

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-027, Rev. 5 page 1 of 9
	Subject: Fire Barrier Penetration Seal Installation and Repair	Effective Date: March 6, 2017	Initiated by: Head, Facilities and Site Services
		Supersedes: Revision 4 April 28, 2010	Approved: Director

Management System (Primary): 08.00 Facilities and Property Management
Management System Owner: Head, Facilities and Site Services
Management Process: 08.17 Fire Protection & Life Safety
Process Owner: Head, Facilities and Site Services
Sub-Process: 08.17.05 Inspection, Testing and Maintenance
Sub-Process Owner: Head, Engineering and Infrastructure
Subject Matter Experts (SMEs): Penetration Engineer, Fire Protection Engineer (AHJ), Head, Fabrication and Operations; Head, Facilities and Site Services

1.0 PURPOSE

This procedure establishes the requirements for the installation/repair/modification of fire seals and penetrations at C-Site and D-Site. Additionally, when a new or repaired/modified penetration constitutes a fire barrier breach, a Fire Seal/Penetration Addition/Removal Permit must be issued. The requirements for issuing Fire Seal/Penetration Addition/Removal Permits are also addressed in this procedure.

2.0 SCOPE

- 2.1 This procedure provides the general requirements that apply for the installation, repair, or modification 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.
- 2.2 This procedure specifically addresses the following:
1. Installation of new fire barrier penetration seals in accordance with approved field installation drawing(s).
 2. 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).
 3. Installation of HVAC seals and related penetrations in accordance with approved field installation drawings(s).
 4. Repair or replacement of existing non-conforming fire barrier penetration seals.
 5. Issuance of Fire Seal/Penetration Addition/Removal Permits.

3.0 DEFINITIONS

ATI – The Accountable Technical Individual responsible for the system or item that passes through the new penetration or that requires a physical modification to an existing penetration. Manages approvals and documentation for the particular job and assures the Seal and/or Coring/Drilling Installers compliance with this procedure.

Fire Protection Engineer (FPE) – The PPPL qualified fire protection engineer who is designated as the PPPL fire protection authority and has been designated by the DOE as the “Authority Having Jurisdiction (AHJ)” for specific fire codes.

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.

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

4.0 REFERENCES

4.1 References:

1. PPPL Doc.# SR/TFTR/1-7C "Design Features - Buildings and Support Structures" (D-Site specific)
2. The Life Safety Code (National Fire Protection Association (NFPA) 101, Current Edition)
3. The New Jersey Uniform Fire Code (Current Edition)
4. ES&HD 5008-PPPL, Environment, Safety & Health Directives Manual
5. Current UL Fire Resistance Directory, Volume 1 & 2
6. UL Standard and ANSI/UL 1479 (ASTM Standard E814) “Fire Tests through Penetration Firestops”
7. ESH-004, Job Hazard Analysis
8. ENG-025, Impairments of Fire Dampers and Fire Doors
9. ENG-028, Core Boring, Drilling, and Cutting
10. Material Material Safety Data Sheets (MSDS’s) and Manufacturer Instructions attached (PG 18-189)
11. NFPA 101 Code for Safety of Life from Fire in Buildings and Structure
12. National Environmental Protection Act (NEPA) Planning form #657
13. DOE Order 420.1c, Facility Safety
14. DOE-STD-1066-97, Fire Protection Design Criteria

4.2 Attachments:

1. Generic Fire Penetration Seal Prerequisites and Precautions
2. Penetration Seal Inspection Form
3. Penetration Fire Seal Engineering Disposition Form
4. Fire Seal/Penetration Addition/Removal Permit

5.0 PROCEDURE

Core boring, Cutting or Drilling a New Penetration

5.1 IF Core boring, Cutting or Drilling a New Penetration, PERFORM the following:

Note: If modifying or repairing an existing seal, PROCEED to 5.2.

