

Subject: Fire Barrier Penetration Seal Installation and Repair	Effective Date: February 7, 2003	Initiated by: Head, Engineering and Technical Infrastructure
	Supersedes: Rev 1, dated August 9, 2002	Approved: Director

Applicability

This procedure applies to all activities at C and D-Sites of the Laboratory.

Scope

This procedure provides the general requirements that apply to all fire barrier penetration seal maintenance, repair, and installation activities [i.e., apply to all operations involved in fabrication, assembly, mounting, setting, aligning, inspecting, testing, protection, and cleaning as specified in the approved Statement of Work and/or Work Request.] The scope of this procedure includes:

- Installation of new fire barrier penetration seals in accordance with approved field installation drawing(s).
- Installation of new fire barrier seal(s) where required within electrical conduits where they pass through fire barriers in accordance with this procedure and approved field installation drawing(s).
- Installation of HVAC seals and related penetrations in accordance with approved field installation drawings(s).
- Repair or replacement of existing non-conforming fire barrier penetration seals.

Introduction

The purpose of this procedure is to establish requirements for installation and repair of fire barrier penetration seals (including seals in conduits that pass through fire barriers, where required) in walls, floors and ceilings. This procedure does not address fire door assemblies or fire dampers but does include fire seals around ducts and dampers. The fire barrier penetration seals shall be designed to meet the most restrictive of the following criteria:

1. PPPL Doc.# SR/TFTR/1-7C "Design Features - Buildings and Support Structures" (D-Site specific)
2. The Life Safety Code (NFPA 101, Current Edition)
3. The New Jersey Uniform Fire Code (Current Edition)

4. Other PPPL established fire wall separation requirements (contact PPPL Fire Protection Engineer for current applicable requirements).

Definitions

Installer - The person(s) performing maintenance & installation operations are referred to as the “Installer” in this procedure.

Penetration Engineer – The designated engineer that maintains the database of penetration numbers, inspects and approves the start of work on new penetrations and specifies penetration fire seal design.

ATI – Accountable Technical Individual or Design Engineer that requested the breach of the penetration being sealed.

References

- ENG-025, Fire Seals, Fire Dampers and Fire Doors
- ENG-028, Drilling, Cutting and Core Boring
- PPPL Doc.# SR/TFTR/1-7C "Design Features - Buildings and Support Structures"
- Current UL Fire Resistance Directory, Volume 1 & 2
- UL Standard and ANSI/UL 1479 (ASTM Standard E814) “Fire Tests through Penetration Firestops”
- ES&HD 5008-PPL, Environment, Safety & Health Manual
- DTSD-FSAR-17, Final Safety Analysis Report-TFTR
- Material MSDS’s and MFR Instructions attached (PG 18-189)
- NFPA 101 Code for Safety of Life from Fire in Buildings and Structure
- NEPA Planning form #657
- OP-AD-7, Health Physics Requirements for Removing Radioactive Material from TFTR
- DOE Order 420.1, Facility Safety
- DOE Order 440.1, Worker Protection Management for DOE Federal and Contractor Employees
- DOE-STD-1066-97, Fire Protection Design Criteria

PROCEDURE

Responsibility

Action

- | | |
|------------------------|---|
| ATI or Design Engineer | <ol style="list-style-type: none"> 1. <ol style="list-style-type: none"> a. Notify and obtain permission from the Penetration Engineer to start this procedure for installation or repair of fire barrier penetration seals. |
|------------------------|---|

b. Provide the Penetration Engineer with all necessary information including the penetration number, location and elevation, size, and items passing through the penetration.

c. Provide the necessary drawings that locate the penetrations.

Note: Open-ended conduit or piping passing through the penetration should also be identified to the Penetration Engineer for sealing.

2. Inspect each penetration to help the Design Engineer, ATI or Installer.
The inspection should include the identification of seal difficulties and potential problems and the location of any open ended pipe or conduit that should be considered part of the penetration seal.

Penetration
Engineer

3. Issue a field installation drawing or generic drawing(s) and a Seal Inspection Form (see attachment 3) for each fire barrier penetration seal, if required, as referenced in the Statement of Work (SOW) and/or Work Request.

