NRC FORM 313
(1-84)
10 CFR 30, 32, 33, 34, 35 and 40

APPLICATION FOR MATERIAL LICENSE

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 5-31-87

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

FEDERAL AGENCIES FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIAL SECTION B
631 PARK AVENUE
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
MATERIAL RADIATION PROTECTION SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
MATERIAL RADIATION PROTECTION SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [X] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [ ] C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

McLouth Steel Products Corporation
1650 West Jefferson Avenue
Trenton, Michigan 48183

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

1491 West Jefferson Avenue
Trenton, Michigan 48183

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Theodore G. Main

TELEPHONE NUMBER

(313)246-4196

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES /

8506070101 850510
REG3 LIC30
21-24498-01 PDR

10. RADIATION SAFETY PROGRAM.

11. WASTE MAN

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY 10 CFR 170.31(3)(E)
AMOUNT ENCLOSED $ 230.00

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE–CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
Theodore G. Main	Theodore G. Main	Manager of Safety	4/24/85

14. VOLUNTARY ECONOMIC DATA

a. ANNUAL RECEIPTS

- [ ] <$250K
- [ ] $250K–500K
- [ ] $500K–750K
- [ ] $750K–1M
- [ ] $1M–3.5M
- [ ] $3.5M–7M
- [ ] $7M–10M
- [X] >$10M

b. NUMBER OF EMPLOYEES *(Total for entire facility excluding outside contractors)*
2,200

c. NUMBER OF BEDS
Not Applicable

d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION *(dollar and/or staff hours)* ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? *(NRC regulations permit it to protect confidential commercial or financial–proprietary–information furnished to the agency in confidence)*

- [X] YES
- [ ] NO

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
APP + MAT	11	3P		
AMOUNT RECEIVED	CHECK NUMBER			DATE
$230	212077		CONTROL NO. 78799	5/3/85

PRIVACY ACT STATEMENT ON THE REVERSE

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on NRC Form 313. This information is maintained in a system of records designated as NRC-3 and described at 40 Federal Register 45334 (October 1, 1975).

1. **AUTHORITY:** Sections 81 and 161(b) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2111 and 2201(b)).

2. **PRINCIPAL PURPOSE(S):** The information is evaluated by the NRC staff pursuant to the criteria set forth in 10 CFR Parts 30, 32, 33, 34, 35 and 40 to determine whether the application meets the requirements of the Atomic Energy Act of 1954, as amended, and the Commission's regulations, for the issuance of a radioactive material license or amendment thereof.

3. **ROUTINE USES:** The information may be (a) provided to State health departments for their information and use; and (b) provided to Federal, State, and local health officials and other persons in the event of incident or exposure, for their information, investigation, and protection of the public health and safety. The information may also be disclosed to appropriate Federal, State, and local agencies in the event that the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, or local agency to the extent relevant and necessary for an NRC decision or to an appropriate Federal agency to the extent relevant and necessary for that agency's decision about you.

4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** Disclosure of the requested information is voluntary. If the requested information is not furnished, however, the application for radioactive material license, or amendment thereof, will not be processed. A request that information be held from public inspection must be in accordance with the provisions of 10 CFR 2.790. Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned n ed to inspect the document.

5. **SYSTEM MANAGER(S) AND ADDRESS:** U.S. Nuclear Regulatory Commission
Director, Division of Fuel Cycle and Material Safety
Office of Nuclear Material Safety and Safeguards
Washington, D.C. 20555

McLOUTH STEEL PRODUCTS CORPORATION
Application for Material License(cont.)

Item 5 - Radioactive Material:

The radioactive material for which this license application is submitted is Americium 241. For purposes of this application, McLouth Steel will have possession of a minimum of four(4) sealed sources each containing one(1) curie each of Americium 241. The sealed sources are manufactured by New England Nuclear and are designated Model No. NER-479-C.

The sealed sources will be used in a Reuter-Stokes Safety Ray Sensing System Model No. RSS-811. This Safety Ray Sensing System has been licensed to Reuter-Stokes by Republic Steel, the latter having a general license for the Safety Ray Sensing System. Republic Steel has received the Nuclear Regulatory Commission's Steel Source and Devices Safety Evaluation No. NR566D101G.

No single sealed source will contain more than one(1) curie of Americium 241(i.e., #1 Ci Am-241).

Item 6 - Purpose(s) For Which Licensed Material Will Be Used:

The Reuter-Stokes Safety Ray Sensing System will be installed on McLouth Steel Products Corporation's Hot Strip Mill Flying Shear. The Safety Ray Sensing System will be used in the steel mill to determine the presence or absence of the hot metal as it moves from roughing to shearing at speeds up to 3700 feet per minute. For further reference, McLouth Steel Products Corporation has attached hereto and incorporated by reference the following articles and/or brochures that detail the purposing of the Safety Ray Sensing System:

1. Republic Steel Brochure titled "Safety Ray Sensing System."

2. Article titled "Noncontact Sensing System Succeeds Where Infrared Devices Fail," reprinted from 33 Magazine, April 1976.

3. Reuter-Stokes Safety Ray Sensing System brochure.

4. Reuter-Stokes Engineering Data Sheet for Safety Ray Sensing System.

Item 7 - Individual(s) Responsible for Radiation Safety Program and Their Training and Experience:

The following individuals are "responsible individuals":

a. Theodore G. Main, Manager of Safety and Radiation Safety Officer.

b. Robert J. Ford, Superintendent of Process Control Engineering.

Attached hereto and incorporated by reference herein are the Training and Experience Resumes of Messrs. Main and Ford.

Reuter-Stokes has been retained to provide all services relating to installation, initial radiation survey, training, maintenance and leak-testing. At the time the Safety Ray Sensing System is installed by Reuter-Stokes, training will be provided to the above-referenced "responsible individuals" and other necessary personnel. McLouth Steel Products Corporation covenants that the gauges will not be operated until such time as the training has been received and that it will maintain records of the training received for five years after the training is completed. Additionally, Reuter-Stokes has been retained to provide semi-annual radiation surveys and wipe tests. As well as continued maintenance of the Safety Ray Sensing System.

Item 8 - Training for Individuals Working in or Frequenting Restricted Areas:

McLouth Steel Products Corporation covenants that a trained "responsible individual" will always be physically present at its facility when the Safety Ray Sensing System is in use. All employees who will operate the Safety Ray Sensing System or work within the restricted area shall receive training and instruction given at the time of installation by Reuter-Stokes.

Item 9 - Facilities and Equipment:

The Safety Ray Sensing System will be installed on McLouth Steel Products Corporation's Hot Strip Mill in substantial conformity with the typical arrangement sketch as set forth in the reprint of 33 Magazine, April 1976, which has been attached hereto and incorporated by reference herein. Additional schematic diagrams are set forth in the Republic Steel and Reuter-Stokes brochures which are also attached hereto and incorporated by reference herein.

The environmental conditions to which the Safety Ray Sensing System will be exposed will be the conditions for which the system was designed (i.e., hot strip mill). The system will be exposed to temperatures ranging to 2100 degrees fahreneit. As a result, the ambient temperature will be reduced by use of a continuous water spray system which will be under continuous observation by the operator of the Hot Strip Mill. Interruption of the continuous water spray system will cause an immediate shutdown of the Hot Strip Mill until such time as the cooling system failure has been analyzed and rectified.

The Supervisor of the Hot Strip Mill will inspect the Safety Ray Sensing System daily. The inspection will include, but not be limited to, visual inspection for proper shutter operation, visual verification that the labels are legible and visible, visual verification of the correct operation of the continuous water spray cooling system.

In the event of an accident involving damage to the Safety Ray Sensing System, the McLouth Steel Products Corporation's Radiation Safety Procedure will be followed.

As "responsible individuals," Messrs. Main and Ford will be immediately notified of the accident. The telephone extension numbers for Messrs. Main and Ford are 4196 and 4129, respectively, and have been disclosed to all employees that will have access to the restricted area. Notice will be immediately provided to the Nuclear Regulatory Commission by Mr. Main.

Item 10 - Radiation Safety Program:

As Radiation Safety Officer, Mr. Main's duties and responsibilities include, but are not limited to the assurance that any sealed source on the premises is used in accordance with its intended use, leak tests are conducted at appropriate intervals, lock-out procedures are followed in accordance with published procedures, and repairs and/or maintenance is performed by qualified individuals.

In this instance, all services such as installation, initial radiation survey, maintenance, leak-testing, device relocation and removal will be performed by Reuter-Stokes, the device manufacturer (NRC No. 34-18233-01). The address of Reuter-Stokes is as follows:

Reuter-Stokes, Inc.
18530 South Miles Parkway
Cleveland, Ohio 44128
Telephone No. (216)581-9400
Telex No. 985253

Notwithstanding the fact that Reuter-Stokes will be providing the services described in the preceding paragraph, in the event that verification of possible leaks will be necessary in light of an accident, McLouth Steel Products Corporation has available a Victoreen Model No. 440 survey instrument that is capable of measuring within 300 mr/HR range.

Regarding leak-testing, such testing will be performed initially and at six(6) month intervals by Reuter-Stokes, Inc.. Such tests will be as the Nuclear Regulatory Commission has deemed appropriate pursuant to Section 30.53, "Tests,"of 10 CRF Part 30.

Concerning lock-out procedures, McLouth Steel Products Corporation has implemented such procedures so that personnel will not be subjected to unnecessary exposure. These procedures detail the means by which McLouth Steel Products Corporation prevents employees from entering the radiation beam during maintenance, repairs, or other work in, on, or around the Hot Strip Mill. These lock-out procedures will be provided to employees working in the restricted area and have been posted so that the relevant employees can review the procedures. Messrs. Main and Ford, who have been designated "responsible individuals" in Item 7 above, are the individuals who will be responsible for ensuring that the lock-out procedures are followed.

Item 11 - Waste Management:

Removal and Disposal of any sealed source will be conducted and completed by Reuter-Stokes, Inc. the original supplier of the Safety Ray Sensing System. Reuter-Stokes, Inc. is an authorized recipient as specified in paragraph 20.301(a) of 10 CFR Part 20. Reuter-Stokes, Inc. has been granted a license for disposal of this material by NCR No. 34-18233-01.

McLOUTH STEEL PRODUCTS CORPORATION
RADIATION PROTECTION PROGRAM

Training and Experience Resume

Robert J. Ford, Superintendant,
Process Control Engineering

Attended a certified Radiation Protection Seminar in 1978 conducted by Kay-Ray Inc., in Arlington Heights, Illinois.

This formal training course was conducted over a two week period and consisted of the principles and practices of radiation protection, radioactivity measurement standardization and monitoring techniques and instruments, mathematics and calculations basic to the use and measurement of radioactivity and biological effects of radioactivity.

Experience with radiation was gained with the previous owner, McLouth Steel Corporation, over the past 19 years using CS 137 - 4 curies, AM 241 - 1000 milicuries and Pu-Be 63.99 Kg which were previously utilized in the Blast Furnace coke hopper moisture density gauges.

TGM/ljs

Attachment A

McLOUTH STEEL PRODUCTS CORPORATION
RADIATION PROTECTION PROGRAM

Training and Experience Resume

Theodore G. Main, Manager of Safety and
Radiation Protection Officer

Attended a Radiation Protection Seminar in 1977 conducted by the American Iron and Steel Institute at Pittsburg, Pennsylvania.

This formal training course was conducted over a three day period and consisted of the principles and practices of radiation protection, radioactivity measurement standardization and monitoring techniques and instruments, mathematics and calculations basic to the use and measurement of radioactivity and bioligical effects of radioactivity.

Experience with radiation was gained with the previous owner, McLouth Steel Corporation over the past 10 years using CS 137-4 curies, AM 241 - 1000 milicuries and PU-BE - 63.99 Kg which were previously utilized in the Blast Furnace coke hopper moisture density gauges.

See attached course outline.

TGM/ljs

Attachment B

CONTROL NO. ? 8799

BASIC RADIATION SAFETY IN THE STEEL INDUSTRY

AT
GREATER PITTSBURGH AIRPORT
HOTEL
PITTSBURGH, PA.

SPONSORED BY

SUBCOMMITTEE ON RADIATION
AMERICAN IRON & STEEL INSTITUTE
1000 16th STREET, N.W.
WASHINGTON, D.C. 20036

ATTACHMENT B 1

LIST OF INSTRUCTORS

Peter A. Hernandez
Manager, Environmental Science
Interlake, Incorporated

Dr. R. J. Koch
Senior Research Chemist
X-Ray & Spectro Chemical Labs
Armco Steel Corporation

Anthony LaMastra
Radiation Control Engineer
Bethlehem Steel Corporation

A. A. Mammarelli, Jr.,
Manager, Industrial Health Engineering
Jones & Laughlin Steel Corporation

Thomas J. Radcliffe
Radiation Control Officer
Republic Steel Corporation

Dr. Neil Wald
Professor
Graduate School of Public Health
University of Pittsburgh

Robert V. Wheeler
Assistant Managing Director
Landauer Division
Technical Operations, Inc.