Responsibility	Action
Cognizant Individual/ATI	1. Contact the Penetration Engineer to discuss the penetration location and general requirements.
	2. Generates a drawing or sketch showing the location and size of the penetration. Assistance from the Penetration Engineer or from Drafting may be required to identify the proper drawings.
Penetration Engineer	3. Ensures the requirements of ENG-028 are employed in parallel with the requirements of this procedure.
	4. Reviews the facility drawings for any structural implications and evaluates structural issues related to the penetration.
	5. Issues new Penetration Number(s) and updates the penetration database.
Cognizant Individual/ATI	6. Unless determined by the Responsible Line Manager (RLM) to not be necessary, issue Engineering Change Notices (ECNs) to Drafting Department to update facility drawings with new penetration location(s).
	7. Prepares and obtains approvals of Attachments 3 and 4. Obtains a Fire Seal/Penetration Addition/Removal Permit (Attachment 4) from the Penetration Engineer for each new penetration of a fire wall.
	8. Drills/core bores new penetration per the requirements of ENG-028.
	9. Notifies Quality Control (QC) to inspect the new core bore or altered penetration.
QC	10. Inspects penetrations from both sides to the extent possible to verify penetration integrity. Periodically monitor the work in progress for conformance to this and other applicable PPPL requirements.
Cognizant Individual/ATI	11. Notifies the Penetration Engineer, the Site Protection Division, and the area Facility Manager when penetration activities are completed.

Responsibility	Action
Penetration Engineer	12. Works with Operations Center to log Core Boring and Drilling Permits and issue follow-up notices for permits that have not been closed-out. Sends notifications of permits and closes-outs to Site Protection Division, the Fire Protection Engineer and QC for their awareness.
Site Protection Division	13. Reviews the log of Core Boring and Drilling Permits and maintains awareness of open <u>fire barrier</u> penetrations and fulfils related responsibilities per PPPL Procedure ENG-025.
ATI	14. When the penetration is ready to be fire sealed, PROCEED to Section 5.2.

Modifying/Repairing an Existing Penetration or Initial Seal Installation

5.2 Installation, Modification, or Repair of a Fire Seal

Responsibility	Action
ATI	<ol style="list-style-type: none"> 1. Notify and obtain permission from the Penetration Engineer to start this procedure for installation of the fire barrier penetration seals. 2. Provide the Penetration Engineer with all necessary information including the penetration number, location and elevation, size, and items passing through the penetration. 3. Provide the necessary drawings that locate the penetration. Note: Open-ended conduit or piping passing through the penetration should also be identified to the Penetration Engineer for sealing. 4. Inspect each penetration. 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 (or Fire Protection Engineer for C-Site Legacy Penetrations)	<ol style="list-style-type: none"> 5. Issue a field installation drawing or generic drawing(s) and a Seal Inspection Form (see attachment 2) 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. <u>Dimensional requirements shown on the drawings shall be considered minimum requirements.</u> All seals shall be made using materials and methods which have been tested by Underwriters Laboratories (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 4) and listed on the form.

Note 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 shall be documented on Attachment 3 ("Penetration Fire Seal Engineering Disposition Form") and attached to Attachment 2. The alternative design should be as close to the UL approved design as possible using engineering disposition and other seal designs.

Note B: A copy of the "alternative design" must be reviewed by the Fire Protection Engineer and approved by the Facilities Division Head.

ATI

6. Satisfies all applicable prerequisites listed in Attachment 1 prior to commencing work.
7. Ensures the precautions of Attachment 1 are understood and annotated in the Job Hazard Analysis as appropriate.
8. Obtains a Fire Seal/Penetration Addition/Removal Permit (Attachment 4) from the Penetration Engineer.

Seal Installer

9. Furnish all approved materials and tools to provide for a complete installation. The UL approved seal design drawing, which can be found attached to the Seal Inspection Form (Attachment 2) lists the required fire stop materials.
10. Verify the proper depths, annular space and product types before the start of installation or repair. During installation, measure the depth and width of materials as indicated in the approved detail.
11. Notify the Penetration Engineer for resolution in the event of a conflict between installation documents and/or drawings.
12. Notify QC, then remove any nonconforming, temporary, or combustible material from the given seal as necessary or as directed by the Penetration Engineer.
13. Remove all combustible damning material used to temporarily hold the seal in place after the seal is cured.

Seal Installer

14. Identify un-sealed open-ended conduits or other aspects of the penetration fire sealing activity that were over-looked by the ATI or Penetration Engineer. Contact the Penetration Engineer to inspect over-looked items or to issue instructions for sealing open conduit or missed penetrations.
15. Complete the Penetration Seal Inspection Form (Attachment 2) 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

16. Conduct random and timely inspections of penetration seals to allow for corrections to be made before the completion of firestop installation if the inspector will not be present for the duration of the installation.

