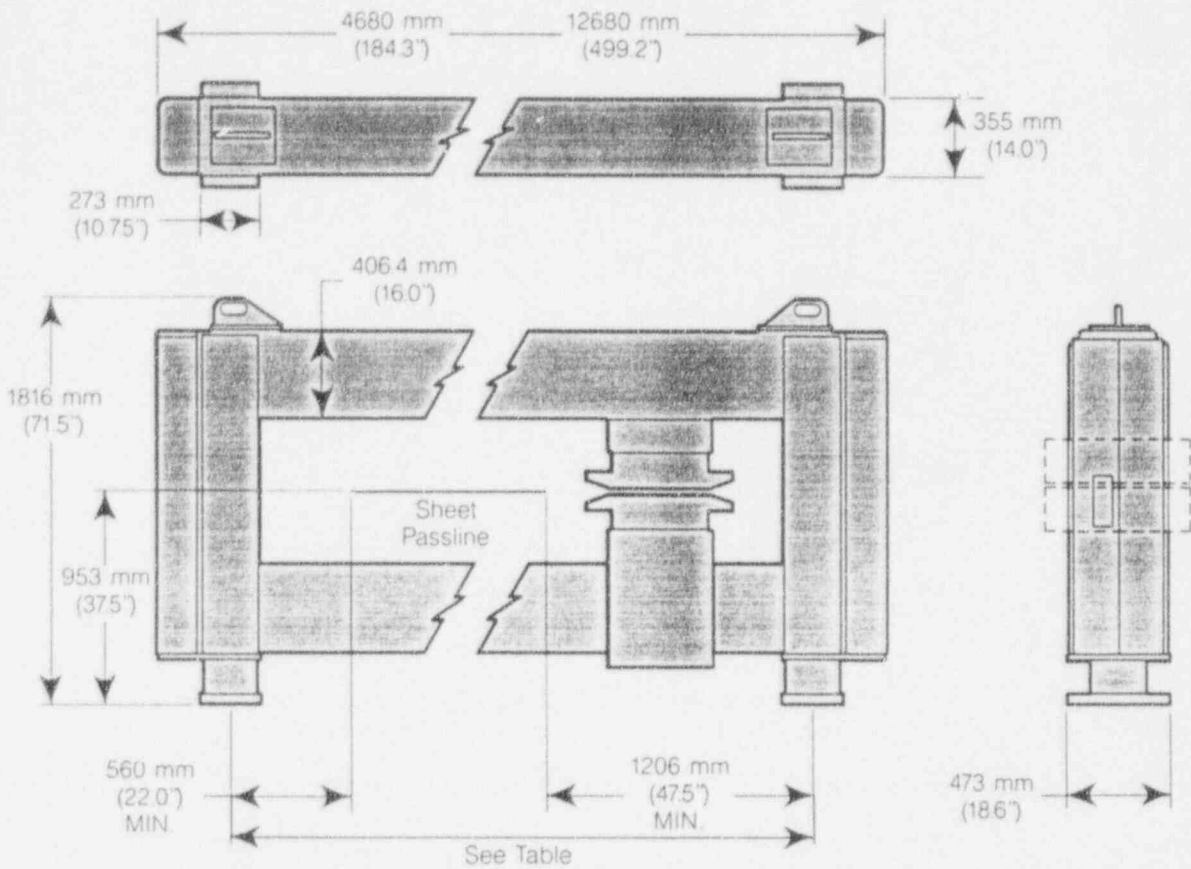
**Electric Power**

115 VAC, 1 KVA, 50-60 Hz, plus 220/230 VAC, 0.5 KVA, 50-60 Hz.

**Temperature**

Maximum sheet temperature 120°C (250°F); ambient air temperature maximum 80°C (175°F).

Extended temperature range available upon request.