Leonard M. Zolkos
Supervisor, Industrial Hygiene
Inland Steel Corporation

John A. Janous
Director, Industrial Health & Safety
Services
American Iron & Steel Institute

AGENDA
BASIC RADIATION SAFETY IN THE STEEL INDUSTRY

November 1, 1977

0950 - 1000
Introduction, Administration
Mr. Janous

1000 - 1100
Description of Ionizing Radiation Sources & Applications in the Steel Industry
Mr. Mammarelli

1100 - 1230
Physics of Radiation
Dr. Koch

1230 - 1330
Lunch

1330 - 1415
Units Used in Radiation Protection
Dr. Koch

1415 - 1500
Methods of Detection, Instrumentation
Mr. Radcliffe

1500 - 1515
Coffee Break

1516 - 1600
Methods of Detection, Instrumentation Cont'd

1600 - 1700
Leak Testing and Contamination Levels
Mr. Zolks

1700 - 1725
Radioactivity in Water
Mr. Hernandez

1725 - 1730
Homework Assignment
Dr. Koch

1730 - 1900
Dinner

1900 - 2030
Radiation Survey Techniques
Mr. Mammarelli

November 2, 1977

0830 - 1000
Basic Radiation Protection Techniques
Mr. LaMastra

1000 - 1015
Coffee Break

1015 - 1215
Personnel Dosimetry
Mr. Wheeler

1215 - 1315
Lunch

1315 - 1445
Reports, Record-keeping, Regulations
Mr. LaMastra

1445 - 1500
Coffee Break

1500 - 1600
Medical and Other X-ray Machine Protection
Mr. LaMastra

1600 - 1700
Biological Effects
Dr. Wald

1700 - 1830
Dinner

1830 - 2030
Homework Assistance, Consultation, Special Problems, AEC Film - "Radiation in Perspective"
Committee

November 3, 1977

0800 - 0830
Homework Review
Dr. Koch

0830 - 1000
License Applications
Mr. Mammarelli

1000 - 1015
Coffee Break

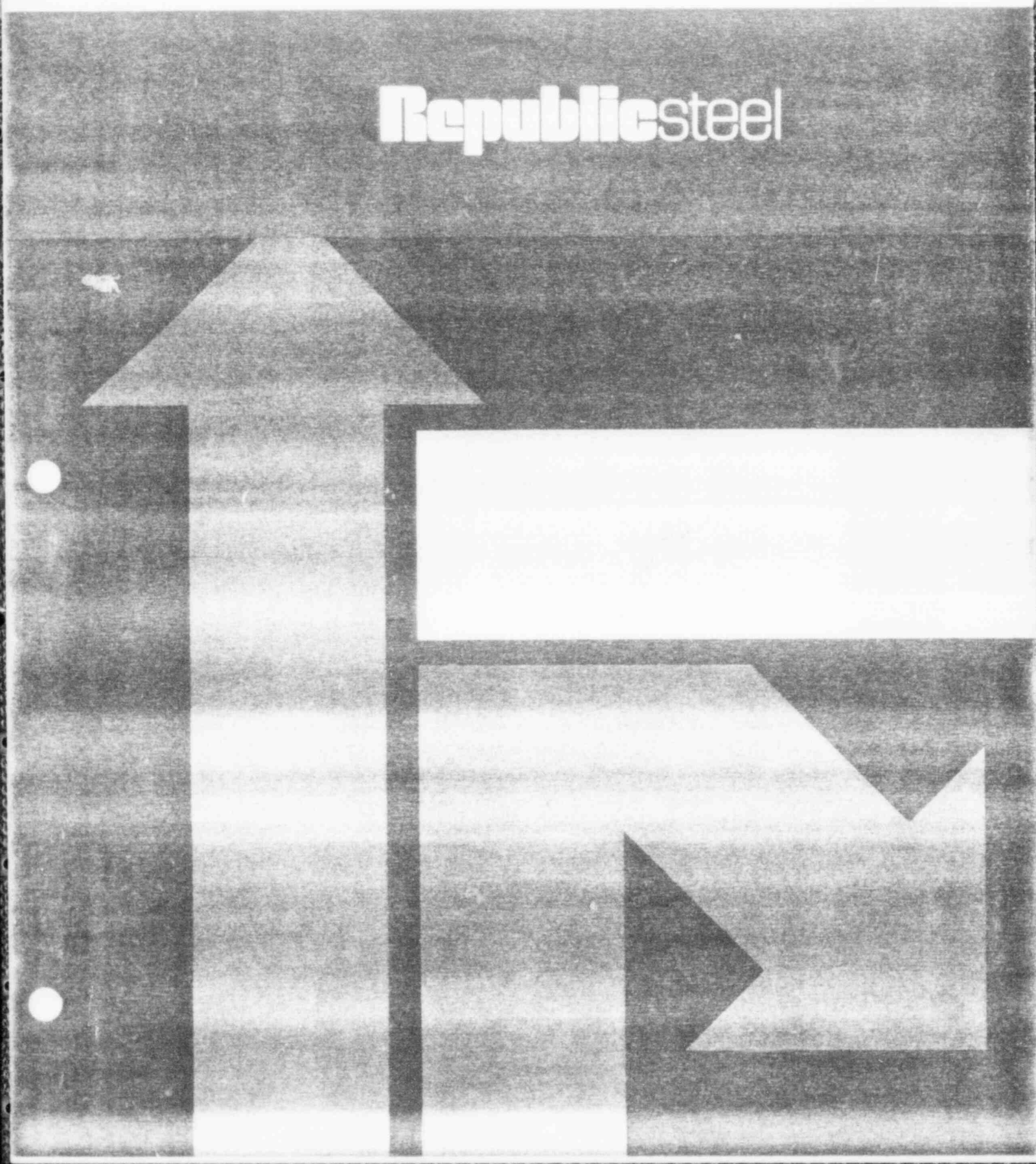
1015 - 1145
Model Radiation Protection Programs for the Steel Industry
Committee Panel Discussion

1145 - 1300
Lunch

1300 - 1345
Written Examination

1345 - 1400
Course Critique
Mr. Janous

SAFETY RAY®
Sensing System



Operation of today's high speed production and processing lines requires automatic surveillance systems that will operate in all environments and under severe conditions when necessary. With line down-time becoming more expensive and on-the-job accidents more costly, companies must select a sensor that provides safety in operation, has a high reliability, has a fast response time, is relatively inexpensive, has a low operating cost and is easily installed and maintained. The sensor that meets all of these parameters is SAFETY RAY.

The SAFETY RAY is a non-contact sensing system using a low intensity gamma radiation source with appropriate electronics to detect the presence or absence of moving objects. Its primary utility is to replace present sensing devices which must rely either upon direct contact with the moving material or the ability to detect the material by photoelectric or infrared detectors. In severe environments created by dust or steam which may render optical detection system inoperable, a consistently reliable method of detection should be used. SAFETY RAY is a rugged sensing system which has proven to be extremely reliable in severe operating conditions.

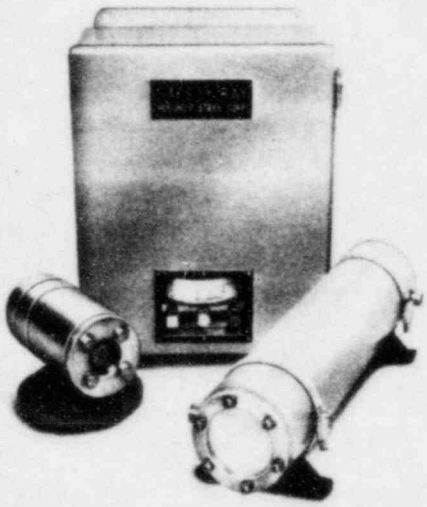
Operation

The SAFETY RAY incorporates a narrow beam of gamma radiation of low, safe intensity directed toward a remote detector. Objects passing through the beam reduce the radiation reaching the detector. This change of intensity of gamma rays reaching the detector is read electronically on accompanying equipment.

Source

The SAFETY RAY source assembly produces a radiation beam safe for personnel even though they may pass directly through the beam path.

The source assembly consists of a low energy gamma radiation source, Americium 241 (Am 241), a source holder, and a special radiation collimator. The unit requires no electrical power, is not affected by vibration and may be operated in areas over 1000°F (537°C) temperatures. The half life of Am 241 is 458 years, eliminating the need to replace the source due to a decrease of its intensity. The source supplied with SAFETY RAY is 1 curie of Am 241, which produces 60 KEV gamma rays. Stronger sources may be obtained, depending upon the requirements of the installation.



Detector

The detector portion of the SAFETY RAY system has a water cooled stainless steel jacket surrounding the detection devices. Depending upon use area conditions, the water cooled jacket may not be required. Within the detector is a scintillation crystal and photomultiplier tube. With the high efficiency of the detector, the source may be placed as far as 35 feet (10.6 meters) away from the detector and operate with a 100 millisecond response.

If the distance is greater than 35 feet (10.6 meters), or the response sought is faster than 100 milliseconds, the source strength can be increased.

Electronics

The solid-state electronics unit is modularized on plug-in circuit boards for ease of troubleshooting and low maintenance. Signals are continuously monitored by special circuits and provide an automatic alarm if they deviate from the desired value.

Applications

The SAFETY RAY has been successfully used in steel mill operations where, because of the presence of large amounts of steam, the infrared (IR) detection system previously employed functioned unreliably.

Because of its high reliability in detecting the presence or absence of material, the SAFETY RAY detection system was coupled to computers to provide computer tracking and automatic control of numerous mill operations.

Drawing

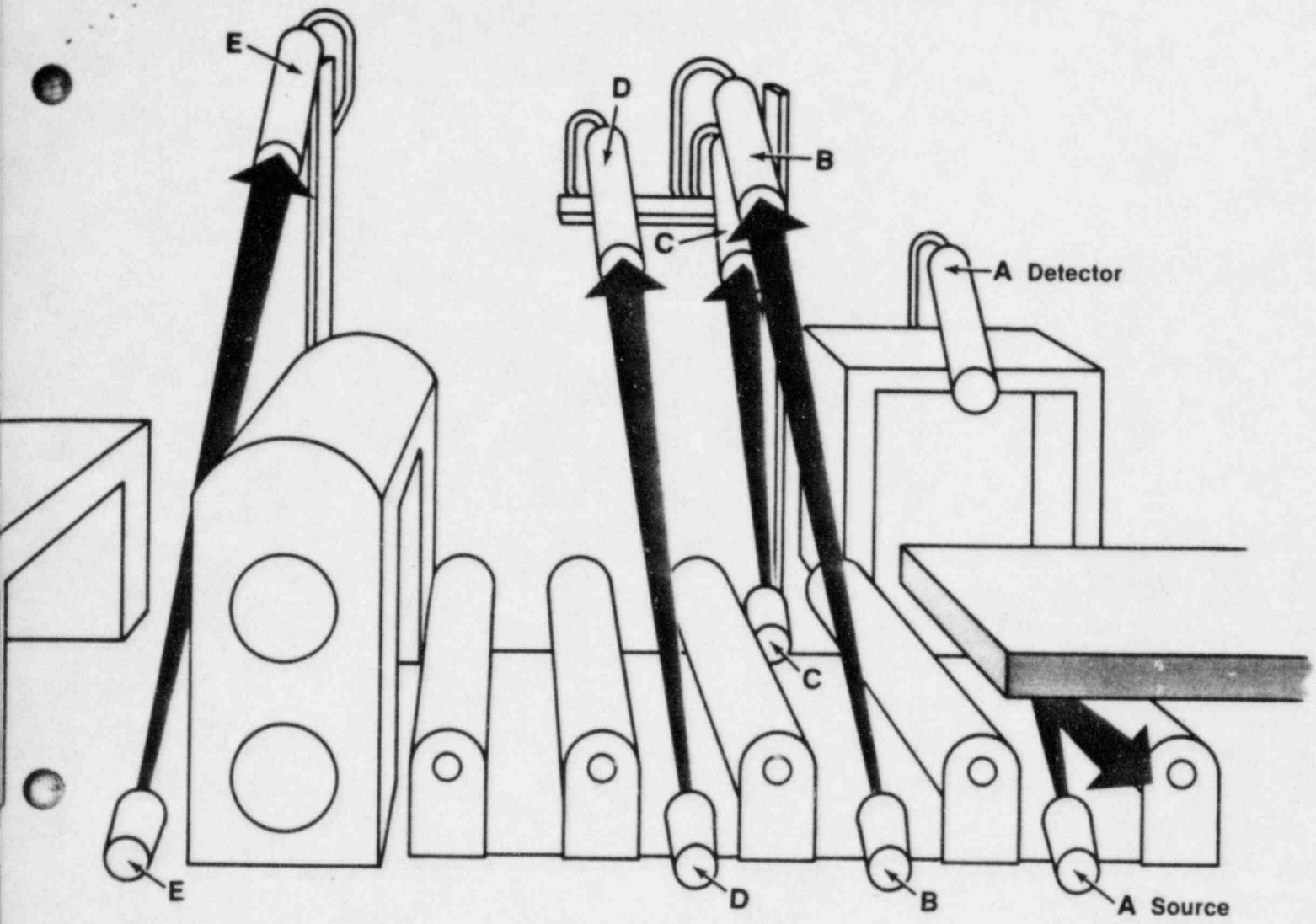
By referring to the numbered detectors in the accompanying drawing, it is possible to understand the integration of the SAFETY RAY into an existing mill, or how it can be installed into a new production line.

As the mill product passes over the source, it blocks the gamma rays from the detector. The detector electronically registers a reduction or absence of the gamma rays, and the electronics unit automatically activates the preset function. When the item passes, and the gamma rays again strike the detector, the electronics unit returns the process to a standby mode.

1. Detector "A" works in conjunction with detector "B". The time at which the detectors are activated, in relationship to one another, is used to compute the speed at which the product is moving.

2. Detector "B" also works in conjunction with detector "C". Both detector "B" and detector "C" are placed in line with each other at a right

*SAFETY RAY is a trademark of Republic Steel Corporation



angle to the direction of product movement. Should the gamma rays of one of the source be blocked before the other, the reason would be due to a diagonal end on the front of the mill product. Blocking transmission of gamma rays starts the shear timing cycle which allows the product to be sheared at the nearest point where a straight edge can be made.

3. Conversely, when detectors "B" and "C" begin receiving radiation from their source prior to detector "D", this indicates the end of the product and end shearing operations are begun. Should the end have a diagonal cut, the timing operation is computed to produce a straight end.

4. When the rays directed toward detector "E" are blocked, descaling controls are activated. The passage of the material past this point and the transmission of gamma rays to the detector discontinues the descaling operation.

5. Blocking of the gamma rays at a sixth detector (not shown) located further down the production line, at a coiler approach table, signals the start-up of the coiling operation.

Advantages

Completely safe for operators.

"Sees" through steam, water spray, snow, and dust conditions.

Source can operate in the most severe environments.

Non-contact highly reliable detection of objects.

Simple design for reliable high speed operation and low maintenance.

Other potential application areas

The SAFETY RAY is best applied in areas of severe environmental conditions that prevent the successful use of conventional infrared, photoelectric, sonic or mechanical sensors. Some of these applications include:

Detect the presence of moving objects or machinery in severe environments.

Located on moving machinery, to detect the proximity of objects or people to prevent collision.

Monitor restricted areas to provide an alarm upon intrusion.

Operate in explosive (gas, coal dust) environments.

Provide Go/No Go proportional signals over distances not practical for conduit and wire runs.

Availability

Application for a patent has been filed by Republic Steel Corporation, and the SAFETY RAY is available through Republic Steel's Special Markets Division, or, for distribution outside the U.S.A., through International Projects Division. Price and delivery will be submitted upon request.

#2

Noncontact sensing system succeeds where infrared devices fail

Safety Ray, Republic Steel's new sensing system, works under severe operating conditions. In one application, it is claimed, the system is 100% reliable in the presence of water and steam

Several failures of the infrared electro-optical control devices on Republic Steel Corp's computerized 84-in. hot strip mill led its Research Center to look for a sensing system that would work under severe operating conditions. The result of the search is a noncontact sensing system designated Safety Ray.

According to Republic spokesmen, today's generation of high-speed hot strip and plate mills require safe, fast, and extremely reliable sensing systems or metal detectors. When coupled to process computers, these detectors provide product tracking and automatic control of many of the mill's operations.

A wide variety of infrared detectors has been used in steel mills to determine the presence or absence of the hot metal as it moves from roughing to shearing, finishing, and coil winding at speeds up to 3700 fpm. Although some infrared detectors work better than others, none are completely reliable, and all are adversely affected by steam, which causes the infrared radiation to be attenuated, thereby reducing its efficiency. To remove the excessive steam produced when hot metal is cooled by jets of water, mill operators air-blast the steel as it passes under the watchful eye of a series of infrared detectors. Although this lessens the problem, it does not eliminate it.

