RADIATION PROTECTION PROCEDURE **Ref: TSG 10.4**

TITLE: **THE HANDLING STORAGE AND TRANSPORT OF RADIOACTIVE MATERIALS** **ISSUE: 5**

DOCUMENT CONTROL NUMBER:

APPROVAL AND AUTHORISATION SHEET

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1. G D HEAD	Managing Director Tyco Electronic Product Group	.....	

ATTACHMENT E

CONTENTS LIST

1.0 INTRODUCTION

This Procedure sets out the policy for the package, despatch and transport of Ion Chamber Smoke Detectors (ICSD) within the United Kingdom and to and from countries who are signatories to the International Atomic Energy Agency (IAEA) Regulations. This procedure covers all movements of detectors including hand carriage. The storage and transport of Radioactive Level Gauges is also covered. For transport to and from countries outside IAEA Regulations, please contact Company Radiation Protection Supervisor (RPS).

This procedure also describes the terms of acceptance for receipt of FGS and scrap detectors at the warehouse.

2.0 SCOPE

This work instruction applies to all Directors, General Managers, their appointed Radiation Protection Supervisors, and local responsible persons for handling Radioactive Substances.It includes Local Rules for the new and waste detectors and mobile sources.

This specifically includes the transport of detectors from the customer to the Warehouse for disposal. This includes Thorn and Non-Thorn Detectors. It is imperative that detectors are always disposed of correctly, never to a skip or landfill.

This procedure applies to all divisions of Tyco Electronic Product Group.

3.0 RESPONSIBILITIES

The General Manager Quality & Product Support

To ensure regular audits of this procedure.

The Manufacturing Director

To ensure that receipt, storage, and despatch of radioactive materials, and the manufacture of Detectors meet legal and company requirements. To appoint the Technical Services Manager and the company RPS.

The Technical Director

To ensure that the design of products which incorporate Radioactive materials meet legal requirements.

To ensure the receipt, storage, use and despatch of Radioactive sources at R & D UK.

The Director of Purchasing and Distribution

To ensure that all instances of incorrectly packed or transported goods received at the warehouse are promptly reported to the Company Radiological Protection Supervisor. To ensure that all outgoing goods are transported to the correct regulations.

To ensure the requirement of the EURATOM agreement is met.

The Company Radiation Protection Supervisor (RPS)

Appointed by the Technical Services Manager, to ensure that this procedure is followed on a day to day basis. To ensure that this procedure meets company and legislative requirements.

Local Responsible Person

To ensure that this procedure is followed.
To notify RPS in the event of an incident

4.0 DEFINITIONS

m	-	Metre
EURATOM	-	EC Council Regulation 1493/93 Shipments of Radioactive Substances between EC member states.
NSL	-	Non Stock Listed
RSA	-	Radioactive Substances Act 1993
IAEA	-	International Atomic Energy Authority
IRR	-	Ionising Radiation's Regulations 1985
ICSD	-	Ion Chamber Smoke Detectors
RPS	-	Radiation Protection Supervisor
HSE	-	Health and Safety Executive
Am241	-	Americium 241 Isotope
Ra226	-	Radium 226 Isotope

IST	-	Internal Stock Transfer (note)
EA	-	Environment Agency
Road Transport Reqs.	-	Road Transport Regulations SI 1996 No. 1350
Driver Training	-	Carriage of Dangerous Goods by road. Regulations SI 1996 No. 2094.
FGS	-	Finished Goods Stock
ADR	-	Vocational Driver Training to City & Guilds Standard for Carriage of Radioactive Materials by Road
RTA	-	Road Traffic Accident
NAIR	-	National Arrangements for Incidents Involving Radioactivity

5.0 PROCEDURE

5.1 Equipment and Materials Used

Vehicle Placards (Class 7)	Not Stockcoded
Standard Letter (Confirmation of disposal)	TSG 10.4 Appendix I
Health & Safety Data Sheet (Liquid Level Guages)	TSG 10.4 Appendix II
Polythene Bag (for single detector)	123-001-050
Branch Returns Note (BRN)	AM 1117/000
Service Detector Movement Docket	AM 0467/000
Packing Tape (50mm)	120-081-015
Radioactive Label Trefoil (excepted)	AM 1635/000
Consignment Certificate	AM 0240/000
Notice in Vehicle (Fireproof)	517-001-223
IST/Scrap Note	AM 0842/599
MF Cardboard Box	123-002-546
MF Output Label	120-247-121
Company Radioactive Notice	AM 1809/0000
Despatch Note (for shipment from warehouse to branch store only)	AM 1179/551
Radioactive Label Trefoil - Stores	AM 1634/000
Trefoil Symbol (II yellow small Ra226)	AM 1636/000
Radioactive Label Trefoil White 1	AM 1626/000
Cardboard Box Type A (Free Issue from Warehouse)	Safeguard Smokepac (NSL).
Address Label from Warehouse for disposal F3	AM 1627/000
Address Label from Warehouse for disposal F5	AM 1628/000
Address Label from Warehouse for disposal F6	AM 1629/000
Address Label from Warehouse for disposal F7	AM 1630/000
Address Label from Warehouse for disposal MF	AM 1631/000

Please note that some of the above items may have to be ordered using a BSO from the Warehouse.

5.2 Health and Safety

Health and Safety is of the utmost importance when handling Ion Chamber Detectors. Any Detectors which are in any way suspected of being mechanically damaged should be bagged and sealed and the area thoroughly monitored to ensure no contamination has taken place.

Detectors without any identification should be referred to the Company RPS.

Local Rules must be adhered to.

Only trained operators are allowed to work with Radioactive materials. The name of the local RPS is available from the company RPS or your General Manager/ Director.

When packing or unpacking waste or superficially damaged detectors, impermeable gloves must be worn. Place the plastic bag over damaged or Radium detectors prior to removing them from their base.

It is not necessary to use gloves for the installation of MF/RAFT Detectors.

5.2.1 Incident Reporting Procedure

In the event of any incident, contact the local RPS. If the incident is serious and the local RPS is not available, contact the company RPS immediately at Walthamstow on 0181 919 4078. If the local RPS and company RPS are unavailable. In the last resort, contact the Managing Director, Tyco Electronic Product Group at Billet Road, Walthamstow.

Refer to section 7.4.5 for contingency plan.

5.3 Procedure

5.3.1 Despatch & Return of Finished Goods & Service Detectors to UK Destinations

This section covers the despatch of MF/RAFT Series detectors from the factory to the warehouse and from the warehouse to branch/site or return from branch/site to warehouse, and the transit of complete MF/RAFT Detectors in their finished packaging.

A consignment certificate is required for shipment of Finished Goods Detectors between Billet Road and the Warehouse. It is the duty of the Production Manager to retain records (see Section 6.0)

Goods despatched from the Warehouse, must be accompanied by the despatch note. The maximum quantity of any consignment is 200MBq, this is equivalent to 6000 MF/RAFT Detectors.

Returned goods must be accompanied by Consignment Certificate and packed in original packaging and accompanied by a BRN if claiming credit.

Notice in vehicle is **not** required.

The storage of Finished Goods Ion Detectors must remain at Branch until installed. (Not at site).

A normal courier service such as Lynx standard service is acceptable for transporting this type of consignment.

5.3.2 Despatch of Sample MF/RAFT Detectors to UK Destinations

This section covers the despatch of detectors or sources for example between Sunbury & the Walthamstow Factory.

- Detectors & Sources must be booked out from the Consignors (Senders) Stock and booked into the Consignees (Receivers) Stock to maintain accurate records for both areas.
- To Local Responsible Person is responsible for stock records.
- All despatches must be accompanied by a consignment certificate.
- To be packed as 5.3.4.3.
- For any other type of ionisation detectors, please refer to company RPA.
- Refer to 'Driver Training' section 5.5.

5.3.3 Despatch of Finished Goods to International Destinations

This section covers the despatch of MF/RAFT Series Detectors from the Warehouse to international destinations within the jurisdiction of the IAEA.

The requirements are as in 5.3.1 above, and in addition the materials must be shipped to IAEA Regulations. The packaging must be able to withstand the rigours of international transport.

For shipments between EC States, the European regulation No. 1493/93 requires registration with consignees competent Authority prior to international shipment.

Shipments from EC Member States to UK

This includes FGS Ion Chamber Detectors (e.g. System Sensor from Italy), Scrap Ion Chamber Detectors from any EC Member State, or Ion Chamber Sources as Component Stock from any EC Member State.

The person responsible is the Purchasing Manager at the Warehouse.

The duties are:-

To complete the initial declaration of the type and quantity of radioactive material it is intended to ship to the UK. This declaration must be sent to the Environment Agency (EA), who will authorise and return it.

The declaration must be sent to the supplier of Radioactive Material in the Foreign EC State. (Note the declarations can be for one shipment or multiple shipments over 3 years).

It is the duty of the supplier in the Foreign EC State to send details of actual shipments to the UK every 3 months to the Environment Agency. (It is assumed these are matched against the 3 yearly declaration).

Shipments from the UK to EC Member States

This includes FGS Ion Chamber Detectors, Scrap Ion Chamber Detectors, or Ion Chamber Sources as Component Stock.

The person responsible is the Purchasing Manager at the Warehouse.

The duties are:-

To ensure that the recipient has the declaration authorised by the Competent Authority in that country to receive radioactive material and a copy is held on file at Walthamstow. The actual shipments must only be made in accordance with the declaration and the shipment records held with the declaration.

To send details of actual shipments received to the relevant Competent Authority in the EC Member State, from which the Radioactive Materials are being sent. These details must be sent every 3 months.

The goods must be described as Radioactive material and include a Proper Shipping Name and Description including a United Nations Number as indicated below.

UN NUMBER	NAME & DESCRIPTION	OTHER RISKS
2910	Radioactive material Excepted Package articles	None

5.3.4 Packaging & Despatch of Waste (scrap) or Detectors within UK

This section covers the collection and despatch of waste detectors of all types (including Non-Thorn) from the customer's premises via the Warehouse to their final destination. Detectors need to be sorted into the correct category before packaging and despatch.

DETECTOR TYPE	CATEGORY	SECTION BELOW
F6, F7, MF/RAFT - All Types + NSL AM241 below 2.0MBq	Excepted (Package not greater 200MBq)	5.3.4.3
Thorn F3 & F5 + NSL AM241 above 2.0MBq	I White, Type A	5.3.4.4
Ra226	II Yellow, Type A	5.3.4.5

Pre printed address labels are stockcoded and available for shipment of detectors from Warehouse for disposal. Refer to 'Equipment & Materials' section. They are unsuitable for use by the customers.

5.3.4.1 Removal from Customers Premises (All types)

Detectors must be packed correctly as detailed below, with a consignment certificate and Service Detector Movement Docket completed before removal from site, one copy to remain with customer. This notifies the customer of the number and type of detectors removed. Please refer to Appendix 1 for standard letter if required by customer.

5.3.4.2 Damaged Detectors (All Types)

Detectors may be returned to the warehouse for disposal when they are superficially damaged. They must each be placed in an individual sealed polythene bag, labelled with the Type, the damage sustained and the site from which it was removed, and then packed and shipped as detailed in sections 5.3.4.3 and 5.3.4.4 below. In the event of damage to the extent that the source holder is exposed special packing will be required and advice must be sought from the Company Radiation Protection Supervisor.

5.3.4.3 Packaging - Excepted

- Shipment is classed as "excepted".
- Consignment certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors must be complete and undamaged.
- Must be packed in a sealed plastic bag and then in any suitable cardboard box, so that detectors are not damaged in transit.
- Trefoil label AM1635/000 must be stuck inside the cover before closing the box (So as to be visible when box is opened)
- Detectors are to be packed in maximum of 20 per box, as this is a manageable quantity. Detectors are to be sorted by type.
- Can be transported by either branch or courier service such as Lynx Transport.
- Consignment certificate is required for disposal of waste production detectors, and an I.S.T. must be with each shipment from Billet Road to Warehouse.
- No special labelling is required on outside of box.

5.3.4.4 Packaging - I White, Type A

- Shipment is classed as I White Type A.

- Consignment Certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors may be superficially damaged - see section 5.3.4.2 of this procedure.
- Detectors must be packed in a sealed plastic bag and then in Type A Cardboard Box, so that detectors are not damaged in transit.
- Three Trefoil Labels AM1626/000 must be used (see Consignment Certificate). Two stuck externally at each end and one inside the cover before closing the box (so as to be visible when box is opened).

  Complete label as follows:- Contents:- "Smoke Detectors"
  Activity:- X MBQ

  (where X = Activity of each detector x total number of detectors).

- Detectors are to be packed maximum of 50 per box, smaller quantities must have additional packaging to prevent damage in transit. Detectors are to be sorted by type.
- Shipment MUST only be transported by Securicor Omega. Lynx or Company Transport is unacceptable.

5.3.4.5 <u>Packaging (Radium Ra226 - All Types) - II Yellow</u>

- Shipment is classed as a type A II Yellow package.
- Consignment certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors must be complete and undamaged.
- Must be packed in sealed polythene bag, then packed in cardboard box. (type A) to ensure detectors are not damaged in transit.
  Three trefoil labels AM1636/000 must be completed with contents, Transport Index & Activity (see Consignment Certificate) and two stuck externally at each end and one inside the cover before closing the box (so as to be visible when box is opened).
- Detectors are to be packed maximum of 20 per box, unless fewer than 20 are to be sent. Detectors are to be sorted by type.
- Must only be transported by Securicor Omega. **Lynx or company transport is unacceptable.**
- Radium Detectors (Ra226) must be sent direct from customer's premises to the Warehouse, due to the company licence conditions.

5.3.5 Despatch of Waste (Scrap) Smoke Detectors From International Destinations

This section covers the collection and despatch of all types of waste detectors (including non-Thorn) from international customers premises via the Warehouse to their final destination.

The requirements are as in 5.3.4 above and in addition:-

- The materials must be shipped to IAEA Regulations. The packaging must be able to withstand the rigours of international transport.
- For shipments between EC States, the European regulation No 1493/93 requires either registration with EA or the competent authority in the country to which the detectors are to be sent prior to international shipment.
- The goods must be described as Radioactive Material and include Proper Shipping Name and Description including a United Nations number.

UN Number	Name and Description	Other Risks
2910	Radioactive Material Excepted Package articles	None
2982	Radioactive Material NOS (Not Otherwise Specified)	None

5.3.6 All Consignments

PLEASE NOTE:
Any ionisation detectors returned to the Warehouse without the correct paperwork and/or packaging, will be rejected and returned to the sender at the earliest opportunity, with a recharge for packing and transport and a handling charge for each detector.

5.4 Storage of Radioactive Materials

This is very strictly controlled by Environmental Agency, the relevant legislation being the RSA 1993 and IRR 1985.

5.4.1 Storage at Branch

- All branches that store radioactive material must be registered.

- Finished Goods, waste (scrap) detectors and Radium detectors to be segregated

within the store.

- All waste (scrap) detectors to be shipped to the warehouse for disposal within 4 weeks of receipt.
- Store to be 🖹 hour fire rated construction.
- Store to contain nothing that is flammable.
- Store to be locked at all times.
- Store to be labelled with trefoil AM1634/000 and with Company Radioactive Notice AM1809/000.
- Store to be supervised by a competent (i.e. trained) person.
- RPS must be appointed at each Hub Branch.
- All stock movements must be accurately recorded to reflect Current Stock levels.
- Maximum stock levels are on the Certificate of Registration
- All losses must be reported to the Company RPS immediately.

This store is only to be used for the storage of ICSD.

5.4.2 Storage on Customers Site

- No Finished Goods Ion Chamber Detectors are to be stored at Customers Site.
- Any waste (scrap) detectors that have been removed from the customers system must not be stored on the customers premises.

5.5 Driver Training

Effective from 1st July 1997 the new regulations are compulsory.
Certificates must confirm driver understands points 1, 2 & 3 in 5.5.2 and driver must sign 2 copies; one for driver, one to be held at Branch.

Certificates of training (both 'general' and 'ADR') must be carried by the driver of the vehicle and produced on demand by the police or Vehicle Inspector. Certificates will be issued by Branch Manager.

The regulations are The carriage of Dangerous Goods by Road (Driver Training) Regulations 1996 SI1996 No. 2094. They apply to all staff whether carrying one detector or a large consignment.

Driver Training information is available from the Resourcing Manager based at Sunbury.
Training frequency - every 5 years or when legislation changes.

5.5.1 Excepted Packages

This applies to MF300/500 Lo Pro & Raft. Drivers do not need any special training, however they must be aware of the risks and hazards of transporting these products.
Maximum item limit of 2 MBq, as detectors are 33 KBq, they are below limit.
Maximum package limit of 200 MBq (A_2 Value) is equal to 6000 detectors in any one package.
No practical limit to number of packages.

5.5.2 Type A Packages (less than 11 packages) - I White & II Yellow

This applies to F35/F50 Range & NSL & Radium. Drivers must have "general training" which must include:-

1. Understand the hazards presented by the goods they are transporting and the actions to be taken in the event of an emergency.
2. Know their duties under the Health & Safety at Work Act 1974.
3. Know their duties under the Radioactive Material (Road Transport) (Great Britain) Regulations 1996 (RAMRoad).

The operator of any vehicle must keep a record of the general training provided to any employee.

For details of Type A Packaging, refer to section 5.3.4.4. This will especially apply to TSL Branch Engineers removing F35/F50's, from site to Branch for disposal.

Placarding and metal sign on vehicle required.
Maximum limit per package is 200 MBq (or box of 60 F50's).

5.5.3 Types A Packages (11 or more packages) - I White & II Yellow

In this instance it is recommended that a courier (e.g. Securicor Omega) are used, or if further information is required, please contact Company RPS.

This also applies to F35/F50 Range & NSL & Radium. Drivers must have an ADR Driving Certificate awarded by City & Guilds. This applies to the disposal of F35/F50's from the Warehouse to AEA Winfrith. It would also apply to TSL Branch Engineers when disposing from a large site.

For details of Type A Packaging, refer to section 5.3.4.4.

The vehicle must be placarded with a Class 7 Trefoil (not stockcoded) and carry a fireproof notice in the cab (stockcoded) and fire fighting equipment.

There are also special restrictions on transport of II yellow packages. Please contact RPS for detail.

Maximum limit per package is 200 MBq (or box of 60 F50's).
Maximum number of packages per consignment is unlimited, but the consignment total must be below 2GBq

6.0 RECORDS

- Copies of Consignment Certificate AM0240/000 must be retained at the relevant branch (or point of despatch) for a period of 5 years following confirmation of transport to Billet Road.
- If customer requires confirmation of disposal, the branch is to supply a copy of the consignment certificate from site to branch store and a standard letter in appendix 1.

7.0 LIQUID LEVEL GAUGES

7.1 INTRODUCTION

The purpose of this procedure is to describe a method for limiting the amount of radiation to which the user of a Panax TM64 liquid level gauge is subjected. It is also to ensure that people in the vicinity of the source in use are subjected to the minimum practicable dose. This procedure forms the local rules for use of Panax gauges in compliance with regulation 11 of the Ionising Radiation's Regulations 1985.

7.2 SCOPE

This work instruction is to be utilised by all users of Liquid Level Measuring Devices; normally used within Fixed Extinguishing and Marine Applications.

7.3 DEFINITION

7.3.1 A user shall be a person who has completed a Company recognised course of training and has been issued with the necessary Certificate of Competence.

7.3.2 The user will be familiar with the equipment and be capable of determining an unsafe condition (eg.

lead shielding cylinder of the carrying case not in place, source not in place or leak testing is overdue).

7.3.3 The user will be completely familiar with the Certificate of Registration issued under the Radioactive Substances Act 1993 and pay particular attention to the clause covering the Keeping and Use of Registered Sources, viz: "The gauge will either be kept under continuous surveillance while being used or locked in a suitable store to prevent unauthorised removal".

7.4 PROCEDURE

7.4.1. Equipment

7.4.1.1. When not in use the liquid level gauge will be enclosed in a carrying case designed to limit the surface dose rate to less than 5 micro Sievert per hour and to contain all the component parts of the Measuring Device. A label indicating the isotope type, the source strength and including a trefoil symbol must be visible when the carrying case is open. A current test certificate covering wipe test and fit for purpose and a copy of the certificate of registration must be fixed to the inside of the case so as to be available for scrutiny. Careful assembly of the gauge into the case will ensure that the surface dose rate is kept to the required level. The source must be carried located in the lead shielding of the carrying case when transported.

7.4.1.2. The carrying case must be examined periodically, at least annually and declared fit for use. A record of this check must be maintained.

7.4.1.3. Wipe tests must be carried out by one of the companies below at periods not exceeding 26 months and the certificate displayed in the carrying case. (See Reg 18 IRR 1985).

The recommended companies are:

1) NRPB. Harwell, Glasgow and Leeds. (01235) 831600
2) Negretti Automation. Aylesbury. (01296) 395931

7.4.1.4. Damage to the Source-holder must be reported immediately to the Company Radiation Protection Advisor at Sunbury.

7.4.1.5 There are no controlled areas around the source in use or storage, conditions are in schedule 6.1 of IRR 1985 are met and company RPA is satisfied that no person using the equipment will receive more than 3/10 of an appropriate dose limit.

7.4.2. Use of liquid level gauge

7.4.2.1. To minimise the exposure to radiation during assembly of the source to the stirrup the source should be kept as far from the body as is practicable and only removed from the lead-shielding for assembly immediately before taking measurements. The unshielded source must never be touched by hand. During the period that the source is in use, care must be exercised to prevent other people from being exposed to radiation. Other persons must be kept at least 1 metre away during use.

7.4.2.2. Separate records must be kept for each Source and they must include the date of receipt, the radionuclide, the activity, the identification number and its location. A daily check of the presence of the source must be made and the location must be recorded. These records must be made available for Audit.

7.4.2.3 Prior to visiting a customers premises with a gauge, the customer should be provided with a copy of the Health and Safety Data Sheet provided in Appendix 2.

7.4.3. Transport

7.4.3.1. The Liquid Level Measuring Equipment must be stowed in its carrying case and placed in the restraining frame fitted to the structure of the vehicle while it is in transit. The carrying case must be locked in transit. Prior to transport, the transport container should be checked to ensure that the source is correctly located in its shielding. The transport container itself must be inspected. Report any defects to the RPS. The gauge cannot be transported unless its carrying case is free of defects. The gauge is transported as an 'Excepted Package'.

7.4.3.2. A Consignment Note AM0240/000 must be used every time the gauge is transported (i.e. from branch to site). The records must be kept for 2 years and be available for audit scrutiny.

7.4.3.3 The Radioactive Material (Road Transport) (Great Britain) Regulations 1996 require drivers transporting radioactive sources:

(i) to exercise reasonable care when transporting radioactive material to ensure a gauge is not lost or unlawfully removed from the vehicle.

(ii) to not without reasonable cause leave the vehicle unattended in a place to which the public have access.

7.4.3.4 Actions to take in the event of a Road Traffic Accident (RTA).

The Radioactive Material (Road Transport) (Great Britain) Regulations 1996 require a driver to take certain actions in the event of a RTA. These actions are summarised below.

(i) First priority in the event of a RTA is to save life and prevent further injury, including

prevention of vehicle fire.

(ii) If the vehicle is still roadworthy, but the gauge and its container is undamaged, then return to the branch.

(iii) If the vehicle is not roadworthy, but the gauge and its container is undamaged, then contact the branch and arrange for another vehicle to collect the gauge.

(iv) In the event that the vehicle has overturned, suffered serious damage or been involved in a fire or a gauge has been stolen from the vehicle damaged in the accident then:

(a) contact the police and the RPS. The company RPA must be informed of the incident.

(b) the company RPA must report the accident to the Department of Transport.

If it is suspected that the container or the gauge has been damaged, then the gauge cannot be transported until the company RPA (or RPS after consulting the RPA) has attended the scene of the accident and verified that the container and gauge are undamaged. A certificate to this effect must be provided by the RPA (or RPS) before the gauge can be moved.

(v) If it is suspected that the source rod has been damaged, then no one should attempt to move the gauge until specialist advice has been provided by the company RPA or other radiation adviser (eg. NRPB, local hospital health physicist). In the event that the source rod is damaged, the source itself may be ruptured leading to contamination. Persons must be kept at least 2 metres away from the gauge until advice has been sought.

If the accident occurred on a public highway, or area that the public have access to, then the police may invoke the National Arrangements for Incidents Involving Radioactivity (NAIR) scheme (this would call on a radiation specialist from a local hospital or other institute where specialist advice can be obtained). The driver, if he is able to do so, must co-operate with any radiation specialist who attends the scene.

7.4.4 Storage

7.4.4.1 When the vehicle is not being used on company business or is parked in a public area overnight the gauge must be removed from the vehicle and placed in a suitable

storage. The vehicle must not be used as an overnight store. In the event that it is not

possible to return a gauge to its store at the end of the working day, the company RPA should be contacted to locate an alternative store.

7.4.4.2. Facilities for storage are detailed in 5.4.1. When the vehicle is being used for private purposes the gauge must be placed in a secure storage facility. Users must be familiar with the conditions of use placed upon them by the Certificate of Registration that is displayed at their Registered Office.

7.4.5 Contingency Plan

General - Please refer to section 5.2 Health & Safety, this details the incident reporting procedure.

Lost/stolen - liquid level gauges or fire detectors
Immediate search must be made, if it cannot be found within 1 hour contact company RPA/RPS. If after further search it still cannot be found, then the Environment Agency and the police must be contacted.

Fire - Liquid level gauges or fire detectors
The company RPA/RPS must be contacted immediately. No one should attempt to move the gauge or detectors after the fire - there may be contamination as a result of the fire. The Environment Agency should be notified if the source is damaged in the fire.

Mechanical damage - Liquid level gauges or fire detectors
Contact the company RPA/RPS immediately - Warning there is the possibility that the source/detectors are damaged which could lead to contamination. No one must approach if the source is damaged. The RPS or RPA must check dose rate as soon as practical to ensure it is safe to approach.

Road Traffic Accident - Liquid level gauges or fire detectors.
As 7.4.3.4

8.0 RECORD OF CHANGE

Issue Date	Issue Level	Revision and Summary of Changes
August 1995	1	1st Issue
February 1996	2	Sections 5.3.4 & 5.3.4.4 amended to meet revised conditions for disposal of Radioactive Fire Detectors.
July 1996	3	Sections 5.3.1, 5.3.4.3., 5.4.1, 6.0, 7.4.3.3., amended to meet 1996 Transport Regulations.

June 1997	4	Amended to include Driver Training Regulations 1996 and updated liquid level gauge instructions. Now in 2 identical versions as TSG 10.4 & TSS 10.4.
March 1998	5	Amended to include Director of purchasing and distribution as signatory.

021986

SECTION ONE

CONTENTS:

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO.: NR-0776-D-101-E DATE: September 16, 1994 PAGE 1 OF 2

DEVICE TYPE: Smoke Detector

MODEL: MF Series, OIB (P/N PU 90-21000-1 and P/N PU 90-41000-1), NID-58, NID-68 AS Series

DISTRIBUTOR: Thorn Automated Systems, Inc.
835 Sharon Drive
Westlake, OH 44145

MANUFACTURER: Thorn Security Limited
Technology Centre
The Summit
Hanworth Road
Sunbury-on-Thames
Middlesex
TW16 5DB

Nittan Company, LTD.
11-6, 1-Chome
Hatagaya
Shibuya-ku
Tokyo 151, Japan

SEALED SOURCE MODEL DESIGNATION: Amersham: AMM1001H, AMM1001

ISOTOPE:	MAXIMUM ACTIVITY:
Americium-241	1.0 microcurie (37 kBq)

LEAK TEST FREQUENCY: Not required

PRINCIPAL USE: (P) Ion Generator, Smoke Detectors

CUSTOM DEVICE: _____ YES __X__ NO

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO.: NR-0776-D-101-E DATE: September 16, 1994 PAGE 2 OF 2

DEVICE TYPE: Smoke Detector

DESCRIPTION:

The MF Series consists of models MF312, MF412, and MF512 and is intended for commercial use. All three use the same mechanical construction, and different performance characteristics are obtained by variations on the electrical circuit. The NID-58 is a battery-operated, dual-chamber detector employing a single sealed source. The sensitivity may be adjusted through use of a sensitivity set screw. The OIB is a smaller unit of the NID-58 designed for use in computers, airplanes, etc. The OIB has two alternative numbers (PU90-21000-1 and PU90-41000-1) depending on the vendor. The NID-68AS series are factory adjusted and sealed units that transmit a signal, proprtional to the smoke density, to a control unit. The control unit employs software and user set limits to determine when an alarm threshold has been exceeded.

REFERENCES:

The following supporting documents for the Models MF Series, OIB (P/N PU 90-2000-1 and P/N PU 90-41000-1), NID-58, and NID-68 AS Series smoke detectors are hereby incorporated by reference and are made a part of this registry document.

- Thorn Security, Ltd.'s letters dated October 25, 1989, May 31, 1990 July 20, 1990, August 26, 1993, and February 10, 1994, with enclosures thereto.
- Thorn Automated Systems' letters dated March 14, 1990, August 9, 1990, October 10, 1991, April 25, 1994, and August 18, 1994, with enclosures thereto.
- Autocall, Inc./Nittan Corp.'s letter dated November 15, 1989, with enclosures thereto.
- Affidavit dated March 13, 1992.

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: September 16, 1994 Reviewer: _____
Douglas A. Broaddus

Date: September 16, 1994 Concurrence: _____
Steven L. Baggett

RADIATION PROTECTION PROCEDURE **Ref: TSG 10.4**

TITLE: **THE HANDLING STORAGE AND TRANSPORT OF RADIOACTIVE MATERIALS** **ISSUE: 5**

DOCUMENT CONTROL NUMBER:

APPROVAL AND AUTHORISATION SHEET

ORIGINATED BY	POSITION	SIGNATURE	DATE
1. S CLARK	Company Radiation Protection Supervisor	.....	

VETTED BY	ON BEHALF OF	SIGNATURE	DATE
1. I DALE-LACE	General Manager Quality & Product Support	.....	

APPROVED BY	POSITION	SIGNATURE	DATE
1. N WRIGHT	Technical Services Manager	.....	
2. D STONEHOUSE	Manufacturing Director	.....	
3. D OXNAM	Director of Purchasing & Distribution	.....	
C WESTON	Technical Director	.....	

AUTHORISED BY	POSITION	SIGNATURE	DATE
1. G D HEAD	Managing Director Tyco Electronic Product Group	.....	

ATTACHMENT E8

CONTENTS LIST

1.0 INTRODUCTION

This Procedure sets out the policy for the package, despatch and transport of Ion Chamber Smoke Detectors (ICSD) within the United Kingdom and to and from countries who are signatories to the International Atomic Energy Agency (IAEA) Regulations. This procedure covers all movements of detectors including hand carriage. The storage and transport of Radioactive Level Gauges is also covered. For transport to and from countries outside IAEA Regulations, please contact Company Radiation Protection Supervisor (RPS).

This procedure also describes the terms of acceptance for receipt of FGS and scrap detectors at the warehouse.

2.0 SCOPE

This work instruction applies to all Directors, General Managers, their appointed Radiation Protection Supervisors, and local responsible persons for handling Radioactive Substances.It includes Local Rules for the new and waste detectors and mobile sources.

This specifically includes the transport of detectors from the customer to the Warehouse for disposal. This includes Thorn and Non-Thorn Detectors. It is imperative that detectors are always disposed of correctly, never to a skip or landfill.

This procedure applies to all divisions of Tyco Electronic Product Group.

3.0 RESPONSIBILITIES

The General Manager Quality & Product Support

To ensure regular audits of this procedure.

The Manufacturing Director

To ensure that receipt, storage, and despatch of radioactive materials, and the manufacture of Detectors meet legal and company requirements. To appoint the Technical Services Manager and the company RPS.

The Technical Director

To ensure that the design of products which incorporate Radioactive materials meet legal requirements.

To ensure the receipt, storage, use and despatch of Radioactive sources at R & D UK.

The Director of Purchasing and Distribution

To ensure that all instances of incorrectly packed or transported goods received at the warehouse are promptly reported to the Company Radiological Protection Supervisor. To ensure that all outgoing goods are transported to the correct regulations.

To ensure the requirement of the EURATOM agreement is met.

The Company Radiation Protection Supervisor (RPS)

Appointed by the Technical Services Manager, to ensure that this procedure is followed on a day to day basis. To ensure that this procedure meets company and legislative requirements.

Local Responsible Person

To ensure that this procedure is followed.
To notify RPS in the event of an incident

4.0 DEFINITIONS

m	-	Metre
EURATOM	-	EC Council Regulation 1493/93 Shipments of Radioactive Substances between EC member states.
NSL	-	Non Stock Listed
RSA	-	Radioactive Substances Act 1993
IAEA	-	International Atomic Energy Authority
IRR	-	Ionising Radiation's Regulations 1985
ICSD	-	Ion Chamber Smoke Detectors
RPS	-	Radiation Protection Supervisor
HSE	-	Health and Safety Executive
Am241	-	Americium 241 Isotope
Ra226	-	Radium 226 Isotope

IST	-	Internal Stock Transfer (note)
EA	-	Environment Agency
Road Transport Reqs.	-	Road Transport Regulations SI 1996 No. 1350
Driver Training	-	Carriage of Dangerous Goods by road. Regulations SI 1996 No. 2094.
FGS	-	Finished Goods Stock
ADR	-	Vocational Driver Training to City & Guilds Standard for Carriage of Radioactive Materials by Road
RTA	-	Road Traffic Accident
NAIR	-	National Arrangements for Incidents Involving Radioactivity

5.0 PROCEDURE

5.1 Equipment and Materials Used

Vehicle Placards (Class 7)	Not Stockcoded
Standard Letter (Confirmation of disposal)	TSG 10.4 Appendix I
Health & Safety Data Sheet (Liquid Level Guages)	TSG 10.4 Appendix II
Polythene Bag (for single detector)	123-001-050
Branch Returns Note (BRN)	AM 1117/000
Service Detector Movement Docket	AM 0467/000
Packing Tape (50mm)	120-081-015
Radioactive Label Trefoil (excepted)	AM 1635/000
Consignment Certificate	AM 0240/000
Notice in Vehicle (Fireproof)	517-001-223
IST/Scrap Note	AM 0842/599
MF Cardboard Box	123-002-546
MF Output Label	120-247-121
Company Radioactive Notice	AM 1809/0000
Despatch Note (for shipment from warehouse to branch store only)	AM 1179/551
Radioactive Label Trefoil - Stores	AM 1634/000
Trefoil Symbol (II yellow small Ra226)	AM 1636/000
Radioactive Label Trefoil White 1	AM 1626/000
Cardboard Box Type A (Free Issue from Warehouse)	Safeguard Smokepac (NSL).
Address Label from Warehouse for disposal F3	AM 1627/000
Address Label from Warehouse for disposal F5	AM 1628/000
Address Label from Warehouse for disposal F6	AM 1629/000
Address Label from Warehouse for disposal F7	AM 1630/000
Address Label from Warehouse for disposal MF	AM 1631/000

Please note that some of the above items may have to be ordered using a BSO from the Warehouse.

5.2 Health and Safety

Health and Safety is of the utmost importance when handling Ion Chamber Detectors. Any Detectors which are in any way suspected of being mechanically damaged should be bagged and sealed and the area thoroughly monitored to ensure no contamination has taken place.

Detectors without any identification should be referred to the Company RPS.

Local Rules must be adhered to.

Only trained operators are allowed to work with Radioactive materials. The name of the local RPS is available from the company RPS or your General Manager/ Director.

When packing or unpacking waste or superficially damaged detectors, impermeable gloves must be worn. Place the plastic bag over damaged or Radium detectors prior to removing them from their base.

It is not necessary to use gloves for the installation of MF/RAFT Detectors.

5.2.1 Incident Reporting Procedure

In the event of any incident, contact the local RPS. If the incident is serious and the local RPS is not available, contact the company RPS immediately at Walthamstow on 0181 919 4078. If the local RPS and company RPS are unavailable. In the last resort, contact the Managing Director, Tyco Electronic Product Group at Billet Road, Walthamstow.

Refer to section 7.4.5 for contingency plan.

5.3 Procedure

5.3.1 Despatch & Return of Finished Goods & Service Detectors to UK Destinations

This section covers the despatch of MF/RAFT Series detectors from the factory to the warehouse and from the warehouse to branch/site or return from branch/site to warehouse, and the transit of complete MF/RAFT Detectors in their finished packaging.

A consignment certificate is required for shipment of Finished Goods Detectors between Billet Road and the Warehouse. It is the duty of the Production Manager to retain records (see Section 6.0)

Goods despatched from the Warehouse, must be accompanied by the despatch note. The maximum quantity of any consignment is 200MBq, this is equivalent to 6000 MF/RAFT Detectors.

Returned goods must be accompanied by Consignment Certificate and packed in original packaging and accompanied by a BRN if claiming credit.

Notice in vehicle is **not** required.

The storage of Finished Goods Ion Detectors must remain at Branch until installed. (Not at site).

A normal courier service such as Lynx standard service is acceptable for transporting this type of consignment.

5.3.2 Despatch of Sample MF/RAFT Detectors to UK Destinations

This section covers the despatch of detectors or sources for example between Sunbury & the Walthamstow Factory.

- Detectors & Sources must be booked out from the Consignors (Senders) Stock and booked into the Consignees (Receivers) Stock to maintain accurate records for both areas.
- To Local Responsible Person is responsible for stock records.
- All despatches must be accompanied by a consignment certificate.
- To be packed as 5.3.4.3.
- For any other type of ionisation detectors, please refer to company RPA.
- Refer to 'Driver Training' section 5.5.

5.3.3 Despatch of Finished Goods to International Destinations

This section covers the despatch of MF/RAFT Series Detectors from the Warehouse to international destinations within the jurisdiction of the IAEA.

The requirements are as in 5.3.1 above, and in addition the materials must be shipped to IAEA Regulations. The packaging must be able to withstand the rigours of international transport.

For shipments between EC States, the European regulation No. 1493/93 requires registration with consignees competent Authority prior to international shipment.

Shipments from EC Member States to UK

This includes FGS Ion Chamber Detectors (e.g. System Sensor from Italy), Scrap Ion Chamber Detectors from any EC Member State, or Ion Chamber Sources as Component Stock from any EC Member State.

The person responsible is the Purchasing Manager at the Warehouse.

The duties are:-

To complete the initial declaration of the type and quantity of radioactive material it is intended to ship to the UK. This declaration must be sent to the Environment Agency (EA), who will authorise and return it.

The declaration must be sent to the supplier of Radioactive Material in the Foreign EC State. (Note the declarations can be for one shipment or multiple shipments over 3 years).

It is the duty of the supplier in the Foreign EC State to send details of actual shipments to the UK every 3 months to the Environment Agency. (It is assumed these are matched against the 3 yearly declaration).

Shipments from the UK to EC Member States

This includes FGS Ion Chamber Detectors, Scrap Ion Chamber Detectors, or Ion Chamber Sources as Component Stock.

The person responsible is the Purchasing Manager at the Warehouse.

The duties are:-

To ensure that the recipient has the declaration authorised by the Competent Authority in that country to receive radioactive material and a copy is held on file at Walthamstow. The actual shipments must only be made in accordance with the declaration and the shipment records held with the declaration.

To send details of actual shipments received to the relevant Competent Authority in the EC Member State, from which the Radioactive Materials are being sent. These details must be sent every 3 months.

The goods must be described as Radioactive material and include a Proper Shipping Name and Description including a United Nations Number as indicated below.

UN NUMBER	NAME & DESCRIPTION	OTHER RISKS
2910	Radioactive material Excepted Package articles	None

5.3.4 Packaging & Despatch of Waste (scrap) or Detectors within UK

This section covers the collection and despatch of waste detectors of all types (including Non-Thorn) from the customer's premises via the Warehouse to their final destination. Detectors need to be sorted into the correct category before packaging and despatch.

DETECTOR TYPE	CATEGORY	SECTION BELOW
F6, F7, MF/RAFT - All Types + NSL AM241 below 2.0MBq	Excepted (Package not greater 200MBq)	5.3.4.3
Thorn F3 & F5 + NSL AM241 above 2.0MBq	I White, Type A	5.3.4.4
Ra226	II Yellow, Type A	5.3.4.5

Pre printed address labels are stockcoded and available for shipment of detectors from Warehouse for disposal. Refer to 'Equipment & Materials' section. They are unsuitable for use by the customers.

5.3.4.1 Removal from Customers Premises (All types)

Detectors must be packed correctly as detailed below, with a consignment certificate and Service Detector Movement Docket completed before removal from site, one copy to remain with customer. This notifies the customer of the number and type of detectors removed. Please refer to Appendix 1 for standard letter if required by customer.

5.3.4.2 Damaged Detectors (All Types)

Detectors may be returned to the warehouse for disposal when they are superficially damaged. They must each be placed in an individual sealed polythene bag, labelled with the Type, the damage sustained and the site from which it was removed, and then packed and shipped as detailed in sections 5.3.4.3 and 5.3.4.4 below. In the event of damage to the extent that the source holder is exposed special packing will be required and advice must be sought from the Company Radiation Protection Supervisor.

5.3.4.3 Packaging - Excepted

- Shipment is classed as "excepted".
- Consignment certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors must be complete and undamaged.
- Must be packed in a sealed plastic bag and then in any suitable cardboard box, so that detectors are not damaged in transit.
- Trefoil label AM1635/000 must be stuck inside the cover before closing the box (So as to be visible when box is opened)
- Detectors are to be packed in maximum of 20 per box, as this is a manageable quantity. Detectors are to be sorted by type.
- Can be transported by either branch or courier service such as Lynx Transport.
- Consignment certificate is required for disposal of waste production detectors, and an I.S.T. must be with each shipment from Billet Road to Warehouse.
- No special labelling is required on outside of box.

5.3.4.4 Packaging - I White, Type A

- Shipment is classed as I White Type A.

- Consignment Certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors may be superficially damaged - see section 5.3.4.2 of this procedure.
- Detectors must be packed in a sealed plastic bag and then in Type A Cardboard Box, so that detectors are not damaged in transit.
- Three Trefoil Labels AM1626/000 must be used (see Consignment Certificate). Two stuck externally at each end and one inside the cover before closing the box (so as to be visible when box is opened).

  Complete label as follows:- Contents:- "Smoke Detectors"
  Activity:- X MBQ

  (where X = Activity of each detector x total number of detectors).

- Detectors are to be packed maximum of 50 per box, smaller quantities must have additional packaging to prevent damage in transit. Detectors are to be sorted by type.
- Shipment MUST only be transported by Securicor Omega. Lynx or Company Transport is unacceptable.

5.3.4.5 Packaging (Radium Ra226 - All Types) - II Yellow

- Shipment is classed as a type A II Yellow package.
- Consignment certificate AM0240/000 and service detector movement docket AM0467/000 to be used for branch disposals.
- Detectors must be complete and undamaged.
- Must be packed in sealed polythene bag, then packed in cardboard box. (type A) to ensure detectors are not damaged in transit.
  Three trefoil labels AM1636/000 must be completed with contents, Transport Index & Activity (see Consignment Certificate) and two stuck externally at each end and one inside the cover before closing the box (so as to be visible when box is opened).
- Detectors are to be packed maximum of 20 per box, unless fewer than 20 are to be sent. Detectors are to be sorted by type.
- Must only be transported by Securicor Omega. **Lynx or company transport is unacceptable.**
- Radium Detectors (Ra226) must be sent direct from customer's premises to the Warehouse, due to the company licence conditions.

5.3.5 Despatch of Waste (Scrap) Smoke Detectors From International Destinations

This section covers the collection and despatch of all types of waste detectors (including non-Thorn) from international customers premises via the Warehouse to their final destination.

The requirements are as in 5.3.4 above and in addition:-

- The materials must be shipped to IAEA Regulations. The packaging must be able to withstand the rigours of international transport.
- For shipments between EC States, the European regulation No 1493/93 requires either registration with EA or the competent authority in the country to which the detectors are to be sent prior to international shipment.
- The goods must be described as Radioactive Material and include Proper Shipping Name and Description including a United Nations number.

UN Number	Name and Description	Other Risks
2910	Radioactive Material Excepted Package articles	None
2982	Radioactive Material NOS (Not Otherwise Specified)	None

5.3.6 All Consignments

PLEASE NOTE:
Any ionisation detectors returned to the Warehouse without the correct paperwork and/or packaging, will be rejected and returned to the sender at the earliest opportunity, with a recharge for packing and transport and a handling charge for each detector.

5.4 Storage of Radioactive Materials

This is very strictly controlled by Environmental Agency, the relevant legislation being the RSA 1993 and IRR 1985.

5.4.1 Storage at Branch

- All branches that store radioactive material must be registered.

- Finished Goods, waste (scrap) detectors and Radium detectors to be segregated

within the store.

- All waste (scrap) detectors to be shipped to the warehouse for disposal within 4 weeks of receipt.
- Store to be [illegible] hour fire rated construction.
- Store to contain nothing that is flammable.
- Store to be locked at all times.
- Store to be labelled with trefoil AM1634/000 and with Company Radioactive Notice AM1809/000.
- Store to be supervised by a competent (i.e. trained) person.
- RPS must be appointed at each Hub Branch.
- All stock movements must be accurately recorded to reflect Current Stock levels.
- Maximum stock levels are on the Certificate of Registration
- All losses must be reported to the Company RPS immediately.

This store is only to be used for the storage of ICSD.

5.4.2 Storage on Customers Site

- No Finished Goods Ion Chamber Detectors are to be stored at Customers Site.
- Any waste (scrap) detectors that have been removed from the customers system must not be stored on the customers premises.

5.5 Driver Training

Effective from 1st July 1997 the new regulations are compulsory.
Certificates must confirm driver understands points 1, 2 & 3 in 5.5.2 and driver must sign 2 copies; one for driver, one to be held at Branch.

Certificates of training (both 'general' and 'ADR') must be carried by the driver of the vehicle and produced on demand by the police or Vehicle Inspector. Certificates will be issued by Branch Manager.

The regulations are The carriage of Dangerous Goods by Road (Driver Training) Regulations 1996 SI1996 No. 2094. They apply to all staff whether carrying one detector or a large consignment.

Driver Training information is available from the Resourcing Manager based at Sunbury.
Training frequency - every 5 years or when legislation changes.

5.5.1 Excepted Packages

This applies to MF300/500 Lo Pro & Raft. Drivers do not need any special training, however they must be aware of the risks and hazards of transporting these products.
Maximum item limit of 2 MBq, as detectors are 33 KBq, they are below limit.
Maximum package limit of 200 MBq (A_2 Value) is equal to 6000 detectors in any one package.
No practical limit to number of packages.

