

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-028, Rev. 2 page 1 of 6
Subject: Core Boring, Cutting and Drilling	Effective Date: April 28, 2010	Initiated by: Associate Director, Engineering and Infrastructure	
	Supersedes: TCR ENG-028, R1-003 Dated: 4/1/2005	Approved: Director	

1.0 PURPOSE

This procedure establishes the minimum requirements for the drilling, cutting, or core boring of partial or full-through penetrations to any depth in walls, floors, and ceilings at PPPL.

2.0 SCOPE

2.1 The specific minimum requirements for the boring, drilling or cutting of penetrations in walls, floors and ceilings at PPPL are included in the procedure. The procedure is broken up into two Sections. The first section addresses evolutions where a Core/Drilling Permit is not required and has minimal requirements. The second section addresses drilling/core boring requiring the full requirements of this procedure. Additionally, the following attachments are included:

1. Attachment 1 Core Boring, Cutting and Drilling Generic Requirements, Prerequisites and Precautions
2. Attachment 2 Core Boring and Drilling Permit (typical)
3. Attachment 3 Core Boring and Drilling Field Procedure (typical)
4. Attachment 4 Subcontractor Statement of Work for new D-Site Core Boring Operations (typical)
5. Attachment 5 Qualification of Individuals for the Operation of Sub-surface Scanning Equipment

3.0 DEFINITIONS

Cognizant Individual/ATI – The Cognizant or 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.

Coring/Drilling Installer -The person(s) performing construction & installation operations are referred to as the “Coring/Drilling Installer” in this procedure. This may be an outside contractor or a PPPL employee.

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.

Qualified Person – The designated individual who is qualified to operate the sub-surface scanning equipment per the requirements of Attachment 5 of this procedure.

4.0 REFERENCES

1. ESH-004, Job Hazard Analysis
2. ESH-016, Control of Hazardous Energy (Lockout/Tagout)
3. ENG-027, Fire Barrier Penetration Seal Installation and Repair
4. P-012, Stop Work Authority

SITUATIONS NOT REQUIRING A CORE BORING AND DRILLING PERMIT

5.0 PROCEDURE

5.1 SITUATIONS NOT REQUIRING A CORE BORING AND DRILLING PERMIT

5.1.1 The Figure below provides guidance/requirements for specific situations where a Core Boring and Drilling Permit is not required.

Material	Depth	Type of Drilling	Requirements
Sheet Rock	$\leq 1 \frac{1}{2}$ "	Drill	Class "0" gloves/ Scanned by qualified person
Poured Concrete/Hollow Concrete Block	$\leq 1 \frac{3}{4}$ "	Drill/Coring	Class "0" gloves/ Scanned by qualified person
Hollow Concrete Block	Any	Chisel/hammer	Class "0" gloves/ Scanned by qualified person
Metal Walls/Ceilings/Floors	Any	Drill/Coring	Class "0" gloves/AC Power concurrence

Figure 1 Situations not Requiring a Coring/Drilling Permit

Responsibility	Action
Cognizant Individual/ATI	<ol style="list-style-type: none"> Once the determination has been made that a floor, ceiling, or wall will need to be penetrated will determine whether Section 5.1 or 5.2 of this procedure is applicable by referencing Figure 1. If the work needing to be performed falls within the guidance of Figure 1, PROCEED with this Section; otherwise, PROCEED to Section 5.2. If the work to be performed requires that a through-hole be cored, drilled, or chiseled CONTACT the Penetration Engineer so that the requirements of ENG-027 can be employed.