As a case in point, Republic Steel experienced a number of failures of the infrared electro-optical control devices on its computerized 84-in. hot strip mill in Cleveland.

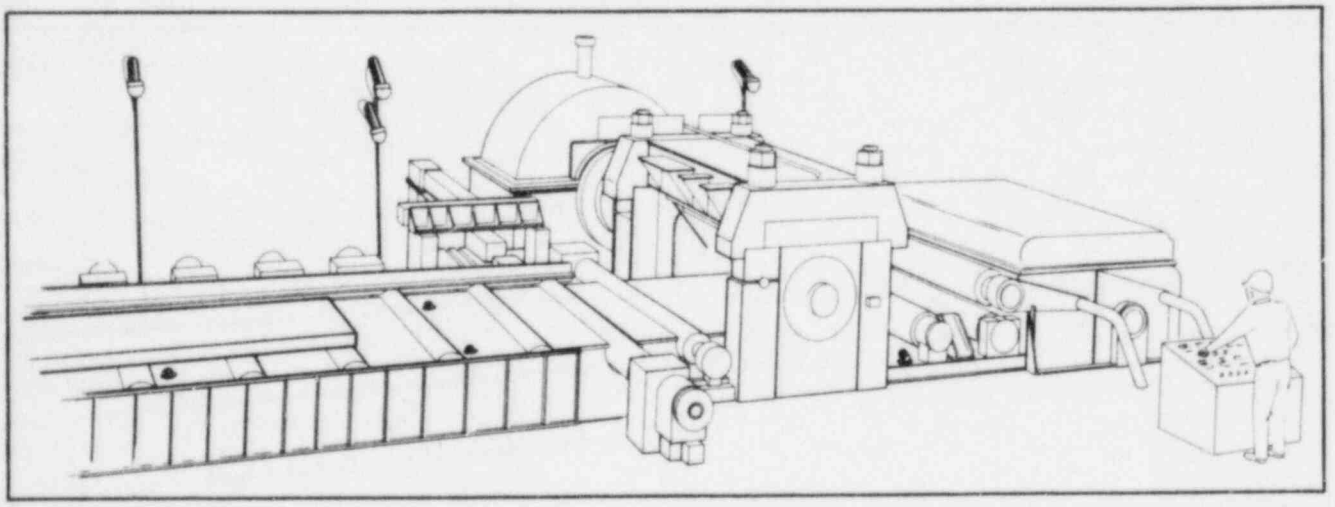
According to Republic, failure of electro-optical systems in hot-mill operations is due primarily to the blocking of infrared radiation by the dense steam generated during the rolling process. In addition, the infrared detectors, which rely on radiation from the slab surface, pose a potential problem if the steel cools to less than the desired temperatures before passing the detectors.

The development of Safety Ray

The Safety Ray sensing system is capable of detecting the presence or absence of any material from very thin strip to a slab of steel and has a response time of 100 millisec, making it suitable for connection to a computer-controlled operation.

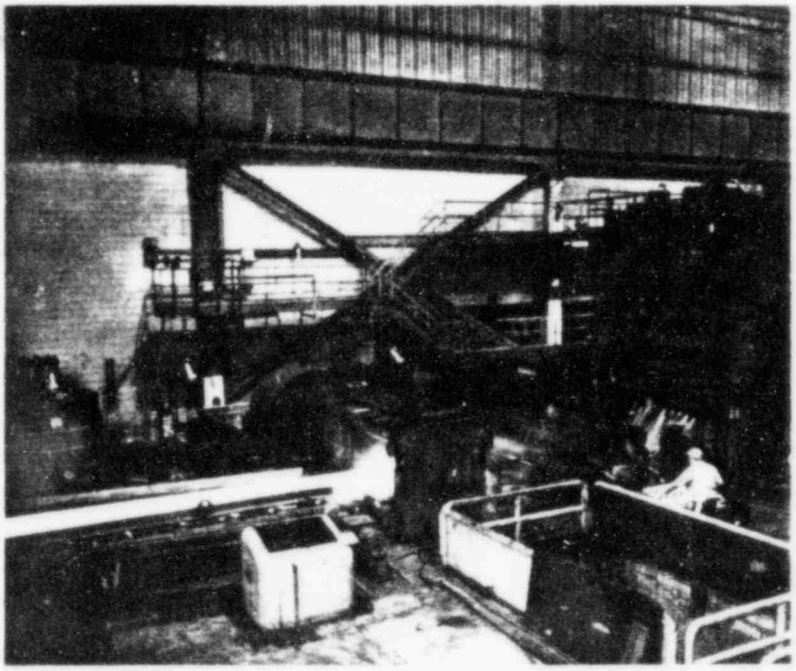
The system uses a low-level gamma-ray source mounted and aligned with a scintillation detector. As long as the gamma rays keep striking the detector, the unit is in a standby mode. If the gamma rays are interrupted or blocked from reaching the detector, the solid-state electronics instantly activate the desired controls.

The Safety Ray sensing system (marketed by Republic Steel's Special Markets Div) uses Americium241 as a source located below the strip pass line. Personnel can pass between the Americium source and the detector without any special precautions. The energy of gamma radiation produced by Americium241 is only 60 keV. It operates successfully in the presence of steam, water, spray, heat, fog, dust, vibration, and a high or low light level.

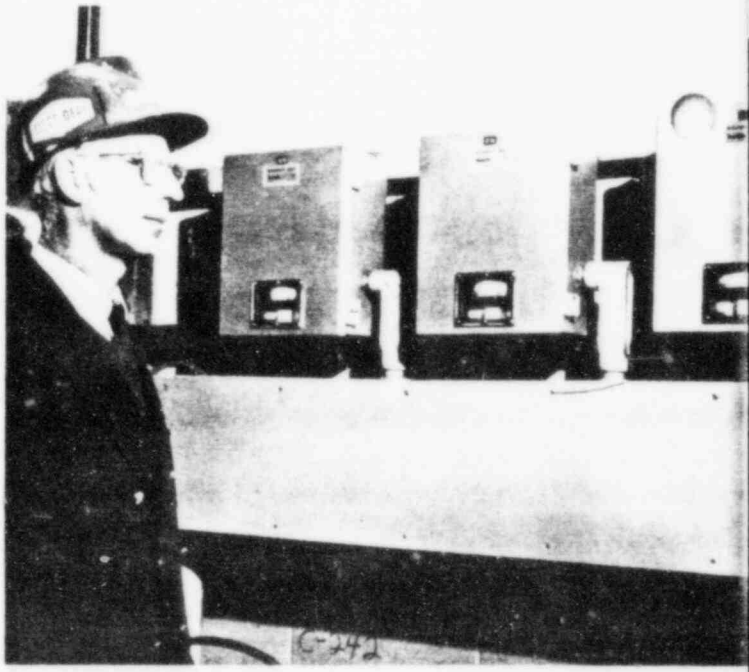


Safety Ray noncontact sensing system is shown in a typical arrangement. Detector placement can be arranged, similar to 2 and 3, to indicate "fishtail," which would start shear timing cycle to permit shearing at nearest point where a straight edge can be made

Reprinted from 33 Magazine, April 1976



Three sensing devices on Algoma's 106-in. hot strip mill determine presence or absence of hot moving metal and speed of the product, start shear cycle, and control descaler and mill setup



Electronic units of the first three Safety Ray sensing systems at Algoma Steel are tied into the General Electric PAC 4010 process computer, which controls many mill operations

Algoma Steel Corp Ltd, Sault Ste Marie, Ontario, was the first steel company, besides Republic, to install the Safety Ray system. Five units have been placed strategically on the company's 106-in. hot strip and 166-in. plate mill. All are tied into a General Electric PAC 4010 process computer, which controls many of the mill's operations.

As the mill product passes over the source, it blocks the gamma rays from the detector. The detector electronically registers a reduction or absence of the gamma rays, and the solid-state electronics unit, modularized on plug-in circuit boards, activates the programmed function. When the metal passes the detection point, the gamma rays again strike the detector, and the electronics unit returns the process to a standby mode.

Specifically, at Algoma, the first two sensing devices positioned upstream of the crop shears are paired to determine the speed at which the product is moving toward the shear and automatically start the shear cycle.

An additional feature, which can be incorporated into the system to crop the metal end automatically, can be seen in the drawing (left). Two detectors may be placed in line with each other and at right angles to the movement of the hot metal. Should the gamma rays of one be blocked before the other, the reason would be a "fishtail" or diagonal end on the steel. Blocking the gamma rays starts the crop-shear cycle, permitting the product to be sheared at the point where a straight edge can be made.

According to John Wright, general foreman for Algoma's electrical maintenance plate and strip department, "the accuracy and reliability of the crop shear cut are vital to a good operation. Insufficient cropping can lead to cobbles in the mill. Cobbles and too much crop can cost thousands of dollars in yield. Unreliable detectors can cause either no crop or, worse yet, can inadvertently cut a bar in half."

The latter phenomenon has not occurred since installation of the Safety Ray, he says.

The third detector controls the operation of the descaling sprays and other mill-setup functions.

The fourth sensing unit picks up the presence of the product after it leaves the last finishing stand on its way to the runout table and two downcoilers about 255 ft from the last finishing stand.

Blocking the gamma rays at the fifth detector activates the startup of the coiling operation. The coilers handle strip 106-in. wide with a maximum weight of 40,000 lb.

Each Safety Ray detector assembly is mounted on an individual stand anchored to the concrete floor. The detector has a water-cooled stainless-steel jacket surrounding the detection devices, which consist of a scintillation crystal and photo-multiplier tube. The detectors can be placed as far as 35 ft from the source. The source assembly can operate in temperatures exceeding 1000F.

Scrap loss and downtime are reduced

Wright has nothing but praise for the Safety Ray sensing system. "It is far superior to any other metal detector now on the market and, in the presence of steam and water, has proved 100% reliable over the past year.

"With it," he adds, "we have eliminated the need for air blasting the product clear of steam and water, reduced scrap loss, and cut equipment downtime."

Last year, Algoma produced 2.8-million of steel and will increase its output to 4-million when its No. 7 blast furnace becomes fully operational in 1976. The company is also installing a second continuous-casting plant and anticipates using the Safety Ray detection system to monitor the performance of the new plant.

#3

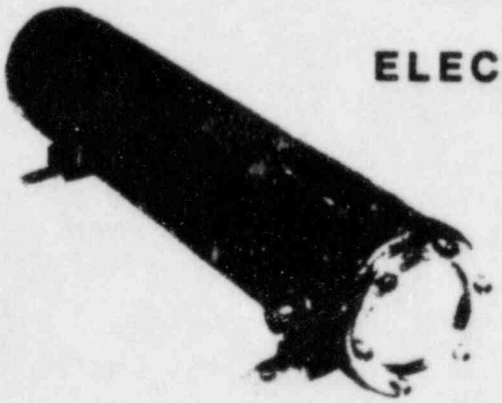
SAFETY RAY
SENSING SYSTEM

REUTER STOKES INC.

CLEVELAND, OHIO

SAFETY RAY
SENSING SYSTEM

ELECTRONICS UNIT



DETECTOR ASSEMBLY

SOURCE ASSEMBLY

TABLE OF CONTENTS

1) Caution: High Voltage

Voltages up to 1200 volts are present in this system.

2) Caution: Radioactive Material

Under normal conditions the encapsulated radioactive material (1CI Am-241) is securely contained within the source holder. If the source holder appears damaged before it is handled, a radiation survey meter must be used to determine the location of the radiation beam and verify the source holder integrity.

RADIATION LICENSING REQUIREMENT

The SAFETY RAY system contains 1 Curie of 241 Am radioactive source and requires an appropriate license from the Nuclear Regulatory Commission or State Health authorities (in agreement states). Use outside the United States requires a license from the appropriate authorities in the country of use. Reuter-Stokes will provide guidance and assistance in obtaining the required licensing.

SAFETY RAY

A. INTRODUCTION

The Safety Ray system, consisting of a gamma-ray source, gamma-ray detector and electronics unit, produces an output signal for the mill computer when a bar is within its detection zone. The collimated source holder containing the source directs a narrow beam of gamma-rays through the bar pass-line towards the detector. The presence of a bar blocks the beam from the detector causing the output signal (contact closure) to be initiated.

B. DESCRIPTION OF OPERATION (Refer to Fig. 1 and Drawing S-811-105)

1. Source Holder

The encapsulated gamma-ray emitting radioactive material (1 Ci Am-241) is enclosed within a stainless steel container which has collimator and beam port to direct the narrow beam toward the detector. The container is mounted on an adjustable bracket which allows the source holder to be aimed at the detector. The dose rate in the beam at the source holder is 40 mR/hr. For additional dose rate measurements see graph below. Dose rates may vary due to environment and background.

0 Feet	40 mR/hr.
1 Feet	18 mR/hr.
2 Feet	16 mR/hr.
3 Feet	12 mR/hr.
4 Feet	10 mR/hr.
5 Feet	6 mR/hr.
6 Feet	5 mR/hr.
7 Feet	4 mR/hr.
8 Feet	3.5 mR/hr.

(cont.)

9 Feet	3 mR/hr.
10 Feet	2.1 mR/hr.
15 Feet	1.1 mR/hr.
20 Feet	.5 mR/hr.
25 Feet	.25 mR/hr.

* Measurements taken with a Victoreen Model 491 survey meter.

2. Detector Unit

When the bar is not present, gamma rays from the source holder enter the detector housing through a stainless steel end window and pass into NaI scintillation crystal. The gamma rays produce light flashes in the crystal which are converted to electrical pulses by the photomultiplier tube. The crystal and PM tube are sealed into an aluminum housing and are replaced as a unit.

The preamplifier (Fig. 2) in the detector unit is a linear amplifier with a gain of 1 which produces a pulse of approximately 100 millivolts for the 60 KEV gamma from Am-241. Gamma ray scattering and background radiation produce a number of pulses of lower or higher amplitude; however, with the bar not present the majority of pulses will be 100 mv.

3. Electronics Unit

The Electronics Unit measures the pulse rate from the detector and supplies a "No Bar" or "Bar" signal to the computer.

Included in the Electronics Unit is a Monitor circuit

which provides a continuous check of the system operation and can provide a "System Normal" signal to the computer.

The 100 mv pulses from the detector cause the Amplifier stage (IC1) on the ratemeter board to saturate producing negative pulses of constant amplitude (about-13v). The Discriminator adjustment varies the threshold voltage allowing only pulses of a specific amplitude or greater to enter the Ratemeter, thus eliminating low level noise pulses.

The Ratemeter state (IC2) produces a DC output current proportional to the input pulse rate. The span adjustment on this stage sets the "No Bar" operating point (0.85 ma on panel meter).

The DC current from the Ratemeter is indicated on the panel meter. It is also applied to the System Monitor circuitry which responds as follows:

1) When the current is below 0.4 ma, relay RL2 is energized and produces a "Bar" signal.