5.5.2 Type A Packages (less than 11 packages) - I White & II Yellow

This applies to F35/F50 Range & NSL & Radium. Drivers must have "general training" which must include:-

1. Understand the hazards presented by the goods they are transporting and the actions to be taken in the event of an emergency.
2. Know their duties under the Health & Safety at Work Act 1974.
3. Know their duties under the Radioactive Material (Road Transport) (Great Britain) Regulations 1996 (RAMRoad).

The operator of any vehicle must keep a record of the general training provided to any employee.

For details of Type A Packaging, refer to section 5.3.4.4. This will especially apply to TSL Branch Engineers removing F35/F50's, from site to Branch for disposal.

Placarding and metal sign on vehicle required.
Maximum limit per package is 200 MBq (or box of 60 F50's).

5.5.3 Types A Packages (11 or more packages) - I White & II Yellow

In this instance it is recommended that a courier (e.g. Securicor Omega) are used, or if further information is required, please contact Company RPS.

This also applies to F35/F50 Range & NSL & Radium. Drivers must have an ADR Driving Certificate awarded by City & Guilds. This applies to the disposal of F35/F50's from the Warehouse to AEA Winfrith. It would also apply to TSL Branch Engineers when disposing from a large site.

For details of Type A Packaging, refer to section 5.3.4.4.

The vehicle must be placarded with a Class 7 Trefoil (not stockcoded) and carry a fireproof notice in the cab (stockcoded) and fire fighting equipment.

There are also special restrictions on transport of II yellow packages. Please contact RPS for detail.

Maximum limit per package is 200 MBq (or box of 60 F50's).
Maximum number of packages per consignment is unlimited, but the consignment total must be below 2GBq

6.0 RECORDS

- Copies of Consignment Certificate AM0240/000 must be retained at the relevant branch (or point of despatch) for a period of 5 years following confirmation of transport to Billet Road.
- If customer requires confirmation of disposal, the branch is to supply a copy of the consignment certificate from site to branch store and a standard letter in appendix 1.

7.0 LIQUID LEVEL GAUGES

7.1 INTRODUCTION

The purpose of this procedure is to describe a method for limiting the amount of radiation to which the user of a Panax TM64 liquid level gauge is subjected. It is also to ensure that people in the vicinity of the source in use are subjected to the minimum practicable dose. This procedure forms the local rules for use of Panax gauges in compliance with regulation 11 of the Ionising Radiation's Regulations 1985.

7.2 SCOPE

This work instruction is to be utilised by all users of Liquid Level Measuring Devices; normally used within Fixed Extinguishing and Marine Applications.

7.3 DEFINITION

7.3.1 A user shall be a person who has completed a Company recognised course of training and has been issued with the necessary Certificate of Competence.

7.3.2 The user will be familiar with the equipment and be capable of determining an unsafe condition (eg.

lead shielding cylinder of the carrying case not in place, source not in place or leak testing is overdue).

7.3.3 The user will be completely familiar with the Certificate of Registration issued under the Radioactive Substances Act 1993 and pay particular attention to the clause covering the Keeping and Use of Registered Sources, viz: "The gauge will either be kept under continuous surveillance while being used or locked in a suitable store to prevent unauthorised removal".

7.4 PROCEDURE

7.4.1. Equipment

7.4.1.1. When not in use the liquid level gauge will be enclosed in a carrying case designed to limit the surface dose rate to less than 5 micro Sievert per hour and to contain all the component parts of the Measuring Device. A label indicating the isotope type, the source strength and including a trefoil symbol must be visible when the carrying case is open. A current test certificate covering wipe test and fit for purpose and a copy of the certificate of registration must be fixed to the inside of the case so as to be available for scrutiny. Careful assembly of the gauge into the case will ensure that the surface dose rate is kept to the required level. The source must be carried located in the lead shielding of the carrying case when transported.

7.4.1.2. The carrying case must be examined periodically, at least annually and declared fit for use. A record of this check must be maintained.

7.4.1.3. Wipe tests must be carried out by one of the companies below at periods not exceeding 26 months and the certificate displayed in the carrying case. (See Reg 18 IRR 1985).

The recommended companies are:

1) NRPB. Harwell, Glasgow and Leeds. (01235) 831600
2) Negretti Automation. Aylesbury. (01296) 395931

7.4.1.4. Damage to the Source-holder must be reported immediately to the Company Radiation Protection Advisor at Sunbury.

7.4.1.5 There are no controlled areas around the source in use or storage, conditions are in schedule 6.1 of IRR 1985 are met and company RPA is satisfied that no person using the equipment will receive more than 3/10 of an appropriate dose limit.

7.4.2. Use of liquid level gauge

7.4.2.1. To minimise the exposure to radiation during assembly of the source to the stirrup the source should be kept as far from the body as is practicable and only removed from the lead-shielding for assembly immediately before taking measurements. The unshielded source must never be touched by hand. During the period that the source is in use, care must be exercised to prevent other people from being exposed to radiation. Other persons must be kept at least 1 metre away during use.

7.4.2.2. Separate records must be kept for each Source and they must include the date of receipt, the radionuclide, the activity, the identification number and its location. A daily check of the presence of the source must be made and the location must be recorded. These records must be made available for Audit.

7.4.2.3 Prior to visiting a customers premises with a gauge, the customer should be provided with a copy of the Health and Safety Data Sheet provided in Appendix 2.

7.4.3. Transport

7.4.3.1. The Liquid Level Measuring Equipment must be stowed in its carrying case and placed in the restraining frame fitted to the structure of the vehicle while it is in transit. The carrying case must be locked in transit. Prior to transport, the transport container should be checked to ensure that the source is correctly located in its shielding. The transport container itself must be inspected. Report any defects to the RPS. The gauge cannot be transported unless its carrying case is free of defects. The gauge is transported as an 'Excepted Package'.

7.4.3.2. A Consignment Note AM0240/000 must be used every time the gauge is transported (i.e. from branch to site). The records must be kept for 2 years and be available for audit scrutiny.

7.4.3.3 The Radioactive Material (Road Transport) (Great Britain) Regulations 1996 require drivers transporting radioactive sources:

(i) to exercise reasonable care when transporting radioactive material to ensure a gauge is not lost or unlawfully removed from the vehicle.

(ii) to not without reasonable cause leave the vehicle unattended in a place to which the public have access.

7.4.3.4 Actions to take in the event of a Road Traffic Accident (RTA).

The Radioactive Material (Road Transport) (Great Britain) Regulations 1996 require a driver to take certain actions in the event of a RTA. These actions are summarised below.

(i) First priority in the event of a RTA is to save life and prevent further injury, including

prevention of vehicle fire.

(ii) If the vehicle is still roadworthy, but the gauge and its container is undamaged, then return to the branch.

(iii) If the vehicle is not roadworthy, but the gauge and its container is undamaged, then contact the branch and arrange for another vehicle to collect the gauge.

(iv) In the event that the vehicle has overturned, suffered serious damage or been involved in a fire or a gauge has been stolen from the vehicle damaged in the accident then:

(a) contact the police and the RPS. The company RPA must be informed of the incident.

(b) the company RPA must report the accident to the Department of Transport.

If it is suspected that the container or the gauge has been damaged, then the gauge cannot be transported until the company RPA (or RPS after consulting the RPA) has attended the scene of the accident and verified that the container and gauge are undamaged. A certificate to this effect must be provided by the RPA (or RPS) before the gauge can be moved.

(v) If it is suspected that the source rod has been damaged, then no one should attempt to move the gauge until specialist advice has been provided by the company RPA or other radiation adviser (eg. NRPB, local hospital health physicist). In the event that the source rod is damaged, the source itself may be ruptured leading to contamination. Persons must be kept at least 2 metres away from the gauge until advice has been sought.

If the accident occurred on a public highway, or area that the public have access to, then the police may invoke the National Arrangements for Incidents Involving Radioactivity (NAIR) scheme (this would call on a radiation specialist from a local hospital or other institute where specialist advice can be obtained). The driver, if he is able to do so, must co-operate with any radiation specialist who attends the scene.

7.4.4 Storage

7.4.4.1 When the vehicle is not being used on company business or is parked in a public area overnight the gauge must be removed from the vehicle and placed in a suitable

storage. The vehicle must not be used as an overnight store. In the event that it is not

possible to return a gauge to its store at the end of the working day, the company RPA should be contacted to locate an alternative store.

7.4.4.2. Facilities for storage are detailed in 5.4.1. When the vehicle is being used for private purposes the gauge must be placed in a secure storage facility. Users must be familiar with the conditions of use placed upon them by the Certificate of Registration that is displayed at their Registered Office.

7.4.5 Contingency Plan

General - Please refer to section 5.2 Health & Safety, this details the incident reporting procedure.

Lost/stolen - liquid level gauges or fire detectors
Immediate search must be made, if it cannot be found within 1 hour contact company RPA/RPS. If after further search it still cannot be found, then the Environment Agency and the police must be contacted.

Fire - Liquid level gauges or fire detectors
The company RPA/RPS must be contacted immediately. No one should attempt to move the gauge or detectors after the fire - there may be contamination as a result of the fire. The Environment Agency should be notified if the source is damaged in the fire.

Mechanical damage - Liquid level gauges or fire detectors
Contact the company RPA/RPS immediately - Warning there is the possibility that the source/detectors are damaged which could lead to contamination. No one must approach if the source is damaged. The RPS or RPA must check dose rate as soon as practical to ensure it is safe to approach.

Road Traffic Accident - Liquid level gauges or fire detectors.
As 7.4.3.4

8.0 RECORD OF CHANGE

Issue Date	Issue Level	Revision and Summary of Changes
August 1995	1	1st Issue
February 1996	2	Sections 5.3.4 & 5.3.4.4 amended to meet revised conditions for disposal of Radioactive Fire Detectors.
July 1996	3	Sections 5.3.1, 5.3.4.3., 5.4.1, 6.0, 7.4.3.3., amended to meet 1996 Transport Regulations.

June 1997	4	Amended to include Driver Training Regulations 1996 and updated liquid level gauge instructions. Now in 2 identical versions as TSG 10.4 & TSS 10.4.
March 1998	5	Amended to include Director of purchasing and distribution as signatory.

Grinnell®
FIRE PROTECTION SYSTEMS COMPANY
835 Sharon Drive
Westlake, Ohio 44145

A tyco INTERNATIONAL LTD. COMPANY

July 20, 1998

Changes for Registry No: NR-776-D-101-E dated September 16, 1994

Model Designation:

The model designations MF Series, OID (P/N PU 90-2000-1 and P/N 90-41000-1), NID-58 and NID-68 AS Series are no longer manufactured.

The new model designation is Lo-Pro Series

Distributor:

The distributor has been changed to Grinnell Fire Protection Systems Co. as described in the application to amend license 34-23772-01. This section should read

Grinnell Fire Protection Systems Co.
835 Sharon Drive
Westlake, Ohio
(440) 871-9900

The manufacturer is still Thorn Security Limited, but does business as Tyco Electronic Products Group. The correspondence and documentation related to their activities bear either name.

Nittan Company, LTD. no longer produces the series of detectors applicable with this registry.

Sealed Source Model Designation

Current information will remain the same

Isotope: **Maximum Activity:**

Current information will remain the same

Leak Test Frequency:

Current information will remain the same

Principle Use:

Current information will remain the same

Custom Device:

Current information will remain the same

Device Type:

Current information will remain the same

Device Type:

The Lo-Pro series Ion Detectors consist of models 612 and 912 and is intended for commercial use. Both detectors use the same mechanical construction. Different performance characteristics are obtained by variations in the electrical circuity.

References

Due to the fact that Thorn Security Limited and Nittan Company LTD no longer manufacture the models listed on the registry, the documents listed under References no longer apply. They are identified below and attachments are included with this amendment.

Attachment #	Date	Description
A1-1	October 25, 1989	Request for evaluation and Registration of MF312 Ion Chamber Detectors
A1-2	May 31, 1990	Supplement to submission for MF series detector evaluation
A1-3	July 20, 1990	The label is no longer valid, the only place it can be found is on existing detectors.
A1-4	August 26, 1993	
A1-5	February 10, 1994	Change of address notification
A2-1	March 14, 1990	Application for License to Possess MF 312 Ion Detectors
A2-2	August 9, 1990	Thorn quality procedure no longer applies. Replaced as identified in section III of this application. Appendix E7
A2-3	October 10,1991	Amendment request for Nittan Detectors which are no longer manufactured and attached News release of Autocall purchase
A2-4	April 25, 1994	Request for transfer of licenses to Mattingly One Limited
A2-5	August 18, 1994	Change of status letter
A3	November 15, 1990	Updated documents for license 12-16029-01E
A4	March 13, 1992	Affidavit signed by E. Joseph Martini.

[redacted]

Fee 12/2

Log Dec. 89 ISSUED
Remitter
Check No. NO 101 0001 370136
Amount $1,600
Fee Category 9A
Type of Fee APP
Date Check Rec'd 12-15-89
Date Completed
By A Cantley

THORN SECURITY

THORN SECURITY Limited
Security House
Twickenham Road
Feltham
Middlesex TW13 6SQ
England
Telephone 01-755
Telex 881491G
Fax 01-755 0831

Mr. Stephen Baggett
NRC Office of Nuclear Materials
Safety and Safeguards
WASHINGTON DC
20555 USA

Date: 25thOct'89

Copy: L.Kaiser
W.Vodak
W.Fawcett
R.Barrett
cfi: B.E.H.Laluvein

Subject: Safety Evaluation and Reistration of THORN SECURITY MF312 Ion Chamber Smoke Detector

Dear Mr. Baggett,

We hereby apply for Safety Evaluation and Registration of our MF312 Ion Chamber Detector. Enclosed are the Application Fee of $1600, two sets of the documentation required and two Dummy Detectors from which one cover has been removed to facilitate your easy inspection.

If you need any further information or clarification, please do not hesitate to contact either the writer of this letter or our Mr. R. Barrett.

It is worth mentioning that when the registration of the design is complete, our colleagues at THORN AUTOMATED SYSTEMS Inc. of Westlake Ohio, will be the US distributor of the devices. They will, of course, be applying for a License to carry out this function in the near future.

We are looking forward to a successful outcome to this application. Could you possibly indicate the likely timescale to achieve registration, assuming no technical difficulties. Perhaps it would also be useful for us to know the average time taken for simple applications such as ours.

Very best regards,

Yours sincerely,

Peter Carlton
PDS Manager

ATTACHMENT A1-1

A THORN EMI
Registered
No. 23246
Registered
Security House
Twickenham
Feltham
Middlesex

BS 5445 : Part 7 : 1984
EN 54 : Part 7
UDC 614.842.435 : 654.924.56 : 620.1

Components of automatic fire detection systems

Part 7. Specification for point-type smoke detectors using scattered light, transmitted light or ionization

Organes constitutifs des systèmes de détection automatique d'incendie
Partie 7. Détecteurs ponctuels de fumée, fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière et de l'ionisation

Bestandteile automatischer Brandmeldeanlagen
Teil 7. Punktförmige Rauchmelder, nach dem Streulicht-, Durchlicht-, oder Ionisationsprinzip

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 54
Part 7
July 1982

UDC 614.842.435 : 654.924.56 : 620.1

Key words: fire fighting, fire detection systems, smoke, automatic control, specifications, tests, marking, light diffusion, light transmission, ionization, performance tests, reproducibility, vibration tests, impact tests, environmental tests, corrosion tests, voltage fluctuations, insulation resistance, dielectric strength tests, test equipment

English version

Components of automatic fire detection systems

Part 7. Point type smoke detectors; Detectors using scattered light, transmitted light or ionization

Organes constitutifs des systèmes de détection automatique d'incendie.
Partie 7. Détecteurs ponctuels de fumée; Détecteurs fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière et de l'ionisation

Bestandteile automatischer Brandmeldeanlagen.
Teil 7. Punktförmige Rauchmelder; Rauchmelder nach dem Streulicht-, Durchlicht-, oder Ionisationsprinzip

This European Standard was accepted by CEN on 1982-07-30. CEN members are bound to comply with the requirements of CEN Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to CEN Central Secretariat has the same status as the official versions.

CEN members are the national standards organizations of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue Bréderode 2, B-1000 Brussels

Components of automatic fire detection systems

Part 7. Point type smoke detectors; detectors using scattered light, transmitted light or ionization

1. Object and field of application

This European Standard specifies requirements, test methods and performance criteria for point-type, re-settable smoke detectors that operate using scattered light, transmitted light, or ionization.

For the testing of other types of smoke detectors, or smoke detectors working on different principles, this standard should only be used for guidance. Smoke detectors with special characteristics and developed for specific risks are not covered by this standard.

NOTE. Certain types of detector contain radioactive materials. The national requirements differ from country to country and are not specified in this standard.

2. Methods of test and test schedules

2.1 General requirements for testing

The detectors shall be tested according to the schedule in annex A.

Where applicable in each test, the detector(s) under test shall be connected to supply and indicating equipment in accordance with the data supplied by the manufacturer. If the supply and indicating equipment affects the response behaviour of a detector a special note shall be provided in the test report.

If a detector permits adjustment of the threshold value, it shall meet the requirements of the standard at the extremes of adjustment.

If the requirements of any one of the clauses in this Part are not met, then the type of detector does not comply with this Part 7 of the standard EN 54.

NOTE 1. Smoke detectors are subjected to basic tests and fire sensitivity tests. In the basic tests (clause 5 to 20) the detectors are tested in various ways to determine whether they are basically capable of withstanding certain ambient conditions that may occur in practice, so as to be sufficiently certain that the detector will remain functional for a sufficiently long period of practical use, or at least for a period between two services or inspections of the installed fire detection system. Furthermore, the basic tests verify the constancy of the response threshold of an individual detector and the similarity of response threshold of detectors relative to one another. The behaviour of the detectors in the case of fire is not examined in the basic tests.

NOTE 2. In clause 21, the fire sensitivity tests according to EN 54-9, the detectors are subjected to various real test fires in a fire test room. In this way, the response behaviour of the detectors to real fires is verified and the sensitivity of the detectors to various defined fires is determined.

2.2 General tolerance for methods of test

Where tolerances are not specified in the methods of test given in the annexes, a general tolerance of ± 5 % shall be assumed.

3. General requirements

3.1 Data

The manufacturer shall ensure that any type of detector purporting to comply with this Part of EN 54 is capable of passing all the tests and other requirements given herein. Detectors which are intended for marketing as separate units for installation in different systems shall be marked with sufficient operational data to ensure their performanc in accordance with this standard, or alternatively such data shall be provided separately. The manufacturer shall specify the operating principle of the detector.

3.2 Marking

Each detector purporting to comply with the requirements of this Part of EN 54 shall be marked with:

(a) the number of this standard (i.e. EN 54-7);

(b) the name or trademark of the organization accepting liability for compliance of the detector with this Part of EN 54 (this organization may be the manufacturer or the supplier of the detector);

NOTE. In some countries it is required that certification of compliance with this standard is carried out by an approved test house. Such requirements will normally be given in a national particularity to this standard.

(c) the type number of the detector.

3.3 Individual indication of operation

Each smoke detector shall be provided with an indicating lamp, or equivalent visual indication, by which the individual detector releasing an alarm may be identified.

4. Response threshold value

Measurement of response threshold value, required for the tests specified in clauses 5 to 17 and 20, shall be carried out in the manner described in annex B.

NOTE. In this Part of EN 54, m is the response threshold value for scattered light smoke detectors and transmitted light smoke detectors, and y is the response threshold value for ionization smoke detectors. (See annex B.)

5. Switch-on

The detector shall be tested in the manner described in annex C.

The detector shall be deemed to comply with the requirements of this clause if the ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ is not greater than 1,6, and the lower response threshold value y_{min} is not less than 0,2 or m_{min} is not less than 0,05 dB/m and if the detector emits neither a fault signal nor an alarm signal during the test.

6. Repeatability

The detector shall be tested in the manner described in annex D.

The detector shall be deemed to comply with the requirements of this clause if the ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ is not greater than 1,6 and the lower response threshold value y_{min} is not less than 0,2 or m_{min} is not less than 0,05 dB/m

7. Directional dependence

The detector shall be tested in the manner described in annex E.

The detector shall be deemed to comply with the requirements of this clause if the ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ is not greater than 1,6, and the lower response threshold value y_{min} is not less than 0,2 or m_{min} is not less than 0,05 dB/m

8. Reproducibility

The detectors shall be tested in the manner described in annex F.

The detector shall be deemed to comply with the requirements of this clause if no breakdown or flashover is observed during the test.

20. Low ambient temperature

The detector shall be tested in the manner described in annex S.

The detector shall be deemed to comply with the requirements of this clause if

(a) during the fall in temperature and during the stabilization period no fault signal or alarm signal is emitted;

(b) the ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ is not greater than 1,6.

21. Fire sensitivity

The four detectors shall be tested in the manner described in EN 54-9 using test fires TF 2, TF 3, TF 4 and TF 5.

The detectors shall be deemed to comply with the requirements of this clause of EN 54-7 if all the detectors detect the test fires TF 2, TF 3, TF 4 and TF 5 and can be classified as being class A, B or C.

Annex B

Measurement of the response threshold values in the wind tunnel

B.1 Test method

The detector provided for the test shall be installed in the wind tunnel (B.2) in its normal operating position with the fastenings provided for this purpose. The detector shall be connected to its control and indicating equipment for 15 min to 20 min before commencing measurement.

The air velocity in the wind tunnel in the proximity of the detector shall be 0,2 ± 0,04 m/s for all tests unless a different value is expressly indicated, e.g. the test according to clause 10.

The air temperature in the wind tunnel shall be 23 ± 5 °C, unless a different value is expressly indicated, e.g. the test according to clause 11.

In all the measurements of the response thresholds of a particular type detector, other than those of annex J, the air temperature in the wind tunnel shall not vary by more than 5 °C, unless a different value is expressly indicated, e.g. the test according to clause 11.

In all tests the supply voltage to the detectors shall be between 99 % and 101 % of the nominal supply voltage, unless a different value is expressly indicated, e.g. the test according to clause 9.

Before commencing each measurement the wind tunnel and the detector to be tested shall be free from aerosol.

All aerosol density measurements shall be carried out in the proximity of the detector.

A test aerosol (see B.3) shall be fed into the wind tunnel so that:

$$\frac{\Delta m}{\Delta t} < 0{,}2 \quad \frac{\text{dB/m}}{\text{min}} \quad \text{(for optical smoke detectors)}$$

$$\frac{\Delta y}{\Delta t} < 0{,}15\ \text{min}^{-1} \quad \text{(for ionization smoke detectors)}$$

See B.4 for the definitions of m and y.

The initially selected rate of increase in aerosol density shall be similar for all measurements in the wind tunnel.

At the moment of response of the detector the value m shall be recorded for optical detectors or y for ionization detectors.

B.2 Wind tunnel

A closed circuit wind tunnel capable of air velocities between 0,1 m/s and 1 m/s shall be used for the test. Means shall be provided for the introduction of the test aerosol such that, in the measuring section, a homogeneous dispersion of aerosol density is obtained over the cross-section.

The air temperature in the wind tunnel shall be capable of being raised from 20 °C to 50 °C at a rate of < 1 °C/min.

A plan of the measuring section, and the positions of the measuring instruments and smoke detectors being tested are shown in figure 1.

B.3 Test aerosol

A polydispersive aerosol shall be used as the test aerosol. The maximum of its particle size distribution shall be between 0,5 µm and 1 µm. The refractive index of the aerosol particles should be approximately 1,4.

The test aerosol shall be generated, reproducible and stable with regard to the following parameters:

- particle size distribution,
- optical constants of the particles,
- particle shape,
- particle structure.

The stability of the aerosol should be ensured. One possible method to ensure that the aerosol is stable is to measure the ratio $m : y$.

It is recommended that an aerosol generator producing a paraffin oil mist is used as the test aerosol (e.g. liquid paraffin which is used for pharmaceutical purposes).

B.4 Response threshold value, measuring instruments

B.4.1 *Optical method*

The response threshold value of optical smoke detectors is characterized by the absorbance index of the test aerosol measured at the moment of response.

The absorbance index is designated m and given in units of decibels per metre (dB/m). The defining equation

$$m = \frac{10}{d} \log_{10} \frac{P_o}{P}$$

applies for the absorbance index, where

- d = the optical measuring length in the test aerosol (measured in m);
- P_o = the radiated power received without the test aerosol;
- P = the radiated power received with the test aerosol.

The measuring instrument shall have the following properties:

(a) the length of the measuring zone in which the aerosol is measured shall be not more than 1,1 m; greater effective optical measuring lengths can be obtained by reflection of the measuring beam inside the measuring zone;

(b) the optical system shall be arranged so that any light scattered by more than 3° by the test aerosol is disregarded by the light detector;

(c) at least 50 % of the effective power of the light beam shall be within a wavelength range of from 800 nm to 950 nm, not more than 1 % of the effective radiated power shall be within a wavelength range below 800 nm and not more than 10 % of the effective radiated power shall be within a wavelength range above 1050 nm (the effective radiated power in each wavelength range is the product of the power emitted by the light source, the transmission level of the optical measuring path in clean air and the sensitivity of the indicator within this wavelength range);

(d) the measurements shall be carried out with a degree of accuracy such that, for all smoke densities between 0 dB/m and 2 dB/m, the error of measurement does not exceed 0,02 dB/m + 5 % of the smoke density indicated

Before and after each test in which response threshold values are measured, the indication shown on the measuring instrument shall be compared with an indication in clean air. If there is a discrepancy of more than 0,02 dB/m between the two measured values of such a pair, the response threshold value measured shall be deemed invalid and the measurement shall be repeated.

B.4.2.3 *Technical data*

(a) *Radiation source:*

isotope	Am^{241}
activity	130 kBq (3,5 µCi) ± 5 %
average α energy	4,5 MeV ± 5 %

The radiation source is gripped by its holder in such a way that no open cut edges are accessible, and its open surface is protected by a noble metal layer so that no americium is accessible on the surface.

Form of radiation source:

circular disc
ϕ = 27 mm

(b) *Ionization chamber:*

The current-voltage characteristic of the chamber measured in aerosol free air at:

pressure	= 101,3 ± 1 kPa (760 mmHg)(1, 013 bar),
temperature	= 25 ± 2 °C,
relative humidity	= 55 ± 20 %,

should be as in figure 4. The chamber impedance (reciprocal of the slope of the current-voltage characteristic) should be $1,9 \times 10^{11}$ Ω ± 5 %.

The chamber is normally operated in the circuit of figure 5. The supply voltage should be such that the current in the measuring electrodes is 100 pA.

(c) *Current measuring amplifier:*

$R_i < 10^9$ Ω

(d) *Suction system:*

quantity of air required 30 l/min ± 10 %.

Annex C

Switch on test

The response threshold value of the detector shall be measured according to annex B. The detector shall remain connected to its supply and indicating equipment for 7 days without interruption. After this period the response threshold value shall be once more determined according to annex B.

The flow direction is arbitrary, but it shall be the same for both measurements.

The greater response threshold value is given the symbol y_{max} or m_{max}, the lesser value is given the symbol y_{min} or m_{min}.

Annex D

Repeatability test

The response threshold value of the detector shall be measured 6 times according to annex B.

The flow direction is arbitrary, but it shall be the same for all 6 measurements.

The maximum response threshold value is given the symbol y_{max} or m_{max}, the minimum value is given the symbol y_{min} or m_{min}.

Annex E

Test for directional dependence

The response threshold value of the detector shall be measured according to annex B. A total of 8 measurements shall be taken, the detector being rotated 45° about a vertical axis between each measurement, so that the measurements are taken for 8 different flow directions.

The detector faces facing the air flow for which the maximum and minimum response threshold values were measured, shall be marked accordingly. In the following tests the corresponding directions are called respectively 'most unfavourable' and 'most favourable' direction.

The maximum response threshold value is given the symbol y_{max} or m_{max}, the minimum value is given the symbol y_{min} or m_{min}.

Annex F

Reproducibility test

The response threshold values of the detectors shall be measured and recorded according to annex B for the most unfavourable flow direction.

The maximum response threshold value is given the symbol y_{max} or m_{max}, the minimum value is given the symbol y_{min} or m_{min}.

Annex G

Variations of supply voltage test

The response threshold value of the detector shall be measured twice according to annex B, for the most unfavourable flow direction, once at the upper limit and once at the lower limit of the nominal supply voltage range specified by the manufacturer. If no voltage range is given, the response threshold value shall be measured once at 85 % and once at 110 % of the nominal supply voltage.

The maximum response threshold value is given the symbol y_{max} or m_{max}, the minimum value is given the symbol y_{min} or m_{min}.

Annex H

Test for sensitivity to air movement

H.1 Response behaviour

The response threshold value of the detector shall be measured as in annex B for the most and least favourable flow directions. The response threshold values in these tests are $y_{(0,2)max}$ and $y_{(0,2)min}$ or $m_{(0,2)max}$ and $m_{(0,2)min}$. The tests shall be repeated using an air velocity in the proximity of the detector of 1 ± 0,2 m/s. The response threshold values in these tests are $y_{(1,0)max}$ and $y_{(1,0)min}$ or $m_{(1,0)max}$ and $m_{(1,0)min}$.

H.2 False alarm behaviour

The detector shall be placed in a suitable wind tunnel and subjected to an aerosol-free air flow at a velocity of v = 5 ± 0,5 m/s and then to a gust lasting 2 s at a velocity of 10 ± 1 m/s. The most favourable flow direction shall be used. Any signal emitted shall be recorded.

Annex J

High ambient temperature test

The detector shall be installed in the wind tunnel in its normal operating position with the most unfavourable flow direction and connected to its control and indicating equipment. The air temperature in the wind tunnel shall be θ = 23 ± 5 °C. The air temperature in the wind tunnel shall then be increased to 50 ± 2 °C at a rate of ≤ 1 °C/min

Annex N

Shock test

The detector shall be mounted by means of its normal fastenings, at the centre of the underside of a timber beam in its normal operating position and shall be connected to the control and indicating equipment. The timber beam shall be of oak (European or American White)[1] and shall have cross-sectional dimensions of 100 mm x 50 mm. It shall be clamped on its narrower face to two oak supports of 50 mm width and of sufficient height that the detector does not touch the floor. The supports shall be placed freely on edge at 900 mm centres on a level concrete floor and at right angles to the longitudinal axis of the beam. A cylindrical steel block weighing 1 kg shall be dropped five times on to the centre of the upper horizontal face of the beam from a height of 700 mm. The area of impact of the weight is 18 cm^2 ± 10 %. The block shall be guided by suitable means so as to strike the beam with its longitudinal axis vertical.

A suggested but not compulsory form of apparatus is shown in figure 7.

After the test the response threshold value of the detector shall be measured according to annex B in the most unfavourable flow direction.

Of the two response threshold values measured in clauses 8 and 15, the greater is given the symbol y_{max} or m_{max}, the lesser value is given the symbol y_{min} or m_{min}.

Annex O

Impact test

O.1 Method of test

One detector shall be tested. The detector shall be mounted on a rigid horizontal backing board by means of its normal fastenings, in its normal operating position and connected to the supply and indicating equipment.

It shall be subjected to an impact of 1,9 ± 0,1 J delivered in a horizontal direction, at a velocity of 1,5 ± 0,125 m/s, by a swinging hammer having a hard aluminium head made from aluminium alloy Al-Cu4SiMg to ISO 209[2], solution treated and precipitation treated condition, with a plane impact face at an angle of 60° to the horizontal when in the striking position.

After the impact the detector and its connections shall remain undisturbed for at least 1 minute.

Without any change to the position of the detector relative to its mounting base or socket, the detector shall be disconnected from the supply and indicating equipment and shall be transferred from the impact test apparatus to the test tunnel, together with its backing board.

The response threshold value of the detector shall then be measured according to annex B in the most unfavourable flow direction.

Of the two response threshold values measured in clauses 8 and 16, the maximum value is given the symbol y_{max} or m_{max} and the minimum value the symbol y_{min} or m_{min}.

O.2 Apparatus

Unless otherwise specified all dimensions in O.2 are subject to a tolerance of ± 0,5 mm.

O.2.1 This apparatus (figure 8) consists essentially of a swinging hammer comprising a rectangular section head with a chamfered impact face mounted on a tubular steel shaft. The hammer is fixed into a steel boss which runs on ball bearings on a fixed steel shaft mounted in a rigid steel frame, so that the hammer can rotate freely about the axis of the fixed shaft. The design of the rigid frame is such as to allow complete rotation of the hammer assembly when the detector is not present.

O.2.2 The striker is of dimensions 76 mm wide x 50 mm deep x 94 mm long (overall dimensions). It has a plane impact face chamfered at 60 ± 1° to the long axis of the head. The tubular steel shaft has an outside diameter of 25 ± 0,1 mm with walls 1,6 ± 0,1 mm thick.

O.2.3 The striker is mounted on the shaft so that its long axis is at a radial distance of 305 mm from the axis of rotation of the assembly, the two axes being mutually perpendicular. The central boss is 102 mm in outside diameter and 200 mm long and is mounted coaxially on the fixed steel pivot shaft, which is 25 mm in diameter. The precise diameter of the shaft will depend on the bearings used.

O.2.4 Diametrically oppose the hammer shaft are two steel counter balance arms, each 20 mm in outside diameter and 185 mm long. These arms are screwed into the boss so that a length of 150 mm protrudes. A steel counter balance weight is mounted on the arms so that its position can be adjusted to balance the weight of the striker and arms, as in figure 8. On one end of the central boss is mounted a 12 mm wide x 150 mm in diameter aluminium alloy pulley and round this an inextensible cable is wound, one end being fixed to the pulley. The other end of the cable supports the operating weight.

O.2.5 The rigid frame also supports the mounting board on which the detector is mounted by its normal fixings and connected to its normal indicating equipment. The mounting board is adjustable vertically so that the centre of the impact face of the hammer will strike the detector when the hammer is moving horizontally, as shown in figure 8.

The blow shall be struck by the centre of the impact face and the azimuthal direction of impact, relative to the detector, shall be chosen as most likely to impair the normal functioning of the detector. A suitable but not compulsory apparatus is described in O.2 and shown in figure 8.

O.2.6 To operate the apparatus the position of the detector and mounting board is first adjusted as shown in figure 8 and the mounting board is then secured rigidly to the frame. The hammer assembly is then balanced carefully by adjustment of the counter balance weight with the

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1) European oak = *Quercus robur L.*
Quercus petraea Liebl.
American White oak = *Quercus spp.* principally
Quercus alba L.
Quercus prinus L.
Quercus lyrata Walt.

Annex R

Dielectric strength test

The detector shall be subjected to the following climatic conditions for at least 24 h:

Temperature: 25 ± 1 °C

Relative humidity: $50 \begin{smallmatrix}+3\\-2\end{smallmatrix}$ %

The detector shall be mounted in its normal position on a metal plate which is regarded as the earth connection. Using a voltage generator capable of delivering a sinusoidal voltage of between 40 Hz and 60 Hz, with an adjustable amplitude of 0 V to 1500 V r.m.s. (effective value), and a constant short-circuit current of 10 A r.m.s. (effective value), an increasing test voltage shall be applied between the metal plate and the short-circuited connecting wires.

This shall be carried out as follows:

(a) for detectors with nominal supply voltages of below 50 V, the test voltage shall be increased from 0 V to 500 V at a rate of 100 V/s to 500 V/s and maintained at the final magnitude for 60 ± 5 s;

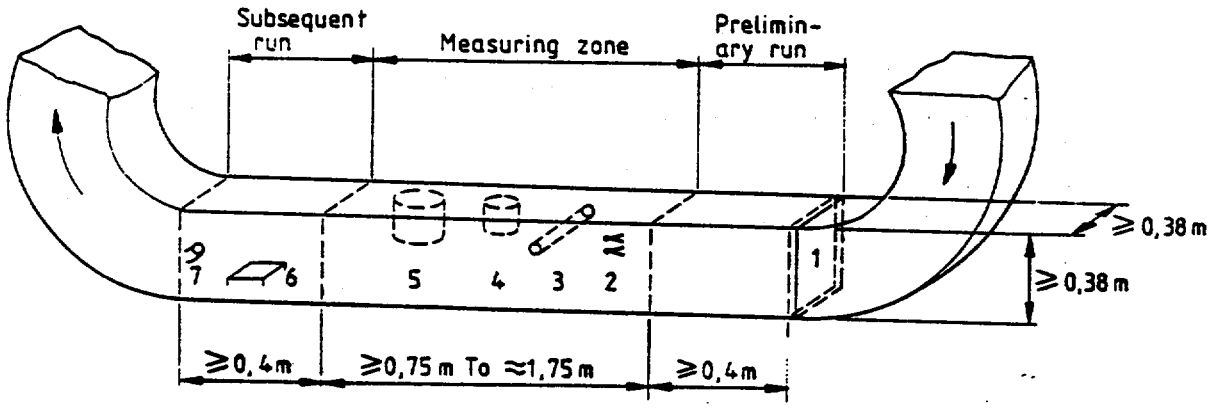
(b) for detectors with nominal supply voltages of more than 50 V and less than 500 V, the test voltage shall be increased from 0 V to 1500 V at a rate of 100 V/s to 500 V/s and maintained at the final magnitude for 60 ± 5 s.

Annex S

Low ambient temperature test

The detector shall be connected to its supply and indicating equipment and placed in a chamber at a temperature of between 15 °C and 25 °C for a period of at least 1 h. The air temperature in the chamber shall then be reduced to −20 ± 2 °C at a rate not greater than 0,5 °C/min. The detector shall be left at this ambient temperature for one hour to allow its temperature to stabilize. The conditions in the chamber shall be such that condensation or ice cannot form on the detector.

At the end of the stabilization period, the detector shall be removed from the chamber and kept for a period of 1 h to 2 h at an ambient temperature between 15 °C and 25 °C and at a relative humidity of 70 % or less. The response threshold value shall be measured and recorded according to annex B for the most unfavourable flow direction. Of the two response threshold values measured in the tests in accordance with clauses 8 and 20, the greater value is given the symbol y_{max} or m_{max}, the lesser value is given the symbol y_{min} or m_{min}.



(1) Sieve/Net
(2) Measurement of flow rate and temperature
(3) Optical measurement (light transmission method)
(4) Detectors to be tested
(5) Ionization measuring chamber } mounting on cover plate
(6) Heating element
(7) Aerosol supply

Figure 1. Arrangement of smoke detector and test apparatus in the wind tunnel

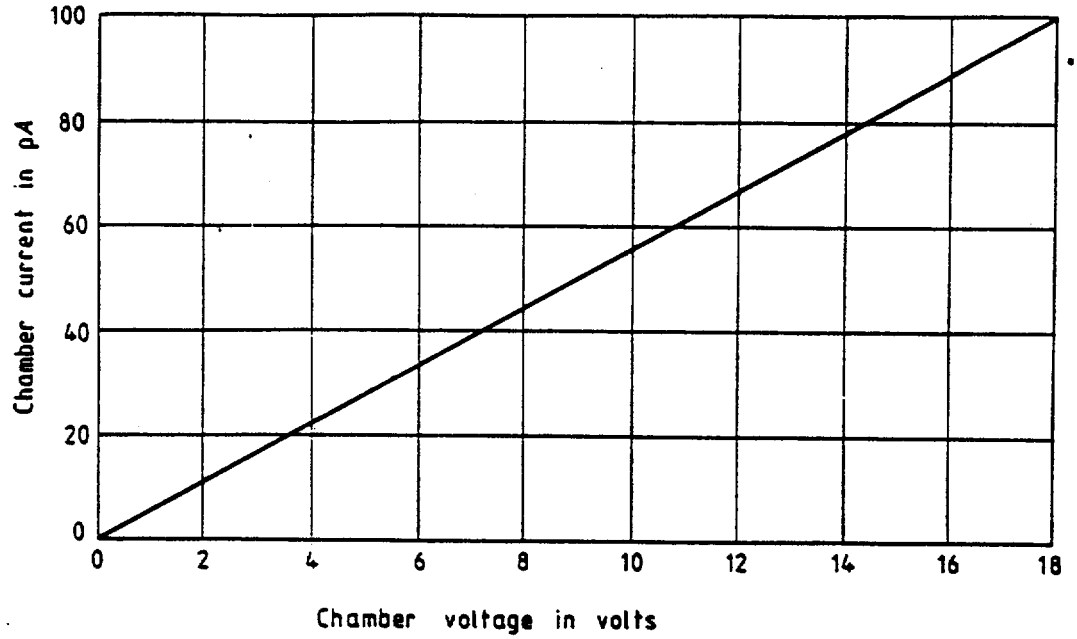


Figure 4. Ionization measuring chamber; current-voltage characteristic

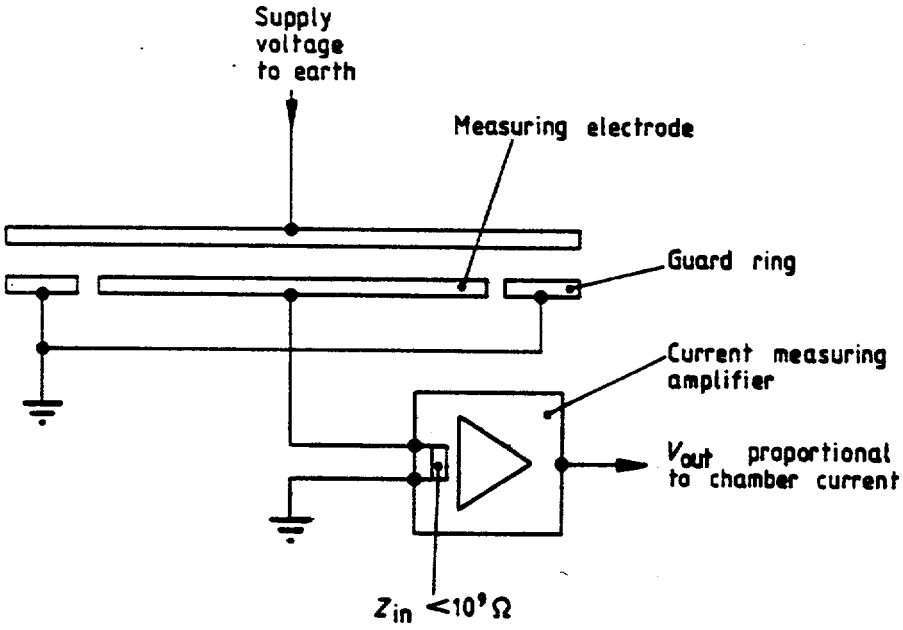
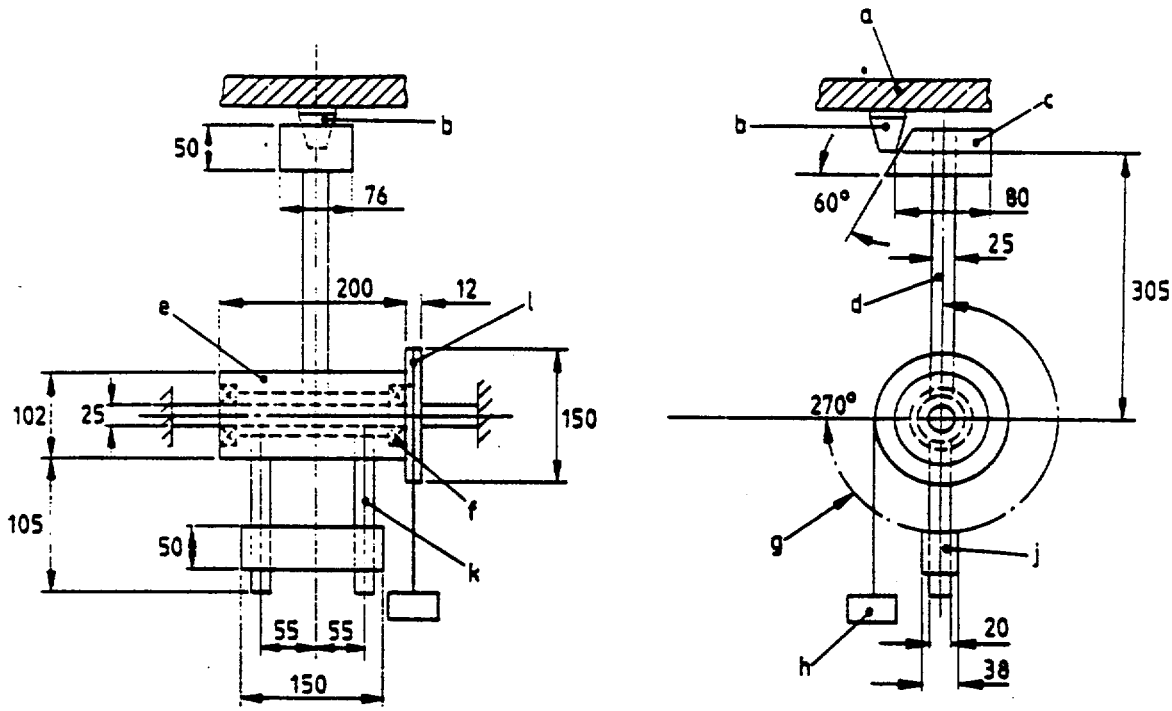


Figure 5. Operating circuit



a) Mounting board
b) Detector
c) Striker
d) Striker shaft
e) Boss
f) Ball bearings
g) 270° angle of movement
h) Operating weight
j) Counter balance weight
k) Counter balance arms
l) Pulley

Dimensions in millimetres

NOTE. The sizes given to the dimensions are for guidance only.

Figure 8. Impact apparatus

National appendix Y

Publications referred to

*EN 54 : Part 1	
published as	BS 5445 : Part 1 : 1977 Components for automatic fire detection systems Part 1 Introduction
*EN 54 : Part 5	
published as	BS 5445 : Part 5 : 1977 Components for automatic fire detection systems Part 5 Heat sensitive detectors — point detectors containing a static element
*EN 54 : Part 8	
published as	BS 5445 : Part 8 : 1984 Components for automatic fire detection systems Part 8 Specification for high temperature heat detectors
EN 54 : Part 9	
published as	BS 5445 : Part 9 : 1984 Components for automatic fire detection systems Part 9 Methods of fire sensitivity test
*BS 1470	Wrought aluminium and aluminium alloys for general engineering purposes — plate, sheet and strip
BS 5839	Fire detection and alarm systems in buildings Part 1 Code of practice for installation and servicing
ISO 209	Composition of wrought products of aluminium and aluminium alloys — Chemical composition (per cent)

NOTE. As explained in the national foreword, the reference in the text to ISO 209 is to a material that is equivalent to an aluminium alloy in BS 1470 : 1972.