STANDARD LENGTH HOLE CENTERS MILLIMETER / INCH	MAX. TRIM. MILLIMETER / INCH
4000/157.5	2235/87.9
5000/196.9	3235/127.4
6000/236.2	4235/166.7
7000/275.6	5235/206.1
8000/315.0	6235/245.5
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11000/433.1	9235/363.6
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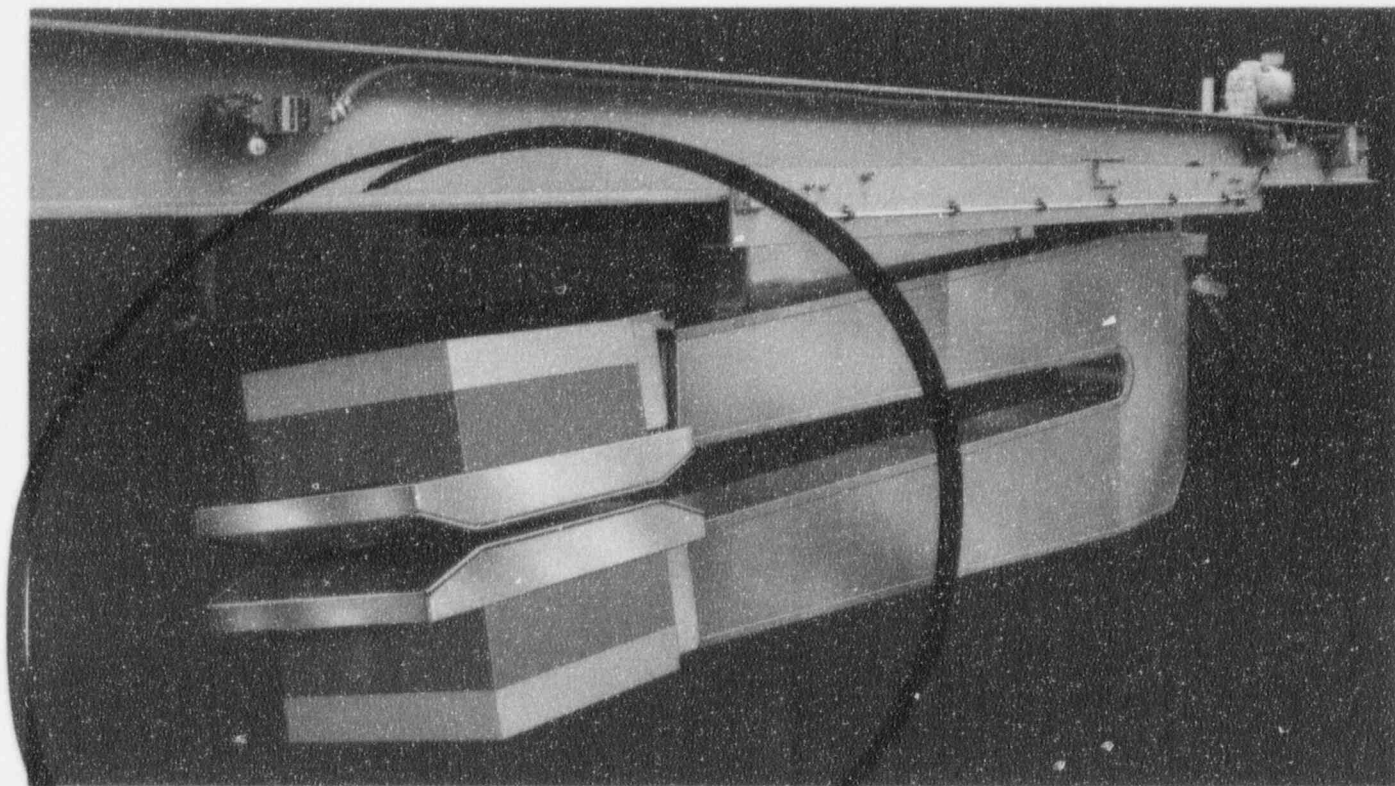
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AccuRay<sup>®</sup> 1180 MicroPlus<sup>™</sup>

## MICROSCAN<sup>™</sup> U-Frame



### EXECUTIVE SUMMARY

The AccuRay MICROSCAN U-Frame provides a solid sensor foundation for exceptional measurement stability, reliability and ease of maintenance in the harsh paper mill environment.

### DESCRIPTION

The U-Frame offers papermakers precise across-the-sheet scanning or single-point positioning of AccuRay MICROSCAN Sensors. The frame's heavy-duty, one-piece construction, thermal stabilization, and specially designed inner stiffeners ensure permanent, accurate alignment of these sensors during operation.

In addition, the U-Frame's modular head design provides superior on-line measurement of multiple process variables including weight, moisture, caliper, brightness, formation, opacity, ash, gloss, smoothness, and edge-of-sheet. In case of process upsets, the U-bracket and sensors can be quickly retracted using a pushbutton, operator station, or sheet break detectors. Individual sensors can also be removed easily for off-machine servicing.

The MICROSCAN U-Frame consists of four basic components: a support structure, traversing U-bracket assembly, measurement sensor package, and cable distribution system.