These drawings shall indicate materials, thickness, and clearance of materials to be used. Dimensional requirements shown on the drawing shall be considered minimum requirements. All seals shall be made using materials and methods which have been tested by Underwriters Labs (UL) or another recognized testing laboratory and have been shown to provide the fire separation required.

Most UL approved fire seal designs are pre-defined and given a specific UL drawing number. This field installation drawing will be attached directly to the Seal Inspection Form (Attachment 3) and listed on the form.

a. When the UL approved fire-seal design does not match the exact configuration of penetration and/or penetrating items, an "alternative design" fire-seal can be documented on Attachment 4 ("Penetration Fire Seal Engineering Disposition Form") and attached to Attachment #3. The alternative design should be as close to the UL approved design as possible using engineering disposition and other seal designs.

b. A copy of the "alternative design" must be reviewed by the Fire Protection Engineer and approved by the Head of Engineering and Technical Infrastructure.

Installer

4. Satisfy all applicable prerequisites listed in Attachment 1 prior to commencing work.

5. Furnish all approved materials and tools to provide for a complete installation. Approved materials and tools are listed in Attachment 2. The UL approved seal

design drawing, which can be found attached to the Seal Inspection Form lists the required fire stop materials.

6. Notify the Penetration Engineer for resolution in the event of a conflict between installation documents and/or drawings or for review and approval of materials not listed on Attachment 2.
7. Remove any nonconforming, temporary or combustible material from the given seal as necessary or as directed by the Penetration Engineer.
8. Inspect the penetration to ensure that it is clean prior to pouring or installing seal material.
9. Follow the installation instructions printed on the sealant or material container/package.
10. Perform all work to provide for a complete installation in accordance with applicable precautions listed in Attachment 1, the approved installation drawings, and the SOW, Work Request, and/or procedure.
11. Remove all combustible damming material used to temporarily hold the seal in place after the seal is cured.

Quality Control
(QC)

12. Visually inspect welds for any penetrations requiring welding and document the inspection. All welding shall be done by a PPPL approved welder in accordance with approved field installation drawing(s).

Installer

13. Identify un-sealed open-ended conduits or other aspects of the penetration fire sealing activity that were over-looked by the Design Engineer or Penetration Engineer. Contact the Penetration Engineer to inspect over-looked items or to issue instructions for sealing open conduit or missed penetrations.
14. Complete the Penetration Seal Inspection Form for each penetration seal or conduit seal and obtain final Quality Control inspection. A copy of the field installation drawing(s), if used, shall be attached to the completed form.

QC

15. Inspect all fire barrier penetration seals from both sides to the extent possible, (fill side and damming side), to verify penetration integrity. Where damming material that was installed around or at the base of a seal during construction has been left in place, there is no need to remove the non-combustible damming material for inspection if it appears undisturbed. If the backside is inaccessible for inspections, indicate that fact in the remarks section of Attachment 3, the Penetration Seal Inspection Form.

Acceptance criteria for a fire barrier penetration seal requires that the seal is free of cracks or damage and installed in accordance with drawings and other approved

documentation. If the particular seal is cracked or damaged, the seal shall be repaired by removing the damaged material from the seal and installing new compatible material in accordance with this procedure.

- Installer
16. Checks that all tools are accounted for at the end of each work shift. Reports any missing tools immediately to the Penetration Engineer.
 17. Upon completion of a penetration seal, the installer shall write the penetration number on the wall, in close proximity to the penetration. Use black dry marker with approximately one and one half (1 1/2) inch high numbers. Marker must be permanent type.
 18. Turns over all completed forms for each penetration seal and field installation drawing, with QC sign-offs to the Accountable Technical Individual (ATI).
- ATI
19. Notifies the Penetration Engineer, the Site Protection Division (ESU), and the Facility Manager of the area where the penetration was made. Provides completed Penetration Seal Inspection Form to the Operations Center.
- Site Protection Division
20. Reviews the log of penetration permits and maintains awareness of open fire barrier penetrations and fulfills related responsibilities per PPPL Procedure ENG-025.