National appendix Z

National committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Fire Standard Committee (FSM/—) to Technical Committee FSM/12 upon which the following bodies were represented:

Association of Manufacturers Allied to the Electrical and Electronic Industry (Beama Ltd)
British Fire Protection Systems Association Ltd
British Telecommunications
Chartered Institution of Building Services
Chief and Assistant Chief Fire Officers Association
Department of Health and Social Security
Department of the Environment. Building Research Establishment (Fire Research Station)
Department of the Environment. Property Services Agency
Department of Transport — Marine Directorate
Electrical Contractors Association
Electrical Installation Equipment Manufacturers Association (Beama Ltd)
Fire Insurers Research and Testing Organization (FIRTO)
Fire Offices Committee
Fire Protection Association
Greater London Council
Home Office
Institution of Electrical Engineers
Institution of Fire Engineers
Ministry of Defence
Royal Institute of British Architects
Telecommunication Engineering & Manufacturing Association (TEMA)

The following body was also represented in the drafting of the standard:

Electricity Supply Industry in England and Wales

*Referred to in the national foreword only.

THORN SECURITY

THORN SECURITY Limited
Security House
Twickenham Road
Feltham
Middlesex. TW13 6JQ
England
Telephone: 01-755 3333
Telex: 8814916
Fax: 01-755 0831

Mr.Floyd DesChamps
Commercial Section-Medical, Academic
and Commercial Use Safety Branch
United Staes Nuclear Regulatory Commission
Washington D.C. 20555
U.S.A.

Our Ref:MF312 Your Ref:

31 May 1990

Dear Mr. DesChamps

Registration of Ion Chamber Smoke Detectors

Following your correspondence on the above subject and the subsequent telephone conversations with our Roger Barrett, we are enclosing a set of replies prepared by him against your questions.

It is our belief that all the outstanding matters are resolved by the enclosed documents, but if further clarification is needed, please do not hesitate to contact us again. We are eager to meet all your specified requirements as soon as possible because our application to UL for listing is nearing completion.

Very best regards

Yours sincerely

Peter Carlton
PDS Manager

Attachment A

REGISTRATION OF MF-SERIES ION CHAMBER SMOKE DETECTORS

Supplement to Submission

The points given below are supplementary to the original submission of the THORN Security MF Series detectors dated 18 October 1989. The section numbers refer to the numbered questions in the letter from Mr Floyd DesChamps of NRC, dated 28 March 1990.

1. We would like the registration to cover the MF series of detectors. The series currently includes the following types which are intended for sale in the USA:

   MF312 MF412 MF512

2. We can confirm that the mandatory information will be included in the labelling for the point-of-sale packaging. We propose to use a label of the type described in the "LABELLING AND PACKAGING" section on page 10 of the application document.

3. A copy of BS5445 Part 7 is attached as requested.

   We are also attaching additional information covering further type testing of the MF series detectors. This is a copy of a report produced by the National Radiological Protection Board detailing testing of the MF301 detector to the NEA recommendations. We submit that the tests are also applicable to the MF312, MF412 and MF512 variants which use the same housing and source assembly.

4. The dose rates quoted refer to an activity of 0.9 microcuries of Americium 241.

5. Section 32.27 a):

   In normal use of the detector, the highest exposure will be experienced by installation and service personnel. It can be assumed that these personnel will be handling detectors singly and may be in contact with them for, say, a maximum of one hour per day or two hundred and fifty hours per year. This would result in an absolute maximum dose of 0.0015 rad to the hands of the personnel concerned (using the figures given on page 7 of the submission document) which is below the maximum level in Column I of the table in 32.28.

   During storage and distribution the personnel having the highest exposure will be those in the warehouse where they are initially stored. The detectors will be imported by THORN Automated Systems Inc. and will be stored in a locked caged portion of their warehouse facility prior to distribution. The personnel handling detectors will be trained in their correct handling and will avoid prolonged exposure. It can be assumed that these workers will experience exposure to hands and feet from boxes of detectors for, say, one hour per day resulting in a total dose of the order of 0.015 rad. This again is well below the level given in Column I of the table in 32.28.

The entire facility is protected with a fire alarm and security system armed with motion monitoring devices to detect unauthorized movement within the building. The risk to persons other than authorized personnel is therefore reduced to a minimum.

Section 32.27 b):

The effectiveness of the containment of the source during normal use is demonstrated by the type testing of the detector against fire detector standards such as BS5445. The physical tests conducted and reported in the test report TE30200 show that the mechanical structure is capable of withstanding normal and abnormal handling without loss of integrity. This conclusion is also supported by the more recent tests conducted by NRPB.

Section 32.27 c):

The testing cited in 6. above, particularly that conducted by NRPB, covers "credible abuse and likely accidental damage" to the detectors. Results show that the probability of loss of integrity of the containment is acceptably low. In the unlikely event that the housing of the detector is damaged to the extent that the outer cover is removed, the maximum dose is still limited to 0.05 rad per year. Hence, the probability of exceeding the dose of Column II of 32.28 is low.

The worst scenario is that of a fire in the warehouse in which large numbers of detectors are stored. We can assume that at any time the warehouse holds a stock of 5,000 detectors (i.e. approximately one month's usage). The fire and incineration tests indicate that if 5,000 detectors were completely destroyed in a fire, the total activity released would be 37*5,000 Bq or 185 kBq (5 microcuries). This activity would be spread by the fire plume over an area of say 1,000,000 square metres, resulting in a contamination level of $5*10^{-6}$ microcuries per square metre. This low level of contamination would result in doses many orders of magnitude lower than those given in Column II of 32.28.

6. The manufacturing procedure has been revised to include a wipe test on 100% of detectors. The updated Quality Plan reflects this change.

R Barrett
30 May 1990

- Sample perform parts
- Final a-

National Radiological Protection Board, Northern Centre, Hospital Lane, Cookridge, Leeds LS16 6RW
Telephone: (0532) 679041 · Fax: (0532) 613190

Consumer Products Report

Report Number:	NRPB/CP 3/037
Report for:	Mr P Carlton Thorn Security Limited Security House Twickenham Road Feltham Middlesex TW13 6JQ
Subject:	Testing Ionisation Chamber Smoke Detectors to NEA recommendations
Sample:	Multistation Ionisation Chambers Smoke Detector Model MF301 + MF300 base.
Date of completion of tests:	25th April 1990
Date of report:	26th April 1990

Introduction

The ionisation chamber smoke detector contains an Americium-241 with an activity of 33.3 kBq [0.9 μCi]. The detectors were assessed for compliance with the requirements of the recommendations of the Nuclear Energy Agency (Ref. 1).

NEA Preliminary Tests

Access to the source

Access to the source can only be gained by removing the detector from its base and forcibly dismantling it.

Marking and Labelling

The base of the detector head bears an adhesive paper label. This label bears the following wording 'Caution - contains radioactive material - Americium-241, 33.3 kBq and the radiation trefoil symbol.

Dose Rates

A photon spectrum from a single smoke detector was accumulated using a shielded lithium drifted silicon detector. Dose rates were calculated using the known efficiency of the silicon detector and appropriate dose rate conversion factors. The results were used to calibrate a low energy photon scintillation probe. Dose rates from the other detectors were measured using the scintillation probe.

The maximum dose equivalent rate measured was 2.3×10^{-3} $\mu Sv\ h^{-1}$ at a distance of 0.1 metres from the surface of the smoke detector. The NEA requires that the dose rate does not exceed 1 $\mu Sv\ h^{-1}$ at a 0.1 metres from the surface of the detector.

Contamination

Surface contamination was assessed by wiping each detector with methanol moistened swabs and measuring the transferred activity using an alpha scintillation drawer. The following areas of the detectors were checked.

(i) The outer surface of the detector
(ii) The inner surface of the ionisation chamber
(iii) The source and soure holder

In all cases the levels of radioactive contamination assessed were less than 0.37 Bq cm^{-2}. The NEA states that a detector shall fail the initial tests if the contamination exceeds this value.

Additional NEA tests

The NEA testing programme is intended to simulate the damage and other effects produced by normal use, credible abuse and likely accidental damage. The programme is detailed in reference 1. The integrity of the sources before and after each test was assessed principally by wipe testing as described above. With the exception of the 600°C fire test and the 1200°C incineration test the results are given below.

Test	Activity transferred from the source after test (Bq)
Temperature	< 0.1
Impact	< 0.1
Drop	< 0.1
Vibration	< 0.1

A source is considered to have retained its integrity if the removed activity is less than 185 Bq.

Fire Test at 600°C and Incineration Test at 1200°C

The procedure and apparatus used for the 600°C and 1200°C tests are detailed in reference 1.

The measured activities in each part of the apparatus after the test are given in the table below.

Apparatus	Measured Activity in Bq	
	600°C	1200°C
Vapour Trap	< 37	< 37
Filter	< 0.1	< 0.1
Debris	< 0.1	-
Source	< 0.1	-
Total	< 37.3	< 37.1

A detector is considered to have failed the 600°C test if the sum of activity remote from the source exceeds 185 Bq.

For the 1200°C test, a detector is considered to have failed if the activity in the vapour trap and on the filter exceeds 1% of the source activity.

Conclusion

The smoke detectors performed satisfactorily in the NEA tests.

J Dunderdale

Note: This report covers the following additional detectors and bases which would perform in the NEA test similarly to the above detector and base.

MF301L MF301H MF301D MF301DH	MF301Ex MF300Ex	MF401 MF501 MF500 MF501Ex MF500Ex
PF301 PF301L PF301H PF301D PF301DH P300	PF301Ex P300Ex	PF501 P500 PF50Ex P500E

Reference 1. Recommendations for ionisation chambers smoke detectors in implementation of radiation protection standards. Nuclear Energy Agency of the Organisation for Economic Co-operation and Development 1977.

JD/PVS/JEW
26/4/90
CP 3,15

THORN Security

THORN Security Limited
Technology Centre
Dawley Road
Hayes
Middlesex UB3 1HH
Telephone 081-848 9779
Fax 081-848 6565
Telex 934135

Mr Floyd DesChamps
Commercial Section-Medical, Academic
and Commercial Use Safety Branch
United States Nuclear Regulatory Commission
Washington D.C. 20555
U.S.A.

20 July 1990

Dear Floyd,

MF312 Ion Chamber Detectors

Enclosed is a copy of the drawing of the label we shall be fitting to the cover of the Chamber of the above detector.

This is in line with our previous discussions and completes the package of information needed for NRC registration of our detector.

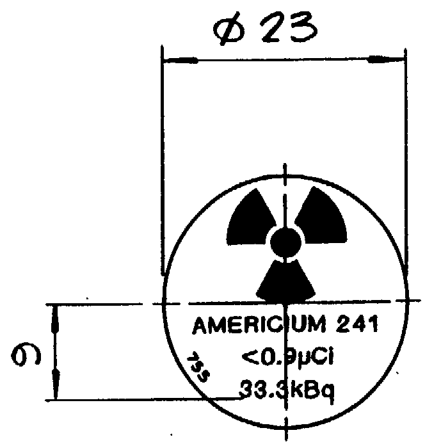
We look forward to receiving formal registration within the next week or two.

Very best regards,

Yours sincerely,

P Carlton
PDS Manager

A-3



NOTES:

1. LABEL IS TO BE PUNCHED OUT OF A PAPER ROLL OF TAPE ON SUPPORT FILM.
2. ARTWORK SYMBOL AND LEGENDS ARE TO BE MATT BLACK AND LABEL BACKGROUND IS TO BE MATT WHITE.
3. LABEL ARTWORK IS TO BE DISPOSED ABOUT THE HORIZONTAL CENTRE LINE AS SHOWN AND IT IS TO BE EQUALLY DISPOSED ABOUT THE VERTICAL CENTRE LINE.
4. FOR ARTWORK SEE SHEET 2 OF THIS DRAWING.

APP'D	[signature]
ISSUE	A 10/7/90

TITLE: ION CHAMBER LABEL	DRAWN GAH 10/7/90 ENG'R [signature]	MATERIAL: SEE NOTE 1.	SCALE 2:1	THIRD ANGLE PROJECTION	IF IN DOUBT - ASK!
	DEV. No. 066/303/3		TOLERANCES (UNLESS STATED)		DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED TO BE READ IN CONJUNCTION WITH BS 308
	DRAWING No. 120-147-755	FINISH: ———	GENERAL ± 0.4 mm	HOLE CENTRES ± 0.12mm	RELEVANT DRAWINGS
A3	SHEET 1 OF 2		HOLE DIAMETERS +0.1 mm −0	ANGULAR ± 30'	USED ON 516-020-007

THORN Security Limited © 198

THORN Security Limited

AMERICIUM 241

155

<0.9μCi

33.3kBq

REDUCE TO 100mm

DRAWING No. 120-147-755 ISS. A

ISSUE	APP'D
A 10/7/90	QR

IF IN DOUBT - ASK!

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED TO BE READ IN CONJUNCTION WITH BS 308

TITLE: ION CHAMBER LABEL

DRAWN: GAH 10/7/90 ENG'R:

DEV. No. 066/303/3

DRAWING No. 120-147-755

SHEET 2 OF 2

MATERIAL: SEE SHEET 1

FINISH: ———

SCALE: 4:1 THIRD ANGLE PROJECTION

TOLERANCES (UNLESS STATED)

GENERAL	± 0.4 mm
HOLE CENTRES	± 0.12mm
HOLE DIAMETERS	+ 0.1 mm − 0
ANGULAR	± 30'

RELEVANT DRAWINGS

USED ON: 516-020-007

A3

THORN Security Limited
Security House
The Summit
Hanworth Road
Sunbury-on-Thames
Middlesex
TW16 5DB
Telephone 0932 743333
Fax 0932 743155
Telex 8814916

Mr F Deschamps
Nuclear Regulatory Commission
Commercial Section - Medical,
Academic & Commercial Use
Safety Branch
Washington DC 20555
U S A

Date: 10th February 1994

Dear Mr Deschamps

Change of Address for THORN Security Technology Centre

Would you please note that from the 18th February 1994, our Technology Centre - which includes the research and development activities and all approvals activities for products - will be permanently re-located to our new head office site. The details of the address, telephone number etc, are given below:

THORN Security Ltd Technology Centre
The Summit
Hanworth Road
Sunbury-on-Thames
Middlesex
TW16 5DB

Tel: No. 0932 743333
Fax: No. 0932 743155

For direct contact with the undersigned, please use telephone number 0932 743243.

Would you be kind enough to amend your records accordingly. We trust this will not involve you in excessive internal work, but if any re-registration fees are payable, please send the invoice to the new address, marked for my attention.

Very best regards

Yours sincerely

Peter Carlton
Principal Engineer (Approvals)

ATTACHMENT A-5

Registered Office
Security House
The Summit
Hanworth Road
Sunbury-on-Thames
Middlesex TW16 5DB
Registered in England No. 728345

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

IMPORTANT NOTICE

PURCHASE ORDERS/PAYMENT

The invoice for the fee(s) and associated interest, penalties, and administrative costs, if any, constitutes a debt to the United States pursuant to Federal law and implementing regulations. Please do not send a purchase order for NRC's completion in order to effect payment of the invoice. The NRC will not accept or execute any purchase order submitted by an applicant/licensee as a condition to the applicant/licensee paying this debt. The NRC also reserves the right not to accept or execute any claim form or other document submitted by an applicant/licensee as a condition to the applicant/licensee paying this debt. If a purchase order is sent without payment and the invoice becomes past due, the NRC will not waive any interest, penalties, or administrative charges upon receipt of the payment.

Payment should be made by check, draft, money order, or electronic funds transfer and made payable to the U.S. Nuclear Regulatory Commission. In order to ensure that your account is properly credited, please reference your invoice number(s) on your payment or return the payment copy of your invoice(s) with your remittance. Federal agencies may also make payment by the On-Line Payment and Collection System (OPAC).

ATTACHMENT A1-4

THORN Automated Systems Inc.

Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

March 14, 1990

Mr. Bruce Carrico
Nuclear Regulatory Commission
Mail Stop OWFN-6H3
Washington, D.C. 20555

Subject: Application for Licence to Distribute THORN Security MF312 Ionisation Chamber Smoke Detector

Dear Mr. Carrico:

Pursuant to our conversation enclosed is our application and fee of $580.00 along with (2) sets of documentation required for THORN Automated Systems request to be the licenced distributor of THORN Security LTD detectors in the U.S.A.

THORN Security Limited filed an application for registration of model MF312 ion chamber smoke detector with Mr. Stephen Baggett of the NRC in Washington D.C. on October 25, 1989. Included in their application was information required for 10 CFR PT 32.26-.27-.28.29. I understand this application has not yet been processed and that our application to distribute will be processed along with it.

I would also reaffirm that THORN Automated Systems fully understands its responsibilities in maintaining proper transfer records, quality assurance, and test records.

THORN Automated Systems will distribute this product from our headquarters located at 835 Sharon Drive, Westlake, OH 44145. Detectors will be shipped to end-users in their original packages with no modifications. Labeling will be in accordance with NRC regulations.

I would also note that these detectors are intended for use in industrial/commercial fire detection systems. They are not intended for sale to the general public for domestic applications.

We have also filed applications for licence to possess these detectors with Mr. Bill Adam at NRC District III Glen Ellyn, IL 60137 on 3/14/90.

Attachment A2-

NRC FORM 374
(10-89)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Thorn Automated Systems, Inc. 2. 835 Sharon Drive Westlake, OH 44145	3. License number 34-23772-01 4. Expiration date May 31, 1995 5. Docket or Reference No. 030-31617

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Americium-241	A. Foil sources (Amersham Int., Inc. Model No. AMM 1001H)	A. No single foil to to exceed 0.9 microcuries, 45 millicuries, total

9. Authorized Use

A. To be used for storage in Thorn Security MF Series ionization smoke detectors incident to distribution in accordance with the conditions of NRC Byproduct Material License No. 34-23772-02E.

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities located at 799 Sharon Drive, Westlake, Ohio and 835 Sharon Drive, Westlake, Ohio.

11. Licensed material shall be used by, or under the supervision of, Daniel Speese or E. Joseph Martini.

12. This license does not authorize commercial distribution of licensed material.

13. Licensed material shall not be used in or on human beings.

14. Sealed sources containing licensed material shall not be opened.

15. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 2 years from the date of each inventory.

5

COPY

I would also note that professional consultants have been retained to perform required training of our personnel to conform to all NRC test and safety regulations.

Thank you for your assistance and please feel free to contact me if you have any questions.

Very truly yours,

E. Joseph Martini

Vice President of Manufacturing/Operations

cc: R. Elzer
L. Kaiser
D. Ross

THORN Automated Systems Inc.

Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

March 14, 1990

TO: DR. BILL ADAM
United States Nuclear Regulatory Commission
Region 111
799 Roosevelt Road
Glen Ellyn, IL 60137

Subject: Application for Licence to Possess THORN Security MF312 Ionisation Chamber Smoke Detectors.

Dear Dr. Adam:

Pursuant to our conversation enclosed is our application and fee of $230 along with two (2) sets of documentation required for THORN Automated Systems request to be licenced to possess THORN Security Detectors in the U.S.A

Also enclosed for your information is summary data and technical information on the detectors.

Thank you for your valuable assistance in helping us prepare this application and please do not hesitate to contact me if you require any further information. I would appreciate your help in securing this licence as quickly as possible.

Very truly yours,

E. Joseph Martini

E. Joseph Martini

Vice President Manufacturing/Operations

cc: R. Elzer
L. Kaiser
D. Ross

NRC Form 374A (3-84) U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: 34-23772-01
Docket or Reference number: 030-31617

16. The licensee shall maintain records of information important to safe and effective decommissioning at 799 Sharon Drive, Westlake, Ohio per the provisions of 10 CFR 30.35(g) until this license is terminated by the Commission.

17. The licensee may transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated March 14, 1990.

For the U.S. Nuclear Regulatory Commission

Date: April 5, 1990

Original Signed
By William J. Adam, Ph.D.
Materials Licensing Section, Region III

COPY

THORN Automated Systems

THORN Automated Systems I
Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

October 10, 1991

Ms. Susan L. Greene
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Dear Ms. Greene:

Pursuant to our recent communications, THORN Automated Systems, Inc. is requesting the N.R.C. amend our Distribution License Number 34-23772-02E, to include Autocall/Nittan smoke detectors:

Device Model	Maximum Quantity Americium 241 per Device
NID-68	1.0 Microcurie
NID-68AS	1.0 Microcurie
NID-68AS-1	1.0 Microcurie
IOB2 (P/N PU90-2000-1 & P/N PU90-41000-1)	1.0 Microcurie

We also request the N.R.C. terminate Autocall/Nittan Distribution License No. 12-16029-03E in conjunction with the transfer of authorization to THORN Automated Systems, Inc.

The following information is submitted to accomplish this transfer:

(a) The name of the organization is THORN Automated Systems, Inc.

(b) Radiation Safety Officer responsibilities will transfer from Mr. Ken Kimura, Autocall/Nittan, to E. Joseph Martini, THORN Automated Systems, Inc.

(c) The transferrer will not remain in business in the United States without the license.

(d) On December 5, 1990, THORN Automated Systems, Inc. purchased Autocall, Inc. by means of a stock purchase arrangement. On April 1, 1991, a corporate reorganization took place which resulted in the transfer of assets of Autocall's field offices to the parent company, THORN, by resolution of the Board of Directors of Autocall.

(e) Organization changes include the transfer of Radiation Safety Officer responsibilities and location of storage and distribution facility; no equipment or procedures will change. All licensed material will be possessed in finished product authorized for distribution to persons exempt from license.

Attachment 2-3

THORN Automated Systems

(f) There is no change in the use, possession, or storage of licensed material. The change in ownership, contact person, and facilities require an amendment of the THORN license and termination of the Autocall/Nittan license. Autocall was the sole customer of Nittan for the products containing licensed materials. Nittan was the only U.L. approved source for these smoke detectors in Autocall's fire protection systems. Product lines will continue as they are; there will be no product changes made.

(g) All required surveillance items and records, including radioactive material inventory, accountability requirements, and records of transfer of persons exempt from license, are current and will be maintained by THORN Automated Systems, Inc.

FACILITY WILL NOT CHANGE ETC

(h) The new facility has previously been used for licensed activity. An inventory audit of licensed material for the Autocall/Nittan facility has been completed, and an instrument survey will be performed. THORN Automated Systems, Inc. agrees to assume full liability for decontamination of the Autocall/Nittan facility.

(i) No decontamination plans or financial assurance arrangements are required for this license.

(j) THORN Automated Systems, Inc. agrees to abide by all commitments or representations previously made to the N.R.C. by Autocall/Nittan with regard to condition 14 of License No. 12-16029-03E. It is our desire that the amended license when issued be without reference to any other previously submitted documents.

(k) Announcement of change of ownership and control of Autocall's physical assets (including licensed material) by THORN is attached.

(l) THORN Automated Systems, Inc. agrees to abide by all constraints, conditions, requirements, representations, and commitments made in the existing license.

Please contact me if you have any questions or require additional information.

Sincerely yours,
THORN Automated Systems, Inc.

Joseph Martini

E. Joseph Martini
Vice President, Manufacturing

EJM:cs

Attachments

THORN Automated Systems

THORN Automated Systems Inc.
Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

News Release

December 6, 1990
For Immediate Release

Contact: Bob Elzer, C.E.O.
THORN Security North America
(216) 871-9900

Casey Kroll, President & C.O.O.
THORN Automated Systems, Inc.
(216) 871-9900

Jim Frankow, President & C.O.O.
Autocall, Inc.
(419) 347-2400

THORN EMI ACQUIRES AUTOCALL

Westlake, Ohio — THORN EMI, the UK-based group with international businesses in electronics, music and rental, has acquired, through its subsidiary, THORN Security North America, 100% of the shares of Autocall, Inc.

THORN Security North America, which represents THORN Security's interest in the North American fire and security industry already has substantial U.S. market presence through its subsidiaries, Malco Plastics and THORN Automated Systems, Inc.

Autocall, Inc. is a major provider of state-of-the-art fire detection and control equipment. Headquartered in Shelby, Ohio, Autocall sells and services its fire products through an extensive network of sales representatives as well as its nine full-service field offices, located throughout the U.S.

MORE

Bob Elzer, CEO of THORN Security North America, commented, "The acquisition of Autocall is a quantum step forward in our strategy of aggressive growth through both organic development and selective acquisitions. We are certain that Autocall's excellent fire product line will greatly enhance THORN Automated Systems' security products and integration capabilities."

THORN Automated Systems is a leading security systems integrator as well as a manufacturer of fire control, detection and access control equipment, and is based in Westlake, Ohio, with offices throughout the U.S.

Autocall will be an integral part of a coordinated strategy with THORN's other operating companies to expand THORN's position in the fire and security market throughout North America.

Jim Frankow, Autocall's President, commented, "The combining of Autocall's expertise in the alarm and detection industry with THORN Automated Systems' recognized integration capabilities catapults THORN into a front runner position in the fire and security industries. This winning combination will enable us to capitalize on the decade of the nineties and emerge as the leader."

###

THORN Automated Systems

THORN Automated Systems, Inc.
Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

April 25, 1994

Carl J. Paperiello
Director, Division of Industrial and
Medical Nuclear Safety
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: THORN Automated Systems, Inc.
Docket Nos. 030-31616, 030-31617
Request for NRC Consent to the Indirect Transfer of Control of THORN Automated Systems, Inc.'s Interest in materials License Nos. 34-23772-02E and 34-237772-01

Dear Mr. Paperiello:

THORN Automated Systems, Inc. ("TASI") hereby requests that the Nuclear Regulatory Commission ("NRC"), pursuant to 10 CFR, Sec. 30.34 (b), consent to the indirect transfer of control of TASI's interest in Materials License Nos. 34-23772-02E and 34-237772-01 that will occur as the result of the purchase of TASI's parent company, KAS Holdings, Inc. by Mattingly One Limited, either directly or through intermediate holding companies.

TASI, a Delaware Company, is a manufacturer and distributor of smoke detection devises containing Americium-241. Pursuant to Materials License Nos. 34-23772-02E and 34-237772-01, TASI is authorized to possess and distribute Americium-241 in the form of foil sources (Amersham Int., Inc. Model No. AMK 1001H).

The following information, regarding the proposed purchase of KAS Holdings, Inc., relates to the NRC Information Notice No. 89-25:

a. There will be no change in the name of the licenses organization.

b. There will be no change in the personnel named in the license.

c. The current licensee will continue to manufacture and distribute smoke detection devices.

d. See Attachment I.

e. There are no plans to change the organization, location, facilities, equipment,

Attachment 1

THORN Automated Systems, Inc.
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procedures, or personnel.

f. There are no plans to change the use, possession, or storage of the licensed materials.

g. All required records such as calibrations, leak tests, surveys, radioactive material inventories and personal exposure records are current and will be kept current up to, at, and after the transaction.

h. There are no plans for any changes in the status of TASI's Westlake, Ohio facility. There is no contamination present at the TASI Westlake, Ohio facility.

i. TASI will retain control of the assets involved in the production of the smoke detection devices.

j. TASI will retain control of the materials licenses.

k. TASI will continue to abide by all constraints, conditions, requirements, representations, and commitments to assure compliance with the license and regulations.

Please contact the undersigned if further information is required. The sale of KAS Holdings, Inc. is scheduled to close on April 29, 1994. I would appreciate receiving a response from your office prior to that date. Thank you for your attention to this matter.

Very truly yours,

THORN Automated Systems, Inc.

H. T. Swanson III
Vice President of Administration

Enclosure: Attachment I

CC: John B. Martin, Administrator
Nuclear Regulatory Commission
Region 3
801 Warrenville Road
Lisle, Illinois 60532

Bramble\Nuclear.Let

THORN Automated Systems, Inc.
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ATTACHMENT I

Description of Transaction

THORN Automated Systems, Inc. ("TASI"), a Delaware Company, is presently owned by KAS Holdings, Inc. ("KAS"), a Delaware Company. KAS owns 100 percent of the common stock of TASI. THORN EMI North American Inc. ("TENA"), a [Delaware] Company currently owns 100 percent of the common stock of KAS. Mattingly One Limited ("Mattingly"), a British Company, will acquire control of TASI as an ongoing entity (the "Transaction"). To effectuate the Transaction, Mattingly will either (i) acquire from TENA 100 percent of the common stock of KAS or (ii) acquire from KAS 100 percent of the common stock of TASI.

TASI will retain its name and personnel and will continue to operate in Westlake, Ohio. TASI will remain the license holder of its two Materials Licenses issued by the NRC.

The Transaction, which also contemplates the acquisition of several overseas companies, is scheduled to be completed in 2 - 3 weeks.

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THORN Automated Systems

THORN Automated Systems, Inc.
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August 18, 1994

Ms. Michelle Burgess
U.S. Nuclear Regulatory Commission
Mail Stop T-8F5
Washington, D.C. 20555-0001

Re: Change of Status

Dear Ms. Burgess:

I am writing to report certain changes which have transpired in recent months which may have a bearing on the Distribution License held by Thorn Automated Systems, Inc. Those changes are as follows:

1. Change of Address for the Thorn Security Technology Centre - Our Technology Centre, which includes research & development and approvals activities has been relocated to our new UK head office site:

   Thorn Security Ltd. Technology Centre
   The Summit
   Hanworth Road
   Sunbury-on-Thames
   Middlesex
   TW16 5DB

   Tel: 0932 743333
   Fax: 0932 743155

2. Change in Parent Company - Prior to May 27, 1994, Thorn Automated Systems, Inc. was a wholly owned subsidiary of THORN EMI plc., a corporation based in the UK. On May 27th, the security division of THORN EMI underwent a Management Buy-Out which included Thorn Automated Systems. Therefore, we are now a wholly owned subsidiary of Thorn Security Ltd. of the UK (THORN EMI retains a 40% ownership share in Thorn Security). In effect, this change in ownership has no effect on the conduct of business and continues to reflect the same management reporting structure as existed before the MBO.

3. Change in Radiation Safety Officer - These responsibilities are being transferred from E. Joseph Martini to H.T. Swanson III.

Attachi

4. Change in Primary Warehousing Location - Thorn Automated Systems has been licensed for the storage of smoke detectors in two locations, 799 and 835 Sharon Drive, Westlake, Ohion 44145. We previously designated our primary warehousing location as 799 Sharon Drive. This location has since been closed. Thorn now does all of its warehousing at the 835 Sharon Drive location.

All other matters relating to the conduct of business remain unaltered. If you have any questions, or require any additional information, please feel free to contact me.

Sincerely,

H.T. Swanson III
Vice President of Administration

cc: E. Joseph Martini

NITTAN CHICAGO REPRESENTATIVE OFFICE

P.O. Box 334, Des Plaines, Illinois 60016, U.S.A.
Phone (312) 640-0270
FAX (312) 640-0809

November 15, 1989

030-31404

US NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Attention: Mr. Bruce Carrico

Subject: Updated Documents For License Renewal
No. NR-481-D-101-E / License No. 12-16029-01E

Dear Mr. Bruce:

In accordance with our telephone conversation in the early part of October, 1989, we have prepared an updated documents as requested and are sending it along with a check of $320 as for the renewal fee.

We have eliminated those models which are no longer being marketed from the list. As a result, we have decided to keep the following models:

1). Model NID-58
2). Model NID-68AS
3). Model NID-68AS-1
4). Model OIB (P/N PU90-2000-1 and P/N PU90-41000-1)

Please note that there are 2 sets of documents, one for the models 1). through 3)., and the other for 4). above. We regarded that those models 1). through 3). can be regarded as being in a same category. The reason for this is that they are built same way using many identical parts. The differences among them are electrical circuits.

We hope that the enclosed information will meet your requirement. If there is any additional information is necessary, please do not contact with us.

Very truly yours,

Ken Kimura
Manager

HQS
Log Nov. 1
Remitter
Check No. 8225 8267
Amount $320 + 260
Fee Category 3H APP
Type of Fee
Date Check Rec'd. 11/22/89 11/15/89
Date Completed
By: Theresa

NOV 2 0

020897

TECHNICAL INFORMATION ON NITTAN IONIZATION TYPE SMOKE DETECTORS

FOR

MODELS: NID-68, NID-68-AS, and NID-68AS-1

October, 1989

TABLE OF CONTENTS

October, 1989

SECTION I

1.0 Description of Products

The All Models of Nittan Ionization Type Smoke Detectors which discussed in this report are product which detect products of combustion material in an early stage of fire and send a signal to the control panel which, in turn, sounds an alarm both audibly and visibly. They are intended to be used as a part of an early fire warning system.

The following models are covered in this report: NID-58, NID-68AS, and NID-68AS-1. All of these models use the same radioactive sealed source, which will be described in the following sections.

Construction-wise the all models are built with the same parts and components as illustrated in the attached drawing. The only difference among them are slight variation in the electrical circuits.

1-1 General Structure of the Detectors

The complete unit of all three models consist of a detector head and a socket as a complete unit. The major parts and components of the detector head are an outer cover, an ionization chamber with a radioactive source, a printed circuit board with all electrical parts and a body. The Socket consists of only wiring terminals to the control panel.

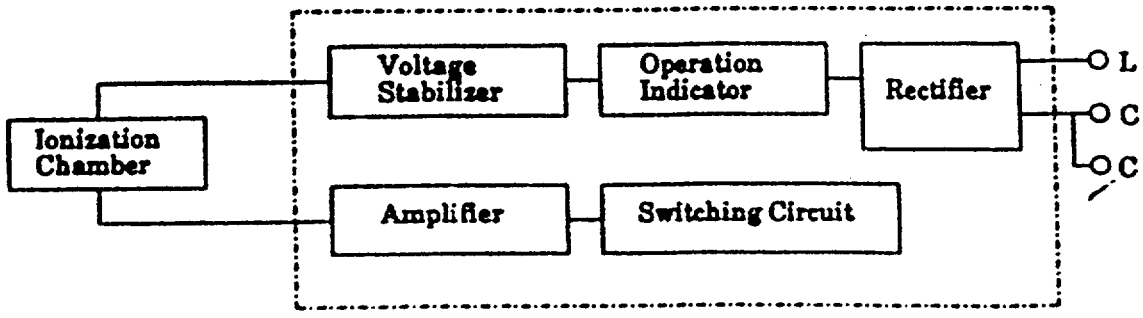
The outer cover, the body, and the head, which house all internal parts and components are made of a modified polycarbonate plastic manufactured by Teijin Chemical Co., Ltd. The brand name of this plastic is "Mulltilon". It is UL-Listed as flammable class form 94 V-0.

The Socket is also made of "Multilon".

1-2 Structural Details

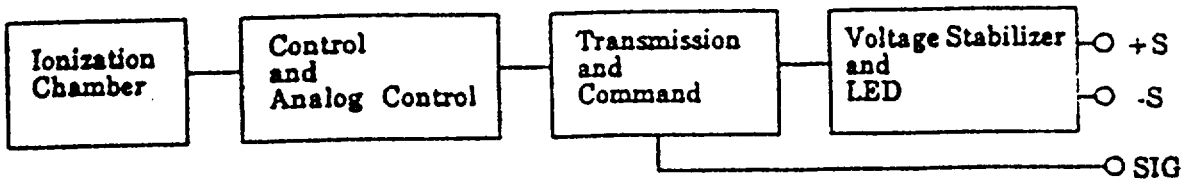
The schematic diagram of each model is shown below.

(a) Model NID-58



Signal Disposition Circuit

(b) Models NID-68-AS, and NID-68-AS-1



Signal Disposition Circuit

1-2-1 Ionization Chamber

As shown in the assembly drawings of Fig. 1 of Section V, in each of model, three stainless steel electrodes (the outer chamber, the gate plate and the anode plate) which form two ionization chambers (one is the reference chamber and the other is the measuring chamber). The air inside of the chambers is ionized by one piece of the radioactive source (Am241/0.7μCi) which is mounted on the anode plate by the RI-holder. The gate plate and the anode plate are supported by separate supporters made of a high insulation polycarbonate resin which are fixed on the shield case. The outer chamber is directly fixed to the shield case.

Products of combustion entering into these chambers reduces the ionization current and changes the voltage across the measuring chamber, changes the impedance balance between both chambers. This voltage change, correlated to the density of the combustion products, is to be sent to the signal disposition circuit as a smoke signal.

Several opening are provided on the outer chamber for the smoke to enter and the outer cover has many slits which serve as a mechanical buffer to eliminate influence of wind. Furthermore, the stainless steel mesh provided between the outer cover and the outer chamber protects both from insects and dust entering into the chamber which may cause a faulty operation of the detector. This mesh also works as a protector against static electricity and electric noise generated by external devices.

1-2-2 Signal Disposition Circuit

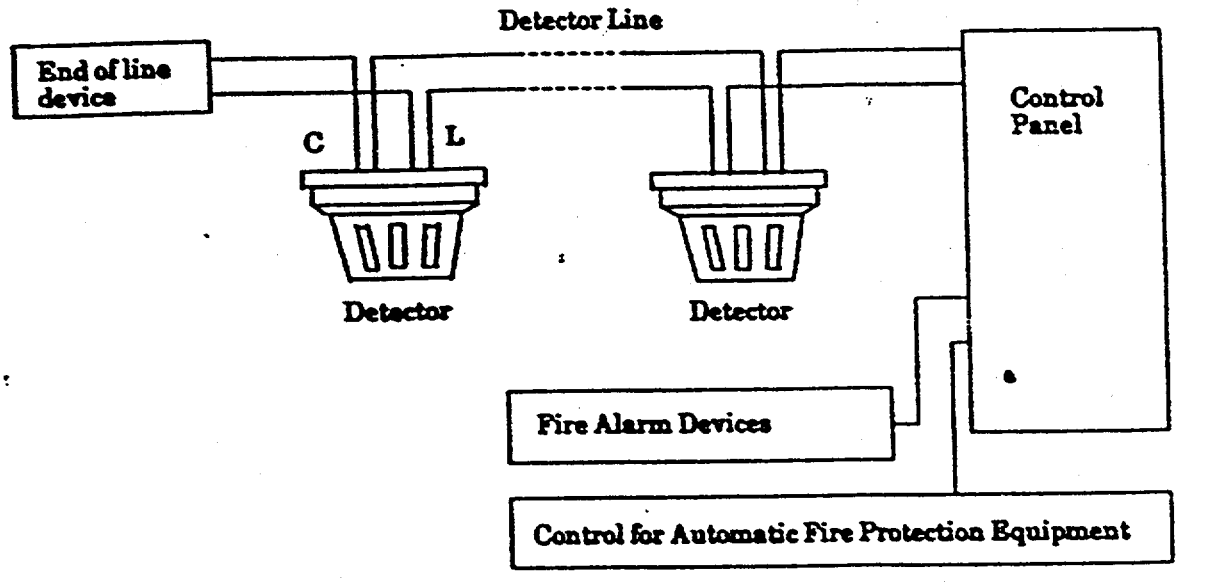
The smoke signal from the ionization chambers is amplified in the amplifier, and when the density of the combustion products reaches a predetermined level, the switching circuit is triggered and the operation indicator is lit.

Since the smoke signal voltage in the ionization chamber varies with the voltage supplied to the chamber, and the voltage supplied to the amplifier is limited in normal operation. The voltage stabilizer controls the voltages of to the chamber and to the amplifier. The rectifier produces non-polarity of the external terminals L and C.

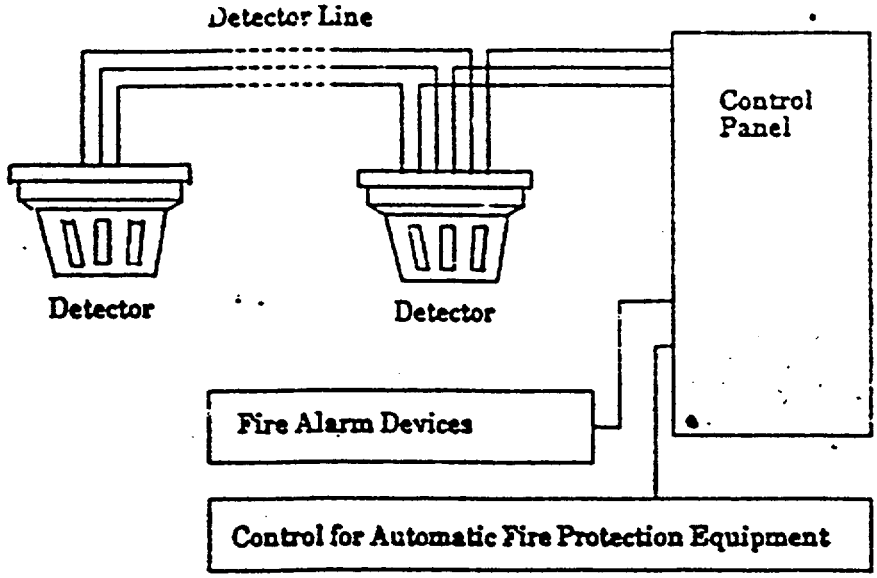
2.0 Intended Use

Each detector is used as a part of fire alarm system which normally consists of a control panel, alarm indicating devices (audio and visual alarm indicators) and remote control devices. Two examples are shown below.

Typical Application of Model NID-58



Typical Application of Models NID-68AS and NID-68AS-1



The control panel supplies the power to the detectors. The lines are also used as signal lines. Removal of any the detector head and the interruption of lines are supervised by the end-of-line device.

2-1 Condition of Use

2-1-1 Under normal condition

When the necessary electric power for normal operation of the detector is supplied form the control panel and no combustion products are present in the ionization chambers, only a very small quiescent current of the detector and line supervising current are fed to the end-of-line device through the detector lines. Under these conditions the control panel indicates "Normal Condition".

2-2 Conditions When Fire is Present

When the products of combustion enter the ionization chambers of the detector, the signal voltage (smoke signal) corresponding to the density of this smoke is sent to the gate section. When this voltage exceeds the fixed barrier value in the amplifying circuit, the amplified signal is transferred to the switching circuit which switch to ON condition. At this time, the detector current increases by approximately 1000 times more than that of normal conditions triggers the signal detection circuit in the control panel so that a fire condition is indicated both audibly and visibly, while the operation indicator in the detector is lit. Furthermore, the control for automatic fire protection equipment is activated by the signal from the control panel if so connected.

2-3 Tampering and Removal of the Detector

For all models of detectors, the following protection is provided to prevent the detector from theft of the installed detector or system trouble due to tampering.

In the case of intentional removable of the detector head results in a line interruption condition and the control panel gives an audible line trouble warning signal. On the other hand, in the case of attempted destruction of the detector mounted on the socket, that is to say, removal the outer cover and outer chamber, no ionization current in the measuring chamber and, thus, resulting in the same condition as fire, in this case, the control panel sounds an alarm. With these protection features, it is less likely that theft or tampering of the detector to will be encountered.

3.0 Radioactive Source Assembly

The radioactive source employed in each model is exactly the same. It is a sliver foil covered with a gold-palladium alloy and held between the anode plate and the RI-holder which are made of stainless steel and are fixed together by spot welding.

The anode plate supported by the anode supporter is covered with the outer chamber. All of these parts are covered with the outer cover. The anode supporter, the gate supporter and the outer chamber are fixed on the shield case. The outer cover and shield cased are fixed on the body. The gate plate, the outer chamber and the shield case are made of stainless steel, while the outer cover and the base are made of UL-Listed polycarbonate, "Mulltilon" classified as a self-extinguishing group 0. Moreover the anode supporter and the gate supporter are made of the UL-Listed Polycarbonate classified as a self-extinguishing group 0. As explained above the radioactive source is covered with threefold covers made of strong material which withstand against strong mechanical stress and high temperature and so located in the inner-most part of the detector, thus, providing extremely high safety features.

SECTION II

1.0 General

1-1 All models of detector are equipped with one piece of Americium-241 sealed foil radioactive source.

This radioactive foil is manufactured by R.C.C. in England, and is sent to Japan Isotope Association where the foil is cut into the appropriate sizes needed for use in the detectors in question prior to shipment to Nittan Company, Ltd,. Each piece of foil is washed clean with water and is subject to a wipe test to assure its leakage does not exceed the standard level (0.005μ Ci). The dose is measured. The manufacturing process is shown in the attached Technical Date #1.

Manufacturing Process

The radionucleoide, amrecium oxide, is uniformly distributed and sintered in a matrix of pure fine gold at temperatures in excess of 800 deg. C. It is further contained between a backing of pure fine silver and front covering of gold palladium alloy (94% gold and 6% palladium) by hot forging. The metal layers now continuously welded together are extended by mean of a power rolling mill to give the required active and overall foil areas.

1-1-1 Type and Quantity of By-product Material

By-product Material	:	Am-241
Activity	:	Typical 0.7μCi, Max. 0.91uCi
Base Material	:	Silver
Active Layer	:	AmO + Fine Gold
Face Covering	:	Gold Palladium Alloy
Total Thickness	:	0.15mm - 0.20mm
Code Number	:	AMMQ-423

1-1-2 Chemical and Physical Form

The radioactive source Am241-used in each of the model is an oxide (AmO2), is insoluable in water and stable to chemicals. This radioactive source is a sealed source sandwiched between two layers of pure fine silver and gold palladium alloy. This sealing method is considered to be the most effective and safest means of capsule-enclosing for obtaining a-particles, and neither physical nor chemical change ever occur during its time of use.

1-1-3 Solubility in Water and Body Fluids

a. Solubility in Water

Three pieces of 312.5μCi Am-241 foils having the same structures as the actual radioactive foil used in the detectors in question show activity leaching-out activity of max. 0.00045% (14.0×10^{-4} μCi) after five hours immersion in water at room temperature with 760mm Hg atmospheric pressure amounts to max. 0.00031% (9.6×10^{-4} μCi). Since the used dosage in each of detector is max. 0.91μCi, its leaching-out amount will be max. 4.1 PCi. This amount can be negligible. (See the attached Technical Data #1, Immersion test (b) and (c)).

b. Solubility in Body Fluids

The radioactive foil Am-241 1.1 μCi with the same structure as the foil used in each detector were immersed in N/10 hydrochloric solution for 4 hours at 98 deg F. In all tests less than 0.37%(4×10^{-3} μCi) of Am-241 was extracted. N/10 hydrocholic acid solution was selected for this test to closely simulate acid body fluids. (Test by Japan Isotope Association).

2.0 External Radiation Level

2-1 The external radiation level was measured with gamma ray at distance of 5cm and 25cm from the surface one detector, Model NID-58. The external gama radiation level was found to be extremely low and almost identical quantities in the back-ground.