The support structure includes a single or dual rail, drive subassembly, and limit switches. The traversing U-bracket assembly consists of a carriage and bearing assembly, a drive system interface, and a U-bracket.

The U-Frame also includes a measurement sensor package for housing MICROSCAN Sensors. The cable distribution system connects these sensors to various utility sources.

Several basic models of U-bracket assemblies and varied drives allow papermakers to select the model best-suited to their needs.

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Combustion Engineering ensures complete and professional installation of the U-Frame through an extensive, worldwide network of C-E service professionals. A skilled C-E Project Team performs all product functions from Specification-Thru-Acceptance to ensure maximum value for the papermaker. In addition, the U-Frame is covered by a full two-year AccuRay Extended Warranty unequalled in the industry.

## FEATURES

### Built strong for accurate, high-performance measurement

- Designed to accommodate multiple sensors to improve system utilization.
- Sensors positioned in a straight line within the measurement head to allow measurement of the same point.
- Scan or single point measurement provided by reversible, variable speed DC motor drive.
- Sensors travel to the edge of the sheet without going off the sheet.
- In case of process upsets, the U-bracket and sensors can be quickly retracted using a pushbutton, operator station, or sheet break detectors.
- Solid-state drive system insensitive to variations in load, line voltage, and ambient temperature.
- Optional high-dust environment protection.
- Rugged, one-piece design and construction.

### Easy to install, maintain and service

- Entire U-bracket and sensor package retractable into off-sheet position for easy threading and maintenance.
- Extensive on-line self-diagnostics for frame drive, control and sensors.
- Permanent alignment of sensor package is built-in for reduced maintenance.
- High-speed emergency withdrawals initiated manually or automatically.
- Serial data link to processing system.
- Remote junction box located away from severe machine environment.
- Pre-connectorized cables for easy installation.
- Focuses on Specification-Thru-Acceptance services for complete client satisfaction.
- Covered by a full two-year AccuRay Extended Warranty unequalled in the industry.

## SPECIFICATIONS

### Traversing:

Scan speed adjustable up to 0.3 m/sec. (12.5 in/sec.)

### Weight:

Payload of 136 kg (300 lbs.) sensor package.

### Positioning:

Sensor positioning reproducible to within 6 mm (0.25 in.)

### Passline:

Sheet passline angles up to 25° from horizontal for throat depths up to 3.8 m (150 in.)

Sheet passline angles up to 12° for throat depths of 4 m to 4.6 m (160 to 180 in.)

### Temperature:

Maximum sheet temperature 120°C (250°F).

Ambient air temperature maximum 80°C (175°F).

### Single-Rail (Model 3102)

#### Availability:

Single-rail model available where machine-direction space is limited.

#### Sheet Length:

For sheets up to 3683 mm (145 in.) wide.

#### Throat Depths:

610 mm to 3683 mm (24 to 145 in.)

#### Rail Length:

Up to 8.9 m (350 in.)

#### Weight:

Approx. 680 kg (1500 lbs.) for standard 145 in. throat.

### Dual-Rail (Model 3103)

#### Availability:

Dual-rail model available for additional stability and wide web processes.

#### Sheet Length:

For sheets up to 4570 mm (180 in.) wide.

#### Throat Depths:

1219 mm to 4570 mm (48 to 180 in.)

#### Rail Length:

Up to 10.8 m (425 in.)

#### Weight:

Approx. 1225 kg (2700 lbs.) for standard 150 in. throat.

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Specifications subject to change

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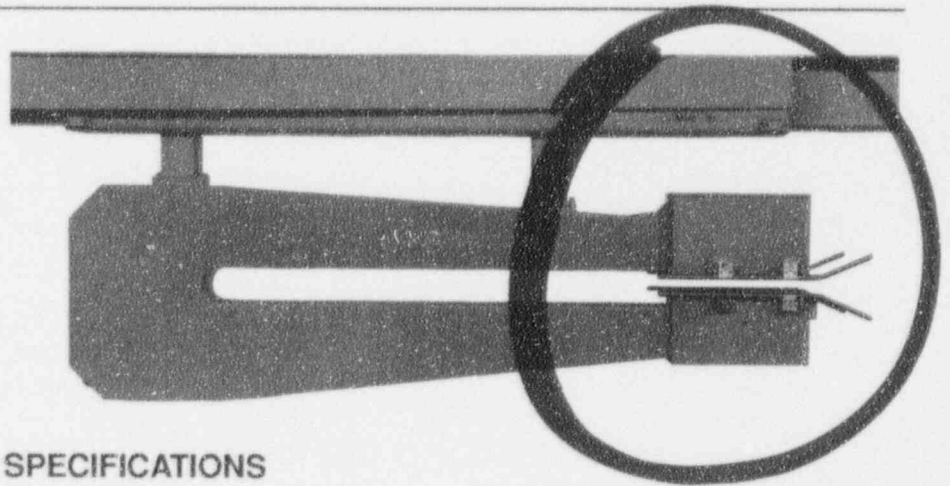
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AccuRay® 1180 MicroPlus™