SITUATIONS NOT REQUIRING A CORE BORING AND DRILLING PERMIT

Responsibility	Action
Qualified Person	<ol style="list-style-type: none"> <li>4. Obtains Class "0" voltage rated gloves which are required to be worn while drilling, coring, or chiseling. <li>5. If drilling into poured concrete, hollow concrete block, or sheet rock, contacts a Qualified Person to have the area scanned for rebar, conduits, or other utilities. <li>6. Performs sub-surface scan (with approved equipment) of affected area to determine if rebar, conduit, or other utilities are present in the affected area.
	<p>NOTE: A person is qualified by satisfactorily completing Attachment 5 of this procedure.</p>
	<p style="text-align: center;">CAUTION:</p> <p style="text-align: center;">If it is thought that any rebar, conduit, or other utility may be in the affected area the assumption shall be made that it is a conduit housing live conductors. Alternate solutions for the location of the drilling will be made.</p>
Cognizant Individual/ATI	<ol style="list-style-type: none"> <li>7. If it is desired to drill/core in areas that are thought to be rebar only, contacts either the Fabrication and Operations Division Head or the Facilities Division Head for permission to continue. <li>8. For drilling into metal ceilings, floors, or walls AC Power shall be consulted to ensure that no electrical issues are present. Follows the advice of AC Power. This step shall be performed in addition to visual checks of the structure being breached. <li>9. Using voltage rated gloves performs the drilling, coring, or chiseling operation as required following the advice of AC power.

SITUATIONS REQUIRING A CORE BORING AND DRILLING PERMIT

5.2 SITUATIONS REQUIRING A CORE BORING AND DRILLING PERMIT

1. This section applies to situations not covered by Figure 1.

Responsibility	Action
Cognizant Individual/ATI	1. For all through-holes contacts the Penetration Engineer to discuss the drilling/penetration location and general requirements as required by ENG-027.
Penetration Engineer	2. Ensures the requirements of ENG-027 are employed for a new penetration and coordinates the activities as needed.
	3. Informs the ATI to prepare a statement of work (Attachment 4) and requisition if an outside subcontractor will be performing the boring, cutting or drilling.
	4. Informs the ATI to issue a written procedure (Attachment 3) incorporating the requirements, prerequisites and precautions of Attachment 1.
Cognizant Individual/ATI	5. Completes the requirements of Attachment 3 as follows: <ol style="list-style-type: none"> a. Marks the desired location(s) and numbers on the floor and wall of the building itself prior to the start of any pre-job surveys. (Note: Numbers will be assigned by the Penetration Engineer). b. Arranges for a sub-surface survey of drilling/coring area with approved scanning equipment to attempt to identify any embedded rebar, conduits or other utilities. c. Contacts AC Power to ensure they perform an AC power check.
Qualified Person	6. Performs sub-surface scan (with approved equipment) of affected area to determine if rebar, conduit, or other utilities are present in the affected area. NOTE: A person is qualified by satisfactorily completing Attachment 5 of this procedure.
	7. Signs Attachment 3 if the affected area is clear of rebar and utilities.
	8. Records any comments in space provided.

SITUATIONS REQUIRING A CORE BORING AND DRILLING PERMIT

Responsibility**Action****CAUTION:**

If it is thought that any rebar, conduit, or other utility may be in the affected area the assumption shall be made that it is a conduit housing live conductors. Alternate solutions for the location of the drilling will be made.

**Cognizant
Individual/ATI**

9. If it is desired to drill/core in areas that are thought to be rebar only, contacts either the Fabrication and Operations Division Head or the Facilities Division Head for permission to continue.

**Fabrication and
Operations Division
Head/Facilities
Division Head**

10. If satisfied that no conduits or other utilities will be breached, signs Attachment 3.

**Power Systems
Branch Head**

11. Once satisfied that no conduits are present in the affected area, signs Attachment 3.

**Penetration
Engineer**

12. Once all of the requirements of Attachment 3 have been completed, issues a Core Boring and Drilling Permit (Attachment 2) and updates the penetration database.

**Coring/Drilling
Installer**

13. Satisfies all applicable requirements and prerequisites listed in Attachment 1 prior to commencing work.
14. Performs all work to provide for a complete installation in accordance with applicable requirements and precautions listed in Attachment 1, the approved penetration procedure, and drawings.

