

### OVERVIEW

The GXH, GAH and GDH series of spark gaps are sealed gas-filled switches with DC breakdown voltages from 250 V to 10 kV. Two-electrode spark gap applications include voltage surge protection, lightning protection, single-shot pulse generators, high energy switches and turbine engine ignition circuits.

### INHERENT HAZARDS

**Sharps** – GXH, GAH and GDH Series Spark Gaps are sufficiently robust to withstand normal handling. However, they do employ a glass envelope that may be broken if knocked, dropped or subject to undue force during installation or removal. If the glass envelope is broken sharp edges of broken glass will be present. Follow all normal procedures for the handling of broken glass and other sharps, including use of tools and/or personal protective equipment.

**Radioactivity** – Most GXH spark gaps contain a small quantity of radioactive tritium gas. Tritium is an isotope of hydrogen and a low-energy beta emitter. The radioactive emissions are effectively contained by the envelope of the device, so present no hazard during normal handling. In the event of breakage, the gas will dissipate very rapidly in an upwards direction, and in any case does not expose persons in the vicinity to a hazardous level of radiation.

Local health, safety and environmental regulations for the holding of small sealed radioactive sources containing tritium should be followed.

The remaining material from a broken device may be swept up and disposed of in accordance with local regulations for very low level waste.

### TRANSPORTATION HAZARDS

**Radioactivity** - Devices may be transported as "exempt" shipments under the IATA dangerous goods regulations, IMDG Code and ADR treaty providing the total consignment does not have an activity level exceeding 1 GBq. GXH series devices have an activity of <5.5 MBq, so up to 180 devices may be transported in a single consignment providing no other radioactive materials are included therein.

### INSTALLATION HAZARDS

There are no additional hazards associated with installation, but care should be taken to avoid exerting undue force on devices that might result in breakage.



Breakage will result in exposure to the inherent hazards described above.

### OPERATIONAL HAZARDS

**High voltages** – Spark Gaps operate at high voltages. Equipment should be designed with adequate creepage and clearance distances for the operating voltage and environmental conditions that will occur in use. Equipment should incorporate protective measures such as fail-safe interlocks, discharge circuits, and warning markings as required by relevant equipment safety standards.

**X-rays** – In common with all vacuum electron tubes, spark gaps produce X-rays when operated at voltages in excess of 5 kV. The level of emissions depends on the operating conditions, voltages, and currents. Equipment designers and manufacturers should include shielding, typically steel and/or lead, to reduce emissions to a safe level in accordance with local radiological protection guidelines. Manufacturers and operators of equipment must perform radiation measurements on their equipment under maximum operating conditions to ensure continued safety. Servicing procedures should advise of the risk of operating equipment with radiation shielding removed and include appropriate mitigation measures.

**Hot surfaces** – A spark gap that has just been in operation may still be hot, even once access panels or doors have been opened. Appropriate warnings should be placed in a prominent position for the protection of servicing personnel

## DECOMMISSIONING

There are no additional hazards associated with decommissioning, but care should be taken to avoid exerting undue force on devices during removal that might result in breakage. Breakage will result in exposure to the inherent hazards described above. Used devices should be placed in a suitable container to reduce risk of breakage prior to being removed to a disposal facility.

## DISPOSAL

Local regulations for the disposal of small sealed devices containing tritium should be followed.

## MATERIAL DATA

The following table of material data provides information to enable disposal in accordance with environmental regulations.

| PRODUCT  | Approximate MASS (g) | Maximum Radioactivity (Tritium) (MBq) | COMPOSITION (% MASS) |          |               |              |                        |                               |
|--|----------------------|---------------------------------------|----------------------|----------|---------------|--------------|------------------------|-------------------------------|
|  |                      |                                       | Glass                | Tungsten | Nickel Alloys | Other Metals | Magnesium Oxide Powder | Other non-hazardous materials |
| All GXH series spark gaps <i>except those listed below</i> | 40g                  | <5.5MBq                               | <30%                 | <25%     | <45%          | <15%         | <3%                    | <2%                           |
| GXH_2A series (e.g. GXH19/2A, GXH20/2A, GXH24/2A)          | 40g                  | <3.3MBq                               |                      |          |               |              |                        |                               |
| GXH_LFC series (e.g. GXH18LFC, GXH20LFC)                   | 40g                  | <0.11MBq                              |                      |          |               |              |                        |                               |
| GXH20S, GXH110M/2  | 40g                  | nil                                   |                      |          |               |              |                        |                               |
| GXH28ILV/DG79, GXH28ILV/DG81, 80412945                     | 30g                  | <0.04MBq                              |                      |          |               |              |                        |                               |
| GDH20  | 40g                  | <0.11MBq                              |                      |          |               |              |                        |                               |
| GAH series (e.g. GAH25UL, GAH29UL, GAH31UL)                | 30g                  | <0.11MBq                              |                      |          |               |              |                        |                               |

In the event of encountering difficulties in disposing of these products, contact e2v technologies for advice.

In the **United Kingdom**, the following regulations generally apply to the holding, use and disposal of e2v GXH, GAH and GDH series spark gaps containing tritium,

- i) for health and safety aspects, "The Ionising Radiations Regulations 1999".
- ii) for environmental aspects,
  - a. England and Wales:-
    - i. The Environmental Permitting (England and Wales) (Amendment) Regulations 2011
  - b. Scotland:-
    - i. The Radioactive Substances Exemption (Scotland) Order 2011,
    - ii. The Radioactive Substances Act 1993 Amendment (Scotland) Regulations 2011
    - iii. The Radioactive Substances Act 1993
  - c. Northern Ireland:-
    - i. The Radioactive Substances Exemption (Northern Ireland) Order 2011
    - ii. The Radioactive Substances Act 1993 (Amendment) Regulations (Northern Ireland) 2011
    - iii. The Radioactive Substances Act 1993

The exemptions in the Environmental Permitting Regulations and Radioactive Substances Orders allow most organisations to hold and dispose of e2v spark gaps containing tritium without an environmental permit (England and Wales) or radioactive substances registration and authorisation (Scotland and Northern Ireland).

In all other countries, local health, safety and environmental regulations must be followed.