2) When the current is between 0.7 ma and 1.0 ma, relays RL1 and RL3 are energized and produce a "No Bar" signal. Also, a "System Normal" signal is supplied to the computer.

3) When the current is between 0.4 and 0.7, or greater than 1.0, the "Calibration Required" indicator is lighted and indicates electronic drift or another maintenance problem.

The Electronics Unit contains three power supplies: a $\pm$ 15v module for the preamp and ratemeter, a + 12v supply for the system Monitor relays, and a 1200v

supply for the PM tube.

C. ADJUSTMENTS

A front panel switch, labeled "Output Signal" is used to disconnect the output signal from the computer while adjustments are being made.

1. Radiation Beam Alignment

The source holder must be adjusted if the radiation beam is not centered on the end-window of the detector. The beam location can be found by the use of a Radiation Survey Meter.

2. Ratemeter Adjustments (see Figure 3)

These adjustments must be made with the radiation beam centered on the detector.

A. Place the test switch in "Test" position.

B. Adjust the Span potentiometer R4 to obtain a reading of 0.85 on the panel meter.

C. Interrupt the radiation beam by placing a piece of steel between the source and detector. The panel meter indication should fall below 0.4 ma. If it does not fall below 0.4 ma, a Discriminator adjustment may be necessary.

D. The Discriminator potentiometer R9 is factory adjusted to produce about .040 volts at pin 3 of IC1. This setting is adequate in most installations to prevent noise pulses from entering the ratemeter. Failure of the panel meter to fall below 0.4 ma when the beam is interrupted may be due to the presence of a high noise level. If excessive noise is suspected, adjust R9 until the panel meter indication falls below 0.4 ma. Recheck the Span adjustment.

E. Return the test switch to the "Normal" position.

3. System Monitor Adjustments (Fig. 4)

The system Monitor trip points are adjusted while observing the panel meter and lights.

a. Place test switch on ratemeter in down position (long time constant, Fig. 3)

b. With bar not present, connect and disconnect input signal (Fig. 4) to obtain full swith of panel meter.

c. Adjust potentiometer R5 for green light on, between 0.7 and 1.0 ma.

d. Observe that the amber light is on for indications below 0.4 ma.

e. Return test switch on ratemeter to up position.

D. TEST POINT SIGNALS

Ratemeter Card (Fig. 3)

TP1 Signal from preamp in detector consisting of random pulses of 100 mv average amplitude.

TP2 Output of ICI on Ratemeter card consisting of random pulses of -13v amplitude.

TP3 Ratemeter output to System Monitor

NO BAR + 1.12v DC

BAR + 0.1v

Power Supply Card (Fig. 5)

TP 5 +15v $\pm$ 0.01v

TP 6 Gnd

TP7 -15v $\pm$ 0.01v

High Voltage (At SHV Connector)

Detector not connected	+ 1200v
Detector connected	+ 1000v

E. TROUBLESHOOTING GUIDE

1. Symptom: a) Unit operational but, with no bar present, Calibrate Required light (white) is on periodically or constantly (panel meter reads between 0.4 and 0.7).

b) Unit not operational due to Bar light (amber) on continuously (meter below 0.4) with no bar present.

These symptoms indicate reduced radiation beam intensity or reduced system gain.

Possible Causes

a. Source holder mis-aimed due to vibration. Check with radiation survey meter.

b. Roll scale build-up on source holder or on source holder heat shield.

c. An object inadvertently placed so as to block radiation beam.

d. Cooling water flow accidently turned off.

e. Power supply failure.

f. Reduced gain in pm tube, preamp, or ratemeter. Follow adjustments procedure as outlined in Part C2 before replacing components.

2. Sympton: With bar present, meter does not read close to zero.

Possible Causes

a. Cooling water flow off.

b. Ripple on ± 15v power supply. Check with scope.

c. Electrical noise pickup from external devices.

d. Radiation present from other sources such as an X-ray thickness gage or pipe weld X-ray inspection unit.

3. Sympton: Meter indication is satisfactory but panel lamps do not correspond to meter.

a. System Monitor card or relays defective. Follow adjustment procedure as outlined in Part C.3 before replacing components.

b. Failure of 12v power supply.

F. TEST UNIT (Available as an Option)

This unit is a variable frequency and amplitude pulse generator which is used to simulate the detector signal. The unit will directly check the operating condition of the ratemeter card, System Monitor card, relays, and indirectly the ± 15 vPS and 12vPS. This unit will not determine the operating condition of the PM tube, pre-amp or HV power supply.

The following steps should be followed when using the Test Unit:

1. Connect the signal cable of the Test Unit to the Signal Input Jack on the Safety Ray chassis.

2. Connect the Test Unit power wire to the +15v test jack (red) on the power supply board.

3. With the Test Unit amplitude control centered (approx. 200 mv pulses) the Frequency control can sweep the Safety Ray panel meter from zero to full scale. The panel lights and relays should correspond to the meter position.

4. With panel meter at 0.5 ma, decrease pulse amplitude, meter currect should drop to zero.

TEST UNIT

G. PARTS LIST - MAJOR COMPONENTS

1. Detector

PM Tube and Crystal	Model 8S2 Harshaw Chemical Co.
Tube Base	Model 266 Ortec Inc.
HV Cable	RG-59
HV Connectors	KV-59-22 & KV-79-13 Kings
Signal Cable	RG-62
Signal Connectors	UG-290 & UG-260 Amphenol
Power Cable	8735 Belden
Power Connectors	3102A10SL-3P & Amphenol 3106A10SL-3S Amphenol
IC1	MC1539 Motorola

2. Power Supplies

± 15v PS	MD-15-B Power Mate Corp.
12v PS	EM 12/15 B PowerMate Corp.
HV PS	Model K15 Venus Scientific Inc.

3. Miscellaneous

Ratemeter IC1 & 2	MC 1539 Motorola
Panel Meter	320E Triplett
Panel Lamps	183-9830-14-604 Dialco #330 Bulb
Relays RL 1, 2, 3	KRP11DG 12vDC Potter Brumfield
AC Fuse Holder	344125A Littlefuse 2 amp Fuse (3AG)

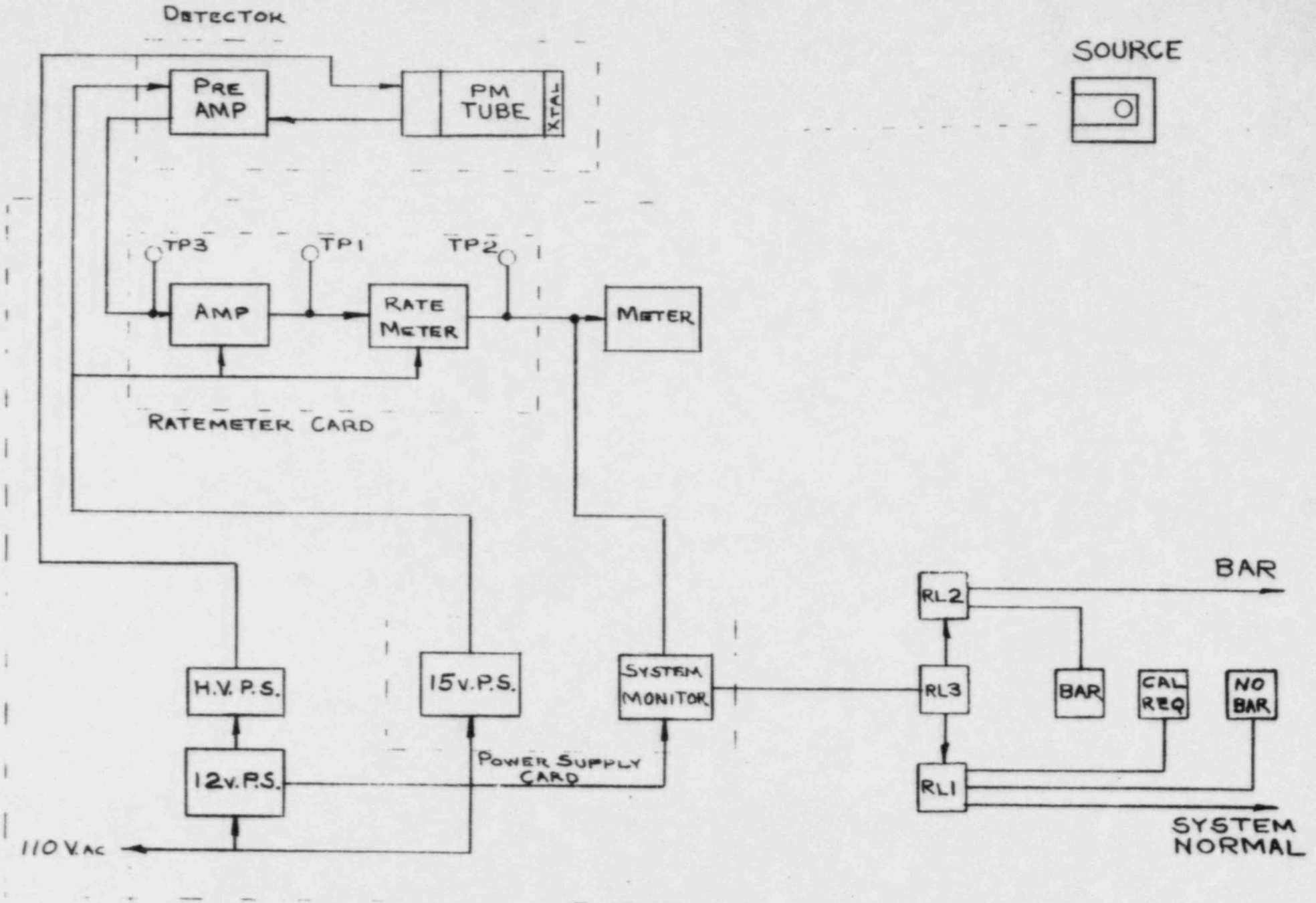


FIG. 1 BLOCK DIAGRAM
(SAFETY RAY S-811)

PRE-AMP

REFERENCE DESIGNATION	DESCRIPTION	
R1,R2	RN55D, 1%, 10KΩ, Metal Film,	Resistor
R3	1/4 Watt, 5%, 1MEGΩ, Carbon Composition,	Resistor
R4	1/4 Watt, 5%, 510Ω, Carbon Composition,	Resistor
R5,R9	RN55D, 1%, 953Ω, Metal Film,	Resistor
R6,R11,R12	RN55D, 1%, 100Ω, Metal Film	
R13		
R7	1/4 Watt, 5%, 6.2KΩ, Carbon Composition,	Resistor
R8	1/4 Watt, 5%, 5.1KΩ, Carbon Composition,	Resistor
R10	RN55D, 1%, 464Ω, Metal Film,	Resistor
C1	(No longer used)	Capacitor
C2	22 MFD, 35V, Tantalum	Capacitor
C3	10 PFD, 1KV., Ceramic (or) 12pf, 1KV, Ceramic	Capacitor
C4,C5,C7	6.8 MFD, 35V., Tantalum	Capacitor
C8,C9		
C6	.22MFD, 35V., Tantalum	Capacitor
D1,D2	1N4001 Fairchild	Diode
Q1	2N3904 Motorola	Transistor
Q2	2N3638A Fairchild	Transistor
Q3	2N3643 Fairchild	Transistor

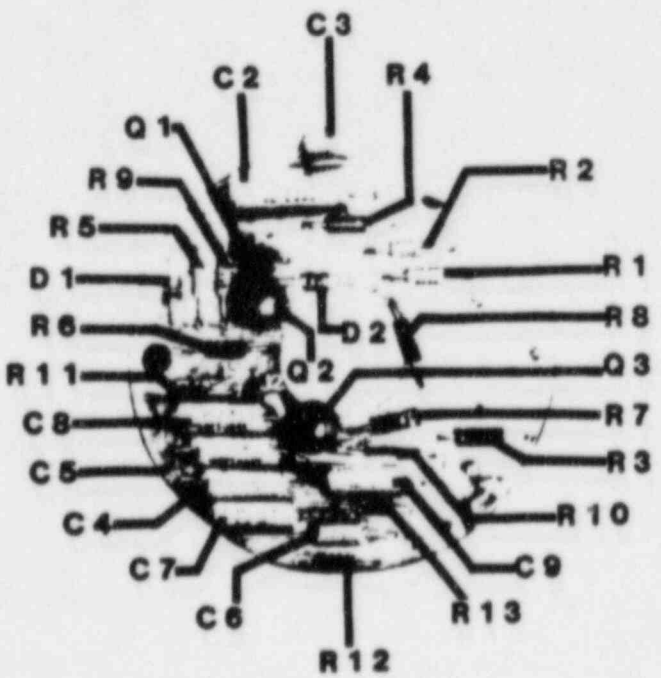
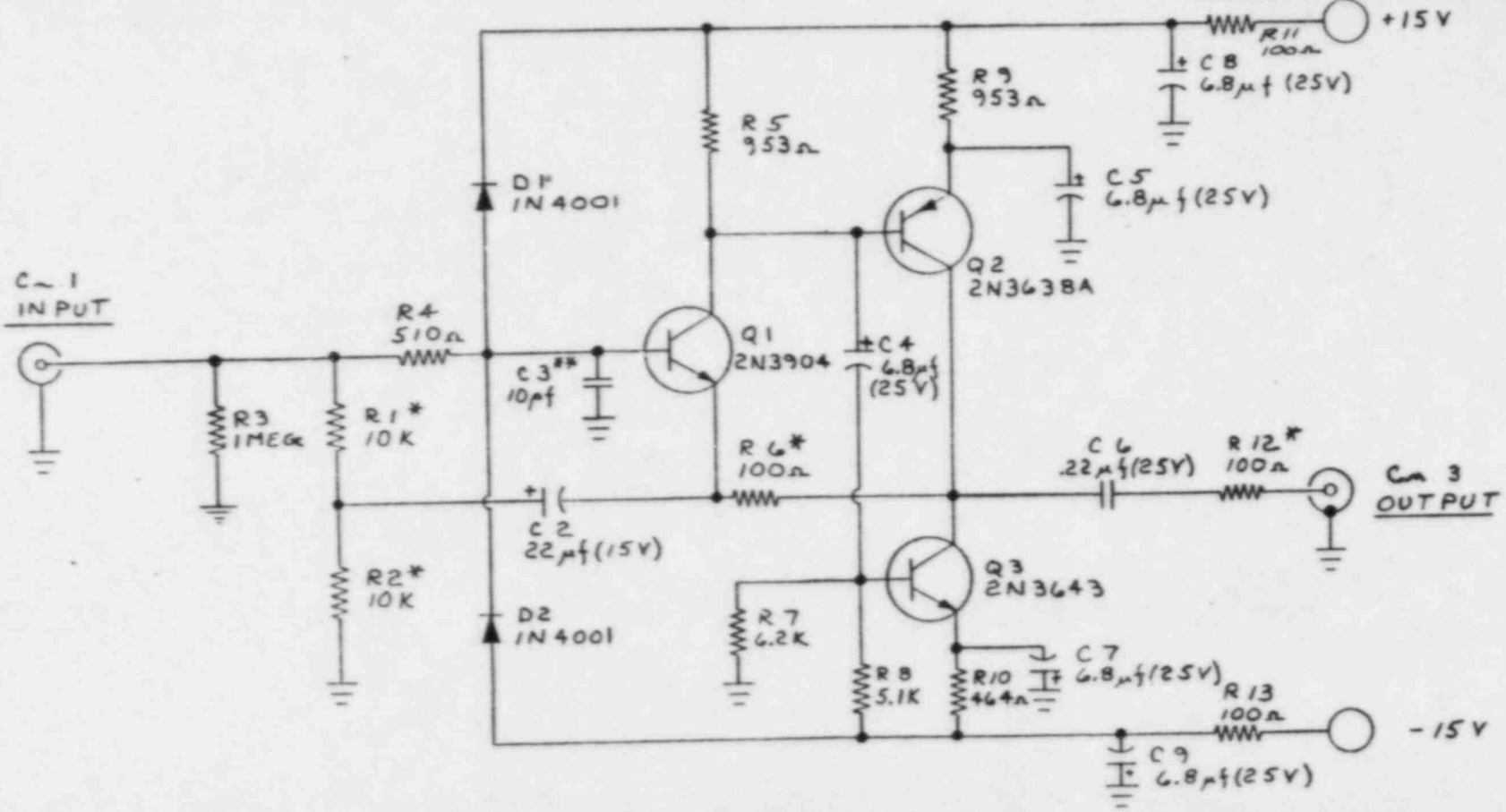