Taking the ratio of dosage into account, the amount of external gama radiation of one detector was calculated as follows:

In the case of 5cm distance from the detector surface: 0.701 μrem/hr.

For distance of 25cm from the detector surface: 0.0025 μrem/hr.

2-2 The alpha particles of the foil are absorbed by the gold palladium of the front cover of the foil as well as by air, therefore, the distance the particles reach is about 5cm in the atmospheric air. Accordingly, no alpha particles can be detected at the distance of 5cm or 25cm from the surface of the detector.

3.0 Degree of Access of the Product to Human Being to the Product During Use

3-1 Possible access of human being to the radioactive foil of the detector is restricted only to cases when the detector is mechanically destroyed and radioactive foil is exposed. It is not likely for this to happen to ordinary people because the detector is handled and maintained for industrial and commercial buildings exclusively by professional experts.

As such, there exists no chance to come in contact with the foil directly. Although a person may intentionally have an access to the detector if he wishes, direct access to the detector, as described in the preceding paragraph, cannot be made because of its structural features. These feature are as follows:

a. The main portion of the outer surface of the detector is made of modified Polycarbonate plastic of high impact proof strength.

b. The radioactive foil is covered with three-fold covers:

1. Outer cover made of modified polycarbonate plastic, which can not be removed without special tools.
2. Outer chamber made of stainless steel
3. Gate plate made of stainless steel

3-2 As a rule, the detector is installed an 8 feet high ceiling of the room, which exclude people from reaching it.

3-3 The installation of the detector is made by a well-trained professional installer. First, the detector socket (containing no radioactive material foil) is installed. The wiring from the control panel are connected to the socket. The detector head is plugged into the detector socket during the final stage of installation. Therefore, the time required to install the detector is very short, and there exists no chance for ordinary people to be effected,especially, since the installation is to be done only by a professional installer. Furthermore, any detector found to defective during testing or maintenance or any other time is to be returned to Nittan without disassembling by installer or maintenance personnel.

4.0 Quantities

4-1 Annual quantity of the by-product material to be distributed:

4-1-1 Annual Sales Quantities: 20,000 pcs.

4-1-2 Radiation Activity Per One Detector: 0.9 μCi

4-1-3 Total annual amount of radioactive material: 18.20 mCi.

4-2 Number of units expected to be stocked at the warehouse.

4-2-1 At Nittan Corporation --------- 1,000 pcs.

4-2-2 At an installation site --------- 50 pcs. average.

4-3 Marketing and Sales Method

Marketing and sales of these detectors are to be done only through one or two authorized companies. Nittan Corporation provides a necessary technical assistance and supervision with respect to installation and maintenance.

Therefore, handling of the detector is to be done only by those person who are well trained and are capable of professional installation, thus, any access by ordinary people to the detector during its normal handling and distribution is completely excluded.

5.0 Expected Useful Life of Product

The expected useful life of the detector is about 15 years. The half life of the Am-241 employed in the smoke detector section is 458 years, therefore, any sensitivity change of the foil is expected during this 15 year's of use.

However, it is appropriate to state that the useful life of the detector is 15 years when taking into consideration the probable dust accumulation on the smoke entering slits which may affect the performance of the detector.

SECTION III

1.0 Prototype test method

1-1 The surface of the DETECTOR is wiped by a filter paper and the alpha-ray quantity, which sticks to the paper filter, is measured by a gas flow counter.

1-2 Endurance test of the DETECTOR

1-2-1 In order to ascertain its safety when exposed to high temperatures, the DETECTOR is put in the thermostatic chamber at 50 deg C with normal moisture for 30 days.

1-2-2 SO2 gas is selected as an intensive corrosive gas in the air, and in order to ascertain the Detectors safety and corrosive resistance, the DETECTOR is subjected to the gas corrosion test under the atmospheric condition of 45 deg C, and about 100% relative humidity. The corrosive gas is produced in the following way: 500ml of thiosulfuric acid soda having density 40g/l is put into a 5-liter decicator and then 10ml of 0.156N sulfuric acid is poured into it twice a day so that SO2 gas is produced. The DETECTOR is exposed to this SO2 gas for 4 days.

1-2-3 In order to ascertain safety against impact, an impact force of 50g is imposed on the installed DETECTOR continuously 5 times.

1-2-4 In order to ascertain safety against vibration, a vibration of 1,000 cycles/mim. with a total amplitude of 4mm is applied for one hour.

Before and after each test above (1-2-1 through 1-2-4) wipe test such as outlined in 1-1 is conducted.

1-3-1 Various kinds of test were conducted on each foil, having the same shape and construction (each activity is 312.5uCi), at R.C.C. in England. The test results are reported in the attached technical data #1, which comprises the following items.

1. Wipe test
2. Heat test at (a) 760 deg C and (b) 815 deg C
3. Immersion test
   - (a) Wipe test
   - (b) Water leaching as measured through the immersion test in water at room temperature for 5 hours long.
   - (c) Water leaching test in boiling water for one hour.
   - (d)+(e) Measurement of leaching out in case of methyl- ketone, acetone, trichloroethane and etc.
4. (a) Impact test
   (b) Drop test

1-3-2 In order to ascertain the validity of safety features under worst conditions of 160μCi foil with same shape and construction various tests were conducted at R.C.C. as shown in the attached Technical Data #2, comprised the following:

Corrosion testing

Samples of foils were exposed to various corrosive gases, to which the DETECTOR will probably be exposed to it when installed in building such as factories.

1. SO2 test
2. HCl test
3. Ammonia test

Heating tests in consideration of fire

1. Heat test at 800 deg C for 10 min.
2. Heat test at 1200 deg C for 1 hour.

2.0 Prototype test results

2-1 The wipe test result of the DETECTOR surface showed the same figure as that of background.

2-2 The wipe test result of the DETECTOR before and after the endurance test showed the same figure as that of background.

2-3-1 1) The wipe test result showed 1.42×10^{-4} μCi maximum, which correspond to 0.000045% and can be considered as 0%.

2) The heat test resulted in almost same amount of leaching amount as in 2-3-1.

3) The immersion test results showed a maximum leaching of 0.00045%. For solvents such as acetone, the leaching amount was found to be about 0.001%.

4) The impact as well as drop tests showed only 0.000029% leaching, which can be considered as zero.

2-3-2 The heat tests, which were set up for worst condition in the case of fire, showed leakage of 0.1%. Applying this figure to 0.7μCi foil, we get 7×10^{-4} μCi.

3.0 Quality Control Procedure

3-1 Tests of Am-241 foils.

3-1-1 The production control tests of the foil conducted at the manufacturer R.C.C.

(a) Visual inspection.

All production is inspected visually for surface damage of the active area. Careful inspection with a low power microscope is carried out on samples from each production run.

(b) An autoradiography examination is carried out on all production foils by placing them in contact with single weight bromide paper for a predetermined time before exposed film is developed and fixed. Distribution of activity and dimensions are carefully examined.

(c) Dust sampling using a continuous airflow sample is performed in the vicinity of the manufacturing equipment during all production. Foil storage areas are similarly monitored.

(d) Five samples of 2.5cm length are taken from each 50cm production batch and subjected to the tests described in the attached Technical Data #1, namely (1) Wipe test, (2) Heat and thermal shock test and (3) Immersion test to ensure uniform integrity of product.

3-1-2 Next, the source foils are cut by the Japan Isotope Association to the appropriate activity for use with the detectors and are cleaned with water. Then, after making it sure that the leaching amount does not exceed the limit of 0.005uCi by wipe test, the activity is measured.

3-1-3 Only the those foils, which have passed the above-mentioned tests at R.C.C. and the Japan Isotope Association, and whose sealing has moreover been proved sufficient, are supplied to Nittan Company, Ltd.

3-2 Nittan Company, Limited conducts the following tests to the Am-241 foils, which are already clamped on the anode plate of the DETECTOR by the RI-holder.

3-2-1 All of the AM-241 foils are examined visually to ascertain whether there exists any defect or stain on their surface. (100% inspection)

3-2-2 The wipe test is conducted by wiping Am-241 foil with filter paper and examing for any leaching. The standard allowable amount found through the wipe test is set up for maximum 0.005 μCi.

This wipe test is conducted based on the statistical sampling plan as per the item 3-2-3. The measuring apparatus is a 2r proportional counter consisting of a scaler (Model TDC5: Japan Radio Corp.) and a radioactive ray detector (Model FC-IE. Japan Radio Corp.).

3-2-3

Lot Size	Sample Size	Number of defective pieces allowed in sample
500 - 624	7	0
625 - 799	8	0
800 - 999	10	0
1000 - 1249	11	0
1250 - 1574	13	0
1575 - 1999	15	0
2000 - 2499	17	0
2500 - 3000	20	0

Nittan receives, are lots of 500 - 3,000 at a time, for which the severe test standard of JIS Z9015, namely AQL=0.4, is applied. From each lot, according to 3-2-3 list, the required number of samples are extracted randomly and these samples are tested in compliance with the standard.

If no samples are rejected among those samples tasted, products belonging to the same lot number are accepted.

If even one piece in the tested samples is found as defective, all products with the same lot number are not to be accepted, and every piece of foil in the same lot is to be individually tested on the same standard.

The foils which are accepted are used in DETECTORs, while the defective ones are not used and are disposed of in the proper way. This test method can eliminate the probability that a defective foil would be used in the DETECTOR.

3-3 The Americium-241 foil is crimped on the anode plate by the RI-holder which is fixed to the anode plate by spot-welding. (Please refer to the Fig. 2 of SECTION V). Since the strength of the spot-welding is greater than the pull force of the RI-holder, the foil, RI-holder and the anode plate are considered to be one rigid body.

The anode plate has the dimension of 12mm diameter, 1.5mm of thickness and its screw part is 4mm diameter and 5.7mm length. This anode plate is firmly screwed to the center pole by special tool and is tied together with the shield case through the anode supporter. Even if the anode plate should be removed from the center pole, it will not come out from the opening of intermediate electrode (gate plate), but remains inside of the reference chamber (inner ionization chamber).

3-4 All finished products are subjected to a 100% of visual inspection to ascertain the proper clamping of the foil to the anode plate. Even if this total check fails to find a defect, the next inspection covers every detector, as described under item 3-5 (inspection of the finished detector) will back it up.

For an example, if the foil were to be removed from the anode plate (this does not happen in actuality), this defect could be easily found through DETECTOR operation tests, because without the foil the DETECTOR will not operate (in the smoke operation test of 3-5-2 and electrical sensitivity test of 3-5-3). Before shipment every DETECTOR is individually inspected in steps of three 3 stages:

* Visual inspection of source foil
* Inspection through operation in the smoke test
*Inspection of electrical sensitivity operation

Thus, any defect, such as loosening of the source foils, is completely eliminated.

3-5 The final inspection is done to every DETECTOR.

3-5-1 Visual test:

To check if the DETECTOR is assembled in the proper way.

3-5-2 Smoke operation test:

To determine whether the DETECTOR responds properly to the smoke concentration of a predetermined density.

3-5-3 Electrical sensitivity test:

To ascertain the test of 3-5-2 electrically.

3-5-4 Temperature and Humidity cycle test:

To ascertain the stability of the DETECTOR.

Through this final inspection, it is confirmed that the assembly as per SECTION II has been executed properly and only the DETECTORs which have passed this final inspection are to be shipped as final products.

SECTION IV ESTIMATION OF RADIATION DOSE AND DOSE COMMITMENT

1.0 Explanation and reason of the does commitment compliance to 32:27a of the NRC regulations.

1-1 Normal Use

The gamma radiation dose of the detector is less than 0.025μrem/hr at the 25cm distance from the surface of the detector as shown in SECTION III. For effective detection of any fire breakout, one unit of detector is usually installed on a ceiling surface, each unit covering 100 square meters. Since the height of a ceiling is generally considered to be 8 feet (2.4m), it is impossible for an ordinary person occupying the room to reach the detector under ordinary daily circumstance.

Assuming that the occupant carry out his daily life for a period of one year at 25cm from the surface of the detector, he would likely receive an external radiation dose of only 2.2 (mrem/year) according to the following calculation:

$$0.025(\mu rem/hr) \times 24(hr/day) \times 365(day/year) = 0.22(mrem/year)$$

Furthermore, assuming that the occupant living directly under the detector and the distance between the detector and the occupant is to be 1 meter, then he would likely to receive an external radiation dose of 1.57×10^{-3} (urem/hr) according to the following calculation:

$$0.025(\mu rem/hr) \times \left(\frac{25cm}{100cm}\right)^2 = 1.57 \times 10^{-3} \ (\mu rem)$$

Assuming he would remain in this position for a period of 50 weeks, 8 hrs/day and 5 days/week, then he would likely receive an external radiation dose of only 3.14urem/year which is calculated as follows:

$$1.57 \times 10^{-3}(\mu rem/hr) \times 8(hrs/day) \times 5(days/wk) \times 50 = 3.14(\mu rem/yr)$$

From the above, under normal condition of use, it is impossible for anyone to receive an external dose of 5 mrem/year. Accordingly, the dose commitment of the detector satisfies to column I of §32-28.

1-2 Normal Disposal

The maintenance of the detectors is carried out by well trained professional installers who are strictly instructed to return any defective detectors to Nittan Corp., and this is also indicated on the labels of the detector. Nittan Corp. conducts necessary periodical training professional installers who are to be engaged in installation and maintenance in conjunction with authorized companies.

1-3 Normal Handling

It is reasonable to assume that the most of the normal handling of the detector is done during installation of the unit. The heads and the sockets are packaged separately. The most time consuming task during the installation is the mounting of the socket to the ceiling which requires two screws and wiring connection with control panel. After these tasks, the head can be mounted on the socket by simply twisting it clock-wise. The time required to install the detector head is considered to be less than one minute per detector.

Since the radioactive foil employed in the detector is located 30mm inward from the surface the detector, the external radiation dose at 25cm from the surface is found to be 2.18 μrem/hr according to the following calculation:

$$\left(\frac{28}{3}\right)^2 \times 0.025\ \mu\text{rem/hr} = 2.18\ \mu\text{rem/hr}$$

Assuming that a maximum of 20 detectors are to be installed at a construction site, the time required to install these detectors will be 4 days and the number of installation jobs be 50 a year, then the external radiation dose is found to be 36.4urem/year according to the following calculation:

$$\frac{2.18\ \mu\text{rem/hr}}{60\ \text{min/hr}} \times 1\ (\text{min/pc}) \times 20\ (\text{pcs/job site}) \times 50\ (\text{jobs/year}) = 36.4\ \mu\text{rem/year}$$

This satisfies the value stipulated in the column I of §32-28.

1-4 Estimate of External Radiation Dose During Maintenance

To ensure a proper operation of a fire alarm system, routine periodical maintenance is required by professionally trained maintenance personnel. Principally the following are required:

a. Routine Check
b. Operation test
c. Functional test

a) The routine check shall be a visual inspection of the outer appearance of the detector installed on a ceiling. The primary purpose of this inspection is to find any apparent damage and dust accumulation which may affect smoke entrance into the detector. The external dose to the maintenance personal is found to be 0.78urem/yr as calculated below.

We have assumed that the time required to complete a routine check to be 5 minutes, the distance from the detector during this check to be 1 meter directly under the detectors and the number of the detector to be inspected by this person to be 6,000 pcs per year.

$$\left(\frac{25}{100}\right)^2 \times 0.025\ (\mu rem/hr) \times \frac{5}{60}\ (hr)$$

$$\times 6000\ (pcs/yr) = 0.78\ \mu rem/year$$

b) The operational test shall be made at least every three months. In this test, each detector shall be tested with actual smoke using the Nittan Smoke Tester which consists of smoke generator and an extension rod to reach the detector installed on ceiling. During this test, each detector must confirm its operation within 1 minute of introduction of smoke to the detector.

The external radiation which maintenance personnel would likely receive during this test is found to be 0.117μrem/yr with the following assumption and calculation. It is assumed that the time required to complete one operational test to be one and one-half minutes, the person engaged in testing is directly 1 meter below the detector and the number of detectors to be tested by this person in one year is 3,000 pcs.

$$\left(\frac{25}{100}\right)^2 \times 0.025\ (\mu rem/hr) \times \frac{1.5}{60}\ (hr)$$

$$\times 3000\ (pcs/yr) = 0.117\ \mu rem/year$$

c) The functional test shall be made at least every 6 months. The purpose of this test is to measure the sensitivity of the detector using The Nittan Delta V Tester. The tester is a monitoring device and has the capability of electrically sending gradual smoke buildup similar to that of an actual fire breakout electrically to smoke detector. The sensitivity of detector can be measured by simply plugging the detector into the socket on the tester and, pressing the test button. It only takes one minute.

During the functional test, it should be confirmed that the measurement taken during this test be within the ranges indicated on the label. If the measurement is not within the specified ranges on the label, the unit should be returned to Nittan Corporation without disassembly.

The external radiation dose which the maintenace person would likely to receive during this functional test is found to be 182 μrem/yr according to the following assumption and calculation.

It is assumed that the handling time required to complete one functional test be 5 minutes, the external radiation dose on the surface of the detector be 2.18 urem/hr from 1.3 of SECTION V and the number of the detectors to be handled in year by this person be 1,000 in total.

2.18 (μrem/hr) x 5 (hr/pc) x 1,000 (pcs/yr) = 182 μrem/yr

From the above, it is concluded that the total external radiation dose which the person would likely receive as a result of performing jobs of a), b), and c) amounts to 183μrem/yr. Therefore, the person for maintenance never receives 5 mrem/yr of the external radiation dose. This satisfies the value in the column I of §32:28.

1-5 Warehouse Storage

The external radiation dose from the detector presumably accumulated at one location during distribution is found to be less than 5mrem per year even under the extremely worst assumed condition according to the following calculation, the value of which satisfies that of table 1 of 32-28.

Five detectors are packed into a cardboard box. The dimension of this this box is 100mm x 130mm x 565mm. Ten of cardboard boxes packed into a large shipping box having dimensions of 280mm x 520mm x 580mm.

The external radiation dose on the surfaces of the cardbord box containing 50 detectors was measured using Low Energy Gamma Ray Survey Meter (Model ICS-501, Arrow Co., Ltd.). The measurements showed that only the bottom surface of the box registered 1 urem/hr activity.

Based on this measurement, we calculated the activities of 1,000 pcs, which is most like to be accumulated at the warehouse of Nittan Corp. at any one time. 20 boxes each containing 50 units are to stacked up as 2 boxes in direction of width, 5 boxes in direction of length, and 2 boxes in direction of height. For a calculation of the maximum external radiation dose for this storage arrangement, we assumed that the external radiation dose will be concentrated at the center of the bottom suface of the pile. The maximum external radiation does is found to be 1.8 μrem/hr according to the following calcuation:

$$\frac{5^2}{52^2} \times 1\ \mu\text{rem/hr} \times (1000/5) = 1.8\ \mu\text{rem/hr}$$

The maximum external radiation dose for a person, who is engaged in working in this warehouse 8 hours a day, 5 days a week, and 50 weeks a year, is found to be 3.12 mrem/yr according to the following calculation.

1.8 (μrem/hr) x 50 (weeks/yr) x 5 (days/week)
x 8 (hours/day) = 3.6 mrem/yr

This value satisfies Column I of §32:28.

Since it is not likely that the person is to remain on the surface of the shipping boxes at all time during his working hours, the actual external radiation dose the person likely receives is less than 3.0 mrem/year.

2.0 Internal Radiation Dose Commitment Under Normal Condition

Internal radiation dose commitment is cause either by taking the radioactive foil through mouth or inhaling it.

2-1 Orally

Taking the foil into human body orally may happen only when the outer chamber is taken off, the gate plate is removed and moreover 2 spot-welding parts of RI-holder are destroyed. Only after this may the foil be removed and brought to the mouth. Such a series of phenomena never takes place.

2-2 Inhalation

The internal radiation dose commitment through inhalation can be considered in case of the fire, and during the handling process of detectors or under installed conditions it is absolutely impossible.

3.0 External Radiation Dose Commitment Under Severe Condition

3-1 Direct External Radiation Dose from Foil

As described in 2-1, this never happens in actuallity. However, assuming the foil would be removed by an accident and people would approach it, then the external dose integrated in 50 years is found to be 13.3 mrem/50 years which is very small and are safe in comparison with that of the value specified in Column II of §32:28 as indicated in the calculation below.

We make an assumption that a person be exposed continuously for 50 years at distance of 28cm from the foil. Since the foil is located about 30mm inward from the surface of the detector, the external radiation dose at the 28cm distance from the foil can be calculated below by taking into consideration the doseage in the case of 25cm distance from the detector surface.

$$\left(\frac{28}{25}\right)^2 \times 0.025 \text{ (urem/hr)} = 0.314 \text{ urem/hr}$$

Accordingly, the external dose of 50 years will be:

$$0.314 \text{ (urem/hr)} \times 24 \text{ (hr/day)} \times 365 \text{ (days/year)} \times \int_0^{50} e^{-\frac{0.693}{138}t} dt = 13.3 \text{ mrem/50 years}$$

4.0 Internal Dose Commitment Under Severe Condition

4-1 Internal Dose Commitment by Inhalation in Case of Fire

4-1-1 Warehouse Fire

The worst case of the dose commitment, we will consider would be if a fire break out a warehouse where 1,000 units of the detectors were stocked. According to the attached technical data #2, 0.1% of the leakage of radioactive foil was detected in the heating test assuming fire conditions. This total quantity can be assumed to be particle which may be possibly inhaled.

To calculate internal dose commitment of a person who remains in a fire condition for 5 minutes, it is assumed that the air volume of a standard whorehouse is 200,000 ft^3 (5.6×10^3 cc) with no air exchange taking place. We calculated the internal dose amount which an occupant would receive in 5 minutes at time of fire as follow.

According to the recommendation of ICRP " Report of Committee II on Allowable Dose Amount of Radioactive Radiation in Human Body(1959), the most critical organ for inhalation of insoluble radioactive dust particles can be considered to the be lung and the rate fa, at which the inhaled particles reach the critical organ, is $0.12.10^4$ cc/8hrs according to the same ICRP report. Therefore, in 5 minutes the person would inhale 1.05×10^3 cc of air as calculated below:

$$\frac{10^4}{8 \text{ hr}} \text{ cc} \times \frac{5}{60} \text{ hr} = 1.05 \times 10^3$$

In case of storing 1,000 units of detectors each with radioactive material of 0.7μCi on an average, the following calculation is made:

$$\text{Dose} = \frac{(0.7 \times 1000)\ \mu\text{Ci} \times (1 \times 10^{-3})}{(5.6 \times 10^{3})\ \text{cc}} \times (1.05 \times 10^{5})\ \text{cc}$$

$$\times\ 0.12 \times \frac{2.2 \times 10^{6}\ \text{dis}}{\text{min} - \mu\text{Ci}} \cdot \frac{5.7\ \text{MeV}}{\text{dis}}$$

$$\times \frac{(1.6 \times 10^{-6})\ \text{ergs}}{1000\ \text{g}}\ \text{MeV}\ \ \frac{\text{g.Rad}}{10^{2}\ \text{ergs}} \cdot \frac{10\ \text{rem}}{\text{Rad}}$$

(Weight of Lung)

$$\times \frac{(5.26 \times 10^{5})\ \text{min}}{\text{years}} \times \int_{0}^{50} e^{-\frac{0.693}{138} t^{5}}\, dt$$

$$= 0.08\ \text{rem/50 years}$$

The situation just described above nerve actually takes place : however, even in such a case, the dose commitment satisfies the value specified in Column II of §32:28.

4-1-2 Building fire in which the detector are installed.

Assuming that the ceiling height of a standard size building be 8 ft. (2.4m), one unit covers 100m² of floor area, considering that there is no air exchange and a person remain in the fire for 5 minutes, then the dose commitment integrated 50 years would be 2.5 rem/50 years as shown in the calculation below:

$$\text{Dose} = \frac{(0.91\mu\text{Ci})\ \ (1 \times 10^{-3})}{(100 \times 10^{4} \times 2.4 \times 10^{3})\text{cc}} (0.05 \times 10^{5})\text{cc}$$

$$\times\ 0.12 \times \frac{2.2 \times 10^{6}\ \text{dis}}{\text{min} - \mu\text{Ci}} \cdot \frac{(5.7)\text{MeV}}{\text{dis}} \cdot \frac{1}{(1000)\text{g}}$$

$$\times \frac{(1.6 \times 10^{-6})\ \text{ergs}}{\text{MeV}} \cdot \frac{\text{g.Rad}}{10^{2}\ \text{ergs}} \cdot \frac{10\ \text{rem}}{\text{Rad}}$$

$$\times \frac{(5.26 \times 10^{5})\ \text{min}}{\text{years}} \times \int_{0}^{50} e^{-\frac{0.693}{138} t}\, dt$$

$$= 2.5\ \text{rem/50 years}$$

Therefore, the value satisfies the that of value of Column II of §32:28.

4-2 Internal dose commitment due to taking foil into human body in sworst case of scenario worst accident.

As already mentioned, the installation of the detectors is carried out by only well-trained professional installers. Therefore, the detectors can not be easily destroyed or disassembled so that radioactive foil could be swalled.

Under normal conditions of use, one may attempt to gain direct access to the radioactive foil by removing the detector head from the socket with intention of destroying or tampering with it. However, the detectors are monitored by a control panel so that any removal of the detector head send a trouble signal to the control panel. In this case, the control panel will send out a trouble signal by means of audible or visual alarms throughout the building.

This enables a supervisor of the building to prevent any theft or tempering of the detectors. It is a preventive measure. Furthermore, in case of removal of the outer chamber located inside of the outer cover, the detector must be remove from the socket which result in a reaction similar to that stated above.

As such, it is almost impossible for anyone to swallow the foil of the detectors that have such preventive measures.

Nevertheless, we assumed that some one swalled the foil and calculated the resulting dose commitment exposed in 50 years to be 11 mrem/50 yrs which is negligible low in comparison with the value specified in the Column II of §32:28.

The maximum activity of the radiation foil in the detector is 0.91 μCi/pc. The foil swalled trough mouth leaks into the gastric juice in the stomach. This leak can be considered as leak amount to N/10 HCL liquid according to SECTION III, and it is 0.37%. We assume all of the leaked radioactive material would be dissolved into body fluids. According to the above-mentioned ICRP report, the rate of transferring from intestine to blood is 10^{-1}.

Furthermore, according to the said ICRP data the rate f2 between the deposit amount in bones and the amount deposited in the whole body is 0.9.

Under these conditions, the internal dose commitment for bones for 50 years is calculated as below.

$$\text{Dose} = (0.91)\mu\text{Ci} \times 0.37 \times 10^{-2} \times 10^{-4} \times 0.9$$

$$\times \frac{(2.2 \times 10^{6})\text{dis}}{\text{min}} \times \frac{28.3\text{MeV}}{\mu\text{Ci}} \times \frac{1}{\text{dis}} \times \frac{1}{7000\text{g}}$$

(Weight of Bone)

$$\times \frac{(1.6 \times 10^{-6})\text{erg}}{\text{MeV}} \times \frac{\text{g.Rad}}{10\ \text{ergs}} \cdot \frac{10\text{rem}}{\text{Rad}}$$

$$\times \frac{(1.6 \times 10^{-6})\ \text{ergs}}{\text{MeV}} \times \frac{\text{g.Rad}}{10^{2}\ \text{ergs}} \cdot \frac{10\ \text{rem}}{\text{Rad}}$$

$$\times \frac{(5.26 \times 10^{5})\ \text{min}}{\text{years}} \times \int_{0}^{50} e^{-\frac{0.693}{138}t}\, dt$$

$$= 11.0\ \text{rem/50 years}$$

4-3 Those value calculated in 4-1 and 4-2 are figures on the assumption of such accidents which never happen in actuality.

Even under those severe conditions, the values do not exceed those values specified in Column II of §32:28. Namely the radioactive foil and its application method in the detector is completely safe and reliable.

SECTION V DRAWINGS AND TECHNICAL DATA

This section contains the followings:

Fig. 1	Construction of Assembled Detector
Fig. 2	RI Foil Assembly Drawing
Fig. 3A	Label Drawing: NID-58
Fig. 3B	Label Drawing: NID-68AS
Fig. 3C	Label Drawing: NID-68AS-1
Fig. 3D	Caution Label
Fig. 4	RI Foil Construction

Technical Data 1, 2 (RI Test Data)

OIB2 (P/N: PU90-2000-1 & PU90-41000-1)

TABLE OF CONTENTS

SECTION I

1.0 Description

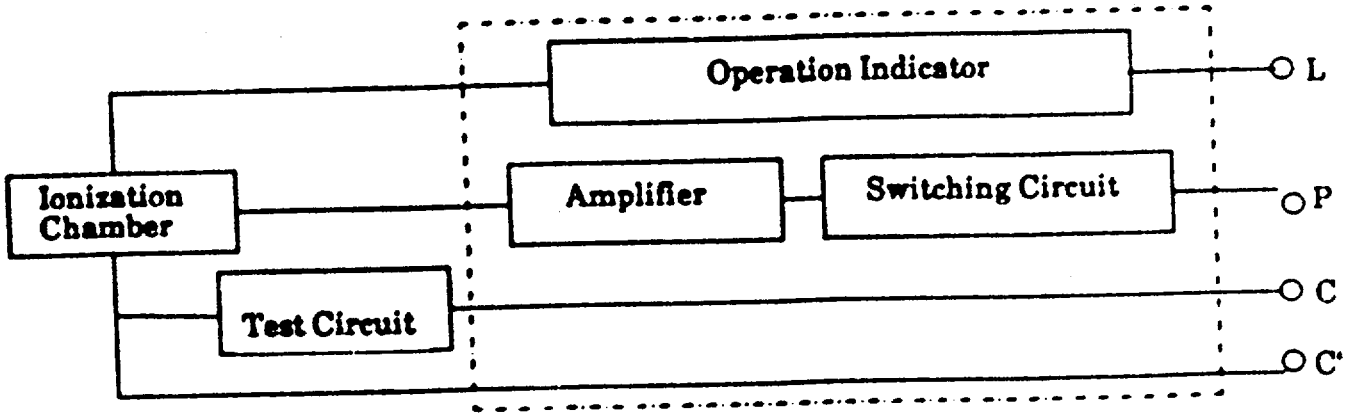
The Ionization Combustion Detector, Model 01B2 detects product of combustion in an early stage of fire and sends a fire signal to the control panel which gives a fire alarm by operation alarm sounders and visible indicators.

1.1 General Structure of the Detector

The detector consists of a detector head and a socket as a complete unit. The detector head consists of some major parts, namely an outer cover, ionization chamber parts including a radioactive source, a printed circuit board with all electric parts and a body. The Outer Cover and the Body which cover all internal parts are made of the polycarbonate plastic which is UL-listed as flame resistant grade, 94 v-o.
The socket made of polycarbonate plastic has external terminals to be connected to a control panel.

1.2 Structure Details

The schematic diagram of the detector is shown as below.



Signal Disposition Circuit

1-2-1 Ionization Chamber

As shown in the assembly drawing fig.1 of section II, three electrodes (the Outer Chamber, the Gate Plate and the Anode Plate)make a formation of two ionization chambers(the Reference Chamber and the Measuring Chamber), which are ionized in common by one piece of the radioactive source(Am-241, 0.7μCi) fixed on the Anode Plate.

which is fixed directly on the center of the Body. The Gate Plate is supported by the supporter made from high insulation resin "Polycarbonate" which is fixed on the Body. The Outer Chamber is directly fixed on the Shield plate by tapping screw. Combustion product entering these chambers reduces the ionization current and changes the voltage across the measuring chamber by the change of impedance balance between both chambers. This voltage change correlated to the density of the combusiton product sent to the Signal Desposition Circuit as a smoke signal. Several openings are provided in the Outer Chamber for the smoke entrance and the Outer Cover having many slits serves as a mechanical buffer to eliminate influence of wind. Furthermore the stainless steel mesh provided between the Outer Cover and the Outer Chamber protects insect and dust which may cause a fault operation of the detector. This mesh works also as a protector against a static electricity and electric noises generated by external devices.

1-2-2 Signal Disposition Circuit

The smoke signal from the ionization chambers is amplified in the Amplifier, and when the density of the combustion product reaches the predetermined level, the Switching Circuit is triggered and the Operation Indicator is lit. A fire signal is given through the terminal P. The Voltage between the external terminals L and C is kept to operational voltage range.

2.0 Intended Use

This detector is used in a fire alarm system by combination with a control panel or as one part of self combined alarm device which contains sounder and signal transmitter.

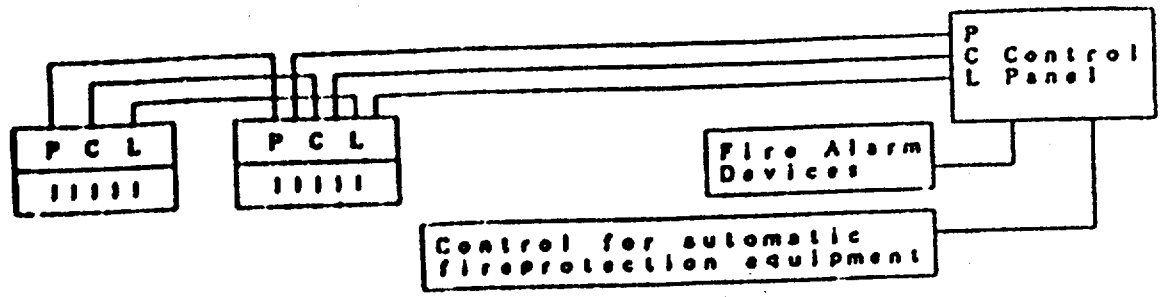


Fig A

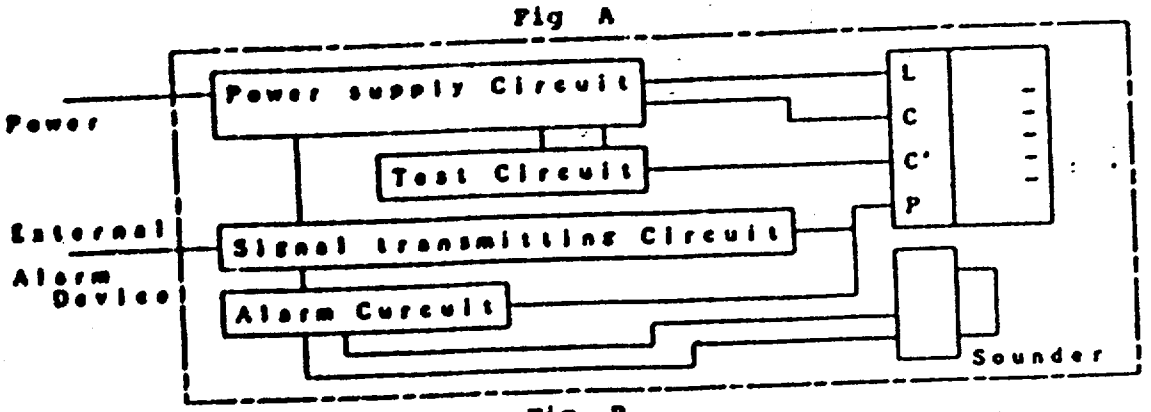


Fig B

Fig A shows fire alarm and control system using this detector. The power from the control panel is supplied to the detector through L and C lines, and the line P is used as a signal line by forming a closed circuit with the line C when the detector is operated. Fig B shows an example of the circuit diagram for self combined alarm device.

2-1 condition of Use

2-1-1 Under normal condition

When the necessary electric power for a normal operation of the detector is supplied from the control panel or the power supply circuit in Fig B and no combustion product exists in the ionization chambers, only very small quiescent current of the detector flows through the detector lines. Under this condition the control panel or the self combined alarm device indicates "Normal Condition".

2-1-2 Under fire condition

When combustion product enters into the ionization chambers of the detector, the signal voltage(smoke signal)corresponding to the density of the smoke is given to the

amplifying circuit. When this voltage exceeds the threshold value, the amplified signal is transfered to the switching Circuit which turns to "ON" condition. The operation indicator in the detector is lit by the current through the terminal L and C and fire signal is given through a closed circuit between termnal P and C to the control panel or the alarm circuit in the self combined alarm device.

2-2 Protection against tampering and removal of the detector

This detector provides lock-up feature to prevent from any removal caused by vibration and etc. When this detctor is installed with surface mounting adaptor, a special tool is required for removing detector head from its socket.
In the case of attempting to destroy the detector mounted in its socket, that is to say, breaking the Outer Cover and the Outer Chamber, it causes no ionization current in the measuring chamber and results in the same condition as fire, when the control panel gives an alarm.

3.0 Radioactive Source Assembly

The radioactive source Am 241 employed in the detector is a silver based foil with a gold -palladium alloy cover and is held between the Anode plate and the RI-Holder, which made of stainless steel and are fixed together by means of curling.
The Anode Plate is covered with the Gate Plate supported on the Gate Supporter, which is furthermore covered with the Outer Chamber. All of these parts are covered with the Outer Cover. The Anode Plate is directly fixed to the Body. The Gate Supporter is fixed through the Shield Plate to the Body. The Outer Chamber, the Shield Case and the Outer Cover are fixed all together to the Body. The Gate Plate, the Outer Chamber and the shield plate are made of stainless steel, while the Outer Cover, the Gate supporter and the Body are made of UL-listed polycarbonate classified as a self-extinguishing group O. As explained above, the radioactive source is covered with threefold covers made of strong material against mechanical stress and high temperature and is located in the inner-most part of the detector, thus, an extremely high safety feature is provided.

SECTION II

1.0 General

1.1 The model 01B2 detector is equipped with one piece of Americium-241 foil as the radioactive source.

This radioactive foil is manufactured by the Radio-chemical Center(R.C.C.) in England, is sent to Japan Isotope Association where the foil is cut into an appropriate size for the use in the model 01B2 detector. Each cut foil is washed cleanly with water and is subjected to a wipe test to make sure its leakage does not exceed the standard level (0.005μ Ci). The dose is measured. The manufacturing process is shown in the attached technical data 1.

Manufacturing process

The radionuclide, as americium oxide, is contained uniformly distributed and sintered in the matrix of pure fine gold at temeratures in excess of 800°C. It is further contained between a backing of pure fine silver and a front covering of gold palladium alloy (94% gold, 6% palladium) by hot forging. The metal layers now continuously welded are extended in area by means of a power rolling mill to give the required active and overall foil areas.

1-1-1 Type and Quantity of By-product Material

By-product Material	:	Am-241
Activity	:	Typical 0.7μCi, Max. 0.9μCi
Base Metal	:	Silver
Active Layer	:	AmO 2 + Fine Gold
facing Covering	:	Gold Palladium Alloy
Total Thickness	:	0.15mm - 0.20mm
Code No	:	AMMO-423

1-1-2 Chemical and Physical Form

The radioactive source Am-241 used in the model 01B2 is an oxide (AmO2), insoluble in water and stable to chemicals. This radioactive source is a sealed source sandwiched

between two metals of pure fine silver and gold palladium alloy. This sealing method is considered to be the most effective and safest means of capsule enclosing in order to obtain α-particles, and neither physical nor chemical changes ever happen during its time of use.

1-1-3 Solubility in Water and Body Fluids

a. Solubility in Water

Three pieces of 312.5 Ci Am-241 foils having the same structure as the actual radioactive foil used in the model 0IB2 show activity leaking-out of max. 0.00045% (14.0 x 10^{-4} μCi) after five hours immersion in water at room temprature. On the other hand, the activity leakingout after immersing in boiling water for one hour at 760mm Hg amounts to max.

0.00031% (9.6 x 10^{-4} μCi). Since the used dosage in 0IB2 is max. 0.9 μCi its leaking-out amount can be max. 4.1 PCi. This amount can be negligible. (See the attached technical date 1, Immersion test (b) (c) .)

b. solubility in Body Fluids

The radioactive foil Am-241 1.1 μCi of the same structure as the foil employed in 0IB2 were immersed in N/10 hydrochloric and solution for 4hours at 98 F. In all tests less than 0.37% (4 x 10^{-3} μCi) Am-241 extracted. N/10 hydrochloric acid solution was selected for this test to simulate most closely the acid body fluids. (Test at Japan Isotope Association)

2.0 External Radiation Level

2-1 The external radiation level was measured by gammaray at distance of 5cm from the surface of the model 0IB2 detector. The gamma external radiation level was found to be extremely low and actually it amounts to near nearly same quantity as that of the back ground in case of 0IB2 foil. Taking the ratio of dosage into account the gamma external radiation amount of one 0IB2 detector was calculated as follows.

In the case of 5cm distance from the detector surface:

0.245 μ rem/hr.

In the case of 25cm distance from the detector surface:

0.015 μ rem/hr.

2-2 The alpha particles of the foil are absorbed by gold palladium of the fornt cover of the foil as well as by air, therefore, the reaching distance of the particles is about 5cm in the atmospheric air. Accordingly, no alpha particle can be detected at the distance of 5cm or 25cm from the detector surface of 01B2.

3.0 Degree of Access of Human Beings to the Product During use

3-1 Possible access of human beings to the radioactive foil of 01B2 is restricted only when the detector is mechanically destroyed and the radioactive foil is exposed. Such a case is not likely to happen for oridnary people because the detector is handled, installed and maintained exclusively by professional experts. Therefore there exists no chance to touch the foil directly. Although a person may have an access to the detector intentionally if he wishes, a direct access to the foil, as described in the preceeding paragraph, is very hard because of its structural features. These features are as follows:

a The main portion of the outer surface of the detector is made of modified Polycarbonate plastics of high impact proof strength.

b The radioactive foil is covered with threefold covers:
   1 Outer Cover made of modified Polycarbonate plastics, which can not be removed without special tool.
   2 Outer Chamber made of Stainless steel
   3 Gate Plate made of Stainless steel

c The detecter can not be removed from its socket without special tool.

3-2 The installation of the detector is made by a well-trained professional installer. At the first step, the detector socket(containing no radioactive foil)is installed in connection with the detector lines coming from the control planel, and then, the detector head is put and locked in the detector socket.
Therefore, the time required to install the detector is verty short, and there exists no chance of affecting ordinary people at all, since the installation is to be done only by a professional installer.
Furthermore, any defective detector found during the test or maintenance or anything else is to be returned to the manufacturer without disassembling by installers or maintenance people.

4.0 Quantities

4-1 Annual quantity of the detector containing the by-product material to be distributed:

4-1-1 Annual Sales Quantities; 5,000 pieces

4-1-2 Radiation Activity per One Detector; 0.9μCi max.

4-1-3 Total annual amount of radioactive material, 4.55 mCi

4-2 Number of units expected to be stocked at the warehouse.

4-2-1 At Nittan Corporation ——— Max. 500 pcs.

4-2-2 At an installation site ——5pcs. in average

4-3 Marketing and Sales Method

Marketing and sales of the model 0IB2 are handled by Nittan Corporation who is also responsible to give a full technical supervision with respect to installation as well as to withdraw of any defective units.

Therefore, the handling of the detector is to be done only those persons who are well trained and are capable of professional installation, thus, any access of an ordinary person to the detector during its normal handling and distribution is completely excluded.

5.0 Expected Useful life of product

The expected useful life of the detector product is about 15 years. The half life of the Am-241 employed in the smoke detection section is 458 years, therefore any sensitivity change of the detector due to decreasing of radioactivity of the foil is not expected during 15 year's of use at all.

However, it is appropriate to state that the useful life of the detector is 15 years considering the probable dust accumulation on the smoke entering slits which may affect the performance of the detector.

SECTION III

1.0 Prototype test method

1-1 The surface of the DETECTOR is wiped by filter paper and the ray quantity, which sticks to the paper filter, is measured by the gasflow-counter.

1-2 Endurance test of the DETECTOR.

1-2-1 In order to ascertain its safety when exposed to high temperature, the DETECTOR is put in the thermostatic chamber at 50°C with nomal moisture for 30 days.

1-2-2 So gas is selected as an intensivelv corrosive gas in the air and in order to ascertain its safetv for corrosive resistance the DETECTOR is exposed in the atmospheric condition of 45°C, about 100% moisture. The corrosive gas is produced in the following way: 500 ml of thiosulfuric acid soda having densitv 40g/l is put into a 5L desiccator and then 10 ml of 0.156N sulfuric scid is poured into it twice a dav so that So gas is produced. The DETECTOR is exposed to this So gas for 4 davs.

1-2-3 In order to ascertain safety against impact, an impact force of 50g is imposed on the installed DETECTOR continuouslv 5 times.

1-2-4 In order to ascertain safety against vibration, a vibration of 1,000 cycles/min with 4mm total amplitude is applied for one hour.

Before and after each test of 1-2-1 to 1-2-4 above mentioned a wipe test as in 1-1 is conducted.

1-3-1 Various kinds of test were conducted on each foil, having the same shape and construction (each activity is 312.5 Ci) at R.C.C. in England. The test results are reported in the attached technical dada No.1, which comprises the following items.

1. Wipe test
2. Heat test at (a) 760°C and (b) 815°C
3. Immersion tests
   (a) Wipe test
   (b) Measurement of water leaching by the immersion test in water at room temperature for 5 hours long
   (c) Water leacking test in boiling water for one hour
   (d) and (e) Measurement of leaching out in case of methyl-ethvl-ketone, acetone, trichloroethane etc.
4. (a) Impact test
   (b) Drop test

1-3-2 In order to ascertain the safety features of 160 Ci foil with same shape and construction under the worst conditions various technical data No.2, which comprises the following items.

Corrosion testing

Samples of foils were exposed to various corrosive gases, which the DETECTOR will probably suffer when installed in such building as factory.

1. SO2 test
2. HCl test
3. Ammonia test

Heating tests in consideration of fire

1. Heat test at 800°C for 10 minutes
2. Heat test at 1,200°C for 1 hour

2.0 Prototype test results

2-1 The wipe test result of the DETECTOR surface showed the same figure as that of back ground.

2-2 The wipe test result of the DETECTOR before and after the DETECTOR'S endurance test showed the same figure as that of back ground.

2-3 (1) The wipe test result showed 1.42×10^{-4} μCi at the maximum, which corresponds to 0.000045% and can be considered as 0%

(2) The heat test resulted in the nearly same leaching amount as 2-3 (1)

(3) The immersion test result showed the maximum leaching of 0.00045%. Against solvents souch as acetone the leaching amount of about 0.001% was found.

(4) The impact as well as drop tests showed only 0.000029% leaching, which can be judged as zero.