Attachments:

1. Prerequisites & Precautions
2. Approved Materials, Tools and Equipment
3. Penetration Seal Inspection Form - Typical
4. Penetration Fire Seal Engineering Disposition Form

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-027 Rev 2 page 1 of 2
	Prerequisites and Precautions		Attachment 1

PREREQUISITES and PRECAUTIONS

PREREQUISITES

Installers shall ensure the following prerequisites are completed prior to commencement of activities:

1. Obtain work permit(s) for all work at D-Site.
2. Deliver a copy of the work permit to the ESU Communications Officer prior to performing any work involving drilling a new penetration or opening an existing one.
3. Schedule work on the Rollover Schedule in order to minimize interference with other activities.
4. Schedule any work requiring Health Physics Support with the Health Physics Manager.
5. Notify QC, the Fire Protection Engineer, and the Facility Manager prior to start of work.
6. Complete a training program on repair, installation, and maintenance of fire barrier penetration seals (contact the Penetration Engineer).
7. Complete a Job Hazard Analysis (JHA) per ESH-004 prior to beginning work.

PRECAUTIONS

Installers shall ensure the following precautions are taken prior to and during activities:

8. Become familiar with, and avoid damaging existing facilities, equipment, cable trays, and cables of all voltages. Walking or standing on cable trays is not permitted without the approval of the Electrical Safety Engineer. (See form 5008.2-1, "Permit for climbing or walking on cable trays")
9. Contact the Shift Supervisor prior to starting work in the Test Cell, Test Cell Basement, or the DARM, and the NSTX Test Cell. It should be noted that testing may be in progress and certain areas are hazardous due to the presence of live equipment/buswork in close proximity to the work area.
10. Wear hard hats at all times in Test Cell and Test Cell Basement as required by postings. Gloves, safety goggles, face shields, respirators, etc. shall be worn or as required by ES&H Directive 5008, Section 8, Chapter 6 or as specified by Industrial Hygiene (IH).
11. Ensure that the work is properly planned and safe physical supports are provided; in particular, ladders, platforms, etc. must be used in accordance with ES&HD-5008, Environmental Safety & Health Manual.

Prerequisites and Precautions**Attachment 1**

12. Mix mortars in accordance with manufactures instruction. Splash goggles and protective gloves shall be used for this operation.
13. Observe all safety requirements for work as required by the Shift Supervisor and/or the Construction Manager.
14. Handle and Store all flammable and combustible liquids (new, used and contaminated) in accordance with ES&HD-5008, Section 5.
15. Exercise care in handling and/or filling of silicone, mortars & compounds to avoid spills on floor. Clean up slippery spills immediately with rags. Use approved solvent to remove silicone residuals and water moistened rags to clean up mortars and compounds.
16. Dispose of all excess & waste materials in accordance with Lab procedure EWM-001 through PPPL Environmental Restoration and Waste Management.
17. Ensure that any welding is performed only by PPPL Qualified Welders.
18. Perform all work in accordance with ES&HD-5008, PPPL Environmental Safety & Health Manual. Installer shall ensure that all safety barricades and signs set up by others are obeyed.
19. Wear disposable dust masks, goggles and/or protective equipment, for any work that produces chips or dust from drilling, cutting or grinding as specified by Industrial Hygiene (IH). Appropriate training and IH evaluation are required. Final Clean up shall be with a vacuum and/or mop (wet method) as determined by the installer.
20. Carry out work such that no permanent ground indications (flashing lights and horn) are activated. Upon activation of a ground alarm, workers are not to leave the area until the ground alarm has been cleared.
21. Restrict the use of flammable solvents to well ventilated areas. Other personnel in the area shall be notified to avoid flame or spark causing activities, including smoking.
22. Obtain a check by a Health Physics representative of all equipment, material, hardware, and devices to be removed from radiologically controlled areas (RCAs).
23. Secure the area at the end of each work shift to assure safe conditions.

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-027 Rev 2 page 1 of 3
	Approved Materials, Tools and Equipment		Attachment 2

APPROVED MATERIALS

No material on following lists should be used unless it is explicitly listed in an approved UL System penetration seal design provided by the Penetration Engineer.

“Approved” materials can not necessarily be combined to make an approved fire seal. A UL approved fire seal design prescription or alternate design per step 3 of this procedure must be followed to create an approved fire seal with approved materials.

Materials Added by Revision 1 of ENG-027

The following Materials are added as part of Revision 1 of ENG-027; they are all from HILTI® and are used in almost all cases.