FIG.2

DWG. NO.	REV.
S-811-101	B

REVISION	REVISED BY	DATE	DESCRIPTION	APP'D
A	BB-DM	6-7-71	SEE ORIGINAL ON FILE	
B	A.	2-26-1	SEE ECN-0046	AL



* METAL FILM 1% RESISTOR
TYPE RN 55D
ALL OTHERS 1/4 WATT CARBON 5%

** C3 - CERAMIC DISC
ALL OTHERS TANTALUM

NOTES:
1 - REMOVE BURRS, BREAK EDGES WHEN APPLICABLE.

ITEM	PART/ASS'Y NO.	DESCRIPTION	QTY.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND DIMENSIONAL LIMITS AS FOLLOWS:

SURFACE FINISH 63	.XX DECIMAL ± .01		
FRACTIONAL ± 1/64	.XXX ± .005		
ANGULAR ± 0° 30'	.XXXX ± .0005		
DRAWN BY PVDM	DATE 11-29-73	CHECKED BY	DATE

REUTER-STOKES CLEVELAND, OHIO 44128

TITLE SAFETY RAY PREAMP SCHEMATIC

MAT'L.

APPROVED BY	DATE	SCALE	DWG. NO. S-811-101	REV. B

RATEMETER

REFERENCE DESIGNATION	DESCRIPTION	
R1,R3	RN55D, 1%, 1.21KΩ, Metal Film	Resistor
R2	RN55D, 1%, 51.1KΩ, Metal Film	Resistor
R5	RN55D, 1%, 19.6KΩ, Metal Film	Resistor
R6,R8,R10	RN55D, 1%, 10KΩ, Metal Film	Resistor
R7	RN55D, 1%, 49.9KΩ, Metal Film	Resistor
R11	RN55D, 1%, 953Ω, Metal Film	Resistor
R12	RN55D, 1%, 1KΩ, Metal Film	Resistor
R13,R14	1/4 Watt, 5%, 10Ω, Carbon Composition	Resistor
R4	50KΩ, #3059P-1-503, Bournes	Potentiometer
R9	5KΩ, #3059P-1-502, Bournes	Potentiometer
C1	(No longer used)	Capacitor
C2	.0015 MFD, #5GA-D15, Sprague	Capacitor
C3	25 MFD, 25V., #TE-1207, Sprague	Capacitor
C4,C6,C7	6.8MFD, #150D685X903B2, Sprague	Capacitor
C5	.002MFD, #5GA D20, Sprague	Capacitor
D1	1N4370, Fairchild	Capacitor
D2	DA170, G.E.	Diode
D3	1N914, Fairchild	Diode
IC1,IC2	MC1539G, Motorola	Integrated Circuit
S1	MSS-1200R, ALCO	Switch

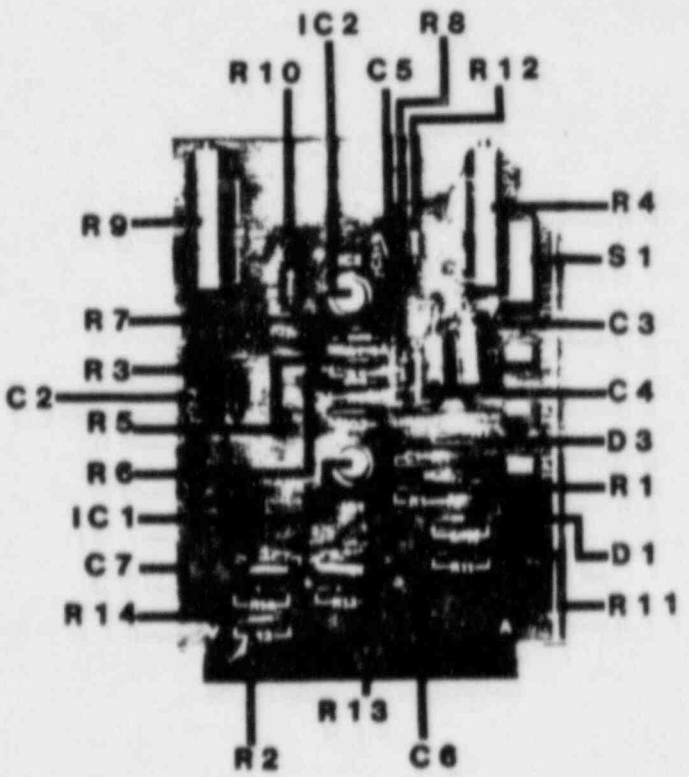
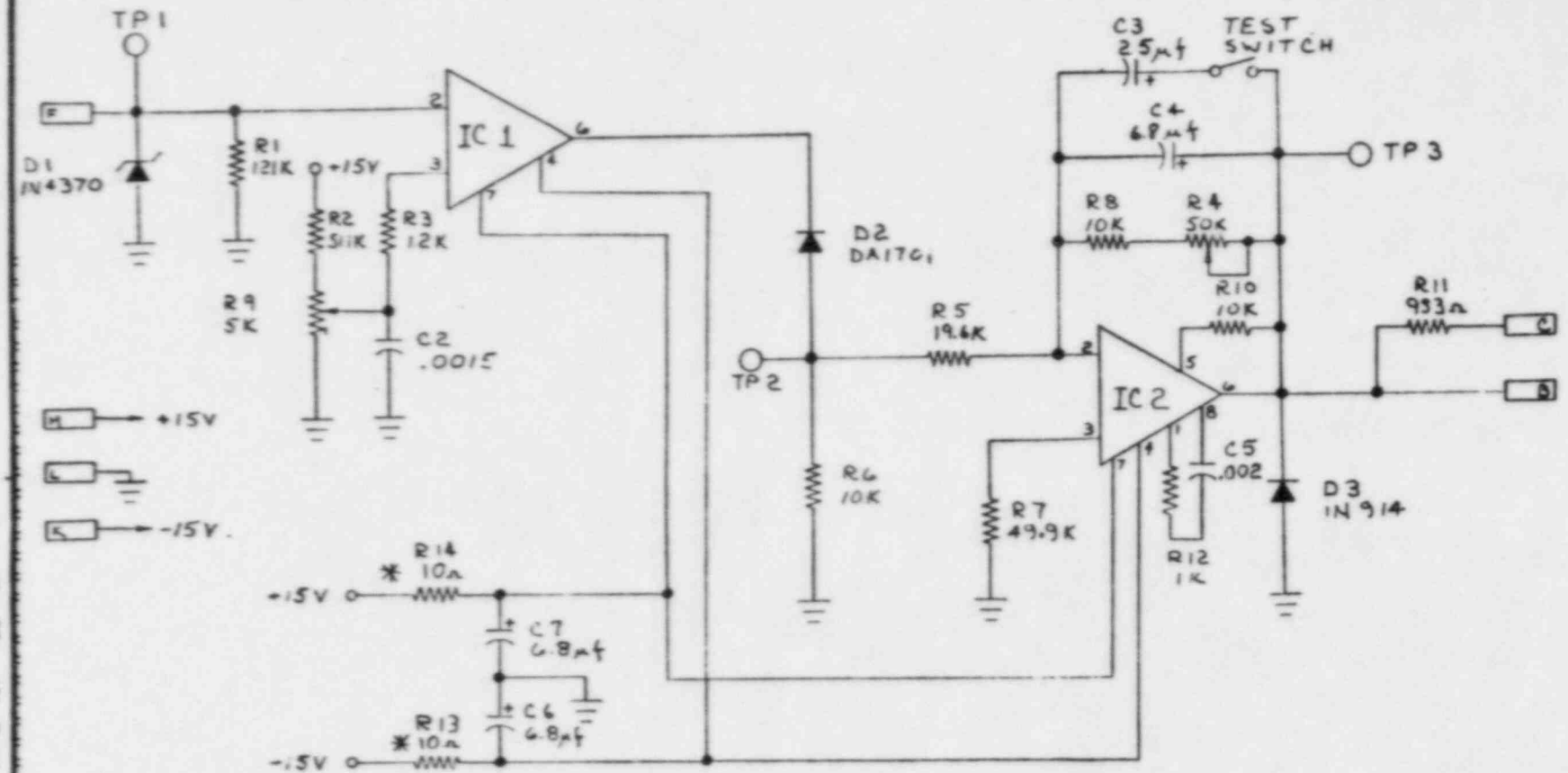


FIG.3

DWG. NO. S-811-102 REV. B

REVISION	REVISED BY	DATE	DESCRIPTION	APP'D
A	BB-DM	6-4-79	SEE ORIGINAL ON FILE	
B	A.	2-28-81	See ECN-0044	A.



Note 1.
* Resistors R13, R14 To Be Carbon Composition 1/4 Watt 5% Tolerance
All Others Are Metal Film 1%

1 - REMOVE BURRS, BREAK EDGES - WHEN APPLICABLE.
NOTES:

ITEM	PART/ASS'Y NO.	DESCRIPTION	QTY.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND DIMENSIONAL LIMITS AS FOLLOWS:

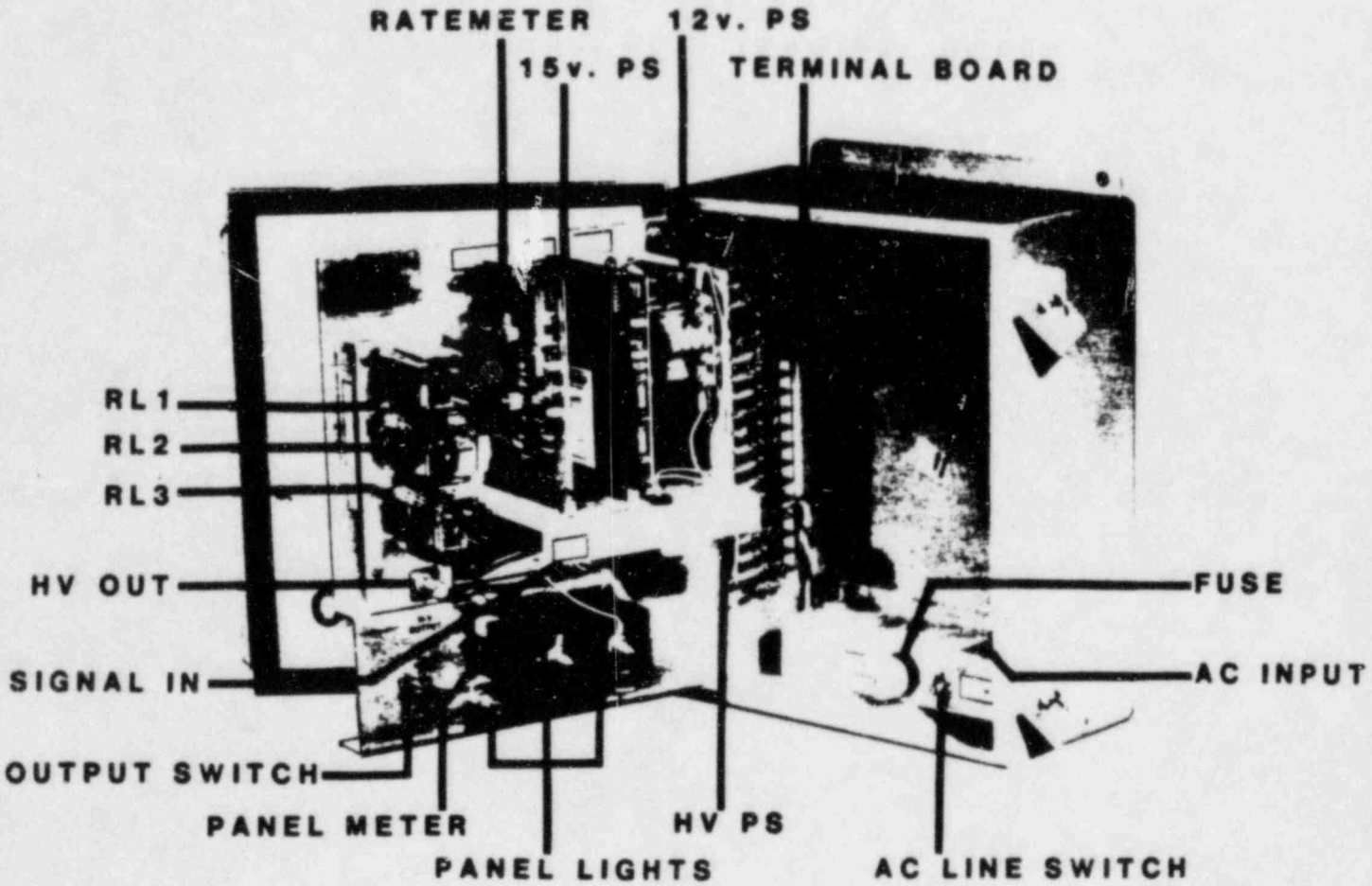
SURFACE FINISH	.XX DECIMAL ± .01	
FRACTIONAL ± 1/64	.XXX ± .005	
ANGULAR ± 0° 30'	.XXXX ± .0005	
DRAWN BY PVDM	DATE 9/1/78	CHECKED BY / DATE

REUTER-STOKES CLEVELAND, OHIO 44128

TITLE RATEMETER SCHEMATIC SAFETY RAY

MAT'L.