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 2, 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.

17. After the seal has been inspected satisfactorily, clears the Fire Seal/Penetration Addition/Removal Permit and gives original copy and Attachment 2 to the Penetration Engineer.

Seal Installer

18. Checks that all tools are accounted for at the end of each work shift. Reports any missing tools immediately to the Penetration Engineer.

19. Upon completion of a penetration seal, if not already completed, the seal 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 ½) inch high numbers. Marker must be a permanent type.

**Penetration
Engineer (or
Fire Protection
Engineer for C-Site
Legacy Penetrations)**

20. Notifies Emergency Services Unit (ESU) of Site Protection that the Penetration Permit (Attachment 4) has been cleared.

**Penetration
Engineer**

21. Updates the Fire Penetration Seal database with all updated information.

**Site Protection
Division**

22. Maintains a list of open penetrations based on information supplied by the Penetration Engineer.

LEGACY C-SITE FIRE PENETRATIONS

(This Procedure Section is effective through December 2019 only)

5.3 Installation, Modification, or Repair of Legacy C-Site Fire Penetrations

Performance of work per this section requires coordination with the Fire Protection Engineer and the Penetration Engineer.

Responsibility	Action
ATI	<p>1. Identifies Legacy Fire Penetration(s):</p> <p>Legacy Penetrations include penetrations that already exist and, in the past, may not have been properly approved, sealed, or inspected in accordance with sections 5.1 and 5.2 of this procedure; or may be missing a seal.</p> <p>2. Prepares a Penetration permit per Section 5.2 of this procedure and includes all Penetration numbers that require work. Permits for Legacy Penetrations may be a Blanket Permit to cover a number of Penetrations requiring review and/or rework. This must be coordinated with the Penetration Engineer and Fire Protection Engineer.</p> <p>NOTE: Existing holes, that are no longer to be used as penetrations for routing pipes, conduits, etc., and that are to be repaired <u>to a condition equivalent to that of the rest of the wall/floor/door</u> – do not have to follow 5.2 <u>and, with the approval of the Fire Protection Engineer</u>, may be repaired per direction of the Cog Engineer. These repairs need to use equivalent, Cog Engineer approved, materials and methods to restore the integrity to a level equivalent to the original construction. Multiple repaired holes under one permit must be labeled in a manner that is traceable to the blanket permit number and identifies the individual locations of each repaired hole (e.g, labeled on the wall with the permit number and sub number or letter – 1234.A, 1234.B, etc.)</p>
Fire Protection Engineer	<p>3. Reviews Legacy Fire Penetrations to determine the condition of the Fire Penetration and the steps required to bring the Fire Penetration into compliance with this Procedure and applicable codes and standards.</p>
ATI	<p>4. Follows all parts of Section 5.2 to correct any issues with a Legacy Fire Penetration and attains final approval of the Fire Protection Engineer/Authority Having Jurisdiction (FPE/AHJ).</p>

6.0 TRAINING

Head, Engineering
and Infrastructure

- A. Target Audience: Department, Division Heads, COGs and ATIs
 Training Method:
 Read only
 Email distribution only
 Frequency:
 Initially and Upon revision or TCR of this Procedure

Penetration
Engineer

- B. Target Audience: Technicians performing this procedure, QC
 Inspectors
 Training Method:
 Training to ENG-027 and ENG-028 - via read only or briefing
 Frequency:
 Once only and Upon revision or TCR of this Procedure
 AND
 Training Method:
 Training to the specific vendor approved procedures and
 materials for fire sealing - via video, classroom, or other
 methods as determined by Penetration Engineer.
 Frequency:
 Once only for each vendor process.

