

# Electrical Penetration Assemblies (EPAs) for Nuclear Power Plants

## Glass-to-metal sealing technology offers highest safety & reliability

Nuclear power plant (NPP) containment structures are entirely sealed-off constructions designed to safely contain the nuclear reactor. In order to keep the radioactive high-energy source controlled, electrical and instrumentation cables are needed through the containment structure to provide power, control signals and monitoring for the reactor.

## Function of Electrical Penetration Assemblies

- **Electrical Penetration Assemblies (EPAs) perform two key functions:**
  - 1) Provide the pass-through for power, control and instrumentation cables to the thousands of instruments, control panels, electric motors and many other electric and electronic devices within
  - 2) Maintain the pressure boundary integrity of the containment structure.
- EPAs are hence **critical safety components** – Reliability of the technology is of utmost importance.

## Product Information

Glass-to-metal sealed (GTMS) penetrations allow the safe conduction of electricity and data through the fire-protective, pressure-resistant and tightly-sealed containment walls of nuclear power plants. In the case of an accident, these GTMS penetrations will withstand seismic shock, high pressure, temperature and radiation, and at the same time prevent steam, pressure and radioactive materials from escaping into the environment.

SCHOTT's penetrations are sealed with glass, which can survive significant accelerations and is insensitive to temperature, radiation and aging for periods much longer than the 60 year design lifetimes of the latest nuclear power plants.

All around the world, SCHOTT's glass-to-metal sealed penetrations have proven their durability and reliability in nuclear power plants as well as other critical and sensitive applications – maintenance-free – since the early 1960s.

## Advantages

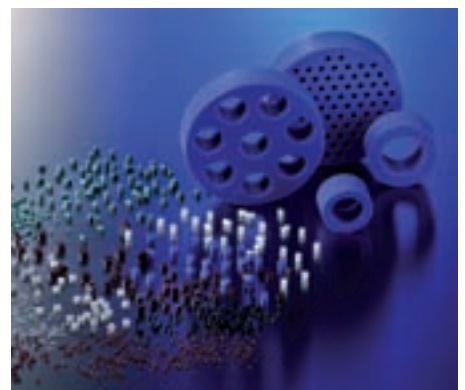
- **Unlimited lifetime** of pressure barrier due to inorganic, glass-to-metal sealing technology
- **Minimum 60 years** of qualified lifetime for assembly
- **Maintenance-free**
- **Easy installation** utilizing a slide-on connector
- **Low life cycle cost** due to low cost installation and age-insensitive technology
- **Minimum space impact**
- **High packing density**
- Especially suitable for installation in **EPR, APWR, AP1000, ABWR, ESBWR and PBMR** due to **high temperature and pressure resistance**



*Assembly of Control and Instrumentation (C&I) penetrations for nuclear power plants prior to sealing.*



*Measurement of glass-to-metal sealed penetrations for PWR and BWR*



*Various sizes and designs of sintered glass preforms.*

# Maintenance-free Performance – 5,000 SCHOTT EPAs in over 50 NPPs around the world

## Our Experience

- Manufactured according to KTA 3403 and compliant to IEEE 317
- 5,000 EPAs installed in more than 50 Nuclear Power Plants worldwide
- Still performing maintenance-free after 40 years service
- Installed in
  - Pressurized Water Reactors (PWR)
  - High Temperature Reactors (HTR) – both Pebble Bed and Prismatic Reactors (PBR)
  - Boiling Water Reactors (BWR)
  - Fast Breeder Reactors (FBR)
- Proven and standard technology in other harsh environments:
  - Nuclear submarines
  - Automotive safety systems (air bags)
  - Oil & Gas
  - Liquefied Natural Gas (LNG) vessels which must routinely cycle between temperature and pressure extremes

## Our Quality Assurance Ensures 100% Final Inspection of All Products

- Our In-house Testing Capabilities:
  - Current / Voltage (up to high voltage)
  - Hermeticity (mass spectrometer)
  - Insulation resistance
  - Corrosion material analysis (REM)
  - Non-destructive Pressure Testing (MPI, DPI)
  - LOCA Simulations

## Our In-house Competences

- Engineering Capabilities:
  - Design of electrical penetrators, connectors and complete systems
- System Expertise:
  - Specific knowledge on thermal and radiation aging of organic materials
  - LOCA load, type tests, reliability investigations
  - Mathematical simulation and calculation, own type test capabilities
- Materials Science Expertise:
  - Europe's largest R&D and Testing Center for Glass
  - Specialty glass melting, milling, spray drying and preform production
  - In-house processing of ceramics
- Surface Treatment Expertise:
  - Major plating facility including Ni (E-less, Watts), Cu, Ag, Au, Sn

## For more information:

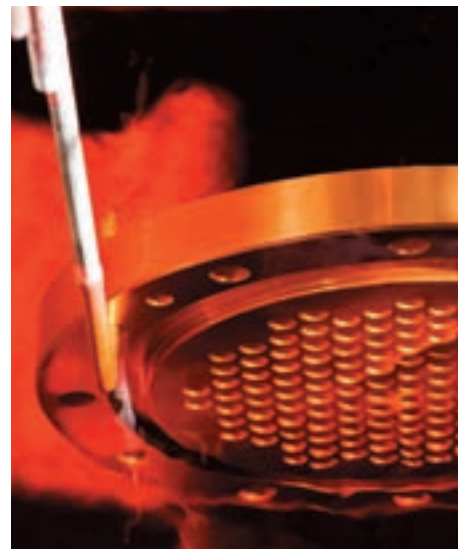
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Measurement of glass-to-metal sealed penetrations for PWR and BWR



Plating of large-scale feedthrough for electrical penetration assembly (EPA)

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glass made of ideas