APPROVED BY / DATE / SCALE / DWG. NO. S-811-102 / REV. B



PARTS LOCATION

FIG.4

15 V. POWER SUPPLY

REFERENCE DESIGNATION	DESCRIPTION	
PS1	MD-15B, 15V., Power Mate Corp.	Power Supply
C1,C2	6.8MFD., #150D685X9035B2, Sprague	Capacitor
C3	.33MFD, #150D334X9035A2, Sprague	Capacitor
C4	.1MFD, #150D104X9035A2, Sprague	Capacitor
R1,R2,R3 R6,R7	RN55D, 1%, 200Ω, Metal Film	Resistor
R4	RN55D, 1%, 8.66KΩ, Metal Film	Resistor
R8	RN55D, 1%, 97.6KΩ, Metal Film	Resistor
R9	RN55D, 1%, 57.6KΩ, Metal Film	Resistor
R10	RN55D, 1%, 82.5KΩ, Metal Film	Resistor
R11	RN55D, 1%, 97.6KΩ, Metal Film	Resistor
R12,R13, R14	RN55D, 1%, 10KΩ, Metal Film	Resistor
R15,R16	1/4 Watt, 5%, 10Ω, Carbon Composition	Resistor
R5	500Ω, #3059P-1-501, Bournes	Potentiometer
U1	LM249 or LM349, National	Integrated Circuit
U2	MC14093, Motorola	Integrated Circuit
Q1,Q2	VN46AF, Regulator, Siliconics	Transistor
D1,D2,D3	1N914, Fairchild	Diode
VR1	UA78M12UC, Fairchild	Voltage Regulator

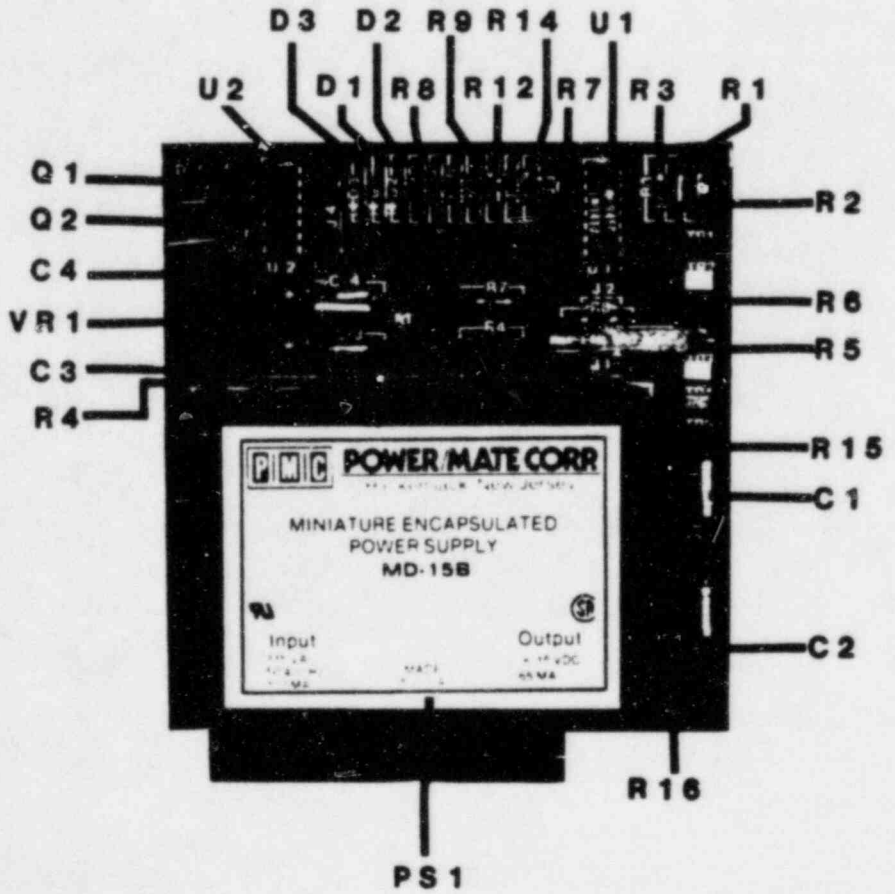
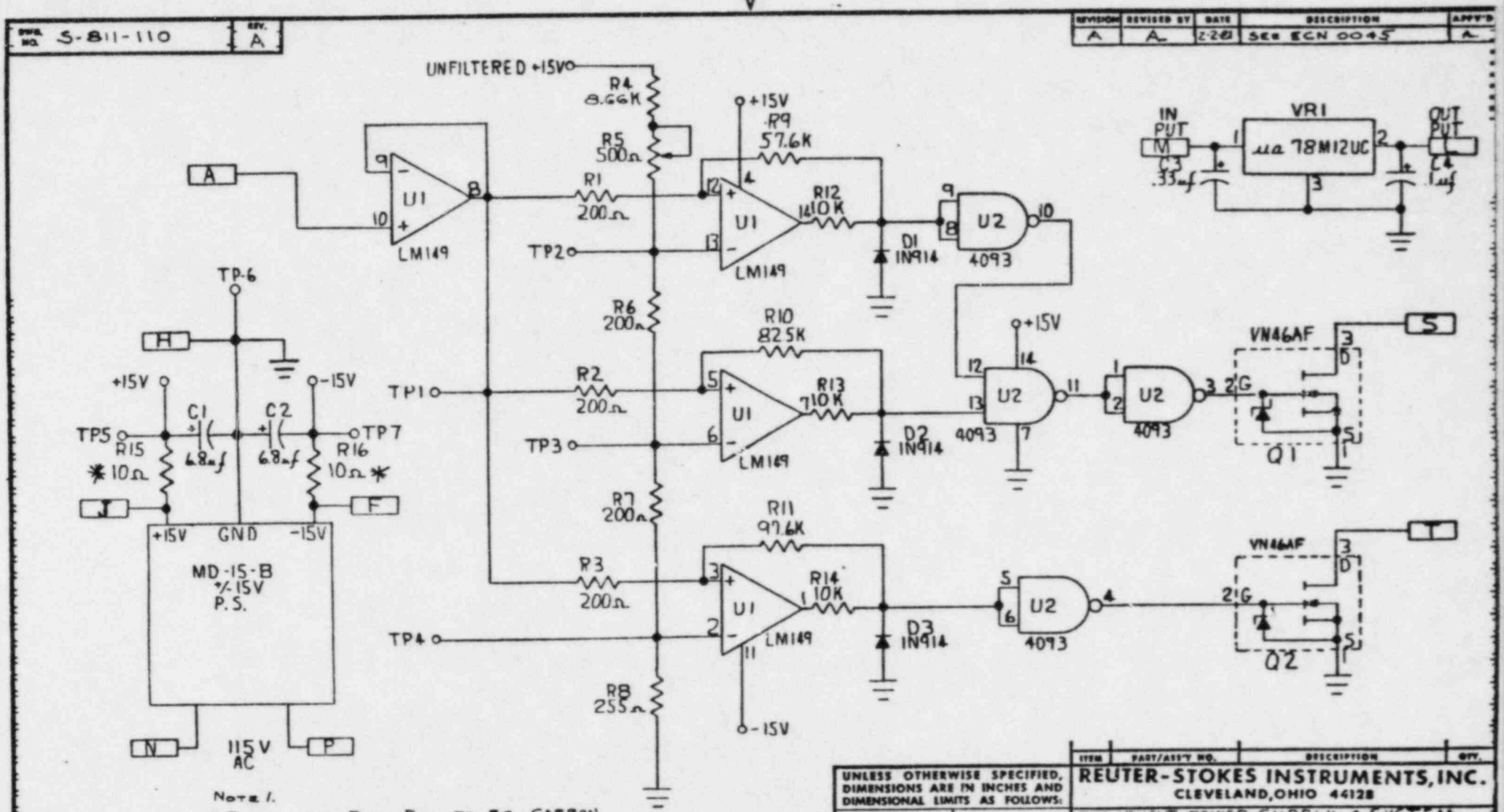


FIG.5

V

DWG. NO. S-811-110 REV. A

REVISION	REVISED BY	DATE	DESCRIPTION	APP'D
A	A.	2-28	SEE ECN 0045	A.



Note 1.
* Resistors R13, R14 to be carbon composition 1/4 watt 5% tolerance
All others are metal film 1%

1 - REMOVE BURRS, BREAK EDGES WHEN APPLICABLE.
NOTES:

ITEM	PART/ASS'Y NO.	DESCRIPTION	QTY.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND DIMENSIONAL LIMITS AS FOLLOWS:

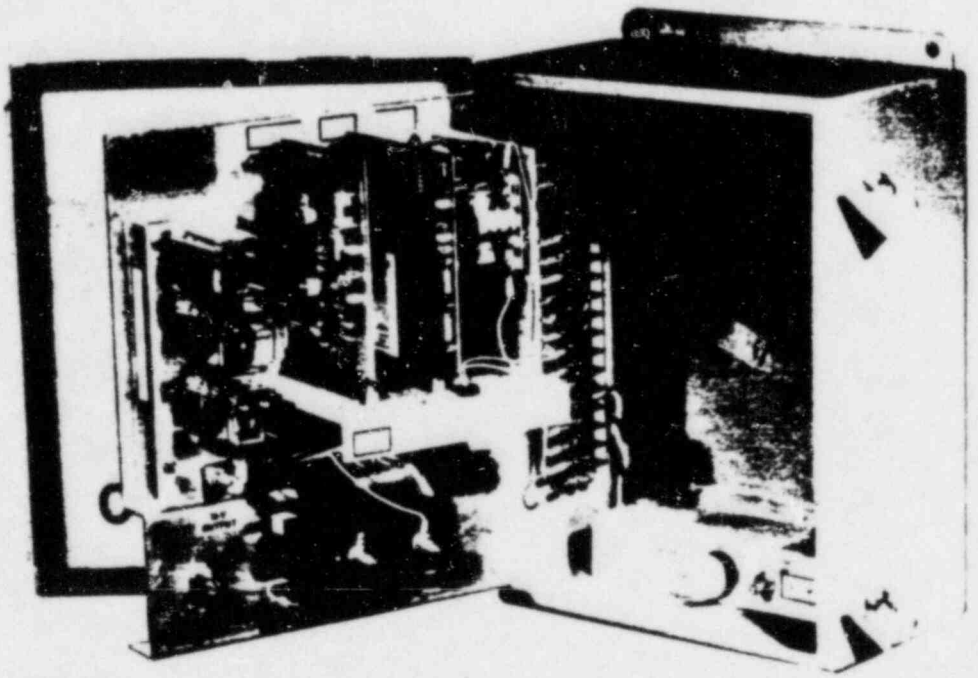
SURFACE FINISH 63	.XX DECIMAL ± .01		
FRACTIONAL ± 1/64	.XXX ± .005		
ANGULAR ± 0° 30'	.XXXX ± .0005		
DRAWN BY BB-DM	DATE 4-79	CHECKED BY	DATE

REUTER-STOKES INSTRUMENTS, INC.
CLEVELAND, OHIO 44128

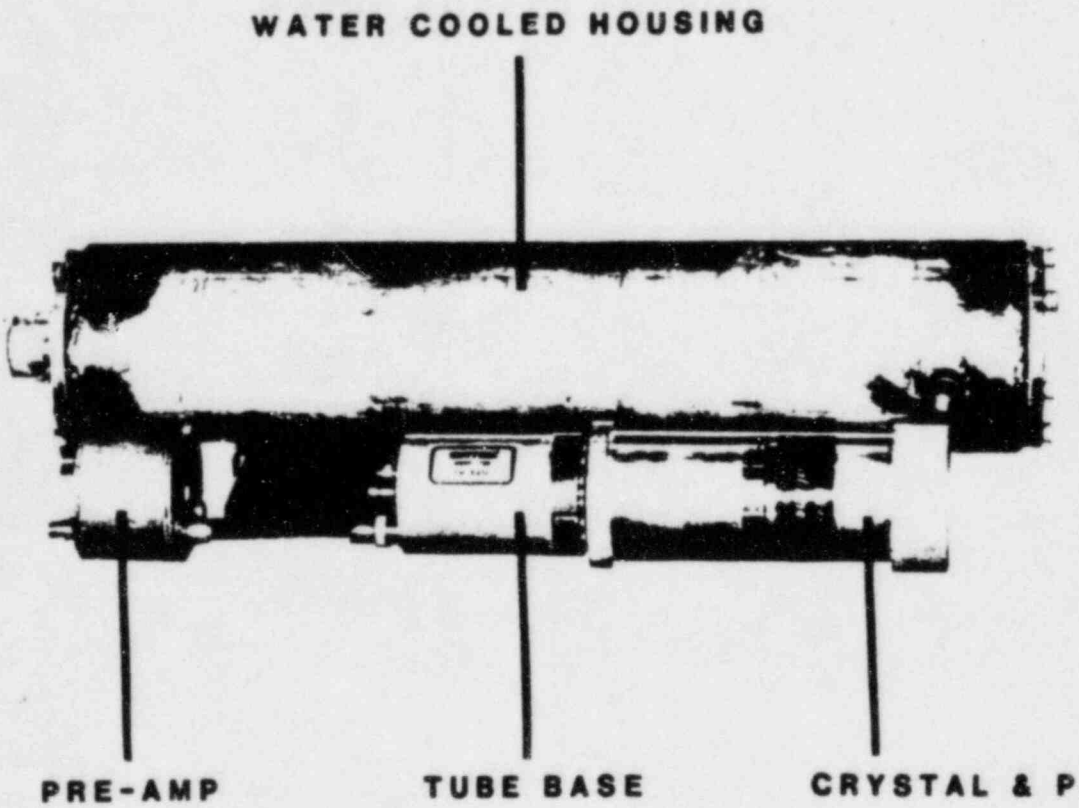
TITLE 15VOLT POWER SUPPLY & SYSTEM MONITOR

MAT'L.