7.0 RECORDS REQUIREMENTS SPECIFIC TO THIS PROCEDURE

Records Custodians must assure records are maintained as follows:

Record Title	Record Custodian	Location	Retention Time
Penetration Seal Inspection Form	Penetration Engineer	Penetration Engineer Files	Cut off at the close of the FY. Destroy 75 yrs after discontinuance of facility. <small>Reference Admin 18: Security, Emergency Planning and Safety Records (9)</small>
Penetration Fire Seal Engineering Disposition Form	Penetration Engineer	Penetration Engineer Files	Cut off at the close of the FY. Destroy 75 yrs after discontinuance of facility. <small>Reference Admin 18: Security, Emergency Planning and Safety Records (9)</small>
Typical Fire Seal/Penetration Addition/Removal Permit Form	Penetration Engineer	Penetration Engineer Files	Cut off at the close of the FY. Destroy 75 yrs after discontinuance of facility. <small>Reference Admin 18: Security, Emergency Planning and Safety Records (9)</small>
Penetration Database	Penetration Engineer	Penetration Engineer Files	Cut off at the close of the FY. Destroy 75 yrs after discontinuance of facility. <small>Reference Admin 18: Security, Emergency Planning and Safety Records (9)</small>

8.0 ATTACHMENTS

Attachment 1	Modifying/repairing a fire penetration seal prerequisites and precautions
Attachment 2	Penetration Seal Inspection Form
Attachment 3	Penetration Fire Seal Engineering Disposition Form
Attachment 4	Typical Fire Seal/Penetration Addition/Removal Permit Form

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-027, Rev. 5 page 1 of 2
MODIFYING/REPAIRING A FIRE PENETRATION SEAL PREREQUISITES AND PRECAUTIONS			Attachment 1

MODIFYING/REPAIRING A FIRE PENETRATION SEAL PREREQUISITES AND PRECAUTIONS

PREREQUISITES

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

1. Obtain work permit (if required).
2. Schedule work on the Rollover Schedule in order to minimize interferences with other activities.
3. Schedule any work requiring Health Physics Support with the Health Physics Manager.
4. Notify QC, the Fire Protection Engineer, and the Facility Manager prior to the start of work.
5. Complete a training program on repair, installation, and maintenance of fire barrier penetration seals approved by the Penetration Engineer.
6. Complete a Job Hazard Analysis (JHA) per ESH-004 prior to beginning work.

PRECAUTIONS

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

1. 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")
2. Contact the Shift Supervisor prior to starting work in the Experimental Areas. 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.
3. Wear hard hats 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).
4. 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.
5. Mix mortars in accordance with manufactures instruction. Splash goggles and protective gloves shall be used for this operation.
6. Observe all safety requirements for work as required by the Shift Supervisor and/or the Construction Manager.
7. Handle and Store all flammable and combustible liquids (new, used and contaminated) in accordance with ES&HD-5008, Section 5.

**MODIFYING/REPAIRING A FIRE PENETRATION SEAL
PREREQUISITES AND PRECAUTIONS****Attachment 1**

8. 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.
9. Dispose of all excess & waste materials in accordance with Lab procedure EWM-001 through PPPL Environmental Restoration and Waste Management.
10. Ensure that any welding is performed only by PPPL Qualified Welders.
11. 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.
12. 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.
13. 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.
14. Obtain a check by a Health Physics representative of all equipment, material, hardware, and devices to be removed from radiologically controlled areas (RCAs) if required by the Radiation Work Permit (RWP).
15. Secure the area at the end of each work shift to assure safe conditions.

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.

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 FORM

UL Approved Design _____

List UL Approved Design Here

Modified for Penetration _____

Created by: _____

Penetration Engineer

Date

Reviewed by: _____

Fire Protection Engineer

Date

Approved by: _____

Facilities Division Head

Date

**Fire Seal/Penetration
Addition/Removal Permit**

The following individual is authorized to
[check one]:

- temporarily remove/reinstall
- drill/install and seal a new penetration
- other

Fire/Gas Seal Penetration No _____

Name _____ Ext. _____

Documentation Required for Approval

WP# _____

Procedure No.: _____

D-Site Supervisor: _____

Comments: _____

Penetration Location and Description

Site: _____

Bldg. / Area: _____

Floor Elevation: _____

Nearest Bldg Columns: _____

Located on: wall Ceiling/Floor

Type: Circular Polygon

Center or Bottom Elevation: _____

System(s)/Service: _____

Schedule and Approval

Work to be performed on [date]: _____

Duration [days/weeks]: _____

Estimated (Re)Sealing Date: _____

Cost Center Work Package Job No.

Authorized By: _____

Penetration Engineer/Date

Copies to: Site Protection ESU, QC