(5) The heat tests, which were set up under the worst conditions in consideration of fire, showed leakage of 0.1%.
Applying this figure to 0.7 μCi foil, we get 7×10^{-4} μCi.

3.0 Quality Control Procedure

3-1 Tests of Am-241 foils.

3-1-1 At first the foils passed the production control tests conducted at the manufacturer R.C.C

(a) Visual inspection. All production is inspected visually for surface damage in the

active area. Careful inspection with a low power microscope is carried out on samples form each production run.

(b) An autoradiograph is carried out on all production foils by placing them in contact with single weight bromide paper for a predetermined time before exposed film is developed and fixed. Distribution of activity and dimension are carefully examined.

(c) Dust sampling using a continuous airflow sampler is performed in the vicinity of the manufacturing equipment during all production. Foil storage areas are similarly monitored.

(d) Five samples of 2.5cm length are taken from each 50m production batch and subjected to the tests described in the attached technical data No.1, namely 1. Wipe test, 2. Heat and thermal shock test, and 3. Immersion test to ensure uniform integrity of product.

3-1-2 In the next place, the source foils are cut by Japan Isotope Association at the appropriate activity and are cleaned by water. Then, the activity is measured after making it sure that the leaking amount dose not exceed the limit of 0.005μ Ci by wipe test.

3-1-3 Only the source foils, which have passed the above-mentioned tests at R.C.C. and Japan Isotope Association and moreover whose sealing has been proved sufficient, are supplied to the manufacturer of this detector

3-2 Nittan Company, LTD conducts the following tests to the Am-241 foils, which are already fixed on the anode plate of 0IB2 detector.

3-2-1 To examine all of the Am-241 foils visually if there exists any defect or stain on their surface.(To check quantity)

3-2-2 To conduct wipe test by wiping Am-241 foil with filter paper and by examining any leaking. The standard allowable amount be the wipe test is set up at maximum 0.005μCi.

This wipe test is conducted based on the statistical sampling plan as per the item 3-2-3. Measuring apparatus is a 2 proportional counter consisting of a scaler (Model TDCS : Japan Radio Corp.) and a radioactive rays detector (FC-IE : Japan Radio Corp.)

3-2-3

Lot size	Sample size	Number of defective pieces allowed in sample
500- 624	7	0
625- 799	8	0
800- 999	10	0
1,000-1,249	11	0
1,250-1,574	13	0
1,575-1,999	15	0
2,000-2,499	17	0
2,500-3,000	20	0

The lot size, which Nittan Corporation receives, are 500-3,000, for which the severe test standard JIS Z9015, namelv AOL=0.4, is applied. From each lot, according to the 3-2-3 list,the samples of required numbers are extracted and these samples are tested in compliance whith the standard.

If no rejected sample is found in the tested samples, all lot numbers belonging to these samples are acceptable.

If even one piece in the tested samples is found as defected, all lot numbers belonging to these samples are unaccepted, and every piece of foil in the same lot is to be individually tested on the same standard

The foils, which are accepted, are applied to DETECTORS, while the defected ones are not used and are disposed of in the proper way. This test method can eliminate any probability that a defect foil may be applied to the DETECTOR.

3-3 The Americium-241 foil is fixed on the Anode Plate by curing. (Please refer the Fig. 2 in Section V)

The Anode Plate has the dimensions of 12.7mm diamter, 2.0mm thickness and its screw part is 3mm dia. and 4.0mm length. This Anode Plate is firmlv screwed to the center of the Bodv by special tool. Even if the Anode Plate should be removed from the center, it will not come out from the opening of of the intermediate electrode (Gate Plate), but remains inside of the reference chamber (inner ionization chamber).

3-4 All of the finished products are subjected to 100% of visual inspection to ascertain the proper fixing of the foil on the anode plate. Even if this total check would fail to find a defect, the next covering every detector, described under item 3-5 (inspection of the finished detector) can follow up.

For example, even if the foil should removed from the anode plate (this does not happen actually), this defect can be found byDETECTORtests, namely: the DETECTORdoes not operate properly when the tests (items 3-5-2 and 3-5-3: Operation by smoke, and Electrical sensitivity check) are conducted. Accordingly, before shipment, every DETECTORis individually inspected through three stages;

Visual inspection of source foils
Inspection by smoke operation
Inspection of electrical sensitvity

Thus, any defect such as loosening of source foils, is completely eliminated.

3-5 The final inspections are done to every DETECTOR.

3-5-1 Visual test: To check if the DETECTOR is assembled in proper way.

3-5-2 Smoke operation test: To check if the DETECTOR gives a right reaction to the smoke of predetermined density.

3-5-3 Electrical sensitivity test: To ascertain the test of 3-5-2 electrically.

3-5-4 Temperature and moisture cycle test: To ascertain stability of the DETECTOR.

Through this final inspection it is confirmed if the assembley as per Section V has been executed in the right way and the DETECTORS which have passed this final inspection only are to be shipped as final products.

SECTION IV 1.0 Estimation of Radiation Dose and Dose Commitment

Explanation and reason why the dose commitment complies to the articcle 32:27 a of the NRC regulations.

1.1 Normal Use

The gamma radiation dose of the model 0IB2 detector is less than 0.015 μrem/hr at the 25cm distance from the surface of the detector as shown in Section II. Under the following conditions, the estimation of the extermal radiation dose which occupant in Lavatory receives in any one year is as follows.

Conditions ;

1. distance from occupant to ceiling on which the detector installed ; 25cm
2. Occupancy : 5 times/day
3. Occupation time ; 30 minutes/time

The external radiation dose per year is

0.015(μrem/hr) x ½ (hr/time) x 5(times/day)=13.7μrem/year

From the above result, under normal condition of use it is impossible for anybody to receive 5mrem/year of the dose. Accordingly the dose commitment of the detector 01B2 satisfies the column 1 of 32-28

1-2 Normal Disposal

Since the maintenace of the model 01B2 smoke detector is made only by well trained professional installers and they are strictly instructed to return any defective detector, if found, to the address indicated on the labels, every defective detector shall be returned to the sole Distributor, Nittan Corporation, without fail.

Nittan Corporation conducts necessary periodical training to those of professional installers who are to be engaged in installation or maintenance.

1-3 Normal Handling

As stated above, the model 01B2 detector can be separated into two parts of the socket, and the head containing the radioactive source.

In case of the detector's installation the authorized installer connects the detector lines from the controlpanel or the self combined alarm device with the socket, which is fixed on the ceiling by two screws. After fixing the wiring as well as the socket the head is locked in the socket.

The external radiation dose which likely be received by the installer is calculated as below.

The time required to install the detector is considered less than one minute per one detector as the detector head is relatively easily mounted on the detector socket.

The measured value of the radiation dose on the surface of the detecter is 3.5μrem/h.

Therefore, assuming that the maximum 100 detectors be installed in one construction site, and the numbers of the installation jobs be 50 in one year, then the external radiation dose is found to be 291.7μrem/year according to the following calculation.

$$\frac{3.5\ \text{rem/hr}}{60\text{min/hr}} \times 1(\text{min/pcs}) \times 100\ (\text{pcs/job site})$$

$$\times 50(\text{jobs/year}) = 291.7\mu\text{rem/year}.$$

This satisfies the value stipulated in the column I of 32-28.

1-4 Estimate of External Radiation Dose During Maintenance

To ensure proper operation of a fire alarm system employing the model 01B2, in principle the following periodical tests will be made by the authorized maintenance person.

a) operational test
b) Functional test

a)The operational test shall be made at least every three months, In this test, each detector installed on ceilling shall be operated by introducing actual smoke into the detector with the specified Smoke Tester which consists of smoke generation section with the rod attached to reach the detector on ceiling. In this test, then it shall be confirmed if each tested detector shall operate properly with in 1 minute.
The external radiation dose which the maintenance person would likely receive is found to be 0.375μrem/year according to the following calculation. It is assumed that the time required to complete one operational test be one and a half minute, the person engaged in testing stay 25cm directly under the detector to be tested by this person in one year be 1,000 pieces.

$$0.015(\mu\text{rem/year}) \times \frac{1.5}{60}\ (\text{hr/pcs}) \times 1{,}000(\text{psc/year}) = 0.374\mu\text{rem/vear}.$$

b)In principle, the functional test shall be made at least every 6 months. The purpose of the test is to measure the sensitivitv of the detector with the use of Delta V Tester. The Delta V Tester is a monitoring device which can simulate electricallv similar condition as gradual smoke entering into the detector in order to measure the sensitivity of the detector (V'). The sensitivity of the detector can be measured by plugging the detector head into the socket of delta V Tester, which can be done very easily and requires only one minute.

During the functional test, it shall be confirmed if the measured operating sensitivity (V') be within that of the range indicated on the label. If the measured sensitivity is not within this range, it shall be returned to Nittan Corporation without disassembling it.

The external radiation dose which the maintenance personal would likely receive during the functional test is found to be 29 μrem/year according to the following assumptions and calculation.

It is assumed that the handling time required to complete one function test be 5 minutes, the external radiation dose on the surface of the detector be 3.5 rem/hr from the measured result and the number of the detectors to be handle in one year by this person be 1,000 pieces in totsal.

$$3.5\ (\mu\text{rem/hr}) \times \frac{5}{60}\ (\text{hr/hcs}) \times 1{,}000(\text{pcs/vear}) = 29\ \mu\text{rem/year}$$

From the above, it is concluded that the total external radiation dose which the person would likely receive as a result of performing Jobs of a), b) amounts to 292 rem/year. Therefore, the person for maintenance never receives 5 mrem/year of the external radiation dose. This satisfies the value in the column I of 32:28.

1-5 Warehouse Storage

The external radiation dose from the model 01B2 detector presumably accumulated at one location during their distribution is found to be less than 5 mrem per year even under the extremely worst assumed condition according to the following calculation, the value of which satisfies the value of table I of 32-28.

10 detectors are packed into a cardboard box, which has the dimentions of 5.5cm height, 9.5cm width and 22cm length.

The external radiation dose on the surface of this cardboard box containing 10 detectors was measured by the gamma ray survey-meter.
As a result of measurement, the maximum extermal radiation dose on the surface of the cardboard box was found to be 7 μrem/h.

In view of convenience of transportation or storage, the shipping box (46cm x 30cm x 30cm) accommodates 30 cardboard boxes. In that case, each cardboard box was located to diminish the total external radiation dose, that is, the location of cardboard box was arranged so as that the surfaces of maximum radiation dose face each other. In this case, the external radiation dose of shipping box was nearly negligible, 0.1 μrem/h.
The maximum external radiation dose of a person, who is engaged in working in this warehouse for a year at the rate of 8 hours a day, 5 days a week and 50 weeks a year, is found to be 0.2 mrem/year according to the following calculation:

0.1(mrem/hr) x 50(weeks/year) x 5(days/week) x 8(hours/day)

= 0.2 mrem/year

This value satisfies Column I of §32:28

2.0 Internal Radiation Dose Commitment Under Normal Condition

Internal radiation dose commitment is caused either by taking the radioactive foil through mouth or by inhaling it.

2-1 Taking through mouth.

Taking the foil into human body through mouth may happen only when the outer chamber is taken off, the gate plate is removed and moreover parts of the RI-Holder are destroyed. And thereafter the removed foil is to be brought into mouth. Such a series of phenomena never takes place.

2-2 Inhaltion

The internal radiation dose commitment through inhalation can be considered only in case of fire, and under handling process of detectors or under installed condition it is absolutely impossible.

3.0 External Radiation Dose Commitment Under Severe condition

3-1 Direct External Radiation Dose from Foil

As described in 2-1,this never happens practicallv. However, assuming the foil would be removed by any accident and people would approach it, then the external dose integrated in 50 years is found to be 6.9 mrem/50 years which is absolutely small and safe in comparison with that value specified in Column II of §32:28 as the below-mentioned calculation indicates.

We take an assumption that a person be exposed continuously for 50 years at the distance of 25cm from the foil. Since the foil is located about 15mm from the detector surface, the external radiation dose at the 25cm distance from the foil can be calculated as below takng into consideration the dose in case of 25cm distance form the detector surface.

$$\left(\frac{26.5}{25}\right)^2 \times 0.015\,(\mu rem/hr) = 0.0612\,\mu rem/hr.$$

Accordingly the external dose exposed in 50 years will be :

$$0.0162(\mu rem/hr) \times 24(hr/day) \times 365(days/year) \int_0^{50} e^{-\frac{0.693\,t}{458}}\,dt = 6.9\ mrem/50\ yeares$$

4.0 Internal radiation Dose Commitment Under severe Condition

4-1 Internal Radiation Dose Commitment by inhalation in case of warehouse fire.

As the worst case we consider the dose commitment when a fire breaks out in the warehouse where 500 units of the detectors are stocked.

According to the attached technical data 2, 0.1% at the heating test assuming a fire, All of this quantity can be assumed as particles to be possibly inhaled. To calculate internal radiation dose commitment of a person who remains in a fire condition for 5 min., it is assumed that the air volume of a standard warehouse is 200,000 ft (5.6×10^9 cc) and air shall not be exchanged. We calculate the internal radiation dose amount which an occupant would receive for 5 minutes at fire.

According to the recommendation of ICRP "Reprot of Committee II on Allowable Dose Amount of Radioactive Radiation in Human Body (1959)", the most critical organ for inhalation of insoluble radioactive dust particles can be considered to be lung and the rate fa, at which the inhaled particles reach the critical organ, is 0.12. The air amount to be inhaled by this person is 10^7 cc/8hrs according to the same ICRP report. Therefore in 5 minutes the person would inhale 1.05×10^5 cc of air as below calculation:

$$\frac{10^7 cc}{8\ hr} \times \frac{5}{60}\ hr = 1.05 \times 10^5\ cc$$

In case of storing 500 units of detectors with each radioactive material of 0.7μCi on average, the following calculation is made:

$$\text{Dose} = \frac{(0.7 \times 500)\mu Ci \quad (1 \times 10^{-3})}{(5.6 \times 10^{4})cc}$$

$$\times (1.05 \times 10^{5})cc$$

$$\times 0.12 \times \frac{2.2 \times 10^{6} \text{ dis}}{\text{min} - \mu Ci} \times \frac{5.7 \text{ MeV}}{\text{dis}}$$

$$\times \frac{(1.6 \times 10^{-6}) \text{ergs}}{1{,}000 \text{ g}} \text{ MeV} \cdot \frac{\text{g.Rad}}{10^{2} \text{ ergs}}$$

$$\cdot \frac{10 \text{ rem}}{\text{RAD}} \cdot \frac{(5.26 \times 10^{5}) \text{ min}}{\text{year}} \times$$

$$\int_{0}^{50} e^{-\frac{0.693}{458}t} \, dt = 0.041 \text{ rem/50 years}$$

The situation just described above never takes place actually; however, even in such a case, the dose commitment satisfies the value specified in Colun II of §32:28

4-2 Internal radiation dose commitment due to taking foil into human body at the worst accident.

As already described, the installation of the model 01B2smoke detectors is carried out by well-educated professional installers.

Therefore, the detectors cannot be sofar destroyed or disassembled so that the radioactive foil could be swallowed.

Under normal condition of use, one may attempt to again direct access to the radioactive foil by removing the detector head from the socket with an intention of destroying or tampering it. However, the model 01B2 is connected electricallv with a control panel to form a fire alarm system and if the detector head should be removed from its socket a trouble signal shall be sent to the control panel.
Upon receiving such a signal from the detector, the control panel sends out the trouble signals by means of audible and/or visible alarms.

As such, the detector is provided completely with a preventive measure against theft and tampering and, therefore, it is absolutely not possible that anv one would swallow the foil.

Never-the less, assuming the case of swallowing the foil, we get the calculation result of the dose commitment exposed in 50 years as 11.0 mrem/50 years which is negligible low in comparison with the value specified in the Column II of §32:28.

The max. activity of the radiation foil in the model 01B2 detector is 0.91 μCi/pcs. The foil swallowed through mouth leaks to gastric juice in the stomach.

This leak can be considered as a leak amount to N/10 HCL liquid according to Section II, and it is 0.37%. We assume all of leaked radioactive material would be dissolved into body fluids. According to the above-mentioned ICRP report, the rate of transferring from intestine to blood is 10^{-4}.

Furthermore, according to the said ICRP data the rate f2 between the deposited amount in bones and the amount deposited in the whole body is 0.9 .

Under these conditions, the internal dose commitment for bones for 50 years is calculated as below.

$$\text{Dose} = (0.91)\ \text{Ci} \times 0.37 \times 10^{-2} \times 10^{-4} \times 0.9$$

$$\times \frac{(2.2 \times 10^{-6})\text{dis}}{\text{min}\,\mu\text{Ci}} \cdot \frac{28.3\ \text{Mev}}{\text{dis}} \times \frac{1}{7000}$$

(weight of bones)

$$\times \frac{(1.6 \times 10^{-6})\text{erg}}{\text{Mev}} \times \frac{\text{g.Rad}}{10\ \text{ergs}} \cdot \frac{10\text{rem}}{\text{Rad}}$$

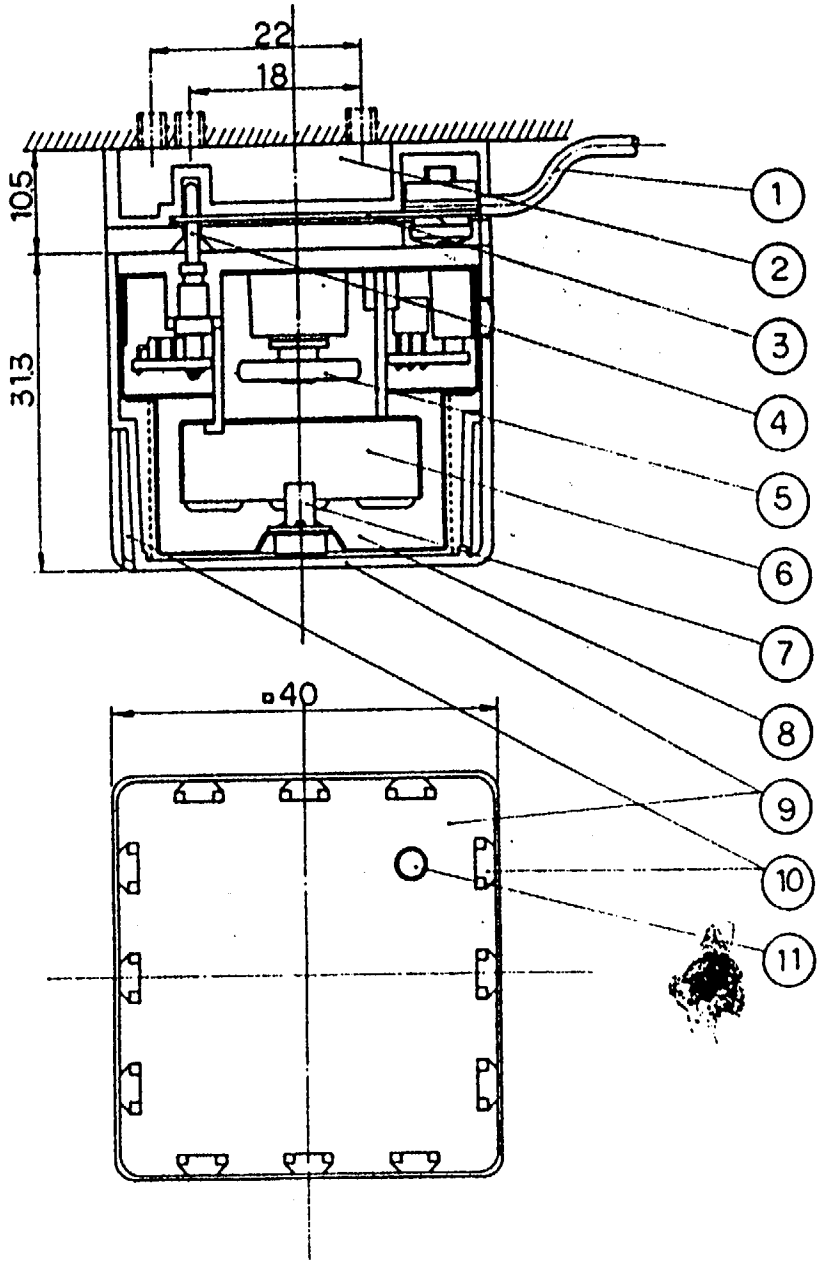
$$\times \frac{(5.26 \times 10^{5})\text{min}}{\text{year}} \times \int_0^{50} e^{-\frac{0.693}{458}t}\, dt$$

$$= 11.0\ \text{mrem/50 year}$$

4-3 Those values calculated in 4-1 and 4-2 are figures on assumption of such accidents, which never happen in actuality.

Even under those severe conditions, the value do not exceed those values specified in Column II of §32:28.

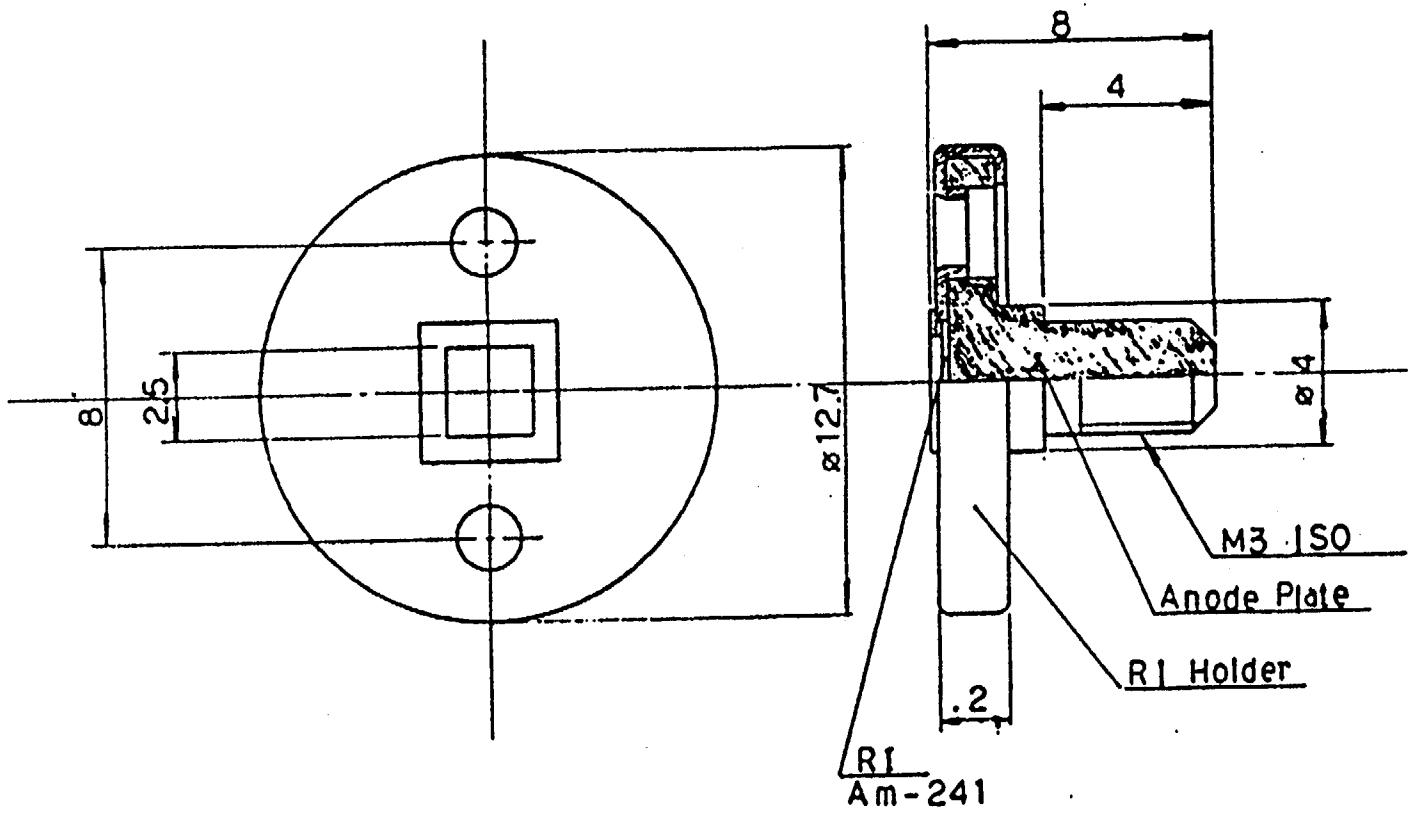
Namely the radioactive foil and its application method in the detector is completely safe and reliable.



Index No.	Description
1	External Wire
2	Socket
3	External Terminal
4	Contact Pin
5	Anode Plate
6	Gate Plate
7	Cathode Pin
8	Outer Chamber
9	Outer Cover
10	Smoke Inlet
11	Indicator

NITTAN

Construction Drawing for 01B2



NITTAN

CHECKED	DRAWN
SCALE /	DATE 10. 1, 1989
DIMENSIONS ARE IN mm	3RD ANGLE PROJECTION

TITLE

Assembly Drawing of
OIB2 RI Source

MODEL NO.

DRAWING NO. -

DO NOT
DISASSEMBLE!

SMOKE DETECTOR
IONIZATION TYPE

MODEL DIB2
SERIAL NO
MFD. DATE

Am241
0.7μCi

CONTAINS RADIOACTIVE MATERIAL
DO NOT DISASSEMBLE
RETURN TO NITTAN FOR DISPOSAL

NITTAN

DO NOT
DISASSEMBLE!

NITTAN

CHECKED	DRAWN
SCALE /	DATE 10. 1. 1989
DIMENSIONS ARE IN mm	3RD ANGLE PROJECTION

TITLE

Label of DIB2

MODEL NO	
DRAWING NO	

Gold/Pd Alloy
Gold Plated

Oct. 1967

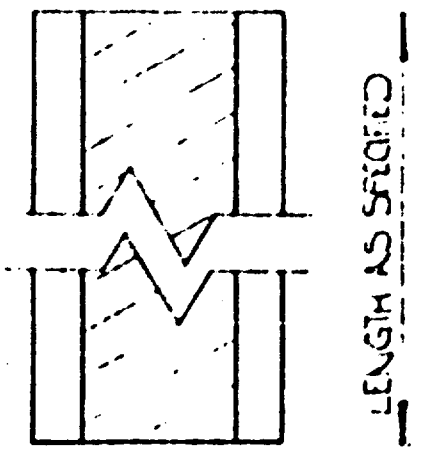
Technical Data - 1

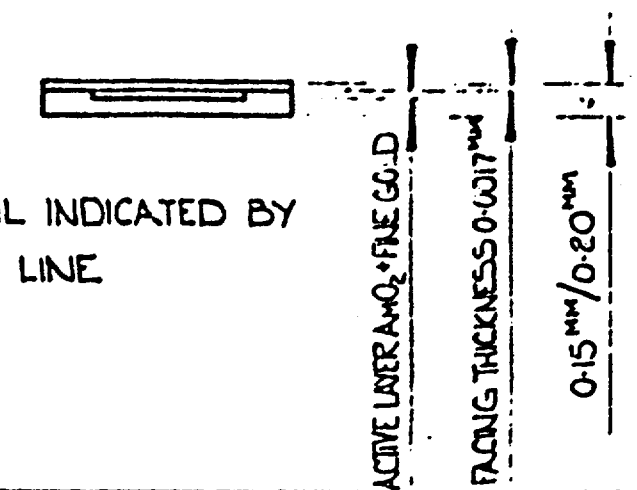
Tests carried out on Americium-241 alpha particle emitting foil manufactured by the Radiochemical Centre

USED ON

DRG No. ARC 8522/S

THIRD ANGLE PROJECTION





BACK OF FOIL INDICATED BY GOLD LINE

TYPE	OVERALL WIDTH	ACTIVE WIDTH	LINEAR ACTIVITY	FACE COVERING	BASE
Q274	$20^{MM}_{-0.5}$	$3^{MM}_{-0.5}$	15 μCi/CM	GOLD/PALLADIUM ALLOY	SILVER
Q423	$20^{MM}_{-0.5}$	$12.5^{MM}_{-0.5}$	10 μCi/CM	GOLD/PALLADIUM ALLOY	SILVER

JOB No.

PROJECT No.

MATERIAL & SPEC

FINISH

SURFACE TEXTURE

DRAWN H.E.L.

REMOVE ALL BURRS

√ UNLESS STATED

TCD.

DIMS. IN M.M.

TOLERANCES — UNLESS STATED

CHKD.

SCALE N.T.S.

ISSUE	DATE	D.O.I. / MOD
A	14.5.71	

APPD.

THE RADIOCHEMICAL CENTRE AMERSHAM BUCKS

CONTRACTOR

TITLE AMERICIUM ^{241} ALPHA EMITTING FOIL

DRG. No. ARC 8522/S

U.D.C.

Tests carried out on americium-241 alpha particle emitting foil manufactured by the [illegible] centre

Type of foil

Americium-241 foil, 100 uc/cm^2

active width	0.5 inches
total width	20 mm
length of samples	25 mm each

Manufacturing process

The radionuclide, as americium oxide, is contained uniformly distributed and sintered in the matrix of pure fine gold at temperatures in excess of 300°C. It is further contained between a backing of pure fine silver and a front covering of gold or gold palladium alloy (94% gold, 6% palladium) by hot forming. The metal layers now continuously welded are extended in area by means of a power rolling mill to give the required active and overall foil areas.

Wipe test based on British Standard 3513: 1962

All wipe tests carried out using 1 inch diameter discs of Whatman No. 1 filter paper moistened with Ethyl Alcohol, and allowed to dry before measurement. Wipe tests are carried out in every case on the active face and back of the foil and the two cut edges. Pressure of filter paper on foil 40-50 grams. Each disc is placed in a glass vial which is filled with a dioxane/toluene based liquid scintillant, and counted in a Nuclear Chicago Mk. 1 liquid scintillation counter. This counter has a dual photomultiplier detector assembly, designed for high efficiency counting of low energy β-emitters like ^{14}C and ^{3}H. In this system the α particles from americium-241 record with 100% efficiency from sources in solution in the scintillant. The counter has been calibrated for americium-241 dried on to filter paper discs, and for these, detection efficiency of about 90% is determined. Results corrected for this efficiency, and reported as microcuries americium-241.

Foil Type	Gold/palladium alloy (94% Au, 6% Pd) covering over active layer		
Sample Number	1	2	3
1. Wipe test on samples after manufacture	1.42×10^{-4}	1.39×10^{-4}	$0.45 \times 10^{-}$
2. Heat and thermal shock tests			
(a) Wipe test before heating	1.42×10^{-4}	1.39×10^{-4}	$0.45 \times 10^{-}$
Wipe test after heating to 760°C	0.65×10^{-4}	0.46×10^{-4}	$1.53 \times 10^{-}$
Wipe test after immersion in liquid nitrogen (-195.84°C)	0.69×10^{-4}	0.51×10^{-4}	$0.95 \times 10^{-}$
(b) Wipe test before heating	0.52×10^{-4}	0.17×10^{-4}	$0.54 \times 10^{-}$
Wipe test after heating to 815°C	0.15×10^{-4}	0.47×10^{-4}	$0.05 \times 10^{-}$
Wipe test after immersion in liquid nitrogen (-195.84°C)	0.55×10^{-4}	NIL	$0.49 \times 10^{-}$

Foil Type

Sample Number	1	2	3
3. Immersion tests.			
(a) Wipe tests as Test 1 on three control samples	1.42×10^{-4}	1.39×10^{-4}	0.45×10^{-4}
(b) After 5 hours immersion in water at room temperature			
i) Wipe test before immersion	NIL	1.86×10^{-4}	1.03×10^{-4}
ii) Activity leached out	9.3×10^{-4}	14.0×10^{-4}	8.5×10^{-4}
iii) Wipe test after immersion	0.65×10^{-4}	1.0×10^{-4}	1.0×10^{-4}
(c) After 1 hrs immersion in boiling water. Temp 98°C at 740 mm Hg			
i) Wipe test before immersion	0.03×10^{-4}	0.83×10^{-4}	2.63×10^{-4}
ii) Activity leached out	4.85×10^{-4}	3.03×10^{-4}	9.6×10^{-4}
iii) Wipe test after immersion	1.1×10^{-4}	1.4×10^{-4}	2.9×10^{-4}
(d) After 5 hrs immersion in methyl-ethyl ketone.			
i) Wipe test before immersion	2.79×10^{-4}	0.8×10^{-4}	1.57×10^{-4}
ii) Activity leached out	0.26×10^{-4}	1.73×10^{-4}	0.58×10^{-4}
iii) Wipe test after immersion	0.5×10^{-4}	0.39×10^{-4}	1.02×10^{-4}
(e) In this test, solutions were measured to determine the americium-241 extracted during immersion.			
Acetone i) after 24 hrs	33×10^{-4}	31×10^{-4}	32×10^{-4}
ii) after 48 hrs	NIL	16×10^{-4}	NIL
iii) after 72 hrs	5.2×10^{-4}	2.1×10^{-4}	3.9×10^{-4}
iv) after 168 hrs	8.1×10^{-4}	4.3×10^{-4}	5.4×10^{-4}
Trichloroethane i) after 24 hrs	33×10^{-4}	33×10^{-4}	23×10^{-4}
ii) after 48 hrs	NIL	NIL	NIL
iii) after 72 hrs	NIL	4.7×10^{-4}	0.9×10^{-4}
iv) after 168 hrs	5.4×10^{-4}	4.1×10^{-4}	9.0×10^{-4}

Foil Type	[illegible]		
Sample Number	1	2	3
Perchloroethane i) after 24 hrs	28×10^{-4}	35×10^{-4}	$3[illegible] \times 10^{-4}$
ii) after 48 hrs	NIL	NIL	NIL
iii) after 72 hrs	2.5×10^{-4}	4.4×10^{-4}	3.7×10^{-4}
iv) after 168 hrs	6.7×10^{-4}	5.6×10^{-4}	7.2×10^{-4}

4. i) Impact Test:

Steel ball diameter 12.7 mm, weight 8.3 gm, dropped through vertical height in free fall 1 metre. After initial wipe test on foil, the ball was dropped five times on to the face of 3 samples. Foils mounted on solid brass base.

Initial wipe test	1.04×10^{-4}	NIL	$2.33 \times 10^{-}$
Wipe test after 1st impact on foil face	0.91×10^{-4}	0.66×10^{-4}	$0.11 \times 10^{-}$
Wipe test after 2nd impact on foil face	0.37×10^{-4}	0.03×10^{-4}	$0.41 \times 10^{-}$
Wipe test after 3rd impact on foil face	0.03×10^{-4}	0.18×10^{-4}	$0.49 \times 10^{-}$
Wipe test after 4th impact on foil face	0.25×10^{-4}	0.45×10^{-4}	$0.65 \times 10^{-}$
Wipe test after 5th impact on foil face	0.30×10^{-4}	0.60×10^{-4}	$0.47 \times 10^{-}$

Visual inspection showed that all samples had mechanical damage in the form of indentations about 5 mm diameter and 2 mm deep. No evidence of covering metal breakdown.

ii) Drop Test:

Foil samples mounted centrally in aluminium alloy case, 34.2 mm x 24.95 mm x 7.7 mm). The case was dropped five times with each sample through a vertic height of 1 metre in free fall on to a solid brass base.

Initial wipe test	1.24×10^{-4}	0.13×10^{-4}	$0.07 \times 10^{-}$
Wipe test after 1st drop	0.51×10^{-4}	0.44×10^{-4}	$1.03 \times 10^{-}$
Wipe test after 2nd drop	0.03×10^{-4}	0.36×10^{-4}	1.2×10^{-1}
Wipe test after 3rd drop	0.71×10^{-4}	0.67×10^{-4}	1.2×10^{-1}
Wipe test after 4th drop	0.03×10^{-4}	0.21×10^{-4}	1.1×10^{-1}
Wipe test after 5th drop	0.57×10^{-4}	0.59×10^{-4}	$0.13 \times 10^{-}$

Foil Type	Pure fine gold evaporated over active layer		
Sample Number	4	5	6
1. Wipe test on samples after manufacture	0.59×10^{-4}	0.57×10^{-4}	0.42×10^{-4}
2. Heat and thermal shock tests			
(a) Wipe test before heating	0.59×10^{-4}	0.57×10^{-4}	0.42×10^{-4}
Wipe test after heating to 760°C	1.4×10^{-4}	0.4×10^{-4}	0.02×10^{-4}
Wipe test after immersion in liquid nitrogen (-195.84°C)	0.56×10^{-4}	0.64×10^{-4}	0.4×10^{-4}
(b) Wipe test before heating	0.04×10^{-4}	0.97×10^{-4}	0.60×10^{-4}
Wipe test after heating to 815°C	0.58×10^{-4}	0.53×10^{-4}	1.24×10^{-4}
Wipe test after immersion in liquid nitrogen (-195.84°C)	0.3×10^{-4}	0.26×10^{-4}	0.36×10^{-4}
3. Immersion tests			
(a) Wipe tests as Test 1 on three control samples	0.59×10^{-4}	0.57×10^{-4}	0.42×10^{-4}
(b) After 5 hours immersion in water at room temperature			
i) Wipe test before immersion	0.49×10^{-4}	0.61×10^{-4}	4.0×10^{-4}
ii) Activity leached out	18.9×10^{-4}	14.2×10^{-4}	7.4×10^{-4}
iii) Wipe test after immersion	1.45×10^{-4}	1.52×10^{-4}	1.39×10^{-4}
(c) After 1 hrs immersion in boiling water. Temp 98°C at 740 mm Hg			
i) Wipe test before immersion	0.045×10^{-4}	1.53×10^{-4}	1.48×10^{-4}
ii) Activity leached out	10.1×10^{-4}	3.03×10^{-4}	7.8×10^{-4}
iii) Wipe test after immersion	0.65×10^{-4}	5.0×10^{-4}	1.77×10^{-4}
(d) After 5 hrs immersion in methyl-ethyl ketone			
i) Wipe test before immersion	2.16×10^{-4}	0.43×10^{-4}	0.31×10^{-4}
ii) Activity leached out	0.015×10^{-4}	0.25×10^{-4}	0.12×10^{-4}
iii) Wipe test after immersion	2.17×10^{-4}	4.69×10^{-4}	3.36×10^{-4}

Foil type	Pure fine gold cover over active layer		
Sample Number	4	5	6

(e) In this test solutions were measured to determine the americium-241 extracted during immersion.

Acetone	i) after 24 hrs	30×10^{-4}	4.5×10^{-4}	27×10^{-4}
	ii) after 48 hrs	NIL	NIL	NIL
	iii) after 72 hrs	5.7×10^{-4}	5.2×10^{-4}	3.7×10^{-4}
	iv) after 163 hrs	3.4×10^{-4}	5.8×10^{-4}	5.3×10^{-4}
Trichloroethane	i) after 24 hrs	27×10^{-4}	27×10^{-4}	26×10^{-4}
	ii) after 48 hrs	NIL	NIL	33×10^{-4}
	iii) after 72 hrs	0.52×10^{-4}	NIL	NIL
	iv) after 168 hrs	7.0×10^{-4}	4.95×10^{-4}	3.6×10^{-4}
Perchloroethane	i) after 24 hrs	5×10^{-4}	28×10^{-4}	29×10^{-4}
	ii) after 48 hrs	NIL	NIL	12×10^{-4}
	iii) after 72 hrs	3.7×10^{-4}	4.2×10^{-4}	3.6×10^{-4}
	iv) after 168 hrs	5.2×10^{-4}	10.0×10^{-4}	5.4×10^{-4}

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4. i) Impact test:

Steel ball diameter 12.7 mm, weight 8.3 gm, dropped through vertical height in free fall 1 metre. After initial wipe test on foil, the ball was dropped five times on to the face of 3 samples. Foils mounted on solid brass base.

Initial wipe test	0.63×10^{-4}	1.27×10^{-4}	0.56×10^{-4}
Wipe test after 1st impact on foil face	8.9×10^{-4}	0.56×10^{-4}	1.2×10^{-4}
Wipe test after 2nd impact on foil face	3.3×10^{-4}	0.50×10^{-4}	0.61×10^{-4}
Wipe test after 3rd impact on foil face	0.05×10^{-4}	0.20×10^{-4}	0.54×10^{-4}
Wipe test after 4th impact on foil face	0.01×10^{-4}	0.20×10^{-4}	0.60×10^{-4}
Wipe test after 5th impact on foil face	0.79×10^{-4}	0.57×10^{-4}	0.22×10^{-4}

Visual inspection showed that all samples had mechanical damage in the form of indentations about 5 mm diameter and 2 mm deep. No evidence of covering metal breakdown.

Foil type	Pure fine gold covering over active layer		
Sample Number	4	5	6

4. ii) Drop test:

Foil samples mounted centrally in aluminium alloy case, 34.2 mm x 24.95 mm x 7.7 mm. The case was dropped five times with each sample through a vertical height of 1 metre in free fall on to a solid brass base.

Initial wipe test	19.3×10^{-4}	7.9×10^{-4}	$0.65 \times 10^{-}$
Wipe test after 1st drop	9.1×10^{-4}	0.64×10^{-4}	$0.60 \times 10^{-}$
Wipe test after 2nd drop	5.0×10^{-4}	0.21×10^{-4}	$0.60 \times 10^{-}$
Wipe test after 3rd drop	7.0×10^{-4}	0.10×10^{-4}	1.0×10^{-4}
Wipe test after 4th drop	6.8×10^{-4}	0.42×10^{-4}	$0.57 \times 10^{-}$
Wipe test after 5th drop	1.53×10^{-4}	2.7×10^{-4}	$0.05 \times 10^{-}$

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5. Abrasion Test / Repeated Wipe Test

Two foils samples, one with gold front covering and one with gold/palladium alloy front covering, were subjected to repeated wipe tests. Each wipe test recorded was carried out as described earlier under "Wipe Test", excepting that it was repeated five times with the same filter paper and on the whole alpha emitting surface only. Total activity removed from sample with gold front covering 4.48×10^{-3} µc in 122 wipe tests (five wipes each). Total activity removed from sample with gold/palladium alloy front covering 5.63×10^{-3} µc in 122 wipe tests (five wipes each).

The graph shows total activity removed; the increasing percentage being achieved by the addition of each wiped amount. No detectable activity was found on the last 20 wipe tests, representing 100 wipes across the surface of the foil for the sample with the gold front covering and $\sim 2.25 \times 10^{-4}$ µc for the sample with the gold/palladium alloy front covering.

The total activity removed by 610 wipes is $\sim \frac{1}{6 \times 10^4}$ of the total activity of samples in each test.

Production Control

(a) Visual inspection. All production is inspected visually for surface damage in the active area. Careful inspection with a low power microscope is carried out on samples from each production run.

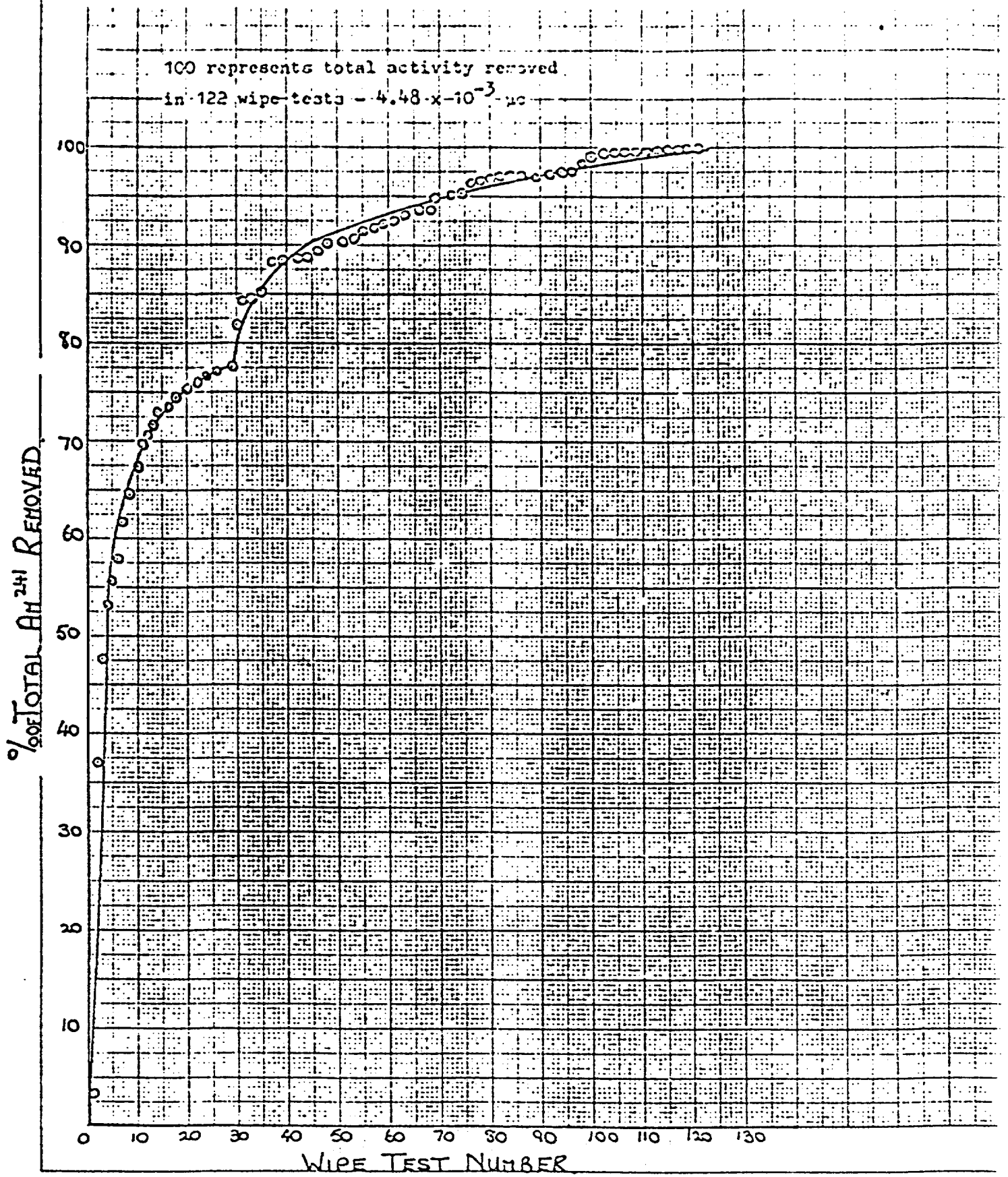
(b) An autoradiograph is carried out on all production foils by placing them in contact with single weight bromide paper for a pre-determined time before exposed film is developed and fixed. Distribution of activity and dimensions are carefully examined.