## Single Point Weight Sensor

### GENERAL DESCRIPTION

A positioning frame and basis weight sensor designed to meet the requirements of short loop control in the Cascade Weight Control program. It consists of a top-mount U-frame with local push-button positioning controls for on and off sheet sensor positioning, and an application matched basis weight sensor.



### FEATURES

A cost effective approach to implement Cascade Weight Control.

Minimum on-sheet and off-sheet space requirements.

Standardization eliminates measurement effects of contaminants on sensor heads.

Presentation of basis weight data available to operating personnel via dedicated digital display.

### SPECIFICATIONS

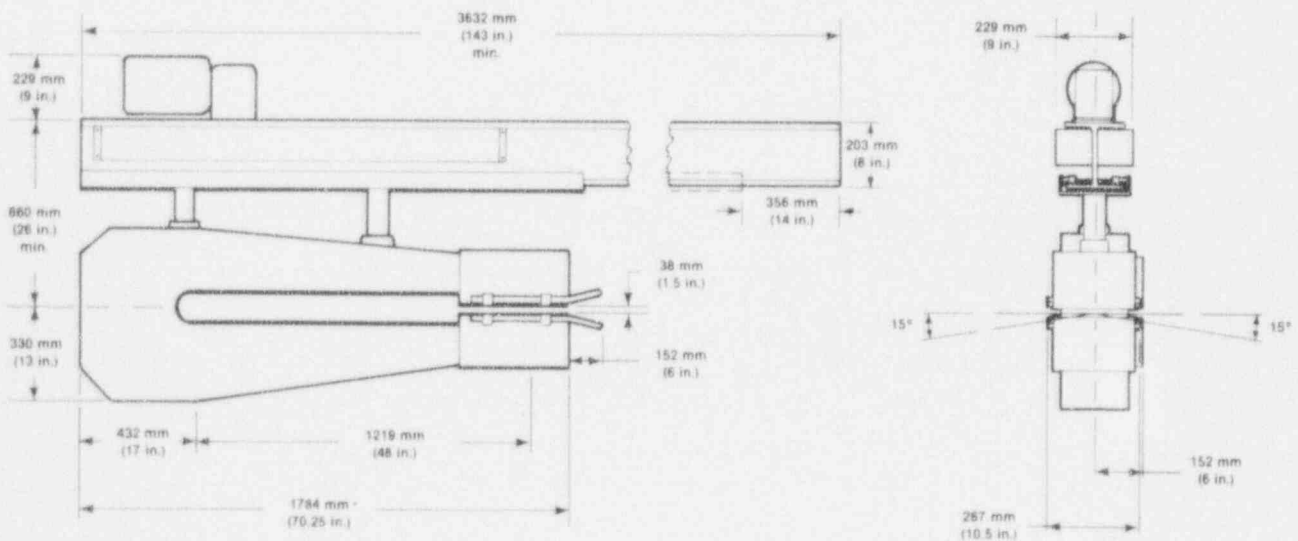
Measurement source of beta radiation is 70 mCi of encapsulated Sr90.  
Air Gap: 38 mm (1.5 in.).

Measurement Range: 73 to 5859 g/m<sup>2</sup> (15 to 1200 lbs/1000 ft<sup>2</sup>).

Repeatability: ± 0.1% of weight output (or 0.15 g/m<sup>2</sup>), whichever is greater.

Typically measures basis weight shifts as small as 0.05%.

Weight change of 38 mm (1.5 in.) column of air due to temperature variation is 0.016 mg/cm<sup>2</sup> per °C (0.009 mg/cm<sup>2</sup> per °F). Heaters set to maintain measuring heads at maximum ambient temperature compensate for this. The heating plus the thermal mass of the heads stabilizes the air gap temperature.



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