APPROVED BY	DATE	SCALE	DWG. NO. S-811-110	REV. A

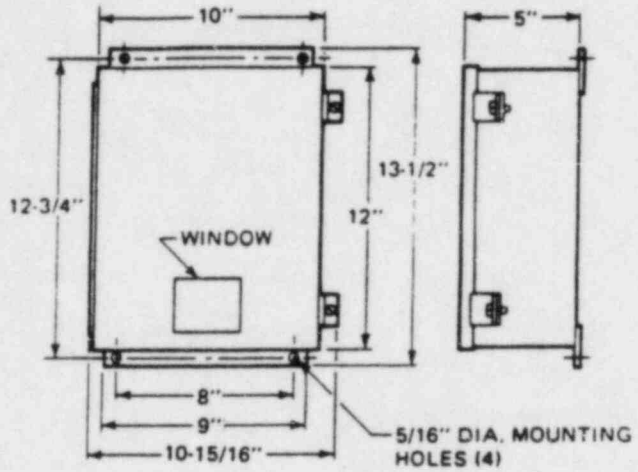


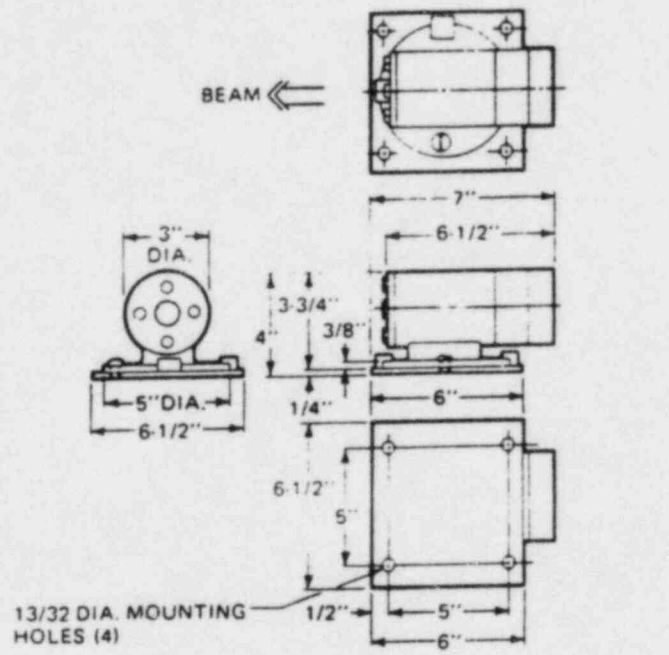
SAFETY RAY ELECTRONICS UNIT

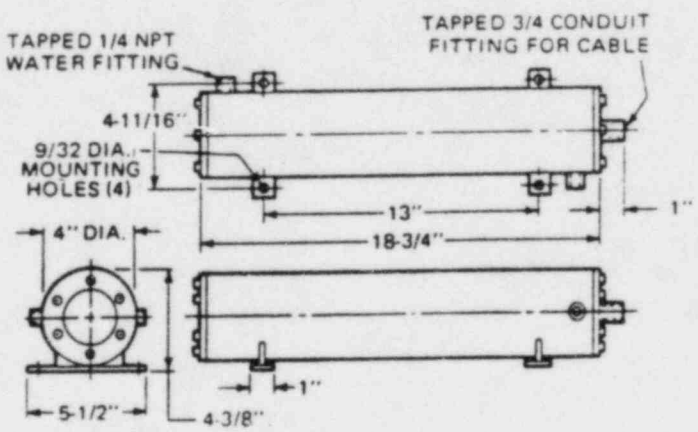


SAFETY RAY DETECTOR ASSEMBLY

CONTROL NO. 13499







reuter stokes
instruments, inc

H. SPARE PARTS (optional)

Crystal and PM tube unit

Preamp

Ratemeter Card

Power Supply Card (± 15v)

Power Supply Assy. (± 12v)

High Voltage Power Supply

AC Line Fuses 2amp 3AG

Panel Lamp Bulbs #330

SAFETY RAY

Typical System Specifications

A) Power Input - 115 VAC at 2 Amp

B) Outputs - 1) Relay contacts (115 VAC at 10 Amp)
2) +12V logic signal (50 MA max.)
3) 0 to 1 volt signal (proportional to radiation intensity)

C) Ambient Operating Temperatures

Source Holder	up to 500°F without cooling
Detector	40°F to 120°F without cooling 40°F to 250° with 1 gal/min water
Indicator/Control	40°F-100°F (control room or motor room environment)

D) Physical Dimensions

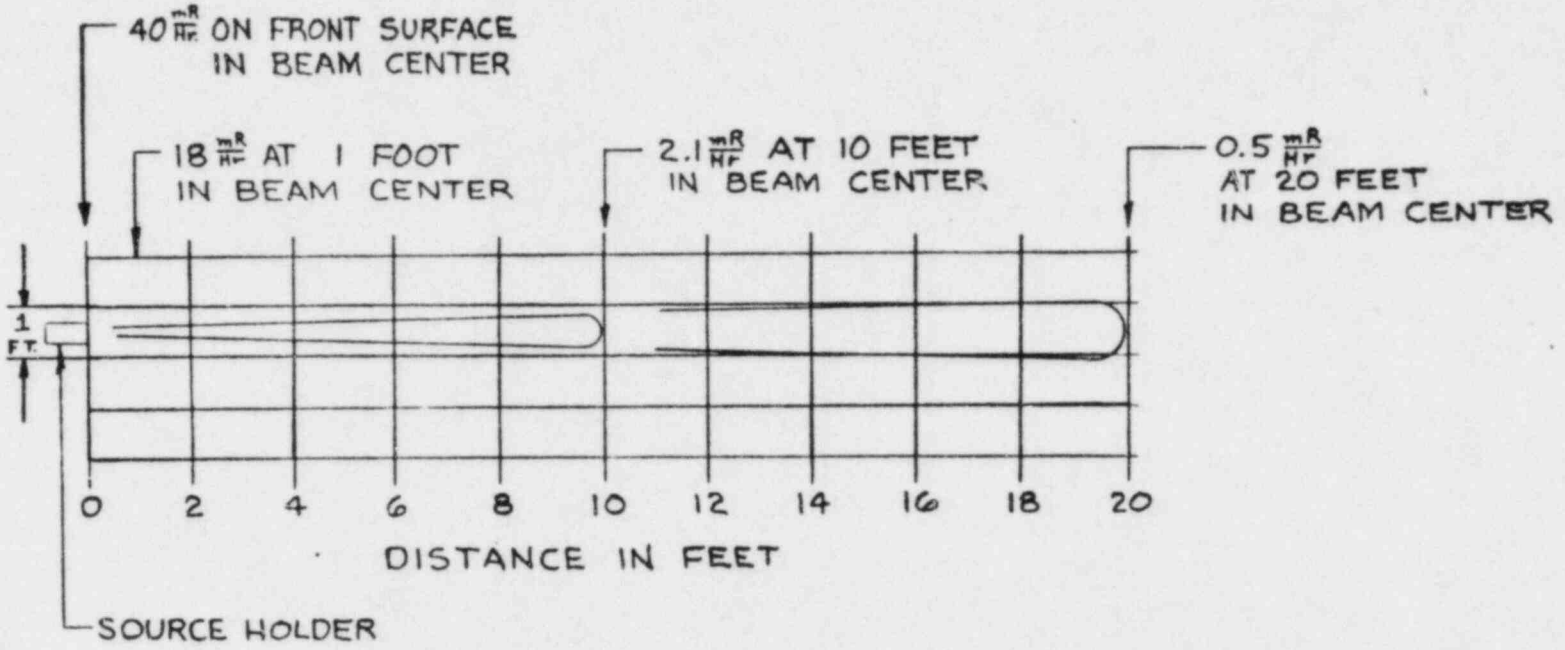
Source to detector distance - 35 ft max.

Detector to Indicator Control - 200 ft max.

DWG. NO.	REV.

REVISION	REVISED BY	DATE	DESCRIPTION	APP'D

NOTE: DOSE ON BACK AND SIDE SURFACE OF HOLDER IS LESS THAN 0.025 $\frac{mR}{Hr}$



ITEM	PART/ASS'Y NO.	DESCRIPTION	QTY.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND DIMENSIONAL LIMITS AS FOLLOWS.

SURFACE FINISH 63 V	.XX DECIMAL ± .01
FRACTIONAL ± 1/64	.XXX ± .002
ANGULAR ± 0° 30'	.XXXX ± .0005

DRAWN BY	DATE	CHECKED BY	DATE
A.R.	3-18-81	A.	3-18-81

REUTER-STOKES CLEVELAND, OHIO 44128

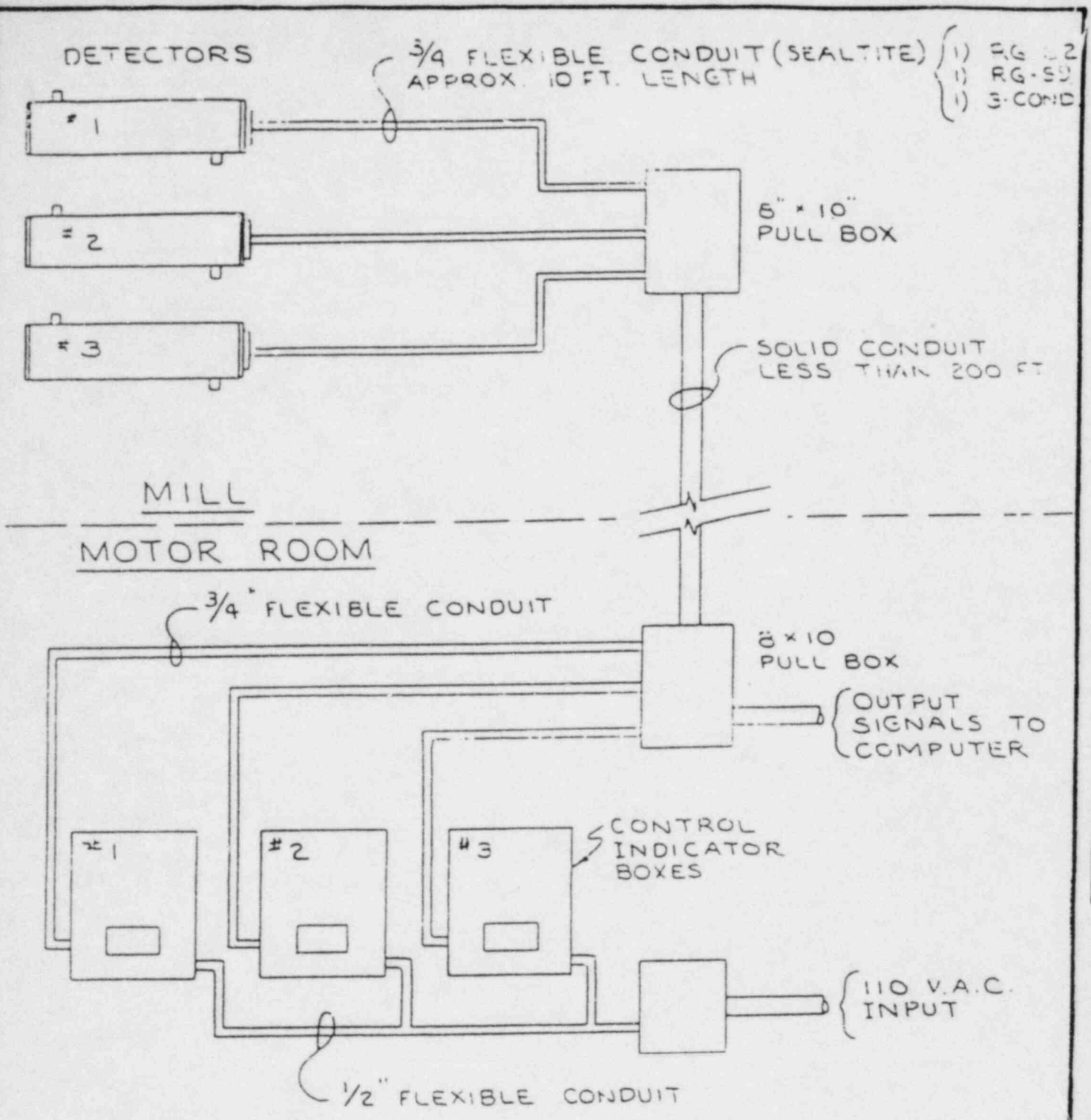
TITLE SAFETY RAY ISODOSE CURVE 1 Ci AM-241

MAT'L.

APPROVED BY	DATE	SCALE	DWG. NO.	REV.
			S-811	

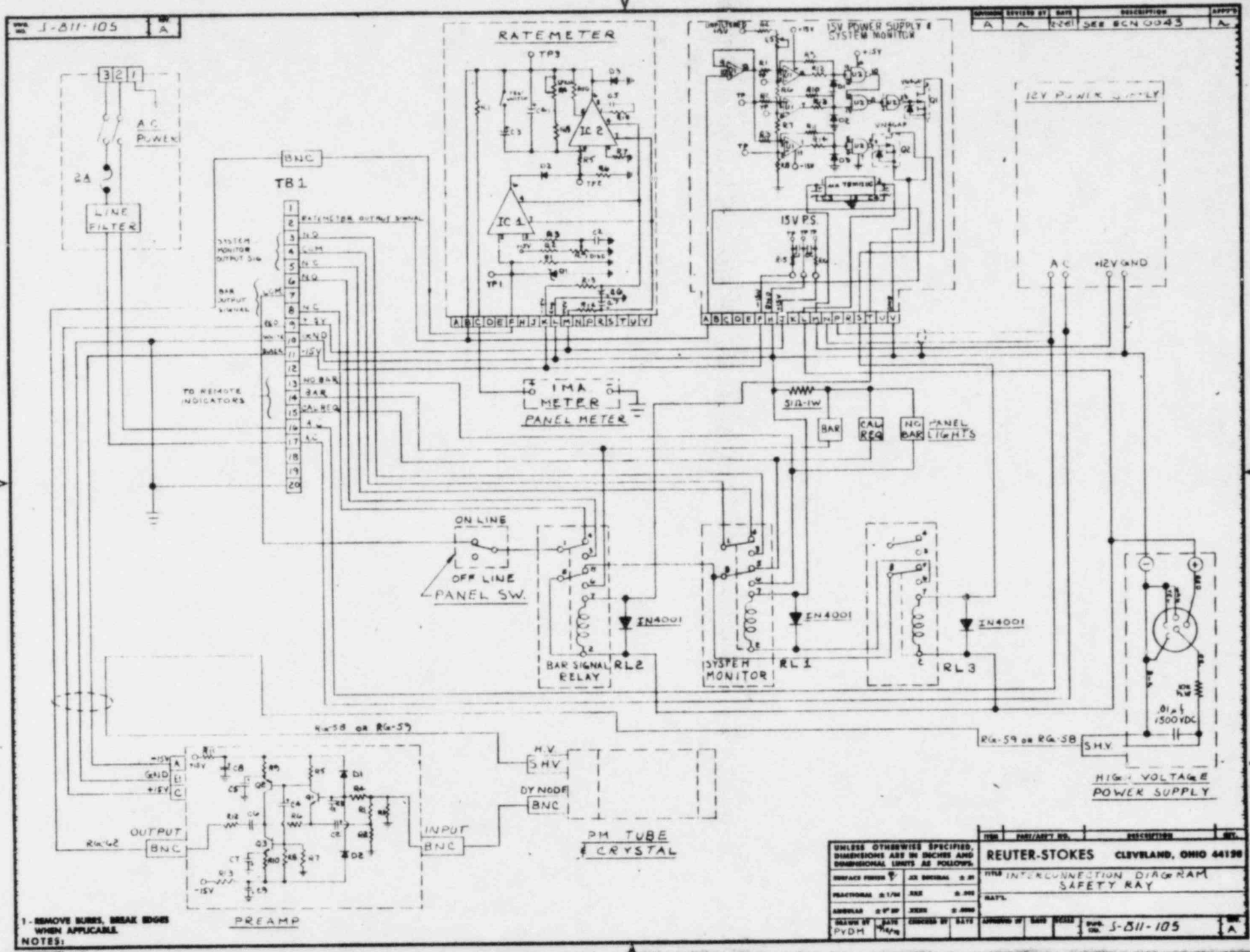
1 - REMOVE BURRS, BREAK EDGES WHEN APPLICABLE.