(c) Dust sampling using a continuous airflow sampler is performed in the vicinity of the manufacturing equipment during all production. Foil storage areas are similarly monitored.

(d) Five samples of 2.5 cm length are taken from each 50 m production batch and subjected to the tests 1, 2 and 3 above to ensure uniform integrity of product

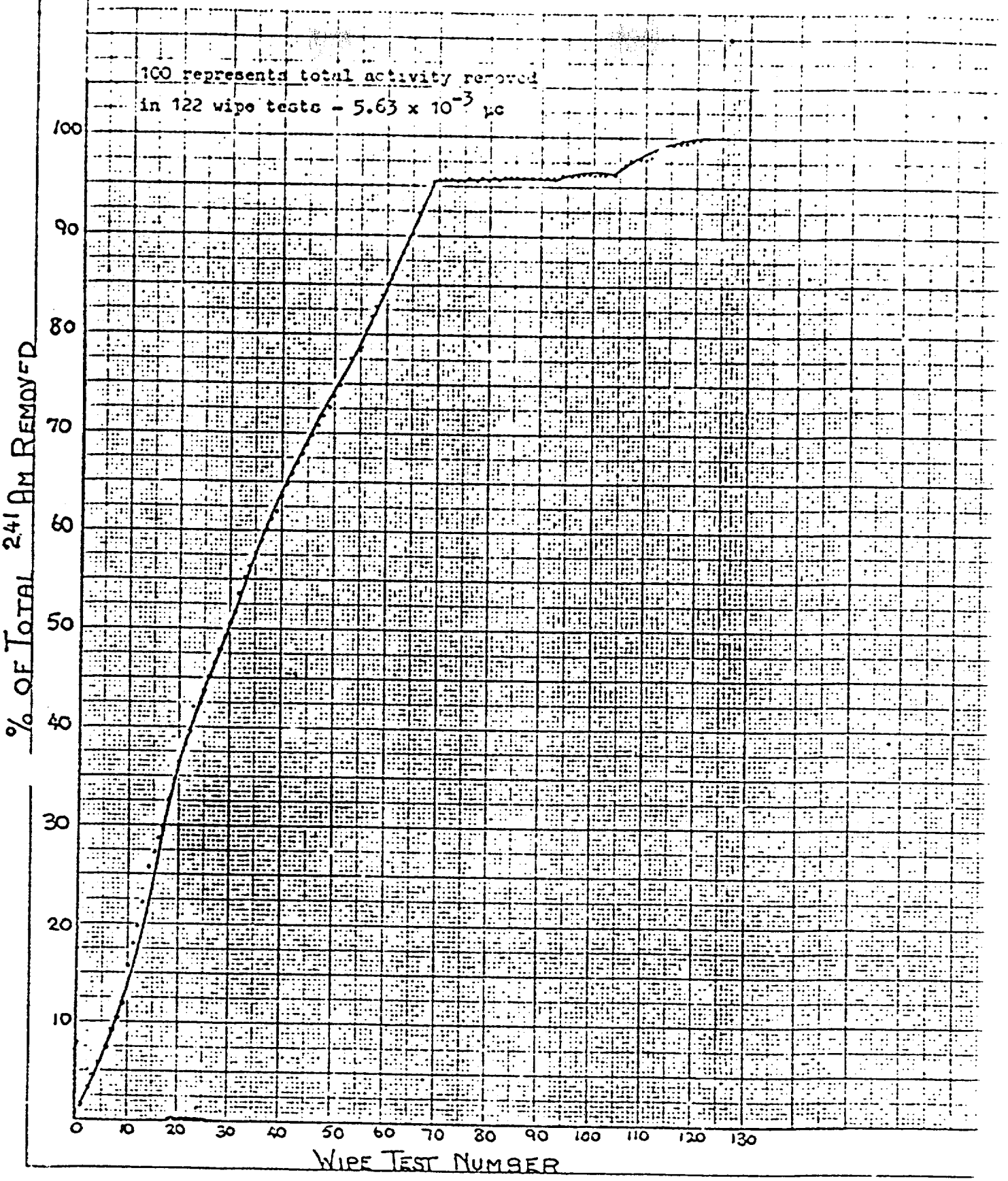
GOLD FACED FOIL

Graph showing removable contamination by continuous wipe testing from ^{241}Am foil until wipe testing filter papers gave no detectable amount.



Gold/palladium alloy 94% , 6% Pd)

Graph showing removable contamination by continuous wipe testing from ^{241}Am foil until wipe testing filter papers gave no detectable amount.



添附資料2.

Technical Data - 2

Testing of Americium-241 Alpha Foils

Test Samples

Samples of foil type Foil 2 1 cm long, active width 12.5 mm, overall width 20 mm, containing 100 μCi americium-241.

Initial Immersion Test: < 0.005 μCi extracted during 16 hours immersion test.

Wipe Test: < 0.005 μCi

CORROSION TESTING

Test 1. Sulphur dioxide test

Samples were exposed for 6 days to moist air containing 1% SO_2.
Immersion test - < 0.2 μCi extracted.
Wipe test - < 0.005 μCi.

2. Hydrogen chloride test

Samples were exposed for 16 days to dry air containing 1 mg HCl gas/litre.
Immersion test - < 0.005 μCi extracted.
Wipe test - < 0.002 μCi.

3. Ammonia test

Samples were exposed for 16 days to dry air containing 10 mg NH_3 gas/litre.
Immersion test - < 0.002 μCi extracted.
Wipe test - < 0.002 μCi.

HEATING TESTS

1. Samples were maintained at 600°C for 10 minutes and then rapidly cooled by immersion in water. This was carried out 50 times on each sample.
   Immersion test - < 0.005 μCi extracted.

2. Samples were maintained at 1200°C for one hour and then rapidly cooled by immersion in water.
   Immersion test - < 0.015 μCi extracted.
   Wipe test - < 0.2 μCi.

THORN Automated Systems

THORN Automated Systems Inc
Corporate Offices
835 Sharon Drive
Westlake, Ohio 44145
(216) 871-9900
FAX (216) 871-8320

AFFIDAVIT

I, E. Joseph Martini, Vice President Manufacturing Operations, on behalf of THORN Automated Systems, Inc. have read and understand all commitments made in the named supporting documents in Nittan Corporation's registration documents NR-481-D-101-E and NR-481-D-102-E and agree on behalf of THORN Automated Systems, Inc. to be legally bound by all statements and representations both express and implied made by Nittan Systems, Inc. in said registrations.

E. Joseph Martini

E. Joseph Martini

THORN Automated Systems, Inc.
Vice President Manufacturing Operations

State of Ohio
County of Cuyahoga

On the day of 13th March 1992 before me came E. Joseph Martini , of THORN Automated Systems, Inc. who executed the foregoing and acknowledged that he executed the same.

Mary Lee Hunt
Notary - My Commission expires 12/14/92

ATTACHMENT A4

SECTION THREE

CONTENTS:

MATERIALS LICENSE

Amendment No. 02

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material* to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Thorn Automated Systems, Inc.	In accordance with letter dated April 9, 1992 3. License number 34-23772-02E is amended in its entirety to read as follows:
2. 835 Sharon Drive Westlake, Ohio 44145	4. Expiration date October 31, 1995
	5. Docket or Reference No. 030-31616

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Americium 241	A. Foil sources in smoke detection devices (Amersham Model AMM1001H, Amersham USA AMM-1001)	A. (Not applicable See Condition 10)

9. Authorized Use

Pursuant to Section 32.26, 10 CFR Part 32, the licensee is authorized to distribute industrial type smoke detector devices as specified in Condition 10, to persons exempt from the requirements for a license pursuant to Section 30.20, 10 CFR Part 30, or equivalent provisions of the regulations of any Agreement State.

CONDITIONS

10. The following smoke detector devices may be distributed pursuant to this license provided the amount of Americium 241 contained in the device does not exceed the amounts specified in the following table:

Device Model	Maximum Quantity per Device
MF Series	1.0 microcurie
OIB (P/N PU90 2000-1 and P/N PU90 41000-1)	1.0 microcurie
NID 58	1.0 microcurie
NID 68 AS Series	1.0 microcurie

11. This license does not authorize possession or use of licensed material.

12. The licensee is only authorized to distribute from its facility located at 835 Sharon Drive, Westlake, Ohio.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: 34-23772-02E
Docket or Reference number: 030-31616
Amendment No. 02

CONDITIONS

(continued)

13. The licensee shall file periodic reports as specified in Section 32.29(c), 10 CFR Part 32.

14. The licensee shall perform tests for leakage and/or contamination in accordance with procedures described in letter dated September 28, 1990. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, the detector lot shall not be transferred without additional evaluation, the manufacturer should be informed of the results and further sampling be performed in order to characterize the problem. Individual detectors shall not be transferred if further testing reveals the presence of 0.005 microcurie or more of removable contamination.

15. Except as specifically provided otherwise by this license, the licensee shall distribute licensed material described in Condition 10 of this license in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licenseee's application and correspondence are more restrictive than the regulations.

    A. Application dated March 14, 1990.

    B. Letters dated October 25, 1989; May 31, 1990; July 20, 1990; August 9, 1990; September 28, 1990; October 1, 1990; and October 2, 1990.

    C. Letters dated November 15, 1989; October 10, 1991; March 13, 1992; March 30, 1992; and April 14, 1992.

    D. Letter dated April 9, 1992.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

DATE: APR 15 1992

BY: _____

Michael A. Lamastra
Medical, Academic, and Commercial
Use Safety Branch
Division of Industrial and
Medical Nuclear Safety, NMSS
Washington, D.C. 20555

Grinnell®
FIRE PROTECTION SYSTEMS COMPANY
835 Sharon Drive
Westlake, Ohio 44145

A tyco INTERNATIONAL LTD. COMPANY

July 20,1998

Application to amend license 34-23772-02E Amendment No. 02

GENERAL

The purpose of this application to amend the distribution license 34-23772-02E, Amendment 02, is to add the Lo-Pro Series Ion Detectors to the license and to remove the previous detectors which are no longer manufactured.

INTRODUCTION

The Lo Pro series detectors, 612I and 912I are smoke detectors using an ionisation chamber sensing element are are intended for use in commercial/ industrial fire detection systems. The ionisation chamber is comprised of a sealed source of Americium 241 with a maximum activity of 0.9 microcuries . The source is purchased complete from Amersham International plc based in the United Kingdom and is listed under NRC registry NR136S174U as model AMM 1001H configuration DSC.A3.

The design of the Lo-Pro series detectors was carried out by Thorn Security Limited, doing business as Tyco Electronic Products Group in the United Kingdom. The detectors have been listed with Underwriters Laboratories against standard UL268, file number S466 category UROX.

The Lo-Pro Series is intended to replace the MF Series detectors covered by the existing license. Both series detectors share common design traits. The Americum 241 source is the same in both detector series, the MF series ion chamber configuration was assembled by Thorn Security during the detector manufacturing process. The Lo-Pro series detectors utilize a completed ion chamber assembly supplied by Amersham.

The housing assemblies of the MF series and Lo-Pro series detectors are designed as snap together assemblies completely enclosing the ion chamber. Both series detectors passed the BS 5445 Part 7 standard testing for vibration, corrosion, impact and shock testing in the United Kingdom by the Loss Prevention Certification Board. Test reports of the Lo-Pro series detectors are included in this application.

Requirements of 10 CFR 32.26

1. *Description of the product and its intended use.*

The 612I and 912I (Lo-Pro) series smoke detectors employ an ionization chamber sensing element and is intended for use in commercial/industrial fire detection systems. The 612I is a conventional non-addressable smoke detector, while the 912I is an addressable smoke detector. The detectors are used in ceiling or wall mount applications in plug in bases which are wired to suitable control and indication equipment. These detectors are not intended for sale to the general public for domestic applications.

2. *Type and quantity of the byproduct material in each unit.*

The Lo-Pro series detectors use an Americium 241 source of 0.9 microcuries maximum, manufactured by

Amersham International plc.
White Lion Road
Amersham
Buckinghamshire, England
United Kingdom
HP9 9LL

The mounted Model AMM 1001H sealed source is registered with the Nuclear Regulatory Commission under No. NR136S174U.

3. *Chemical and physical form of the byproduct material in the product and changes in chemical and physical form that may occur during the useful life of the product.*

The sealed source consists of americium oxide uniformly distributed and sintered in a pure gold matrix which is further contained between a backing of gold coated pure silver and a front covering of either gold or gold-palladium alloy and fabricated by hot forging methods.

Prototype testing of the source to USASI standard N5.10-1968 and respective classifications of C54545 and C44444 have shown that changes in chemical and physical form during the useful life of the product is minimal.

Further details of source construction and prototype testing are included in attachment E1, " Registry of Radioactive Sealed Sources and Devices Safety evaluation of sealed Source".

4. *Solubility in water and body fluids of the byproduct material*

During prototype testing, of the source as detailed in the Registry No. NR136S174U, the foil was immersed in water for 3 weeks at room temperature: Less than .001 microcurie per foil loaded at maximum activity was found in the water.

During prototype testing, of the source as detailed in the Registry No. NR136S174U, was immersed in 0.1 N hydrochloric acid for 24 hours at room temperature: less than 0.004 microcurie activity was leached out.

5. *Details of construction and design of product relating to containment and shielding of byproduct material, and other safety features under normal and severe conditions of handling, storage, use and disposal.*

Sealed Source

The general construction meets Underwriters Laboratories Inc. Standard UL 217 and EN54 part 7. The radioactive material ^{241}Am is incorporated within a gold matrix and sandwiched between a silver backing and a palladium laminate. The face layer is thick enough to retain the radioactive material. The shaped foil pieces are staked into a holder and secured between spot welded metal plates or rolling over the holder edges. The source holders are made of AISI 316 stainless steel to provide maximum corrosion resistance. (See Attachment E2, Amersham Data Sheet 11262

The Lo-Pro series detectors, the 612I and 912I use the same mechanical construction. They differ in performance characteristics based upon the variations of the electronic circuit. The ionization chamber is common to both detectors. The following attachments provide details of design and construction.

Attachment E3

Drawing no.	516-050-31	612I	Assembly
Bill of Material	CL 516-050-031		612I
Drawing no.	516-051-031	912I	Assembly
Bill of Material	CL 516-051-031		912I

6. *Maximum external radiation levels at 5 and 25 centimeters from any external surface of product, averaged over an area not to exceed 10 square centimeters, and the method of measurement.*

The following approximate dose rate calculations of the ion chamber used in the detector are based upon thermoluminescent dosimetry data are shown in the table below and are reprinted from attachment E4, Amersham data sheet 11247 p3

Direction	Distance (cm)	Dose rate MSv/year	Dose rate rem/year
Normal to surface of outer cap electrode	5	0-1	0-01
Normal to surface of outer cap electrode	25	0-005	0-0005
Normal to source electrode	5	0-6	0-06
Normal to source electrode	25	0-03	0-003

7. *Degree of access of human beings to product during normal handling and use.*

The ion chamber is completely enclosed by the detector assembly. The design of the cover and housing makes it impossible to contact or see the source without dismantling the detector. Removal of the cover can be achieved by simultaneously lifting three tabs. The baffle must then be removed by simultaneously prying back three notched tabs. The function of the notched tabs is not readily apparent to those unfamiliar with the construction design.

The safety performance of the Amersham source has met the requirements of ISO 2919 and has met the recommended rating of C32222.

Access to the source is limited during normal handling and use. The packaging does not have to be removed during normal handling for shipping purposes. A clear plastic cover allows visibility of the labeling on the detector body molding.

The cover and baffle, which enshrouds the ion chamber, do not have to be removed during installation. The ion chamber is soldered to the PCB assembly. The PCB assembly is mounted to the body molding with four screws torqued to 1.5 Nm. This assembly method secures the source within the detector and minimizes access.

8. *Total quantity of byproduct material expected to be distributed annually.*

Expected annual distribution of the Lo-Pro series detectors is not expected to exceed 50,000 units, resulting in a maximum total activity of 45 millicuries.

9. *Expected useful life of the product*

The recommended working life of the sealed source is 10 years as described in Amersham data sheet 11262. Attachment E2

10. *Proposed methods of labeling or marking the detector and point of sale package to satisfy requirements of 10 CFR 32.29(b)*

The point of sale label is designed to meets the requirements of 10 CFR 29 b1. This label is clearly visible when the detector is removed.

The exterior of shipping cartons will contain a label to meet the requirements of 10 CFR 32.29 b3. This label will contain the statement; "This package contains radioactive material and has been manufactured in compliance with U.S. NRC safety criteria in 10 CFR 32.27. The purchaser is exempt from any regulatory requirements."

Copies of the labels are provided in Attachment E5.

11. *Procedures for prototype testing of product to demonstrate the effectiveness of the containment, shielding, and other safety features under both normal and severe conditions of handling, storage, use and disposal of the product.*

The source is registered with NRC under NRC Registry No: NR-0136S174-U AMM.1001H (IDNS).

The 612I and 912I series detectors have been approved by Underwriters Laboratories Inc. Listing against standard UL268, file number S466 category UROX. The Los Prevention Certification Board prototype tested the detectors to BS EN5445 Part 7.

12. *Results of prototype testing, including any change in form of the byproduct material contained in the product, the extent to which the byproduct material may be leaked to the environment, any increase in external radiation levels, and any other changes in safety features.*

The sealed source provided by Amersham has been tested to conditions described by USASI standard N5.10-1968 and respective classifications of C54545 and C44444. Details of this testing is found in the Registry in Attachment E1.

The complete detector passed prototype testing by the Loss Prevention Certification Board. The table of contents and the test reports for the 612I and 912I detectors are included in Attachment E6. TE 86995 and TE86927.

13. *Estimated external radiation doses and dose commitments relevant to the safety criteria in 10 CFR 32.27 and the basis for such estimates.*

In normal use, storage and disposal of the detector, the highest exposure will be experience by the installation and service and warehouse personnel. It can be assumed that these personnel will be handling detectors singly or in packages and may be in contact with them for an estimated one hour per day maximum for two hundred and fifty hours per year. This would result in an absolute maximum dose of 0.0017 rem to the hands of the personnel concerned, this is below the maximum level in column I of the table in 10 CFR 32.28.

In normal use, handling and storage it is unlikely that there will be a significant reduction in the effectiveness of the containment or shielding. The prototype testing of the sealed source as outlined in the registry referenced in 11 above, indicate minimal dose commitment. The mechanical integrity of the complete detector was performed under abnormal conditions of use according to BS5445 Part 7 as referenced in 11 above. The testing included corrosion, shock vibration and impact.

The estimates for external radiation doses are based upon the dose rate table provided by Amersham for rem/year of the sealed source only. The addition of the body molding and cover provide additional protection.

14. *Determination that the probabilities with respect to the doses referred to in 32.27 (c) meet criteria of that paragraph.*

The probabilities expressed in determining the dose rates meet the criteria of that paragraph.

15. *Quality control procedures to be followed in the fabrication of production lots of the product and the quality control standards the product will be required to meet.*

The detectors are designed and manufactured by Thorn Security Limited, doing business as, Tyco Electronic Products Group (TEPG), an ISO 9001 registered firm, registration number FM967. See attachment E7.

The ISO 9001 quality system employed by TEPG provide procedures to address all clauses of the ISO standard, particularly, Process Control, Design Control, Document and Data Control and an Internal Audit Process. A specific procedure for handling, storage and transport has been developed to ensure that the product is dispatched according to applicable regulations. See Attachment E8 TSG 10.4

A U.S. division of the Tyco Electronic Products Group resides at Grinnell Fire Protection Systems Co. (GFPS) with responsibilities for design change approval through GFPS operations.

TEPG performs random leak test audits during the manufacturing of Ion Detectors. Records of all leak test results will be forwarded and maintained by GFPS.

The detectors will be initially transferred by Grinnell Fire Protection System Co., an ISO 9001 registered firm, registration number A5562. See attachment E7. The procedures for receipt and shipping are followed to ensure compliance to NRC regulations for labeling, packaging and record keeping. See Attachment E8. Receipt and Shipping of Ion Detectors. This procedure identifies the requirements for inspection, wipe testing and shipping. The identification and maintenance of records required in 10 CFR 32.29 4 c are addressed in this procedure.

Wipe samples performed at GFPS will be analyzed by Stan A. Huber Consultants which is licensed by the State of Illinois. License number IL-010131001.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

(Corrected Copy)

NO.: NR136S174U DATE: October 26, 1979 PAGE 1 OF 4

SEALED SOURCE TYPE: Foil Source

MODEL: AMM1001, AMM1001H

MANUFACTURER/DISTRIBUTOR: Amersham Corporation
2636 S. Clearbrook Drive
Arlington Heights, IL 60005

MANUFACTURER/DISTRIBUTOR:

ISOTOPE: Americium-241 MAXIMUM ACTIVITY: 50 microcuries per square cm of foil

LEAK TEST FREQUENCY:

PRINCIPAL USE: Ion Generators, Smoke Detectors

CUSTOM SOURCE: ___ YES _X_ NO

ATTACHMENT E

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S174U DATE: October 26, 1979 PAGE 2 OF 4

SEALED SOURCE TYPE: Foil Source

DESCRIPTION:

The Model AMM 1001 sealed source consists of americium oxide uniformly distributed and sintered in a pure gold matrix which is further contained between a backing of gold coated pure silver and a front covering of either gold or gold-palladium alloy and fabricated by hot forging methods. The continuously welded metal layers are rolled so that the minimum thickness of the layers are:

gold-palladium alloy	0.0015 mm
americium oxide plus gold	0.0001 mm
gold	0.0001 mm
substrate	0.20 mm

Sub-division of the rolled foil is accomplished by cutting or punching into discs of 5 mm diameter or strips of say 2 mm x 10 mm diameter. At the activity loading specified above, there is no loose or wipable contamination above the wipe test limit of 0.005 microcuries.

The Model AMM 1001H mounted sealed source consists of a sized foil mounted in a "T" shaped standard holder constructed of tin plated brass. Lips of the source holder are rolled over the edge of the foil so the cut edges of the foil are not exposed. The larger diameter of the holder is approximately 5 mm and the length is approximately 6 mm. The useful life is 20 years.

LABELING:

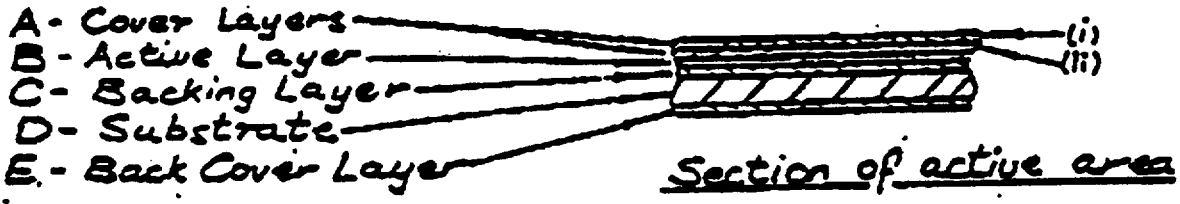
Neither the foils nor mounts are labeled. This evaluation does not describe possible A/S foil sources distributed under other model designations nor sources previously distributed under "AMM" designation.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S174U DATE: October 26, 1979 PAGE 3 OF 4

SEALED SOURCE TYPE: Foil Source

DIAGRAM:



A - (i) Palladium ~ 0,002 mm
(ii) Gold ~ 0,0002 mm
B - Americium Oxide plus Gold ~ 0,002 mm
C - Gold ~ 0,001 mm
D - 0,20 - 0,25 mm
E - Gold - < 0001 mm

PROTOTYPE TESTING:

Prototype Model AMM 1001 blanked sealed sources and Model AMM 1001H mounted sources have been tested to conditions described by USASI standard N5.10-1968 and respective classifications of C54545 and C44444 have been demonstrated. Results of wipe tests of the tested foils were acceptable to less than 0.005 microcuries. In addition, AMM 1001 samples have successfully passed "special form" testing conditions.

Model AMM 1001 foils have experienced the following additional tests:

1. Immersion in water of prototype foils for 3 weeks at room temperature: less than 0.001 microcurie per foil loaded at maximum activity was found in the water.

2. Immersion in 0.1 N hydrochloric acid for 24 hours at room temperature: less than 0.004 microcurie activity was leached out.

3. Foils were subjected to tests in moist air, dry air, sulfur dioxide fumes, hydrochloric acid fumes, ammonia vapor, to repetitive wipe tests (5000X) and welding tests: less than 0.005 microcurie wipable contamination was found. Shelf-life tests of foils with 50 microcuries/cm² loading show no deleterious aging effects after 6 years.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR1365174U DATE: October 26, 1979 PAGE 4 OF 4

SEALED SOURCE TYPE: Foil Source

PROTOTYPE TESTING (CONT'D):

Foils and mounted foils have been subjected to ozone at 0.75 ppm for a period of 60 days and salt spray for 16 days without deleterious results.

QUALITY ASSURANCE AND CONTROL:

Not less than 10 percent of the Model AMM 1001H sources are checked by gamma counting to ensure that the activity in each foil is within specified limits. Each product is visually inspected to check that the rolled-over edge is satisfactory and that the alpha emitting surface is free from surface defects. Each source is wipe tested to an acceptance limit of 0.005 microcuries.

In addition to the above, each Model AMM 1001 foil is checked by alpha spectrometry to determine the adequacy of the gold cover.

REFERENCES:

Date October 26, 1979 Reviewed By /s/ Joseph M. Brown, Jr.

Date October 26, 1979 Concurrence /s/ Earl G. Wright

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

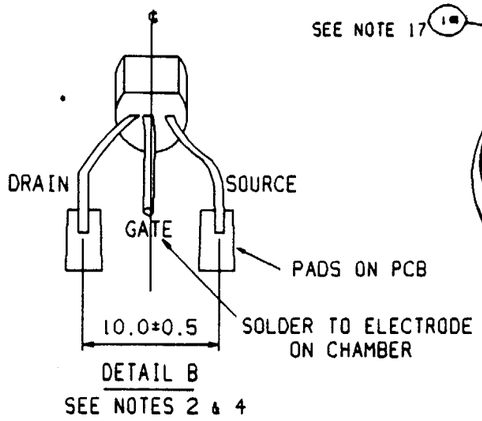
OVERSIZE PAGE(S)

****

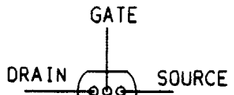
NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

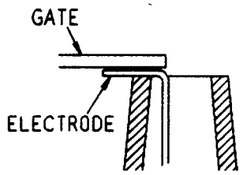
PAPER COPY IS AVAILABLE IN NRC FILE CENTER.



DETAIL B
SEE NOTES 2 & 4



F.E.T. VIEWED FROM UNDERSIDE



DETAIL C
SEE NOTES 2 & 4

VIEW ON ARROW 'A'

NOTES:-

1. FIT BODY BUNG (ITEM 6) AND BODY STOPPER (ITEM 8) INTO BODY (ITEM 5).AS SHOWN.
2. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
3. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
4. AS SHOWN IN DETAIL 'B' SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
5. FIT LED.D3 (ITEM 23) INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22.ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
6. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY. SEE DETAIL 'D'.
7. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-050-031.
12. SOLDER.SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED,STORED,TRANSPORTED,INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

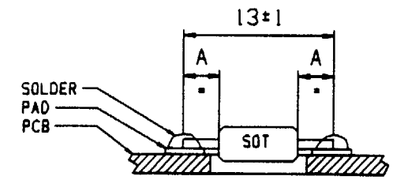


FIG.3

ISSUE	1	2	3	4
	IN2216 29-10-95	008417 31-10-97	008506 4-2-98	008560 31-3-98
APP'D	0.0	0.0	0.0	

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LPCB	UL	VdS	FM	SSC	MARINE

IF IN DOUBT - ASK

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

THORN SECURITY © 1996

TITLE ATTACHMENT E3

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	29-10-96	ENG'R	NAS	18-5-95

DEV.No. 142/001/3

MATERIAL SEE COMPONENTS LIST

SCALE NTS

THIRD ANGLE PROJECTION

TOLERANCES (UNLESS STATED)
GENERAL ±0.4mm

RELEVANT DRAWINGS

ITEM	COMPONENT	DESCRIPTION	BIN	STOCK CODE	DRN	QTY
1	PCB ASSEMBLY	MF612		125-585-533	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-091	*	1
5	BODY	MOULDING		121-003-176	*	1
6	BUNG	CONNECTOR HOLE.MOULDING		121-003-189	*	1
7						
8	BODY STOPPER	MOULDING		121-003-196	*	1
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC-A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-254	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 x 12LG PAN HEAD ST/ST		115-903-062	*	4
14	TRANSISTOR	FET. ION SP T092		125-029-264	*	1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	PRODUCT		120-247-826	*	1
18	ADHESIVE	EASYBOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.0003 Kg
21	PACKAGING	TRAY		123-002-621	*	0.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 Kg
23	LED	SLR-56VW RED.MILKY WHITE				
		If max 20 mA CONTINUOUS (D3)		125-114-124	*	1
24						
25						
26						

ISSUE	1 IN2216 24.10.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 BT.3
APP'D	0.0	0.0	0.0	0.0	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED O
AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHO
APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:
LPCB | UL | ~~VdS~~ | FM | SSC | MARINE |

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		

USED ON

CL 516-050-031

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K		8	125-652-219		1
25	RESISTOR	226K		9	125-652-229		1
25	RESISTOR	237K	0.6W +/-1% S.O.T.	10	125-652-239		1
25	RESISTOR	249K	ONLY 1 OFF OF THE	11	125-652-249		1
25	RESISTOR	261K	LISTED RESISTORS	12	125-652-269		1
25	RESISTOR	274K	(SHTS 2 & 3)	13	125-652-279		1
25	RESISTOR	287K	TO BE SELECTED	14	125-652-289		1
25	RESISTOR	301K	AT FINAL ASSEMBLY	15	125-652-309		1
25	RESISTOR	316K	STAGE	16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	129-652-429		1
25	RESISTOR	442K		23	125-652-449		1
25	RESISTOR	464K		24	125-652-469		1

THORN SECURITY

APP'D	0.0		
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98	

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LPCB	UL	~~FM~~	SBC	MARINE			

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		

USED ON

CL 516-050-031

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	487K		25	125-652-489		1
25	RESISTOR	511K		26	125-652-519		1
25	RESISTOR	536K		27	125-652-539		1
25	RESISTOR	562K		28	125-652-569		1
25	RESISTOR	590K		29	125-652-594		1
25	RESISTOR	619K	0.6W +/-1% S.O.T.	30	125-652-619		1
25	RESISTOR	649K	ONLY 1 OFF OF THE	31	125-652-649		1
25	RESISTOR	681K	LISTED RESISTORS	32	125-652-689		1
25	RESISTOR	715K	(SHTS 2 & 3)	33	125-652-719		1
25	RESISTOR	750K	TO BE SELECTED	34	125-652-754		1
25	RESISTOR	787K	AT FINAL ASSEMBLY	35	125-652-789		1
25	RESISTOR	825K	STAGE	36	125-652-829		1
25	RESISTOR	866K		37	125-652-869		1
25	RESISTOR	909K		38	125-652-909		1
25	RESISTOR	953K		39	125-652-959		1
25	RESISTOR	1M		40	125-652-105		1

THORN SECURITY

APP'D													
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98											

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY.
APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	FM	SSL	MARINE			

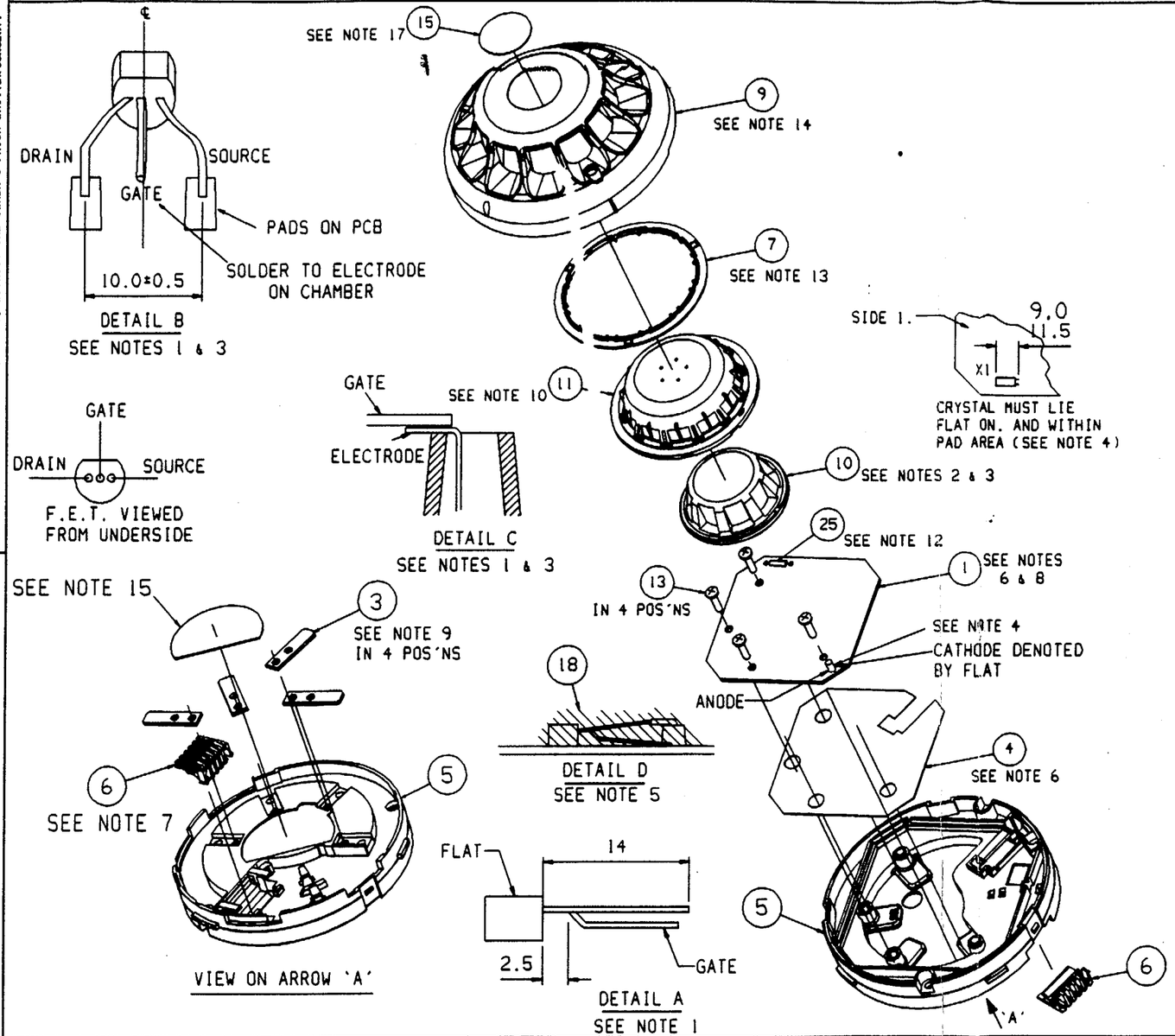
COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96	USED ON
CHECKED			

A4

CL 516-050-031



NOTES:-

1. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
2. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1), THEN SOLDER USING ITEM 22.
3. AS SHOWN IN DETAIL 'B', SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
4. FIT LED.D3 (ITEM 23) FROM SIDE 2 AND CRYSTAL (ITEM 24) FROM SIDE 1 INTO PCB (ITEM 1), AS SHOWN, AND SOLDER USING ITEM 22. ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
5. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY. SEE DETAIL 'D'.
6. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
7. FIT CONNECTOR ASSY (ITEM 6) INTO BODY (ITEM 5), AS SHOWN.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1), BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-051-031.
12. SOLDER, SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22. SEE FIG 3.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393.
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED, STORED, TRANSPORTED, INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

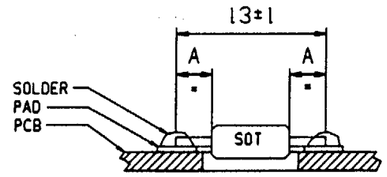


FIG.3

ISSUE		APP'D
1	IN2199 5-9-96	0.0
2	008417 31-10-97	0.0
3	008506 4-2-98	0.0
4	008560 31-3-98	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

~~LPCB~~ | UL | ~~VdS~~ | ~~FM~~ | ~~SBC~~ | ~~MARINE~~ | | | |

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED. TO BE READ IN CONJUNCTION WITH BS 308.

THORN SECURITY

TITLE: 9121 IONISATION ANALOGUE SMOKE DETECTOR

ATTACHMENT E3

DRAWN: EG 5-6-97 | ENG'R:

DEV.No.:

DRAWING No.: 516-051-031

SHEET 1 OF 2

MATERIAL: SEE COMPONENTS LIST

FINISH:

SCALE: NTS

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30'

RELEVANT DRAWINGS

USED ON

A3

ITEM No.	COMPONENT	DESCRIPTION	BIN No.	STOCK CODE	DRW	QTY PER
1	PCB ASSEMBLY	MF901		125-585-256	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-085	*	1
5	BODY	METALLISED		120-037-161	*	1
6	CONNECTOR ASSY	5-WAY		121-004-003	*	1
7	CLOSURE RING	ION.MOULDING		121-003-186	*	1
8						
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-178	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 X 12LG PAN HEAD ST/STL		115-903-062	*	4
14	TRANSISTOR	FET. ION SP T092		125-029-264		1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	BLANK		120-247-826	*	1
18	ADHESIVE	EASY BOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.0003 Kg
21	PACKAGING	TRAY		123-002-621		.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 Kg
23	LED	SLR-56VW RED.MILKY WHITE (D3) If MAX.20mA.CONTINUOUS		125-114-124		1
24	CRYSTAL	32.768kHz (X1)		125-003-005		1

APP'D												
ISSUE	1 IN2199 5-9-96	2 008417 6-11-97	3 008488 15-1-98	4 008506 26.2.98	5 008560 [illegible]							

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

1. PCB | UL | VdS | EMI | SSC | MARINE | 1 | 1 | 1

THORN SECURITY

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

DRAWN PCB 06/05/95

DEV.No. CL142/002/4

CL516-051-031

A4

ITEM No.	COMPONENT	DESCRIPTION	BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	82.5K	1	125-652-828		1
25	RESISTOR	100K	2	125-652-104		1
25	RESISTOR	121K	3	125-652-128		1
25	RESISTOR	140K	4	125-652-144		1
25	RESISTOR	162K	5	125-652-168		1
25	RESISTOR	187K	6	125-652-189		1
25						
25	RESISTOR	205K	7	125-652-209		1
25	RESISTOR	215K	8	125-652-219		1
25	RESISTOR	226K	9	125-652-229		1
25	RESISTOR	237K	10	125-652-239		1
25	RESISTOR	249K	11	125-652-249		1
25	RESISTOR	261K	12	125-652-269		1
25	RESISTOR	274K	13	125-652-279		1
25	RESISTOR	287K	14	125-652-289		1
25	RESISTOR	301K	15	125-652-309		1
25	RESISTOR	316K	16	125-652-319		1
25	RESISTOR	332K	17	125-652-339		1
25	RESISTOR	348K	18	125-652-349		1
25	RESISTOR	365K	19	125-652-369		1
25	RESISTOR	383K	20	125-652-389		1
25	RESISTOR	402K	21	125-652-409		1
25	RESISTOR	422K	22	125-652-429		1
25	RESISTOR	442K	23	125-652-449		1

THORN SECURITY

ISSUE		
1	IN2199	5-9-96
2	008560	2.4.98

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APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	VdS	FM	SCI	MARINE				

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

DRAWN	AAB 05/06/95
DEV.No.	CL142/002/4

A4

CL516-051-031

ITEM No.	COMPONENT	DESCRIPTION		BOM No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	464K	0.6W +/-1% S.O.T.	24	125-652-469		1
25	RESISTOR	487K	ONLY 1 OFF OF THE	25	125-652-489		1
25	RESISTOR	511K	LISTED RESISTORS	26	125-652-519		1
25	RESISTOR	536K	(SHTS 2 & 3) TO BE	27	125-652-539		1
25		562K	SELECTED AT FINAL	28	125-652-569		1
25		590K	ASSEMBLY STAGE	29	125-652-594		1
25		619K		30	125-652-619		1
25		649K		31	125-652-649		1
25		681K		32	125-652-689		1
25		715K		33	125-652-719		1
25		750K		34	125-652-754		1
25		787K		35	125-652-789		1
25		825K		36	125-652-829		1
25		866K		37	125-652-869		1
25		909K		38	125-652-909		1
25		953K		39	125-652-959		1
25		1M		40	125-652-105		1
25							
25							
25							
25							
25							
25							
25							

THORN SECURITY

ISSUE			
1	IN2199 5.9.96		
2	008560 2.4.98		

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

PCB	UL	~~VdE~~	FM	SSC	MARINE			

COMPONENTS LIST FOR

912I IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN PDB 05/06/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 2 OF 2

A4

The Loss Prevention Council
LPC Laboratories
Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86995

TEST REPORT

Title: Technical evaluation of the Thorn Security Limited Model MF901 analogue addressable ionization smoke detector to B.S. 5445; Part 7; 1984/EN54; Part 7; 1982

Client: Loss Prevention Certification Board
Melrose Avenue, Borehamwood, Herts, WD6 2BJ

Date: 29th May 1996

(5)

The Loss Prevention Council
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Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86995

CONTENTS

The Loss Prevention Council
LPC Laboratories
Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86995

1 INTRODUCTION

1.1 Object:

To examine the construction and assess the performance of the Thorn Security Limited Model MF901 analogue addressable ionization smoke detector in conjunction with the M900 mounting base and the Minerva 16E Fire Controller fitted with software configuration package CONSYS 10.1 for compliance with B.S. 5445; Part 7; 1984 / EN54; Part 7; 1982.

The MF901 ionization-chamber smoke detector forms part of the M900 Series of analogue addressable fire detectors. The detector attaches to the M900 universal mounting base to form an analogue addressable detector which transmits analogue signals representing the state of the detector chamber to the Minerva 16E Fire Controller.

In order to provide a fire alarm signal, this signal has to be received and analysed by the Minerva 16E Fire Controller. When considering compliance with B.S. 5445; Part 7; 1984, it is therefore necessary to include the communications protocol and analysis algorithms as part of the detection function.

1.2 Origin of request:

Testing undertaken for the LPCB:

Project No:	64598
Test schedule:	64598/2.3

1.3 Client:

Loss Prevention Certification Board
Melrose Avenue
Borehamwood
Herts WD6 2BJ

1.4 Manufacturer:

Thorn Security Limited
Security House
The Summit
Hanworth Road
Sunbury-on-Thames
Middlesex TW16 5DB

(7)

The Loss Prevention Council
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TE 86995

5.17 Corrosion test - Submission 2, High sensitivity (B.S.5445-7/EN 54-7[1] Clause 17)

5.17.1 Measurements

4 day corrosion			
Specimen No. 17		Orientation (Most unfavourable) : 0°	
Test	**Response threshold value y**	**Designated y_{max} & y_{min}**	**Ratio $y_{max} : y_{min}$**
Response before	0.791*	y_{min}	1.35
Response after	1.067	y_{max}	
* Value before test			

16 day corrosion				
Specimen No. 18			Orientation (Most unfavourable) : 0°	
Test	**Immediate fault signal or false alarm**	**Response threshold value y**	**Designated y_0 & y_{16}**	**Ratio $y_{16} : y_0$**
Response before		0.759*	y_0	0
Response after	IMMEDIATE ALARM	0	y_{16}	
* Value before test				

5.17.2 Comments

4 day corrosion

The specimen subjected to the 4 day phase of the test exhibited the following contamination:- some corrosion of via's on top of PCB and some corrosion around the connector assembly.

Examination of the mounting base showed contamination of the conductor retaining screws and washers as well as the four detector head contacts and the 6 connector pads on the address card.

(5)

The Loss Prevention Council
LPC Laboratories
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16 day corrosion

The specimen subjected to the 16 day phase of the test exhibited heavy contamination of the following components:- the leads of the SOT resistor and the leads of the FET, all the gold-plated spring contacts in the connector assembly, the four PCB retaining/conductor screws and all the via's on top of the PCB.

Examination of the mounting base showed contamination of the conductor retaining screws and washers as well as the four detector head contacts and the 6 connector pads on the address card.

5.17.3 Assessment

The requirements of Clause 17 were met, with the High sensitivity setting for the detector modified for Submission 2.

(6)

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Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86995

6 EVALUATION COMMENTS

It should be noted that the manufacturer only claims that the detector meets the test fires required by BS 5445; Part 7/EN 54; Part 7 with the control panel alarm threshold settings for High or Normal sensitivity and 6 second delay. No testing was requested or conducted at the LOW sensitivity setting or 24 second delay for this evaluation.

The manufacturer's documentation must clearly indicate the sensitivity settings etc. which must be used for the detector to comply with BS 5445; Part 7 and that compliance with the standard is not claimed at any other settings.

7 CONCLUSION

The Thorn Security Model MF901 analogue addressable ionization detector/M900 mounting base combination was tested in conjunction with the Thorn Minerva 16E Fire Controller incorporating software configuration package CONSYS 10.1.

As originally submitted and with the analogue alarm threshold setting at the Controller set at HIGH sensitivity, the Thorn Security Model MF901 analogue addressable ionization smoke detector/M900 mounting base combination met the requirements of Clauses 3, 5, 6-11, 13-16 and 18-20 of B.S. 5445; Part 7; 1984/EN54; Part 7; 1982, but failed to meet the requirements of Clause 17 (Corrosion test). With the analogue alarm threshold setting at NORMAL sensitivity, it also met the requirements of Clause 6 (Repeatability), Clause 8 (Reproducibility) and Clause 21 (Fire sensitivity).

The modified specimens with improved corrosion protection supplied for the second submission subsequently met the requirements of Clause 17 (Corrosion test).

The sixteen specimens supplied for the third submission all fitted with a new address determination ASIC and tested at NORMAL sensitivity met the ratio requirements of Clause 8 (Reproducibility) of the standard. It was noted that the response threshold value (RTV) of each specimen was within the range of RTVs previously measured on the first submission of specimens set at NORMAL sensitivity.

It should be noted that no testing was requested or conducted at the LOW sensitivity setting.

8 REFERENCES

1. B.S. 5445: Part 7: 1984/EN54: Part 7: 1982
Components of automatic fire detection systems - Part 7 Specification for point-type smoke detectors using scattered light, transmitted light or ionization. Incorporating Amendment No. 1. British Standards Institution, London, 1984.