Hilti CP 620 Fire Foam
Hilti CP 680 Cast-In Firestop Device
Hilti FS-ONE High Performance Intumescent Firestop Sealant
Hilti FS 657 Intumescent Fire Block
Hilti CP 645 Intumescent Firestop Wrap Strip
Hilti CP 642 Firestop Collar
Hilti CP 643 Firestop Collar
Hilti CP 672 Firestop Joint Spray
Hilti CP 601S Elastomeric Firestop Sealant
Hilti CP 606 Flexible Firestop Sealant
Hilti CP 678 Cable Coating
Hilti FS 635 Trowelable Firestop Compound
Hilti CP 617 and 617L Firestop Putty Pad
Hilti CP 618 Firestop Putty Stick

Materials from Revision 0 of ENG-027

The following Materials are carried over from Revision 0 of ENG-027; they are listed below for reference only and are generally obsolete for the day to day penetration sealing operations. Materials added for Revision 1 of ENG-027 are all from HILTI® and are used in almost all cases.

B10 Stop Caulk #500

DOW Corning RTV #96-081
DOW Corning (R) 732 Multi-purpose sealant
DOW Corning Primer #200, 50 cs
DOW Corning Expan. Foam #3-6548
Promatec LDSE (Low Density Silicone Elastomer)
Ethafoam (R) 220 Plank Brand Plastic Foam BD (Damming Material)
Five Star Grout
Five Star Grout #100
Flamesafe Compound #FS/FST900 Series
Flamesafe Compound #FS500/FST600 Series
Flamesafe Putty #FSP1000
Flamesafe Mortar #MS50
Flamesafe Ceramic Fiber #CF-1 (Damming Material)
Flamesafe sealant #S100/S105
Flamesafe support wire #SW1
Flamesafe tinn. clips #TN25
Flammadur Mortar #E473
KAOWOOL/ceramic fiber #CF-1/CF-50 (Damming Material)
Marinite 1 Fire Resistant Panel
Novasit Mortar #K2 & K10
11 GA. SS Wire
DOW Corning Sylgard 170 parts “A & “B” silicone elastomer (slow cure).
Schedule 40 Steel pipe sleeves cut to length (various diams.)
SS adjustable pipe clamps
Thermal Ceramics Ceraform Board #126
3M Fire Barrier #FS-195 wrap/strip
3M Fire Barrier CP25 Caulk

APPROVED TOOLS & EQUIPMENT

Consult with the Penetration Engineer for tools or equipment not on this list.

Tools and Equipment

Safety rope/barrier as required

SSD approved solvent

Listed waste cans with covers (to store used solvent, materials/rags)

Clean rags as required

5 Gallon pails as required for mixing

10 Gallon pails as required for mixing

Plastic sheets & bags as required

Masking tape as required

Vacuum Cleaner

Chemical splash goggles

Disposable Rubber Gloves

Battery powered flashlights or temporary pendant lighting

Mixing & mortar application tools (trowels)

Wire cutter(s)

Paint brushes

Portable water source & hose(s)

Hammers, chisels, wire brushes

Air operated pump cart

Black permanent dry marker

NOTE:

Installer is responsible for the provision of tools and checking that all tools are accounted for at the end of each work shift. Any missing tools must be reported immediately to the Penetration Engineer.

Refer to the Statement of Work and/or Work Request for additional tools that are not listed above.

Penetration Seal Inspection Form

Penetration #: _____ Floor Elev: _____ Size: _____

Conduit #: _____ Size: _____

Location: _____

Field Installation drawing number(s) used: _____

Penetration Engineer approval prior to start of work, per ENG-027 Step#1.

Signoff_____
Penetration Engineer_____
Date

Penetration/Conduit seal installation complete:

Signoff_____
Installer_____
Date

Final Quality Control Inspection Acceptance:

Signoff_____
QC Representative_____
Date

Remarks

Penetration Fire Seal Engineering Disposition FormUL Approved Design _____
List UL Approved Design Here

Modified for Penetration #: _____

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Created By: _____
Penetration Engineer Date**Reviewed By:** _____
Fire Protection Engineer Date**Approved By:** _____
Head, Engineering & Technical Infrastructure Date