NOTES:



UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES AND DIMENSIONAL LIMITS AS FOLLOWS:		REUTER-STOKES CLEVELAND, OHIO 44128						
SURFACE FINISH 63	XX DECIMAL ±.01	TITLE SAFETY RAY TYPICAL 3-UNIT WIRING LAYOUT						
FRACTIONAL ±1/64	.XXX ±.003	MAT'L.						
ANGULAR ±0° 30'	.XXXX ±.0003							
DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE	SCALE	DWG. NO.	REV.

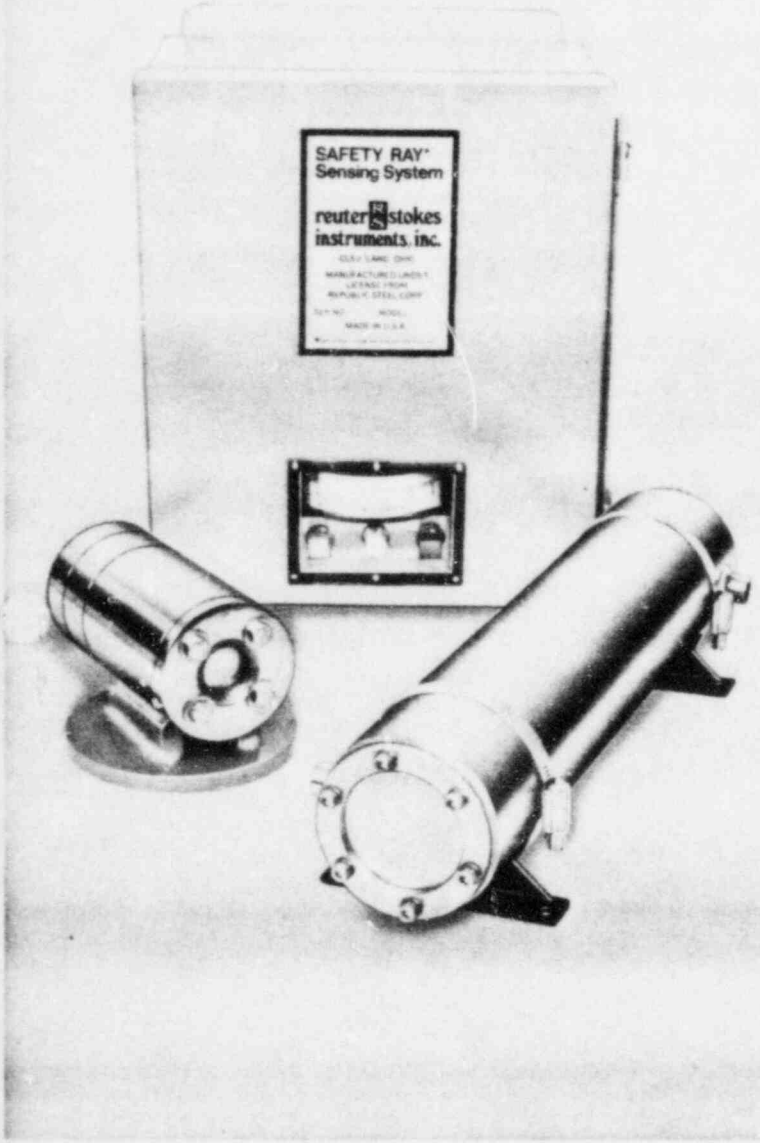
CONTROL NO. 78799


S-811-105
A
RATEMETER
15V POWER SUPPLY & SYSTEM MONITOR
12V POWER SUPPLY
AC POWER
2A
LINE FILTER
BNC
TB1
RATEMETER OUTPUT SIGNAL
SYSTEM MONITOR OUTPUT SIG
BAR OUTPUT SIGNAL
TO REMOTE INDICATORS
IC 1
IC 2
TP1
TP2
TP3
15VPS
AC
+12V GND
1MA METER
PANEL METER
5IA-1W
BAR
CAL REQ
NG BAR
PANEL LIGHTS
ON LINE
OFF LINE
PANEL SW.
IN4001
BAR SIGNAL RELAY
RL2
SYSTEM MONITOR
RL1
RL3
RG-58 OR RG-59
RG-59 OR RG-58
H.V.
SHV
DYNODE
BNC
PM TUBE & CRYSTAL
HIGH VOLTAGE POWER SUPPLY
.01μf 1500VDC
OUTPUT
INPUT
PREAMP
-15V
GND
+15V
REMOVE BURRS, BREAK EDGES WHEN APPLICABLE.
NOTES:
REUTER-STOKES
CLEVELAND, OHIO 44138
INTERCONNECTION DIAGRAM
SAFETY RAY
S-811-105

#4

Engineering Data Sheet 8.01

Safety Ray* Sensing System



SAFETY RAY is a non contact sensing system using a precisely collimated low intensity gamma ray beam. The SAFETY RAY detects the presence of objects, machinery or people and provides a signal for a control system or interlock.

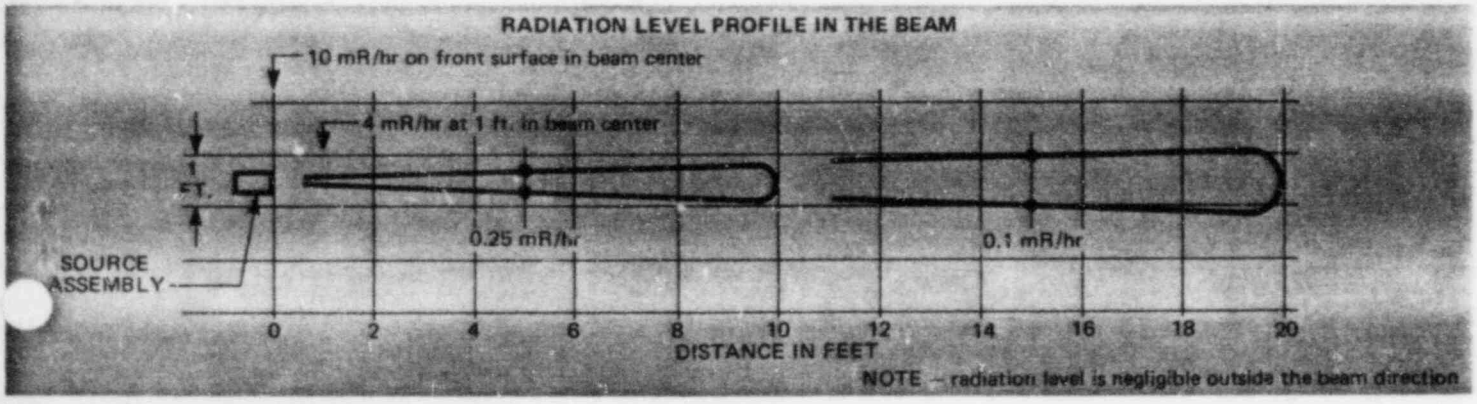
A narrow beam of low energy (60 KeV) gamma rays is aimed at a remotely located detector. An object passing through the beam reduces the radiation intensity at the detector thus indicating its presence.

In the primary metal industry, the signal from the SAFETY RAY can be used for controlling mill operations like crop shear, descaler and tracking.

In other industries, the SAFETY RAY system will be a useful device where non contact detection is required. The main advantage of the SAFETY RAY system is that it can operate in hot, steamy and dusty environments where conventional devices are unreliable.

The SAFETY RAY system consists of three components; source assembly, detector assembly and electronic unit. The distance between the source and detector assembly can be up to 35 feet, with response time of 100 milliseconds.

The source (1 Curie of ^{241}Am) is contained in a thick corrosion proof stainless steel protective holder along with a unique radiation collimator. The detector (scintillator, photomultiplier tube and preamp) is housed in a water cooled jacket for high temperature operation. The electronic unit is fabricated with rubber gasket seals for dusty and humid environments.



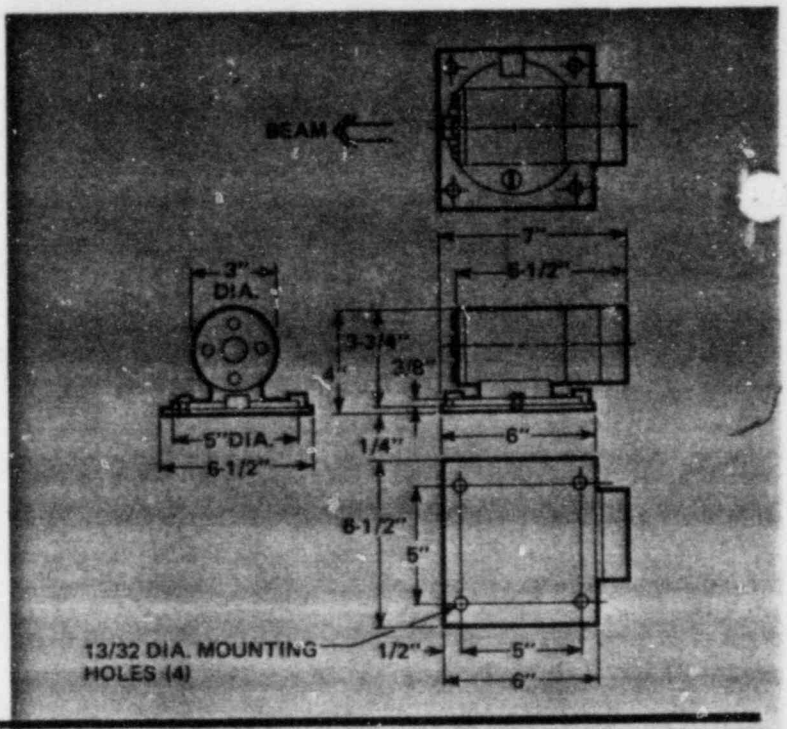
*SAFETY RAY is a trademark of Republic Steel Corporation. SAFETY RAY is manufactured by Reuter-Stokes under license from Republic Steel.

CONTROL NO. 78799

Specifications

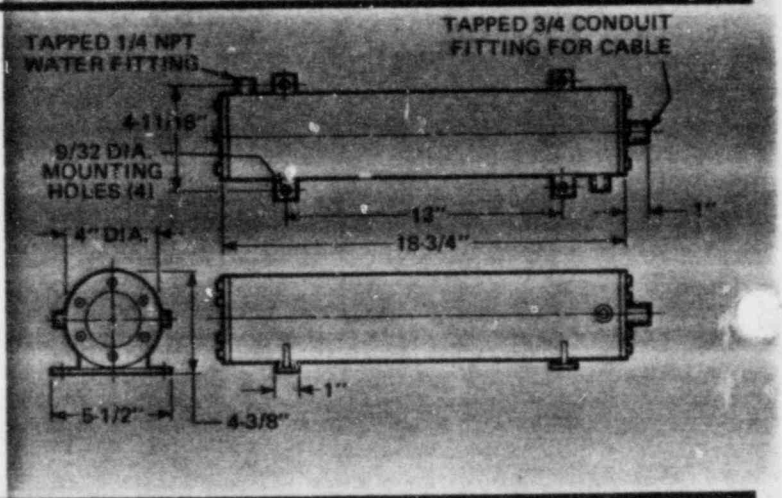
SOURCE ASSEMBLY

Source	1 Curie of ^{241}Am; emits 60 KeV gamma rays.
Shielding	Minimum 1" thick steel shielding all around except in the beam direction.
Radiation Level (see graph)	Outside beam direction – negligible. Even in the beam direction, the radiation level is well below safe limits.
Mechanical	The assembly is made of corrosion proof stainless steel. The source assembly can be rotated on the mounting block for radiation beam alignment.
Weight	≈ 15 Lbs.



DETECTOR ASSEMBLY

Detector	2" dia. X 1/2" NaI (Tl) scintillator with photomultiplier tube and preamplifier. Watercooling is incorporated for high temperature operation. Protective conduit fitting is incorporated for interconnecting cable between the detector and electronic unit.
Mechanical	The detector assembly is constructed of stainless steel with double wall construction for water flow.
Weight	≈ 16 Lbs.

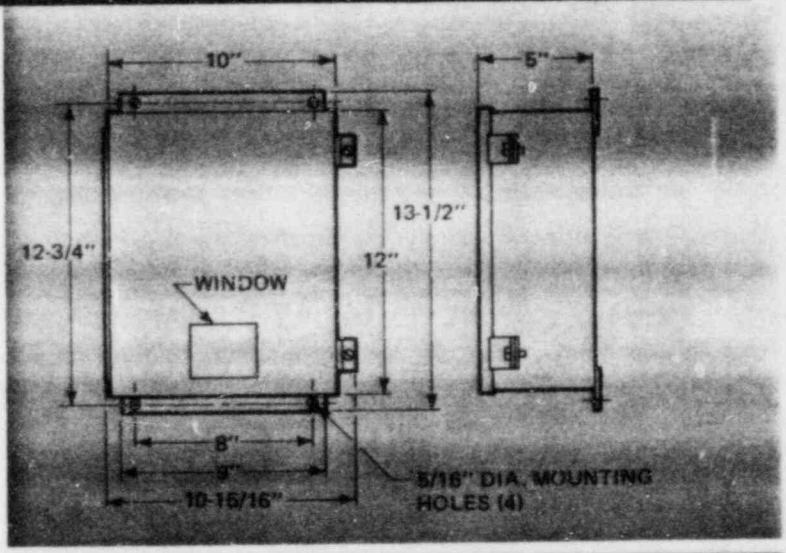


ELECTRONIC UNIT

The electronic unit contains all signal processing electronics and provides the output in the form of relay contacts. The signal from the detector is received in the form of small pulses. The frequency of these small pulses decreases when an object is in the path of the radiation beam. The electronic unit measures the frequency of these pulses and signals if an object is in the path. It can be located as far as 200 feet away from the detector.

The relay contact output from the SAFETY RAY electronic unit can be used to inform the computer or any process controller of the presence of the object.

Mechanical	Enclosure: NEMA Type 4 Holes are provided for wall mounting.
Weight	≈ 28 Lbs.



RADIATION LICENSING REQUIREMENT

The SAFETY RAY system contains 1 Curie of ^{241}Am radioactive source and requires an appropriate license from the Nuclear Regulatory Commission or State Health authorities (in agreement states). Use outside the United States requires a license from the appropriate authorities in the country of use. Reuter-Stokes will provide guidance and assistance in obtaining the required licensing.

reuter RS stokes

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