(7)

The Loss Prevention Council
LPC Laboratories
Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86927

TEST REPORT

Title: Technical evaluation of the Thorn Security Limited Model MF601 conventional ionization smoke detector for LPCB Approval purposes

Client: Loss Prevention Certification Board, Melrose Avenue, Borehamwood, Herts, WD6 2BJ

Date: 11th October 1996

(2)

ATTACHMENT E6

ATTACHMENT E6

The Loss Prevention Council
LPC Laboratories
Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86927

1 INTRODUCTION

1.1 Object: To examine the construction and assess the performance of the Thorn Security Limited Model MF601 conventional ionization smoke detector in conjunction with the M600/M900 universal mounting base for confirmation of compliance with B.S. 5445: Part 7: 1984/EN54: Part 7: 1982 and certain requirements from EFSG/F/95/005:1995 with EMC testing as specified in LPCB test schedule 64598/1.3.

1.2 Origin of request: Testing undertaken for the LPCB:

Project No:	64598
Test schedule:	64598/1.3

1.3 Client: Loss Prevention Certification Board, Melrose Avenue, Borehamwood, Herts WD6 2BJ

1.4 Manufacturer: Thorn Security Limited, 160, Billet Road, Walthamstow, London E17 5DR

The Loss Prevention Council
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Telephone: 0181 207 2345 . Fax: 0181 207 6305

TE 86927

CONTENTS

The Loss Prevention Council
LPC Laboratories
Melrose Avenue, Borehamwood, Hertfordshire, WD6 2BJ. UK
Telephone: 0181 207 2345 Fax: 0181 207 6305

TE 86927

3.3 MF601 Detector modifications

As a result of the MF601 detectors failure to meet the requirements of Clause 17 (Corrosion test), the manufacturer instigated the following changes:-

1. The PCB manufacturing process has been changed so that all vias are now plugged with photoresist rather than being left open. This is to stop the vias from corroding and to stop corrosive vapour getting under the polyfilm and attacking the surface mount components on the rear of the PCB. The process also ensures that the vias are insulated thus preventing surface leakage currents on the top of the PCB between the vias due to corrosion products.

2. The photo resist has been changed so that it overlaps all the unprotected tinned copper pads to exclude corrosion from the edge of the pads, this was shown to eliminate the need to hand tin the test pads.

3. The means of corrosion protection for the FET has changed from hand applied EVA coating to a moulded polyclefin encapsulation.

4. The FET location hole in the PCB has been removed and the film coating on the component side of the board has had a stress relief hole added to prevent "tenting" from occurring around the FET.

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6 EVALUATION COMMENTS

Corrosion Failure

It should be noted that following the initial Corrosion test (Clause 17) failure on the MF601 detector several corrosion test trials were conducted to assess the various build-standard changes made to the detector as described in Section 3.3 of this report.

These tests were considered as development work rather than a series of formal re-submissions.

(3)

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TE 86927

7 CONCLUSION

As originally submitted the Thorn Security Ltd., Model MF601 conventional ionisation smoke detector in conjunction with the M600/M900 universal mounting base met the requirements of Clause 3, 5-16 and 18-21 of B.S. 5445 : Part 7 : 1984/EN54 : Part 7 : 1982 but failed to meet the requirements of Clause 17 (Corrosion test).

When modified as described in Section 3.3 the MF601 ionization smoke detector met the requirements of Clause 17 (Corrosion test). These modifications are not considered to invalidate any of the other tests conducted on the first submission of specimens.

The MF601 ionization smoke detector also met the requirements of the following clauses of EFSG/F/95/005:1995; Clause 2.1 (Individual alarm indication), Clause 2.3 (Base marking) Clause 3.2 (Electrostatic discharge), Clause 3.3 (Radiated electromagnetic fields), Clause 3.4 (Fast transient bursts) and Clause 3.5 (Slow high energy voltage surge).

OVERSIZE PAGE(S)

****

NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

PAPER COPY IS AVAILABLE IN NRC FILE CENTER.

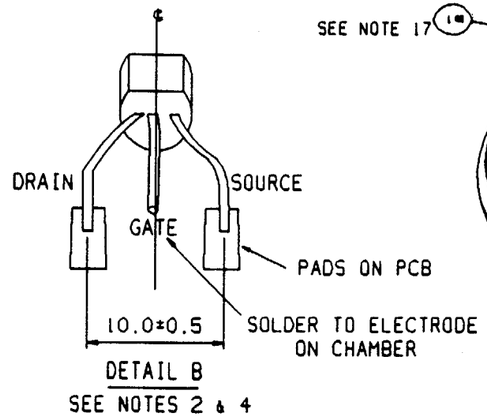
Exterior Package Label

THIS PACKAGE OF DETECTORS CONTAINS RADIOACTIVE MATERIAL. THE DETECTORS HAVE BEEN MANUFACTURED IN COMPLIANCE WITH U.S. NRC SAFETY CRITERIA IN 10 CFR 32.27. THE PURCHASER IS EXEMPT FROM ANY REGULATORY REQUIREMENTS.

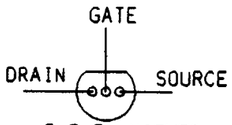
AMERICIUM 241 0.9 microcuries/detector

Distributed by: Grinnell Fire Protection Systems Co.
835 Sharon Drive
Westlake, Ohio 44045

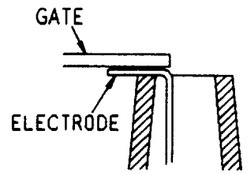
ATTACHMENT E5



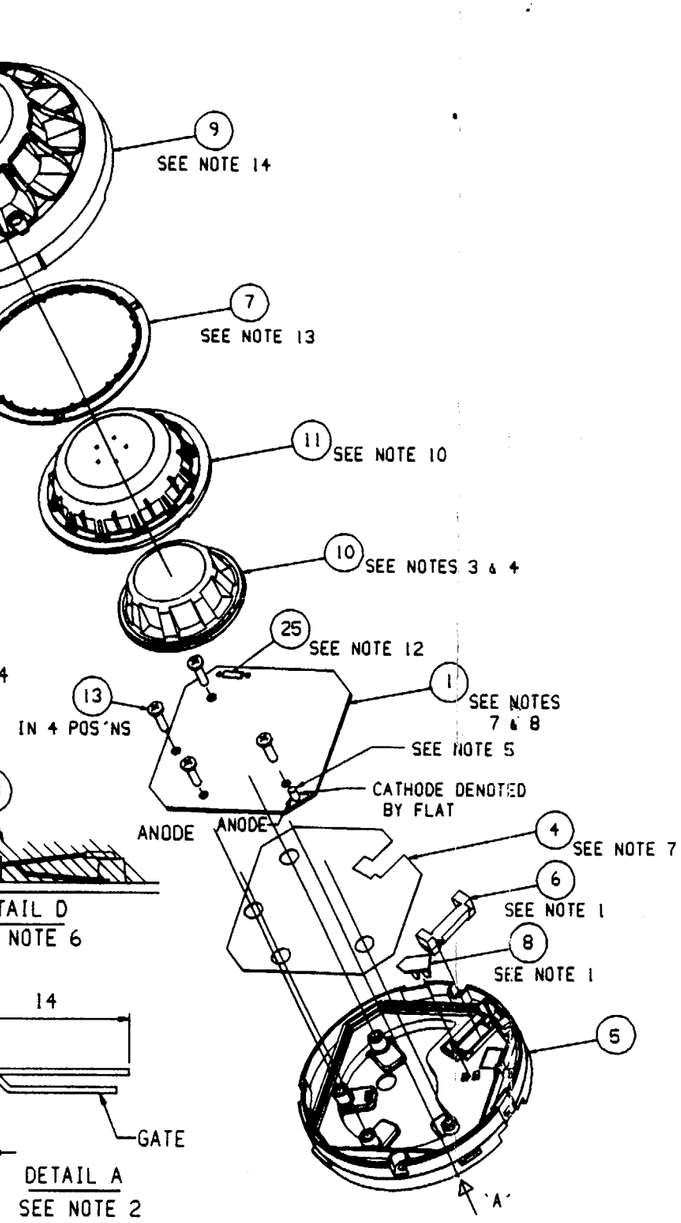
DETAIL B
SEE NOTES 2 & 4

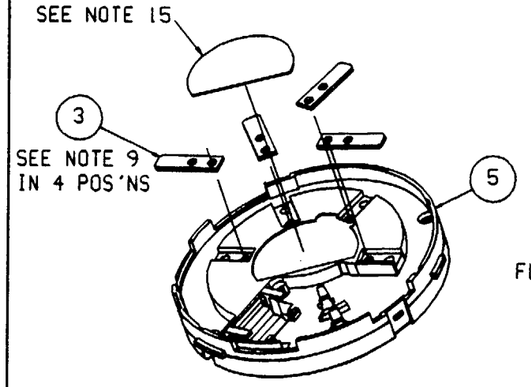


F.E.T. VIEWED FROM UNDERSIDE



DETAIL C
SEE NOTES 2 & 4





VIEW ON ARROW 'A'

DETAIL D
SEE NOTE 6

DETAIL A
SEE NOTE 2

NOTES:-

1. FIT BODY BUNG (ITEM 6) AND BODY STOPPER (ITEM 8) INTO BODY (ITEM 5).AS SHOWN.
2. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
3. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
4. AS SHOWN IN DETAIL 'B' SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
5. FIT LED.03 (ITEM 23) INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22.ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
6. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY. SEE DETAIL 'D'.
7. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-050-031.
12. SOLDER,SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi,3.33kBq DETECTOR TO BE MANUFACTURED,STORED,TRANSPORTED,INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

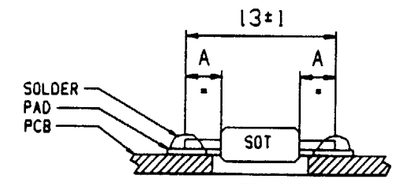


FIG.3

ISSUE	APP'D
1 IN2216 29-10-95	0.0
2 008417 31-10-97	0.0
3 008506 4-2-98	0.0
4 008560 31-3-98	

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[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

IF IN DOUBT - ASK

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

TITLE

6121
IONISATION SMOKE DETECTOR
ATTACHMENT F3

DRAWN	EG	29-10-96	ENG'R	NAS	18-5-95

DEV.No. 142/001/3

DRAWING No. 516-050-031

MATERIAL SEE COMPONENTS LIST

FINISH

SCALE NTS

THIRD ANGLE PROJECTION

TOLERANCES (UNLESS STATED)
GENERAL ±0.4mm
HOLE CENTRES ±0.12mm

RELEVANT DRAWINGS

SED ON

A2

ITEM	COMPONENT	DESCRIPTION	BIN	STOCK CODE	DRN	QTY
1	PCB ASSEMBLY	MF612		125-585-533	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-091	*	1
5	BODY	MOULDING		121-003-176	*	1
6	BUNG	CONNECTOR HOLE.MOULDING		121-003-189	*	1
7						
8	BODY STOPPER	MOULDING		121-003-196	*	1
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC-A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-254	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 x 12LG PAN HEAD ST/ST		115-903-062	*	4
14	TRANSISTOR	FET. ION SP TO92		125-029-264	*	1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	PRODUCT		120-247-826	*	1
18	ADHESIVE	EASYBOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.0003 Kg
21	PACKAGING	TRAY		123-002-621	*	0.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 Kg
23	LED	SLR-56VW RED.MILKY WHITE				
		If max 20 mA CONTINUOUS (D3)		125-114-124	*	1
24						
25						
26						

THORN SECURITY

APP'D	0.0	0.0	0.0	0.0								
ISSUE	1 IN2216 24.10.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 31.3							

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LPCB | UL | [illegible] | FM | SSC | MARINE | | | |

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		

USED ON

CL 516-050-031

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K		8	125-652-219		1
25	RESISTOR	226K		9	125-652-229		1
25	RESISTOR	237K	0.6W +/-1% S.O.T.	10	125-652-239		1
25	RESISTOR	249K	ONLY 1 OFF OF THE	11	125-652-249		1
25	RESISTOR	261K	LISTED RESISTORS	12	125-652-269		1
25	RESISTOR	274K	(SHTS 2 & 3)	13	125-652-279		1
25	RESISTOR	287K	TO BE SELECTED	14	125-652-289		1
25	RESISTOR	301K	AT FINAL ASSEMBLY	15	125-652-309		1
25	RESISTOR	316K	STAGE	16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	129-652-429		1
25	RESISTOR	442K		23	125-652-449		1
25	RESISTOR	464K		24	125-652-469		1

ISSUE	APP'D
1 IN2216 24.10.96	0.0
2 008560 31.3.98	

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LPCB	UL		SM	SSC	MARINE				

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		

USED ON

CL 516-050-031

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	487K		25	125-652-489		1
25	RESISTOR	511K		26	125-652-519		1
25	RESISTOR	536K		27	125-652-539		1
25	RESISTOR .	562K		28	125-652-569		1
25	RESISTOR	590K		29	125-652-594		1
25	RESISTOR	619K	0.6W +/-1% S.O.T.	30	125-652-619		1
25	RESISTOR	649K	ONLY 1 OFF OF THE	31	125-652-649		1
25	RESISTOR	681K	LISTED RESISTORS	32	125-652-689		1
25	RESISTOR	715K	(SHTS 2 & 3)	33	125-652-719		1
25	RESISTOR	750K	TO BE SELECTED	34	125-652-754		1
25	RESISTOR	787K	AT FINAL ASSEMBLY	35	125-652-789		1
25	RESISTOR	825K	STAGE	36	125-652-829		1
25	RESISTOR	866K		37	125-652-869		1
25	RESISTOR	909K		38	125-652-909		1
25	RESISTOR	953K		39	125-652-959		1
25	RESISTOR	1M		40	125-652-105		1

THORN SECURITY

APP'D													
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98											

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APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	VdS	FM	SSL	MARINE			
						1	1	1

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96	USED ON
CHECKED			

A4

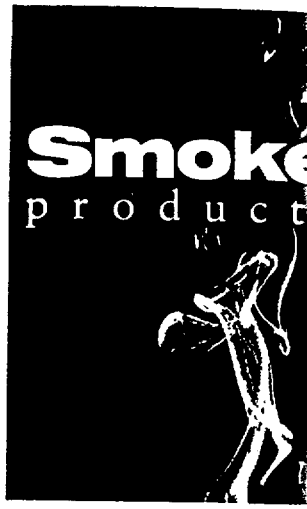
CI 516-050-031

Sources

Smoke detector ionization chambers type DSCA2 and DSCA3

Smoke Products Technical Service
Tel: +44 (0)1494 543745
Fax: +44 (0)1494 543583
WWW: http://www.amersham.co.uk/qsa/
email: QSA@amersham.co.uk

Contact your local Amersham Sales Office for enquiries



PRODUCT SPECIFICATION DATA SHEET 1124

◆ General description

Both products from Amersham™ incorporate a dual ionization chamber of advanced design containing a single radioisotope source producing ionization in both chambers. The design was developed using a computer model to optimize performance characteristics. A performance test electrode is incorporated in the DSCA3. Certain aspects of the designs, including the test electrode, are patented.

The design, manufacture and testing of the DSCA2 and DSCA3 ion chamber is managed within the scope of QSA Quality System which is certified by Lloyds Register Quality Assurance for compliance with BS EN ISO 9001:1994.[1]

The general construction is designed to meet the requirements of Underwriters Laboratories Inc. Standard UL 217[2] and EN 54:part 7.[3]

For maximum corrosion resistance the electrodes and source holder are made of AISI 316 stainless steel, the support moulding of polypropylene and the insulators of polytetrafluoroethylene Teflon™.

Details of the sealed source are given in data sheets 'Americium-241 alpha foil and sources'[4] and 'Safety and Packaging'[5], both available on request. In accordance with OECD requirement[6] the source activity is less than 37kBq (1μCi) ^{241}Am. The Recommended Working Life of the source is 10 years. The BS/ISO/ANSI rating of the ionization chamber is C64646.

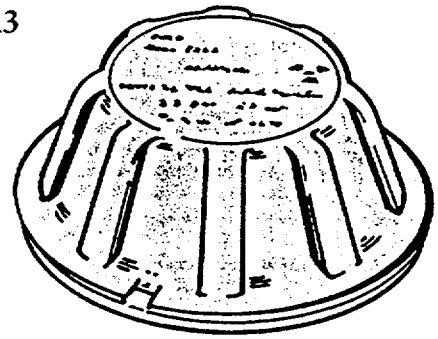
The units as supplied are assembled ready to mount on a suitable printed circuit board using the pre-tinned tags provided. No source adjustment is required.

The DSCA3's test electrode permits the checking not only of the operational functioning of the ion chamber but of all associated electronic circuitry. When actuated, the electrode disturbs the balance conditions to simulate the presence of smoke by an obscuration of 4·0%/ft.

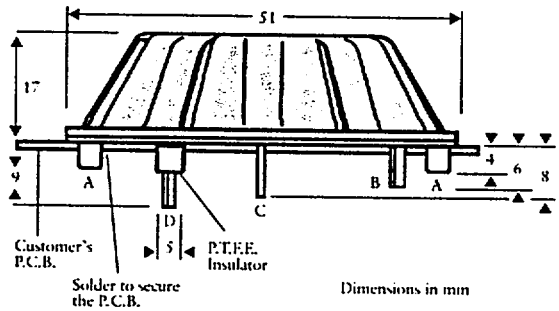
The design is compatible with commercially available integrated circuits. A list of recommended circuits for use in smoke detectors is available on request.

Amersham's expertise in the design and construction of ion chambers is long established and wide-ranging. A consultancy service is available to assist in the design of systems using ion chambers.

DSCA3

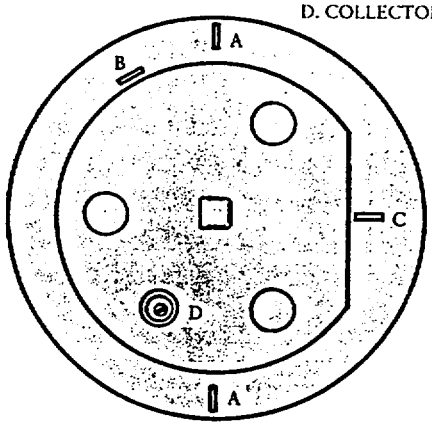


Side view



View from underneath

A. OUTER CAP ELECTRODE
B. SOURCE PLATE ELECTRODE
C. TEST ELECTRODE
D. COLLECTOR ELECTRODE



Amersham QSA

ATTACHMENT E4

◆ Regulatory compliance

Amersham sealed foil sources used in the detectors meet the regulatory requirements of most national authorities worldwide. Virtually all ionization smoke detectors use such sealed sources.

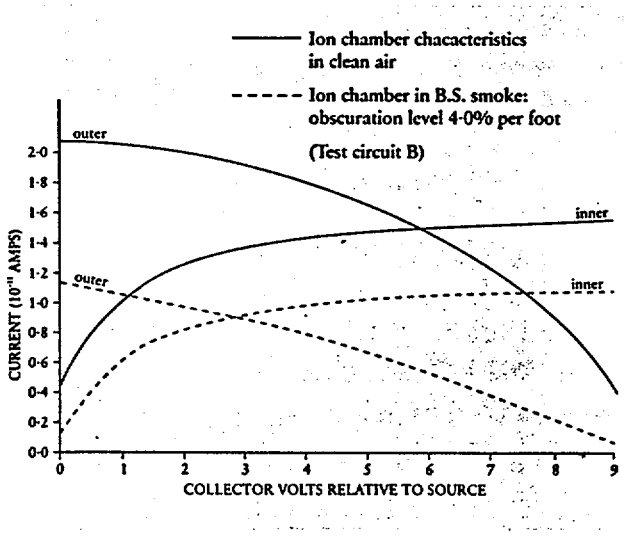
Specifically Amersham sources comply with:

- Underwriters Laboratories Inc. Standard UL 217[2]
- European Norm EN 54[3]
- UK National Radiological Protection Board (NRPB) criteria of acceptability[7] upon which intended UK government legislation relating to smoke detectors is to be based.
- Performance criteria of the Illinois Department of Nuclear Safety where they have been registered under IDNS model number AMM.1001H. IDNS registrations are recognised in the US as equivalent to NRC registration and so have nationwide validity.

◆ Principle of operation

The collector electrode is charged by any imbalance in the ionization currents flowing in the inner and outer chambers, until these currents come into balance. In the absence of smoke or combustion products, the balance potential remains constant, apart from small variations due to statistical fluctuation of the ionization current. In the diagram, this balance potential is illustrated by the crossover point of the continuous lines.

When smoke enters the chambers the ionization currents change, that in the outer chamber more so than in the inner chamber. The collector electrode is then charged to a new balance potential as shown by the crossing of the two broken lines. The change in potential is used to trigger an alarm circuit.



Variation with ambient and other parameters are illustrated in Appendix 1.

The performance of the DSCA3 has been independently assessed in the following two studies:

- in smoldering smoke and fire tests by Underwriters Laboratories Inc.[8]
- in accordance with a 'Testing Programme for Automatic Fire Alarm Equipment for Residential Use' by the Danish Research Centre for Applied Electronics[9]

Copies of both reports are available on request.

◆ Precautions and recommendations

The ionization current is approximately 20 pA. Precautions to preserve the insulation of the input connection path to the electronics are critical for correct operation of the device. In particular the collector electrode and its connections must remain free from contamination, e.g. from solder flux or manual contact. The lead from the collector electrode to the detector circuit should preferably be short and clear of the circuit board and other components.

The chamber is shielded from external electric fields by its outer cover. Suitable shielding should be provided for the associated circuitry, because of the necessarily high impedance of the circuit connected to the chamber collector electrode.

To improve corrosion resistance, the associated circuitry should be sealed in a container, using a suitable sealant where the chamber terminals enter the chamber (avoiding sealant on the collector electrode insulator).

Chambers intended for use at high altitudes may require adjustment of the tripping level of the detector circuit for optimum sensitivity.

Within reasonable limits, the balance potential remains relatively unaffected by temperature, humidity and wind velocity, as shown on the following pages. Amersham can advise on applications in which the ion chamber may operate outside the ambient ranges illustrated.

◆ Specification

The general specification is tabulated below. Conditions, except where specified, are:

– Outer electrode to source electrode potential: 9V

– Temperature: 20°C ± 3°C

– Ambient pressure: atmospheric, near sea level, clean air

	Minimum	Typical	Maximum	Units
Collector electrode balance potential	5·0	–	6·0	V
Change in collector balance potential with smoke:				
at 0·2% obscuration/foot*	–	0·7	–	V
at 4·0% obscuration/foot*	–	3·0	–	V
Insulator leakage	–	–	0·5	pA
Capacitance (collector to outer + source electrodes)	–	6	–	pF
^{241}Am activity:	–	20	26	kBq
	–	0·5	0·7	μCi

*obscuration limits specified by UL 217[2]

◆ Radiological data

Users of these units in all countries should ensure that they comply with all relevant regulations on the control of radioactive materials.

The DSCA3 unit has been independently assessed and found satisfactory in the following respects:

– a general Radiological Assessment by the NRPB[10]

– an NEA 1200°C incineration test by the NRPB[11]

Copies of the NRPB reports are available on request.

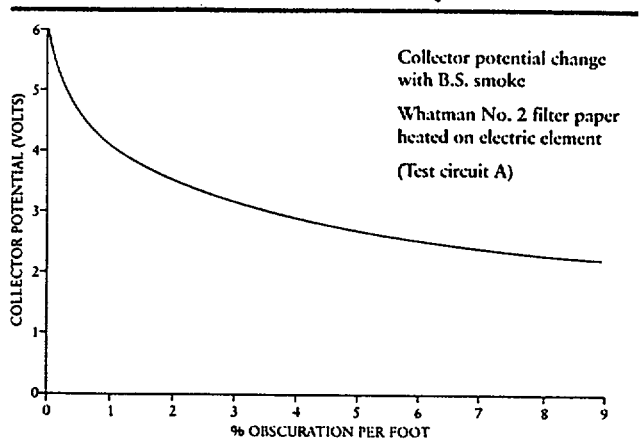
In both devices, external radiation attributable to the ^{241}Am sealed source is normally extremely low. The following approximate dose rate calculations based on thermoluminescent dosimetry data derived in respect of a typical Amersham unit are given for guidance. These data will enable users to comply with the US Code of Federal Regulations [10 CFR.32.26.(6).]

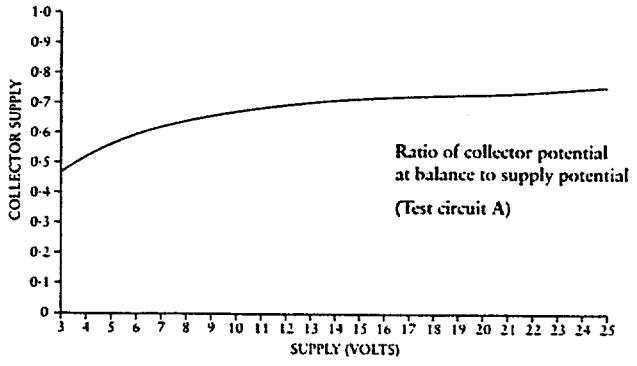
Direction	Distance (cm)	Dose rate mSv/year	Dose rate rem/year
Normal to surface of outer cap electrode	5	0·1	0·01
Normal to surface of outer cap electrode	25	0·005	0·0005
Normal to source electrode	5	0·6	0·06
Normal to source electrode	25	0·03	0·003

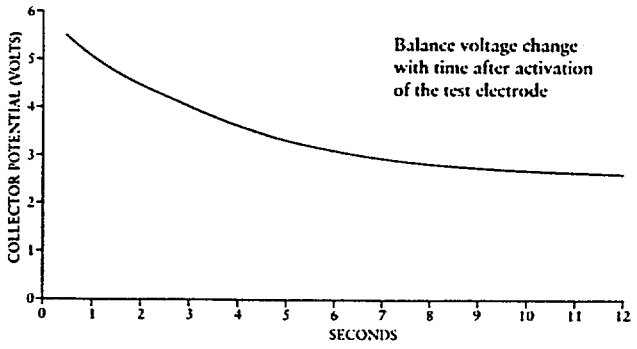
By comparison, a background dose rate in the UK can typically be 2mSv/year (0·2rem/year).

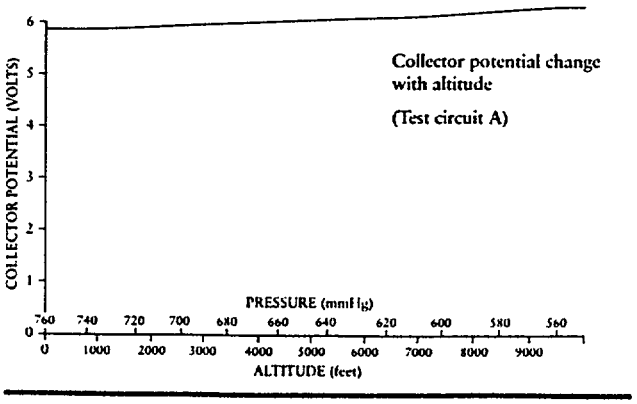
Reference may also be made to the Amersham QSA 'Safety and Packaging' document[5]. For any other safety advice please enquire as above.

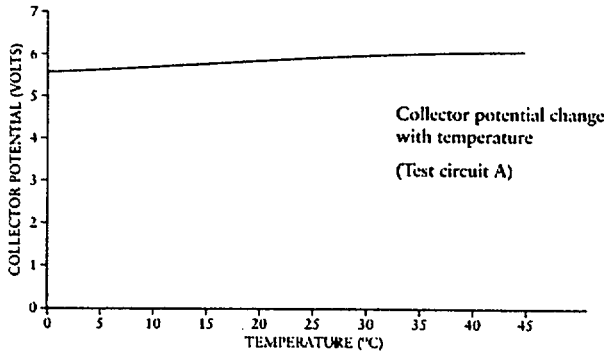
◆ Performance

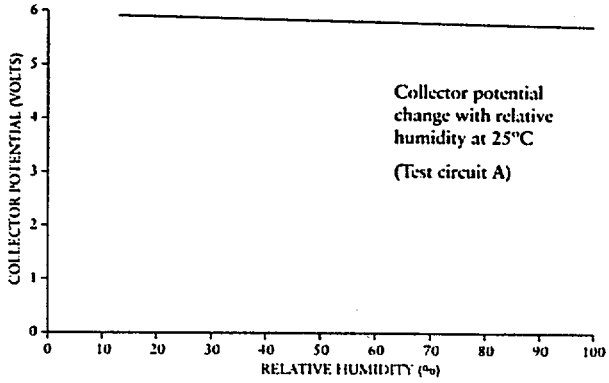


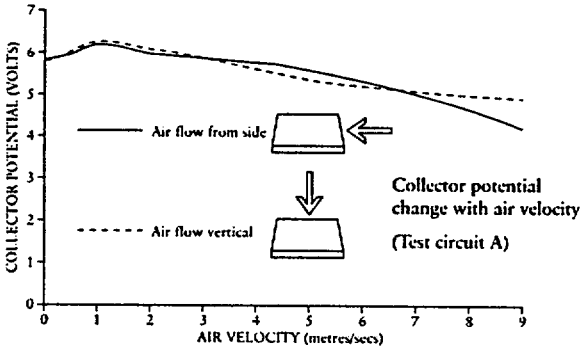




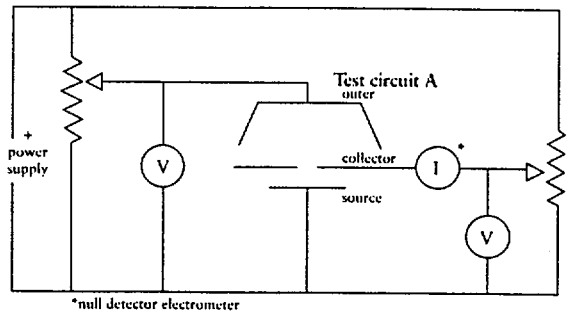


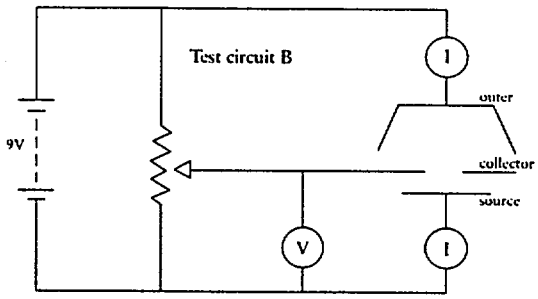






Circuits used to determine typical characteristics





References

1. 'Quality systems: Model for quality assurance in design, development, production, installation and servicing'. BS EN ISO 9001, British Standards Institution, London, 1994.
2. 'Standard for Single and Multiple Station Smoke Detectors'. UL 217, Fourth Edition, Underwriters Laboratories Inc., Northbrook, Illinois, 10th May 1993.
3. 'Components of automatic fire detection systems'. EN 54: Part 7, European Commission for Standardization (CEN), Brussels, July 1982.
4. 'Americium-241 alpha foil and sources'. Data Sheet No. 11262, Amersham International plc, Amersham, 1997.
5. 'Safety and Packaging'. Data sheet reference SOU/120/95/KL, Amersham International plc, Amersham, 1995.
6. 'Recommendations for ionization chamber smoke detectors in implementation of radiation protection standards': Section 6 Nuclear Energy Agency, Organisation for Economic Co-operation and Development, Paris, 1977.
7. 'Board Statement on Approval of Consumer Goods Containing Radioactive Substances". Documents of the NRPB, Volume 3, No. 2, National Radiological Protection Board, Didcot, 1992.
8. 'Smoldering Smoke And Fire Tests for Model DCS.A3'. S2182 78NK7050, Underwriters Laboratories Inc., Northbrook, Illinois, 22nd August 1978.
9. 'Informative Test of AFAR-Equipment'. Report No. 324323, Elektronikcentralen: Danish Research Centre for Applied Electronics, Copenhagen, 10th April 1979.
10. 'Measurement Report: Radiological Assessment'. EMR/1 34/79, National Radiological Protection Board, Didcot, 1979.
11. 'Analytical Report: NEA 1200°C incineration test'. NRPB/CP 3/016, National Radiological Protection Board, Leeds, 1985.

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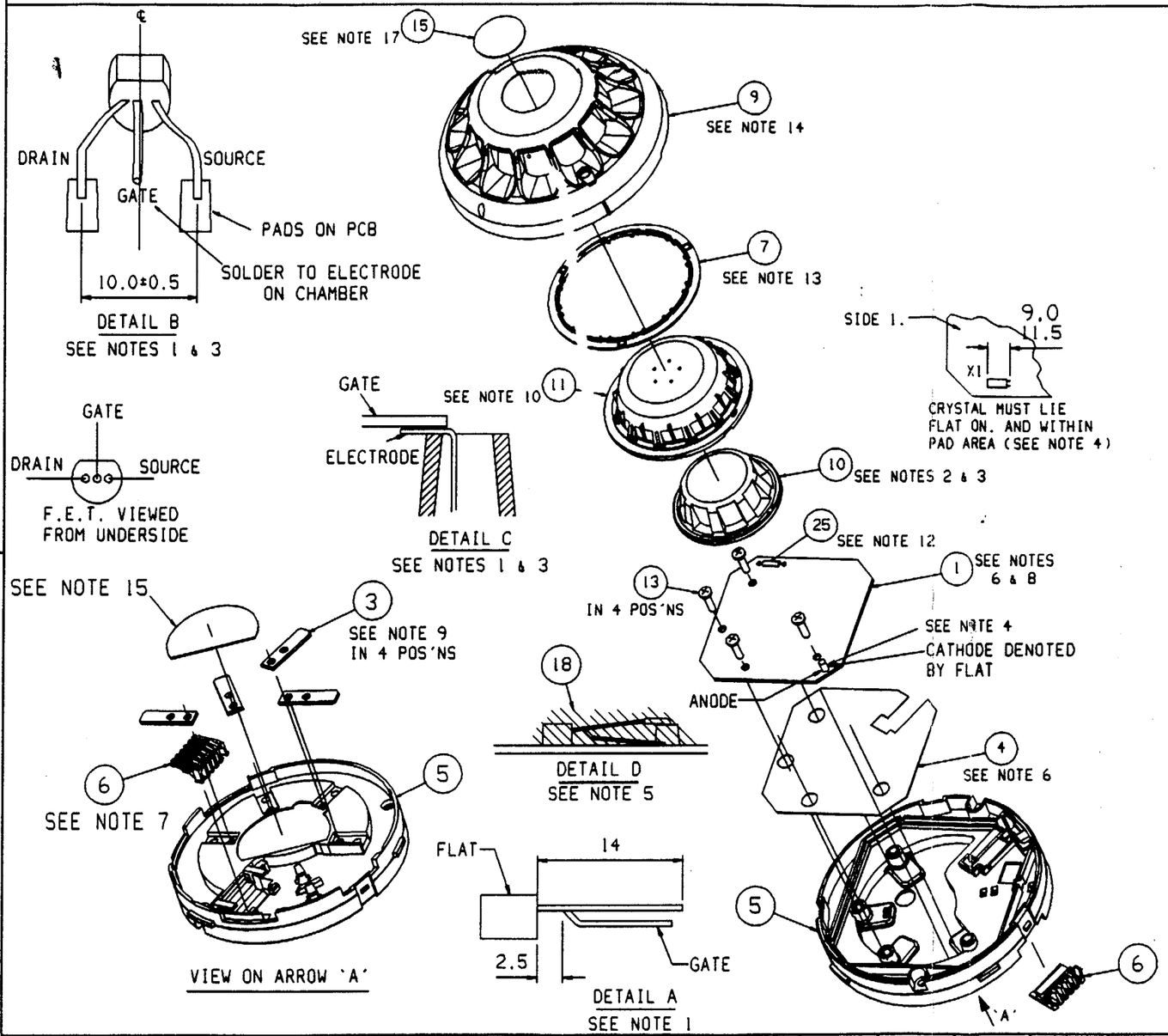
Gieselweg 1 D038110 Braunschweig
Tel: 0 5307 930-0 Fax: 0 5307 930-272

UK
Amersham International plc
Amersham Laboratories White Lion Road
Amersham Buckinghamshire HP7 9LL
Tel: 01494 543745 Fax: 01494 543583

USA
Amersham Corporation
2636 South Clearbrook Drive Arlington Heights Illinois 60005-4692
Tel: 800 323-6695 (toll free) 708 593 6300 Fax: 708 593 8091

SOU/134/97/KL



NOTES:-

1. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
2. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
3. AS SHOWN IN DETAIL 'B'.SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
4. FIT LED.D3 (ITEM 23) FROM SIDE 2 AND CRYSTAL (ITEM 24) FROM SIDE 1 INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22. ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
5. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY.SEE DETAIL 'D'.
6. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
7. FIT CONNECTOR ASSY (ITEM 6) INTO BODY (ITEM 5).AS SHOWN.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-051-031.
12. SOLDER.SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22. SEE FIG 3.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH, ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393.
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED.STORED. TRANSPORTED.INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

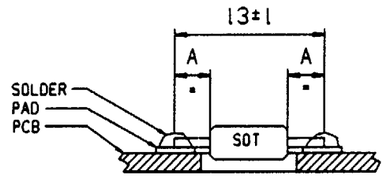


FIG.3

ISSUE		APP'D
1	IN2199 5-9-96	0.0
2	008417 31-10-97	0.0
3	008506 4-2-98	0.0
4	008560 31-3-98	

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LPCB	UL	VdS	FM	SBC	MARINE			

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

THORN SECURITY

TITLE

9121 IONISATION ANALOGUE SMOKE DETECTOR

ATTACHMENT E3

A3

DRAWN EG 5-6-97 ENG'R

DEV.No.

DRAWING No. 516-051-031

SHEET 1 OF 2

MATERIAL SEE COMPONENTS LIST

FINISH

SCALE NTS

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30'

RELEVANT DRAWINGS

USED ON

ITEM No.	COMPONENT	DESCRIPTION	BIN No.	STOCK CODE	DNM	QTY PER
1	PCB ASSEMBLY	MF901		125-585-256	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-085	*	1
5	BODY	METALLISED		120-037-161	*	1
6	CONNECTOR ASSY	5-WAY		121-004-003	*	1
7	CLOSURE RING	ION.MOULDING		121-003-186	*	1
8						
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-178	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 X 12LG PAN HEAD ST/STL		115-903-062	*	4
14	TRANSISTOR	FET. ION SP T092		125-029-264		1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	BLANK		120-247-826	*	1
18	ADHESIVE	EASY BOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.010 KG
21	PACKAGING	TRAY		123-002-621		.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 KG
23	LED	SLR-56VW RED.MILKY WHITE (D3) If MAX.20mA.CONTINUOUS		125-114-124		1
24	CRYSTAL	32.768kHz (X1)		125-003-005		1

ISSUE	1	2	3	4	5
APP'D	IN2199 5-9-96	008417 6-11-97	008488 15-1-98	008506 26.2.98	008560

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	PCB	UL	VdS	FM	SSC	MARINE			
1							1	1	1
2									

THORN SECURITY

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

DRAWN PRB 06/05/95

DEV.No. CL142/002/4

CL516-051-031

A4

ITEM No.	COMPONENT	DESCRIPTION		BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25							
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K	0.6W +/-1% S.O.T.	8	125-652-219		1
25	RESISTOR	226K	ONLY 1 OFF OF THE	9	125-652-229		1
25	RESISTOR	237K	LISTED RESISTORS	10	125-652-239		1
25	RESISTOR	249K	(SHTS 2 & 3) TO BE	11	125-652-249		1
25	RESISTOR	261K	SELECTED AT FINAL	12	125-652-269		1
25	RESISTOR	274K	ASSEMBLY STAGE	13	125-652-279		1
25	RESISTOR	287K		14	125-652-289		1
25	RESISTOR	301K		15	125-652-309		1
25	RESISTOR	316K		16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	125-652-429		1
25	RESISTOR	442K		23	125-652-449		1

THORN SECURITY

ISSUE			
1	IN2199 5-9-96		
2		008560 2.4.98	

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APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	~~VdS~~	FM	SSC	MARINE				

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

DRAWN	PAB 05/06/95
DEV.No.	CL142/002/4
	CL516 051 031

A4

ITEM No.	COMPONENT	DESCRIPTION		M/A No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	464K	0.6W +/-1% S.O.T.	24	125-652-469		1
25	RESISTOR	487K	ONLY 1 OFF OF THE	25	125-652-489		1
25	RESISTOR	511K	LISTED RESISTORS	26	125-652-519		1
25	RESISTOR	536K	(SHTS 2 & 3) TO BE	27	125-652-539		1
25		562K	SELECTED AT FINAL	28	125-652-569		1
25		590K	ASSEMBLY STAGE	29	125-652-594		1
25		619K		30	125-652-619		1
25		649K		31	125-652-649		1
25		681K		32	125-652-689		1
25		715K		33	125-652-719		1
25		750K		34	125-652-754		1
25		787K		35	125-652-789		1
25		825K		36	125-652-829		1
25		866K		37	125-652-869		1
25		909K		38	125-652-909		1
25		953K		39	125-652-959		1
25		1M		40	125-652-105		1
25							
25							
25							
25							
25							
25							
25							

THORN SECURITY

ISSUE		
1	IN2199 5.9.96	
2	008560 2.4.98	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY.
APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

PCB	UL	~~VdS~~	EMI	SSC	MARINE				

COMPONENTS LIST FOR

912I IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN PAB 05/06/95

DEV.No. CL142/002/4

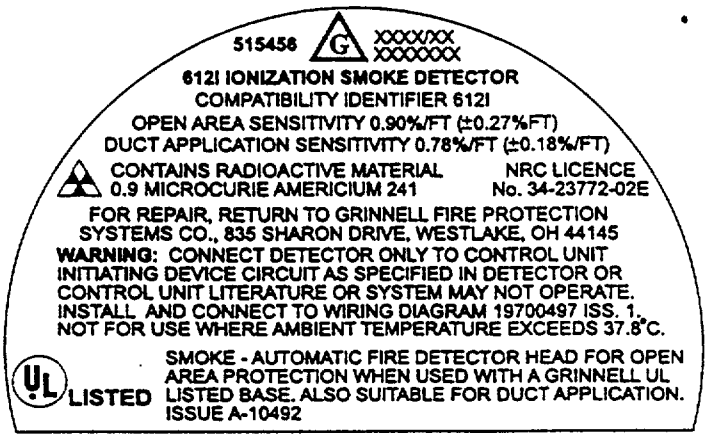
CL516-051-031

SHEET 2 OF 2

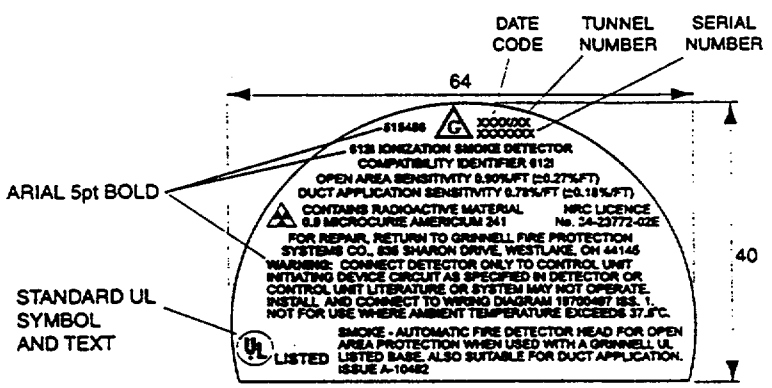
A4

REMOVE ALL BURRS AND SHARP EDGES - DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

DO NOT SCALE - TO BE READ IN CONJUNCTION WITH BS 308 - IF IN DOUBT - ASK!



1.5 : 1



1:1

NOTES:
1. FILE HELD IN ADOBE ILLUSTRATOR 7.0 FORMAT
2. LABEL CAN BE SUPPLIED IN THE FOLLOWING FORMATS:
   .AI, .PDF, .PCX, .TIF, .GIF, .JPG, .WPG.
3. ANY PART OF THE LABEL CAN BE SUPPLIED IN THE ABOVE FORMATS.
4. ALL TEXT 5pt ARIAL EXCEPT WHERE CHANGES SHOWN.
5. BLACK CHARACTERS ON WHITE BACKGROUND.

INK	TDR2000 RIBBON. (UL RECOGNISED ARMOR RIBBON AXR7+)

APP'D			BGHL						RELEVANT DRAWINGS
ISSUE	A 21/4/98	B 24/4/98	1 .2/6/98						USED ON 515456

MATERIAL	FINISH	TOLERANCES (UNLESS STATED)
120-247-826	SEE ABOVE	GENERAL ±0.2mm; HOLE CENTRES ±0.12mm; HOLE DIAMETERS +0.1mm -0; ANGULAR ±30

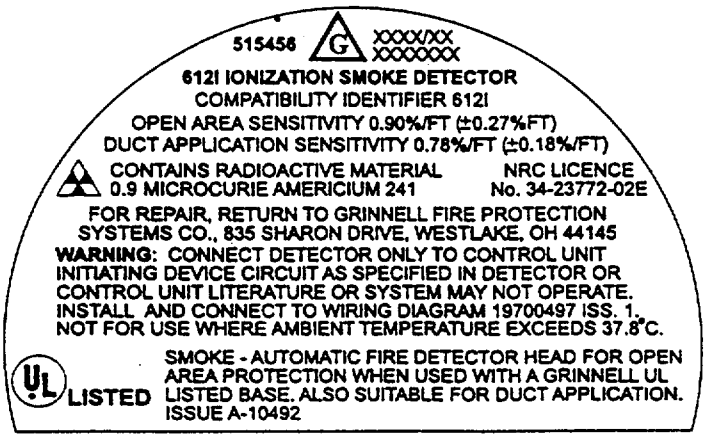
TITLE			
LABEL - 6121 IONIZATION SMOKE DETECTOR (GRINNELL)	DRAWN	2.6.98	DEV.No. 142/315
	ENG'R TA	02/06/98.	
	SCALE		DRAWING No. 515456
	THIRD ANGLE PROJECTION		SHEET 2 OF 2

THORN SECURITY

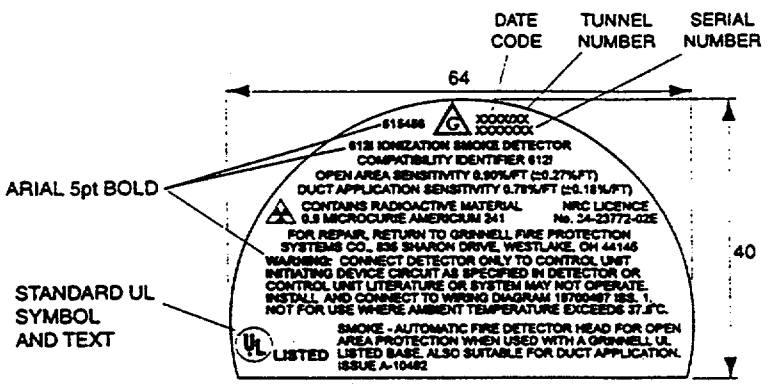
A4

REMOVE ALL BURRS AND SHARP EDGES - DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

DO NOT SCALE - TO BE READ IN CONJUNCTION WITH BS 308 - IF IN DOUBT - ASK!



1.5 : 1



1:1

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2. LABEL CAN BE SUPPLIED IN THE FOLLOWING FORMATS:
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3. ANY PART OF THE LABEL CAN BE SUPPLIED IN THE ABOVE FORMATS.
4. ALL TEXT 5pt ARIAL EXCEPT WHERE CHANGES SHOWN.
5. BLACK CHARACTERS ON WHITE BACKGROUND.

INK	TDR2000 RIBBON. (UL RECOGNISED ARMOR RIBBON AXR7+)

APP'D									RELEVANT DRAWINGS
ISSUE	A 21/4/98	B 24/4/98	1 .2/6/98						USED ON 515456

MATERIAL	FINISH	TOLERANCES (UNLESS STATED)
120-247-826	SEE ABOVE	GENERAL ±0.2mm HOLE CENTRES ±0.12mm HOLE DIAMETERS +0.1mm -0 ANGULAR ±30

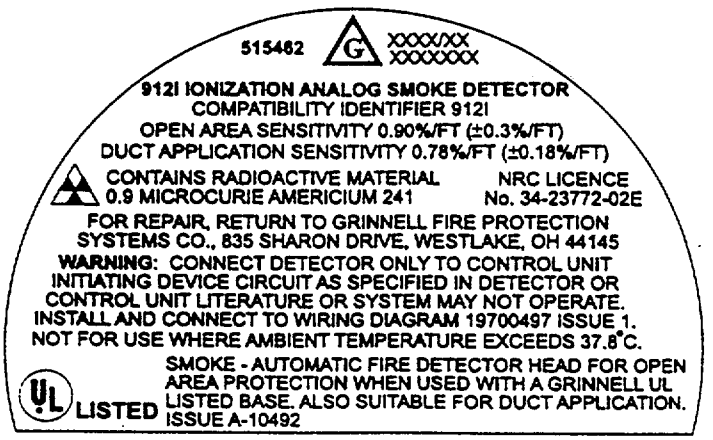
TITLE	DRAWN	2.6.98	DEV. No. 142/315
LABEL - 6121 IONIZATION SMOKE DETECTOR (GRINNELL)	ENG'R TA	02/06/98.	
	SCALE		DRAWING No. 515456
	THIRD ANGLE PROJECTION		SHEET 2 OF 3

THORN SECURITY

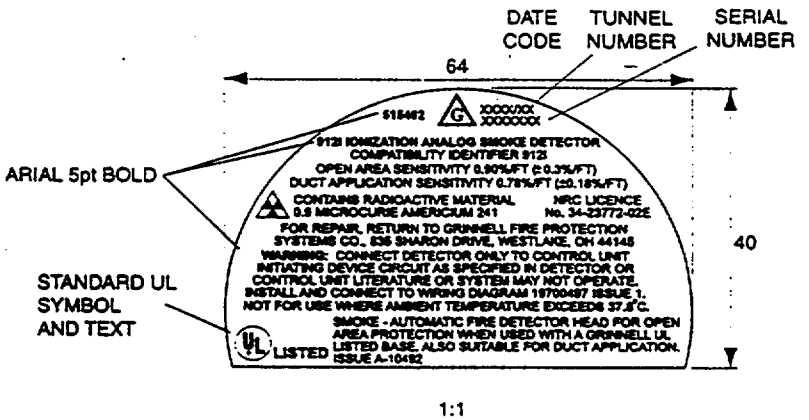
A4

REMOVE ALL BURRS AND SHARP EDGES - DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

DO NOT SCALE - TO BE READ IN CONJUNCTION WITH BS 308 - IF IN DOUBT - ASK!



1.5 : 1



1:1

NOTES:
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3. ANY PART OF THE LABEL CAN BE SUPPLIED IN THE ABOVE FORMATS.
4. ALL TEXT 5pt ARIAL EXCEPT WHERE CHANGES SHOWN.
5. BLACK CHARACTERS ON WHITE BACKGROUND

INK	TDR2000 RIBBON. (UL RECOGNISED ARMOR RIBBON AXR7+)

ISSUE	A	B	1
APP'D			
	21/4/98	.24/4/98	1/6/98

RELEVANT DRAWINGS

USED ON: 515462

MATERIAL	FINISH
120-247-826	SEE ABOVE

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30

TITLE: LABEL - 9121 IONIZATION ANALOG SMOKE DETECTOR (GRINNELL)

DRAWN 2.6.98

ENG'R TAG 02/06/98

SCALE

THIRD ANGLE PROJECTION

DEV.No. 142/316

DRAWING No. 515462

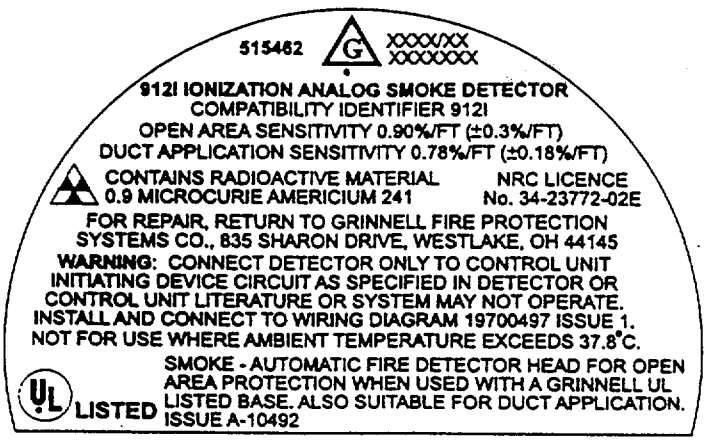
SHEET 2 OF 2

THORN SECURITY

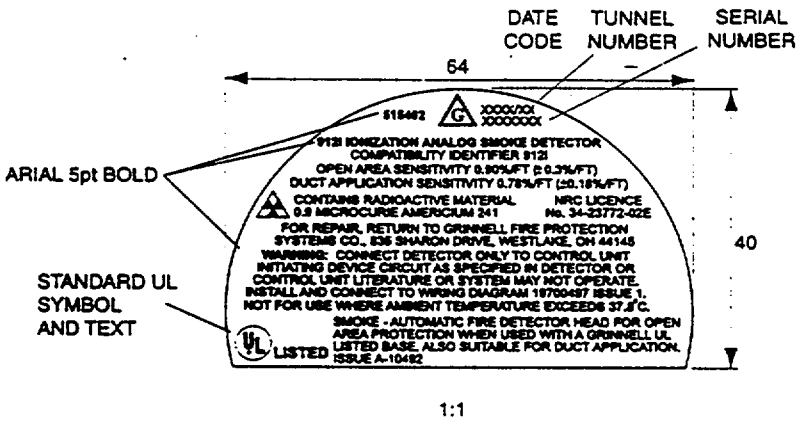
A4

REMOVE ALL BURRS AND SHARP EDGES - DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED

DO NOT SCALE - TO BE READ IN CONJUNCTION WITH BS 308 - IF IN DOUBT - ASK!



1.5 : 1



1:1

NOTES:
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3. ANY PART OF THE LABEL CAN BE SUPPLIED IN THE ABOVE FORMATS.
4. ALL TEXT 5pt ARIAL EXCEPT WHERE CHANGES SHOWN.
5. BLACK CHARACTERS ON WHITE BACKGROUND

INK TDR2000 RIBBON. (UL RECOGNISED ARMOR RIBBON AXR7+)

ISSUE	APP'D	DRAWN
A 21/4/98		
B .24/4/98		
1 1/6/98		

RELEVANT DRAWINGS

USED ON: 515462

MATERIAL: 120-247-826

FINISH: SEE ABOVE

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS -0.1mm -0
ANGULAR ±30

TITLE: LABEL - 9121 IONIZATION ANALOG SMOKE DETECTOR (GRINNELL)

DRAWN: 2.6.98

ENG'R: TAG 02/06/98

SCALE:

THIRD ANGLE PROJECTION

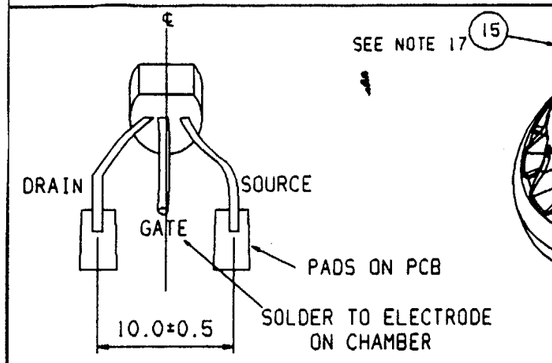
DEV.No. 142/316

DRAWING No. 515462

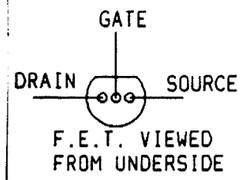
SHEET 2 OF 2

THORN SECURITY

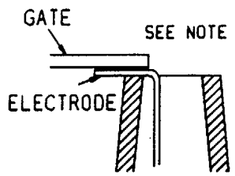
A4



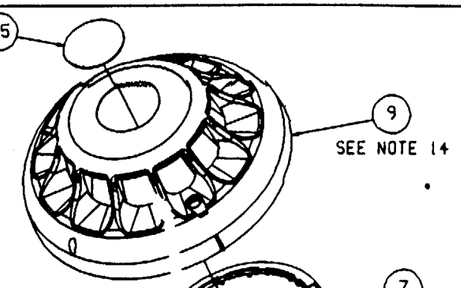
DETAIL B
SEE NOTES 1 & 3

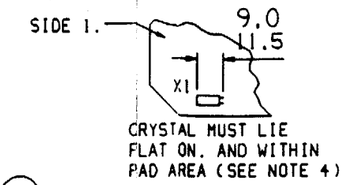


F.E.T. VIEWED FROM UNDERSIDE

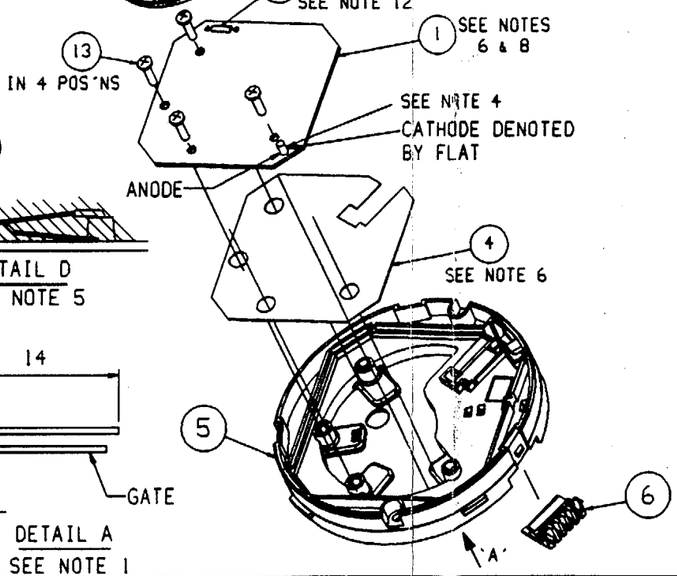


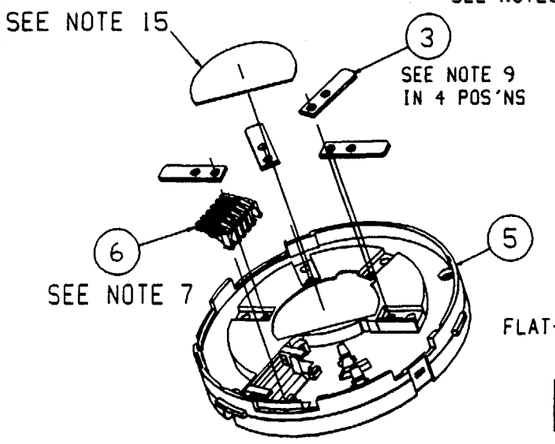
DETAIL C
SEE NOTES 1 & 3





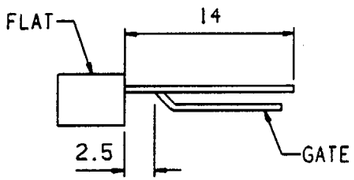
CRYSTAL MUST LIE FLAT ON, AND WITHIN PAD AREA (SEE NOTE 4)





VIEW ON ARROW 'A'

DETAIL D
SEE NOTE 5



DETAIL A
SEE NOTE 1

NOTES:-

1. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
2. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
3. AS SHOWN IN DETAIL 'B'.SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
4. FIT LED.D3 (ITEM 23) FROM SIDE 2 AND CRYSTAL (ITEM 24) FROM SIDE 1 INTO PCB (ITEM 1),AS SHOWN,AND SOLDER USING ITEM 22. ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
5. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY.SEE DETAIL 'D'.
6. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
7. FIT CONNECTOR ASSY (ITEM 6) INTO BODY (ITEM 5),AS SHOWN.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1),BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF, TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-051-031.
12. SOLDER.SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22. SEE FIG 3.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393.
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED.STORED. TRANSPORTED.INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

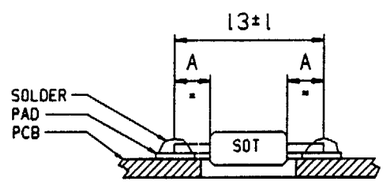


FIG.3

ISSUE		APP'D
1	IN2199 5-9-96	0.0
2	008417 31-10-97	0.0
3	008506 4-2-98	0.0
4	008560 31-3-98	

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LPCB	UL	~~VdS~~	~~FM~~	~~SBC~~	~~MARINE~~		

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

THORN SECURITY

TITLE

912I IONISATION ANALOGUE SMOKE DETECTOR

Attachment E3

A3

DRAWN: EG 5-6-97 ENG'R

DEV.No.

DRAWING No. 516-051-031

SHEET 1 OF 2

MATERIAL: SEE COMPONENTS LIST

FINISH: —

SCALE: NTS

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30'

RELEVANT DRAWINGS

USED ON

ITEM No.	COMPONENT	DESCRIPTION	BIN No.	STOCK CODE	DRN	QTY PER
1	PCB ASSEMBLY	MF901		125-585-256	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-085	*	1
5	BODY	METALLISED		120-037-161	*	1
6	CONNECTOR ASSY	5-WAY		121-004-003	*	1
7	CLOSURE RING	ION.MOULDING		121-003-186	*	1
8						
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-178	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 X 12LG PAN HEAD ST/STL		115-903-062	*	4
14	TRANSISTOR	FET. ION SP T092		125-029-264		1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	BLANK		120-247-826	*	1
18	ADHESIVE	EASY BOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.070 KG
21	PACKAGING	TRAY		123-002-621		.05
22	SOLDER	CRYSTAL 400		121-076-033		.000 KG
23	LED	SLR-56VW RED.MILKY WHITE (D3) If MAX.20mA.CONTINUOUS		125-114-124		1
24	CRYSTAL	32.768kHz (X1)		125-003-005		1

THORN SECURITY

APP'D												
ISSUE	1 IN2199 5.9.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 [illegible]							

COMPONENTS LIST FOR

912I IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN PDB 06/05/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 1 OF 3

A4

ITEM No.	COMPONENT	DESCRIPTION		BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25							
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K	0.6W +/-1% S.O.T.	8	125-652-219		1
25	RESISTOR	226K	ONLY 1 OFF OF THE	9	125-652-229		1
25	RESISTOR	237K	LISTED RESISTORS	10	125-652-239		1
25	RESISTOR	249K	(SHTS 2 & 3) TO BE	11	125-652-249		1
25	RESISTOR	261K	SELECTED AT FINAL	12	125-652-269		1
25	RESISTOR	274K	ASSEMBLY STAGE	13	125-652-279		1
25	RESISTOR	287K		14	125-652-289		1
25	RESISTOR	301K		15	125-652-309		1
25	RESISTOR	316K		16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	125-652-429		1
25	RESISTOR	442K		23	125-652-449		1

THORN SECURITY

COMPONENTS

A4

ISSUE		
1	IN2199 5-9-96	
2		008560 2.4.98

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LPCB	UL	~~VdS~~	FM	SSC	MARITIME				

LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN PMB 05/06/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 2 OF 3

ITEM No.	COMPONENT	DESCRIPTION		BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	464K	0.6W +/-1% S.O.T.	24	125-652-469		1
25	RESISTOR	487K	ONLY 1 OFF OF THE	25	125-652-489		1
25	RESISTOR	511K	LISTED RESISTORS	26	125-652-519		1
25	RESISTOR	536K	(SHTS 2 & 3) TO BE	27	125-652-539		1
25	"	562K	SELECTED AT FINAL	28	125-652-569		1
25	"	590K	ASSEMBLY STAGE	29	125-652-594		1
25	"	619K	"	30	125-652-619		1
25	"	649K	"	31	125-652-649		1
25	"	681K	"	32	125-652-689		1
25	"	715K	"	33	125-652-719		1
25	"	750K	"	34	125-652-754		1
25	"	787K	"	35	125-652-789		1
25	"	825K	"	36	125-652-829		1
25	"	866K	"	37	125-652-869		1
25	"	909K	"	38	125-652-909		1
25	"	953K	"	39	125-652-959		1
25	"	1M	"	40	125-652-105		1
25							
25							
25							
25							
25							
25							
25							

HORN SECURITY

ISSUE		
1	IN2199 5.9.96	
2		008560 2.4.98

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APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

PEB	UL	~~VdS~~	~~FM~~	SSL	MARINE		

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

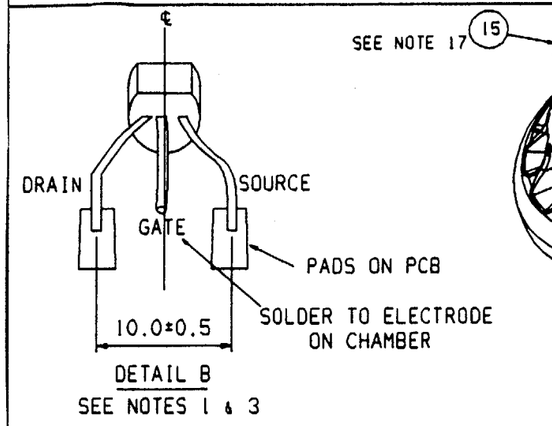
DRAWN PDB 05/06/95

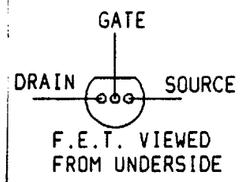
DEV.No. CL142/002/4

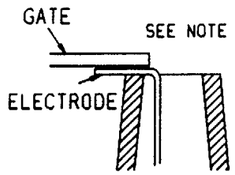
CL516-051-031

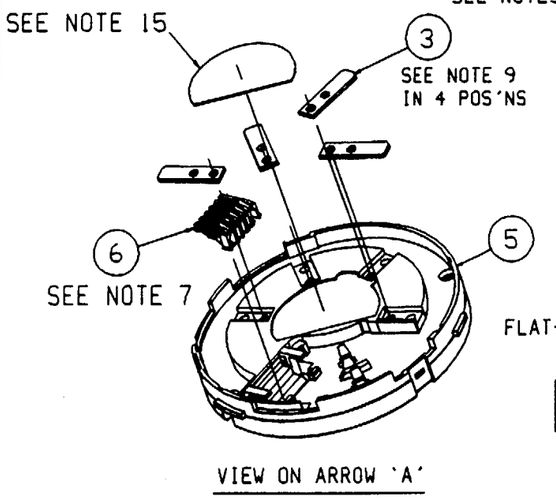
SHEET 3 OF 3

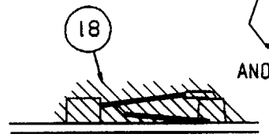
A4

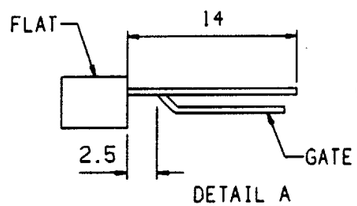












NOTES:-

1. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
2. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
3. AS SHOWN IN DETAIL 'B'.SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
4. FIT LED.D3 (ITEM 23) FROM SIDE 2 AND CRYSTAL (ITEM 24) FROM SIDE 1 INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22. ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
5. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY.SEE DETAIL 'D'.
6. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
7. FIT CONNECTOR ASSY (ITEM 6) INTO BODY (ITEM 5).AS SHOWN.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3), 4 OFF, TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-051-031.
12. SOLDER.SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22. SEE FIG 3.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393.
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED.STORED. TRANSPORTED.INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

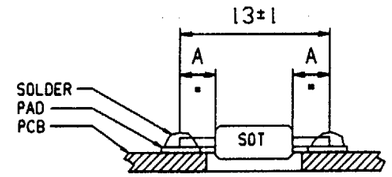


FIG.3

ISSUE		APP'D
1	IN2199 5-9-96	0.0
2	008417 31-10-97	0.0
3	008506 4-2-98	0.0
4	008560 31-3-98	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

	~~LPCB~~	UL	~~VdS~~	~~FM~~	~~SBC~~	~~MARINE~~		

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

THORN SECURITY

TITLE: 9121 IONISATION ANALOGUE SMOKE DETECTOR

Attachment F3

DRAWN: EG 5-6-97 ENG'R:

DEV.No.:

DRAWING No.: 516-051-031

SHEET 1 OF 2

MATERIAL: SEE COMPONENTS LIST

FINISH:

SCALE: NTS

TOLERANCES (UNLESS STATED)
GENERAL ±0.2mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30'

RELEVANT DRAWINGS

USED ON

A3

ITEM No.	COMPONENT	DESCRIPTION	BIN No.	STOCK CODE	DRN	QTY PER
1	PCB ASSEMBLY	MF901		125-585-256	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-085	*	1
5	BODY	METALLISED		120-037-161	*	1
6	CONNECTOR ASSY	5-WAY		121-004-003	*	1
7	CLOSURE RING	ION.MOULDING		121-003-186	*	1
8						
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-178	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 X 12LG PAN HEAD ST/STL		115-903-062	*	4
14	TRANSISTOR	FET. ION SP T092		125-029-264		1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	BLANK		120-247-826	*	1
18	ADHESIVE	EASY BOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.000 KG
21	PACKAGING	TRAY		123-002-621		.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 KG
23	LED	SLR-56VW RED.MILKY WHITE (D3) If MAX.20mA.CONTINUOUS		125-114-124		1
24	CRYSTAL	32.768kHz (X1)		125-003-005		1

THORN SECURITY

APP'D												
ISSUE	1 IN2199 5.9.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 [illegible]							

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN PAB 06/05/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 1 OF 3

A4

ITEM No.	COMPONENT	DESCRIPTION		BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25							
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K	0.6W +/-1% S.O.T.	8	125-652-219		1
25	RESISTOR	226K	ONLY 1 OFF OF THE	9	125-652-229		1
25	RESISTOR	237K	LISTED RESISTORS	10	125-652-239		1
25	RESISTOR	249K	(SHTS 2 & 3) TO BE	11	125-652-249		1
25	RESISTOR	261K	SELECTED AT FINAL	12	125-652-269		1
25	RESISTOR	274K	ASSEMBLY STAGE	13	125-652-279		1
25	RESISTOR	287K		14	125-652-289		1
25	RESISTOR	301K		15	125-652-309		1
25	RESISTOR	316K		16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	125-652-429		1
25	RESISTOR	442K		23	125-652-449		1

THORN SECURITY

ISSUE		
1	IN2199 5-9-96	
2	008560 2.4.98	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	~~VdS~~	FM	SSC	MARINE				

COMPONENTS LIST FOR

9121 IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

DRAWN AMB 05/06/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 2 OF 3

A4

ITEM No.	COMPONENT	DESCRIPTION		BIN No.	STOCK CODE	DRN	QTY PER
25	RESISTOR	464K	0.6W +/-1% S.O.T.	24	125-652-469		1
25	RESISTOR	487K	ONLY 1 OFF OF THE	25	125-652-489		1
25	RESISTOR	511K	LISTED RESISTORS	26	125-652-519		1
25	RESISTOR	536K	(SHTS 2 & 3) TO BE	27	125-652-539		1
25		562K	SELECTED AT FINAL	28	125-652-569		1
25		590K	ASSEMBLY STAGE	29	125-652-594		1
25		619K		30	125-652-619		1
25		649K		31	125-652-649		1
25		681K		32	125-652-689		1
25		715K		33	125-652-719		1
25		750K		34	125-652-754		1
25		787K		35	125-652-789		1
25		825K		36	125-652-829		1
25		866K		37	125-652-869		1
25		909K		38	125-652-909		1
25		953K		39	125-652-959		1
25		1M		40	125-652-105		1
25							
25							
25							
25							
25							
25							

HORN SECURITY

ISSUE	1	2
	IN2199 5.9.96	008560 2.4.98

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY.
APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

1	PCB	UL	~~VdS~~	FM	SSC	MARINE	1	1	1	1

COMPONENTS LIST FOR

912I IONISATION ANALOGUE SMOKE DETECTOR

USED ON DL 516-051-031

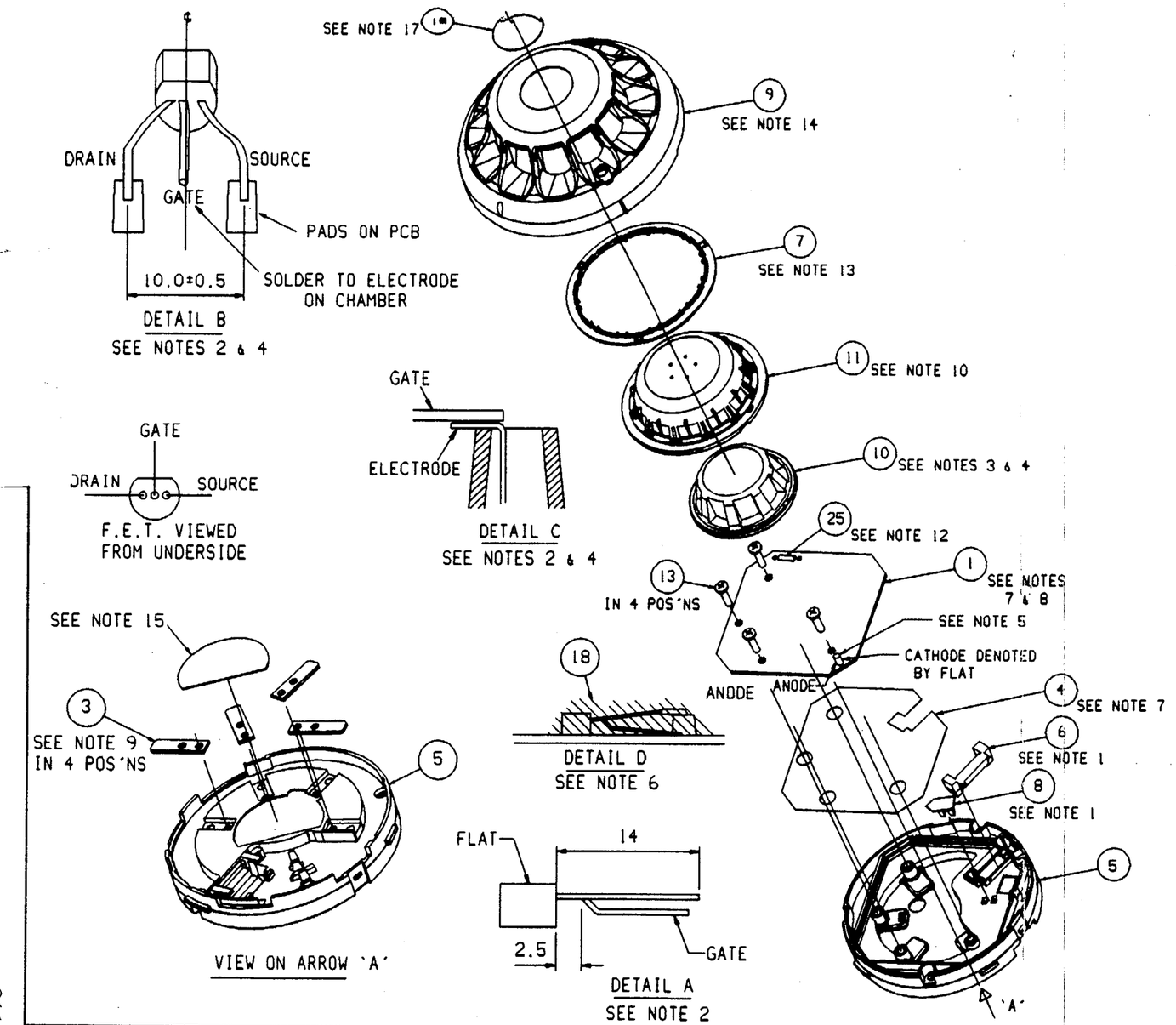
DRAWN PDB 05/06/95

DEV.No. CL142/002/4

CL516-051-031

SHEET 3 OF 3

A4



NOTES:-

1. FIT BODY BUNG (ITEM 6) AND BODY STOPPER (ITEM 8) INTO BODY (ITEM 5).AS SHOWN.
2. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
3. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
4. AS SHOWN IN DETAIL 'B' SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
5. FIT LED.D3 (ITEM 23) INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22.ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
6. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY. SEE DETAIL 'D'.
7. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-050-031.
12. SOLDER,SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED.STORED.TRANSPORTED.INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

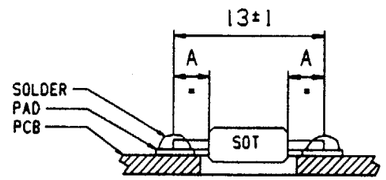


FIG.3

ISSUE	APP'D
1 IN2216 29-10-95	0.0
2 008417 31-10-97	0.0
3 008506 4-2-98	0.0
4 008560 31-3-98	

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

(LPCB) (UL) (VdS) (CNBOP) (SGC) (MARINE)

IF IN DOUBT - ASK

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

TITLE

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	29-10-96	ENG'R	NAS	18-5-95

DEV.No. 142/001/3

DRAWING No. 516-050-031

SHEET 1 OF 2

MATERIAL: SEE COMPONENTS LIST

FINISH:

SCALE: NTS — THIRD ANGLE PROJECTION

TOLERANCES (UNLESS STATED)
GENERAL ±0.4mm
HOLE CENTRES ±0.12mm
HOLE DIAMETERS +0.1mm -0
ANGULAR ±30'

RELEVANT DRAWINGS

USED ON

ATTACHMENT E3

ITEM	COMPONENT	DESCRIPTION	BIN	STOCK CODE	DRN	QTY
1	PCB ASSEMBLY	MF612		125-585-533	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-091	*	1
5	BODY	MOULDING		121-003-176	*	1
6	BUNG	CONNECTOR HOLE.MOULDING		121-003-189	*	1
7						
8	BODY STOPPER	MOULDING		121-003-196	*	1
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC-A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-254	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 x 12LG PAN HEAD ST/ST		115-903-062	*	4
14	TRANSISTOR	FET. ION SP TO92		125-029-264	*	1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	PRODUCT		120-247-826	*	1
18	ADHESIVE	EASYBOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.0003 Kg
21	PACKAGING	TRAY		123-002-621	*	0.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 Kg
23	LED	SLR-56VW RED.MILKY WHITE				
		If max 20 mA CONTINUOUS (D3)		125-114-124	*	1
24						
25						
26						

APP'D	0.0	0.0	0.0	0.0								
ISSUE	1 IN2216 24.10.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 ST.3							

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB | UL | VdS | FM | SSC | MARINE | | | |

THORN SECURITY

A4

COMPONENT LIST FOR:

6121

IONISATION SMOKE DETECTOR

ATTACHMENT E3

DRAWN	EG	24-10-96	USED ON
CHECKED			CL 516-050-031
APPROVED			SHEET 1 OF 3

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K		8	125-652-219		1
25	RESISTOR	226K		9	125-652-229		1
25	RESISTOR	237K	0.6W +/-1% S.O.T.	10	125-652-239		1
25	RESISTOR	249K	ONLY 1 OFF OF THE	11	125-652-249		1
25	RESISTOR	261K	LISTED RESISTORS	12	125-652-269		1
25	RESISTOR	274K	(SHTS 2 & 3)	13	125-652-279		1
25	RESISTOR	287K	TO BE SELECTED	14	125-652-289		1
25	RESISTOR	301K	AT FINAL ASSEMBLY	15	125-652-309		1
25	RESISTOR	316K	STAGE	16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	129-652-429		1
25	RESISTOR	442K		23	125-652-449		1
25	RESISTOR	464K		24	125-652-469		1

THORN SECURITY

APP'D		
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		
APPROVED		

USED ON

CL 516-050-031

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	487K		25	125-652-489		1
25	RESISTOR	511K		26	125-652-519		1
25	RESISTOR	536K		27	125-652-539		1
25	RESISTOR	562K		28	125-652-569		1
25	RESISTOR	590K		29	125-652-594		1
25	RESISTOR	619K	0.6W +/-1% S.O.T.	30	125-652-619		1
25	RESISTOR	649K	ONLY 1 OFF OF THE	31	125-652-649		1
25	RESISTOR	681K	LISTED RESISTORS	32	125-652-689		1
25	RESISTOR	715K	(SHTS 2 & 3)	33	125-652-719		1
25	RESISTOR	750K	TO BE SELECTED	34	125-652-754		1
25	RESISTOR	787K	AT FINAL ASSEMBLY	35	125-652-789		1
25	RESISTOR	825K	STAGE	36	125-652-829		1
25	RESISTOR	866K		37	125-652-869		1
25	RESISTOR	909K		38	125-652-909		1
25	RESISTOR	953K		39	125-652-959		1
25	RESISTOR	1M		40	125-652-105		1

THORN SECURITY

APP'D													
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98											

THIS IS AN APPROVED DRAWING AND MUST NOT BE CHANGED OR AMENDED WITHOUT PRIOR AGREEMENT WITH THE DESIGN AUTHORITY. APPROVED BY THE FOLLOWING APPROVAL AUTHORITIES:

LPCB	UL	VdS	FM	SSL	MARINE						
						1	1				

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

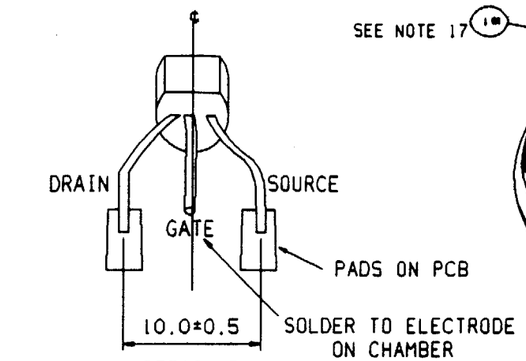
DRAWN	EG	24-10-96
CHECKED		
APPROVED		

USED ON

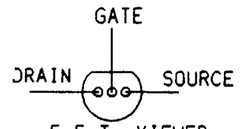
CL 516-050-031

SHEET 3 OF 3

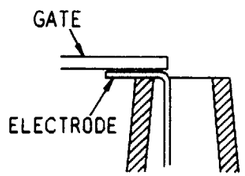
A4



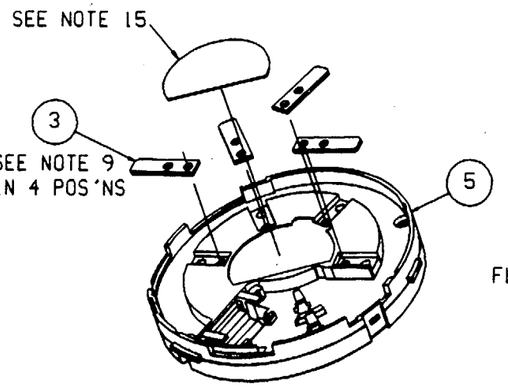
DETAIL B
SEE NOTES 2 & 4



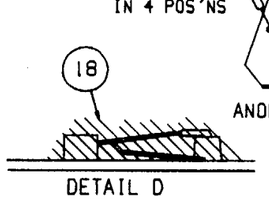
F.E.T. VIEWED FROM UNDERSIDE



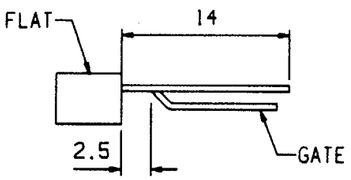
DETAIL C
SEE NOTES 2 & 4



VIEW ON ARROW 'A'



DETAIL D
SEE NOTE 6



DETAIL A
SEE NOTE 2

NOTES:-

1. FIT BODY BUNG (ITEM 6) AND BODY STOPPER (ITEM 8) INTO BODY (ITEM 5).AS SHOWN.
2. FORM TRANSISTOR LEADS OF ITEM 14 AS SHOWN IN DETAILS 'A' & 'B'. FORM SOURCE ELECTRODE ON CHAMBER AS SHOWN IN DETAIL 'C'.
3. FIT ION CHAMBER (ITEM 10) TO PCB ASSEMBLY (ITEM 1).THEN SOLDER USING ITEM 22.
4. AS SHOWN IN DETAIL 'B' SOLDER LEADS OF TRANSISTOR TO PADS ON PCB AND TO SOURCE ELECTRODE ON CHAMBER USING ITEM 22. SEE DETAIL 'C'. REMOVE SHORTING CLIP FROM F.E.T. LEADS.
5. FIT LED.D3 (ITEM 23) INTO PCB (ITEM 1).AS SHOWN.AND SOLDER USING ITEM 22.ENSURING CROPPED LEAD LENGTH DOES NOT EXCEED 1.6 MAX.
6. COVER TRANSISTOR LEADS (ITEM 14) WITH ADHESIVE (ITEM 18) ENSURING NO GAP BETWEEN ADHESIVE AND TRANSISTOR BODY. SEE DETAIL 'D'.
7. APPLY SEAL (ITEM 4) TO UNDERSIDE OF PCB ASSEMBLY.
8. ORIENTATE AND LOCATE PCB ASSY (ITEM 1).BY HOOKING UNDER TAB ON BODY (ITEM 5).
9. SECURE PCB ASSEMBLY (ITEM 1) AND PRESSINGS (ITEM 3). 4 OFF. TO BODY (ITEM 5) USING SCREWS (ITEM 13). TIGHTEN SCREWS TO A TORQUE OF 1.5Nm.
10. CLIP BAFFLE (ITEM 11) TO PCB ASSY.
11. TEST ASSEMBLY TO TS516-050-031.
12. SOLDER,SELECTED S.O.T. RESISTOR (ITEM 25) TO PADS ON PCB ASSY USING ITEM 22.
13. FIT CLOSURE RING (ITEM 7) AROUND LABYRINTH. ORIENTATED SUCH THAT ALIGNMENT MARKER LOCATES ONTO LED.
14. FIT COVER (ITEM 9) TO BODY (ITEM 5).
15. PRINT LABEL AS ON SHEET 2 & ADHERE TO UNDERSIDE OF BODY (ITEM 5). AS SHOWN.
16. SOAK TEST UNIT IN ACCORDANCE WITH SOAK TEST SPEC TS121-200-393
17. ADHERE LABEL (ITEM 15) TO COVER (ITEM 9).
18. FIT DUST CAP (ITEM 12) & DUST CAP BASE (ITEM 16) ONTO DETECTOR

WARNING

ASSEMBLY CONTAINS A SMALL RADIOACTIVE SOURCE Am241<0.9uCi.3.33kBq DETECTOR TO BE MANUFACTURED,STORED,TRANSPORTED,INSTALLED & DISPOSED OF IN ACCORDANCE WITH COMPANY PROCDURES COVERING RADIOACTIVE ION CHAMBER DETECTORS/SENSORS.

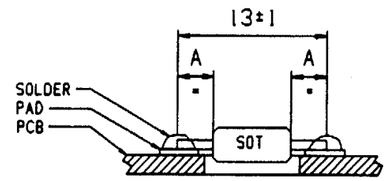


FIG.3

ISSUE	DATE	APP'D
1 IN2216	29-10-95	0.0
2 008417	31-10-97	0.0
3 008506	4-2-98	0.0
4 008560	31-3-98	

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LPCB	UL	VdS	FM	SGL	MARINE

IF IN DOUBT - ASK

DO NOT SCALE - REMOVE ALL BURRS AND SHARP EDGES - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.TO BE READ IN CONJUNCTION WITH BS 308.

TITLE

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	29-10-96	ENG'R	NAS	18-5-95

DEV.No. 142/001/3

DRAWING No. 516-050-031

SHEET 1 OF 2

MATERIAL: SEE COMPONENTS LIST

FINISH

SCALE: NTS

THIRD ANGLE PROJECTION

TOLERANCES (UNLESS STATED)

GENERAL	±0.4mm
HOLE CENTRES	±0.12mm
HOLE DIAMETERS	+0.1mm -0
ANGULAR	±30'

RELEVANT DRAWINGS

USED ON

3

ATTACHMENT E3

ITEM	COMPONENT	DESCRIPTION	BIN	STOCK CODE	DRN	QTY
1	PCB ASSEMBLY	MF612		125-585-533	*	1
2						
3	PRESSING	BODY		125-049-109	*	4
4	SEAL	PCB.POLYFILM		120-046-091	*	1
5	BODY	MOULDING		121-003-176	*	1
6	BUNG	CONNECTOR HOLE.MOULDING		121-003-189	*	1
7						
8	BODY STOPPER	MOULDING		121-003-196	*	1
9	COVER	MOULDING		121-003-173	*	1
10	ION CHAMBER	AMERSHAM DSC-A2		120-258-145		1
11	BAFFLE	MOULDING		121-003-254	*	1
12	DUST CAP	VACUUM FORMED		121-003-253	*	1
13	SCREW	M3 x 12LG PAN HEAD ST/ST		115-903-062	*	4
14	TRANSISTOR	FET. ION SP TO92		125-029-264	*	1
15	LABEL	LOGO		120-247-507	*	1
16	DUST CAP	BASE		121-003-199	*	1
17	LABEL	PRODUCT		120-247-826	*	1
18	ADHESIVE	EASYBOND 795		121-101-104		1g
19						
20	SOLDER	X39B 18 SWG.		121-076-038		.0003 Kg
21	PACKAGING	TRAY		123-002-621	*	0.05
22	SOLDER	CRYSTAL 400		121-076-033		.0001 Kg
23	LED	SLR-56VW RED.MILKY WHITE				
		If max 20 mA CONTINUOUS (D3)		125-114-124	*	1
24						
25						
26						

APP'D	0.0	0.0	0.0	0.0								
ISSUE	1 IN2216 24.10.96	2 008417 6.11.97	3 008488 15.1.98	4 008506 26.2.98	5 008560 ST.3							

THORN SECURITY

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LPCB | UL | [illegible] | FM | SSC | MARINE | | | |

A4

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR
ATTACHMENT E3

DRAWN	EG	24-10-96
CHECKED		
APPROVED		

USED ON

CL 516-050-031

SHEET 1 OF 3

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	82.5K		1	125-652-828		1
25	RESISTOR	100K		2	125-652-104		1
25	RESISTOR	121K		3	125-652-128		1
25	RESISTOR	140K		4	125-652-144		1
25	RESISTOR	162K		5	125-652-168		1
25	RESISTOR	187K		6	125-652-189		1
25	RESISTOR	205K		7	125-652-209		1
25	RESISTOR	215K		8	125-652-219		1
25	RESISTOR	226K		9	125-652-229		1
25	RESISTOR	237K	0.6W +/-1% S.O.T.	10	125-652-239		1
25	RESISTOR	249K	ONLY 1 OFF OF THE	11	125-652-249		1
25	RESISTOR	261K	LISTED RESISTORS	12	125-652-269		1
25	RESISTOR	274K	(SHTS 2 & 3)	13	125-652-279		1
25	RESISTOR	287K	TO BE SELECTED	14	125-652-289		1
25	RESISTOR	301K	AT FINAL ASSEMBLY	15	125-652-309		1
25	RESISTOR	316K	STAGE	16	125-652-319		1
25	RESISTOR	332K		17	125-652-339		1
25	RESISTOR	348K		18	125-652-349		1
25	RESISTOR	365K		19	125-652-369		1
25	RESISTOR	383K		20	125-652-389		1
25	RESISTOR	402K		21	125-652-409		1
25	RESISTOR	422K		22	129-652-429		1
25	RESISTOR	442K		23	125-652-449		1
25	RESISTOR	464K		24	125-652-469		1

THORN SECURITY

APP'D	0.0												
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98											

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LPCB	UL										

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96
CHECKED		
APPROVED		

USED ON

CL 516-050-031

SHEET 2 OF 3

A4

ITEM	COMPONENT	DESCRIPTION		BIN	STOCK CODE	DRN	QTY
25	RESISTER	487K		25	125-652-489		1
25	RESISTOR	511K		26	125-652-519		1
25	RESISTOR	536K		27	125-652-539		1
25	RESISTOR	562K		28	125-652-569		1
25	RESISTOR	590K		29	125-652-594		1
25	RESISTOR	619K	0.6W +/-1% S.O.T.	30	125-652-619		1
25	RESISTOR	649K	ONLY 1 OFF OF THE	31	125-652-649		1
25	RESISTOR	681K	LISTED RESISTORS	32	125-652-689		1
25	RESISTOR	715K	(SHTS 2 & 3)	33	125-652-719		1
25	RESISTOR	750K	TO BE SELECTED	34	125-652-754		1
25	RESISTOR	787K	AT FINAL ASSEMBLY	35	125-652-789		1
25	RESISTOR	825K	STAGE	36	125-652-829		1
25	RESISTOR	866K		37	125-652-869		1
25	RESISTOR	909K		38	125-652-909		1
25	RESISTOR	953K		39	125-652-959		1
25	RESISTOR	1M		40	125-652-105		1

THORN SECURITY

APP'D													
ISSUE	1 IN2216 24.10.96	2 008560 31.3.98											

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LPCB	UL	VdS	FM	SSL	MARINE				
						1	1		1

COMPONENT LIST FOR:

6121
IONISATION SMOKE DETECTOR

DRAWN	EG	24-10-96	USED ON
CHECKED			
APPROVED			

A4

CL 516-050-031

SHEET 3 OF 3

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