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Core Boring, Cutting and Drilling Generic Requirements, Prerequisites & Precautions			Attachment 1

CORE BORING, CUTTING AND DRILLING GENERIC REQUIREMENTS, PREREQUISITES and PRECAUTIONS

REQUIREMENTS

1. Overcuts are not permitted unless noted on the approved drawing.
2. All work shall take place under the supervision of the PPPL Penetration Engineer.
3. Penetrations Permits, and where applicable Flame Permits, shall be obtained prior to starting each penetration.
4. All work requires preparation of a job hazard analysis (JHA) and review of the JHA by all workers at a pre-job briefing prior to starting work (see procedure ESH-004).
5. For work involving boring, cutting or drilling within or into a radiologically controlled area (RCA), PPPL Health Physics must be consulted, and will specify any required radiological precautions (e.g., radiological surveys, water filtering and direction to LEC tanks, personal protective equipment, etc.) in a Radiation Work Permit (RWP) prior to the start of drilling.
6. Installer must install polyethylene sheeting on both sides of the cuts to protect existing equipment.
7. The cutting equipment must be grounded and plugged into a "Ground Fault Interrupter" adapter or circuit, and the mechanic must wear Class "0" electrical insulating gloves provided by ES&H. All persons in the area must not make any other body contact with the cutting machine unless additional insulating measures are taken. An assistant operating a vacuum machine to remove water from the floor, which is potentially in electrical contact with a ground fault (severed conductor), must wear rated gloves as a minimum.
8. Safety goggles and steel toed shoes must be worn by all persons near the drilling/cutting operations.
9. The installer is responsible for securing all cut-out portions / plugs to assure that they do not fall (especially ceiling and floor cut-outs / plugs).
10. Personnel must be available on the breakthrough side of the cut at the time of the breakthrough and equipment must be protected as specified by the cog engineer. If open holes exist in the general area of the cut personnel must monitor the work area and break through side throughout the cutting process or limit the cooling water introduced.
11. The work area must be wiped down and cleaned periodically during the cutting process. Radiation Work Permits (RWPs) may require that, material used for wiping must be released by PPPL Health Physics prior to disposal.
12. The installer must provide temporary seals for the penetrations as soon as they are completed in a manner acceptable to the Penetration Engineer.
13. The installer will install any necessary scaffolding in accordance with the requirements of PPPL ES&H Directive 5008, Section 1, Item 1.6.2.
14. The installer must provide any lift equipment needed to get equipment onto the scaffolding.
15. The installer must provide cutting tools capable of handling the rebar that exists in the location being cut / drilled.

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Core Boring, Cutting and Drilling Generic Requirements, Prerequisites & Precautions			Attachment 1

PREREQUISITES

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

1. Obtain work permit(s) for any work in the Experimental Areas as required by OP-AD-09. D-Site Work Permits.
2. Obtain approval of a Core Boring and Drilling Permit (Attachment 2) prior to performing any work involving drilling a new penetration.
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 and the Facility Manager for the area prior to start of work.

PRECAUTIONS

Installer 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 a cable tray is not permitted without the approval of the Electrical Safety Engineer. (See form 5008.2-1, "Permit for climbing or walking on cable trays"). The Penetration Engineer can be contacted to help get approvals.
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/bus work in close proximity to the work area.
3. Wear hard hats in posted areas. Gloves, safety goggles, face shields, respirators, etc. shall be worn 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. Observe all safety requirements for work as required by the Shift Supervisor and/or the Construction Manager.
6. 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.
7. Wear disposable dust masks, goggles and/or protective equipment, for any work that produces chips or dust from drilling, cutting or grinding or as specified by Industrial Hygiene (IH). Final Clean up shall be with a vacuum and/or mop (wet method) as determined by the installer.
8. Obtain a check by a Health Physics representative of all equipment, material, hardware, and devices to be removed from radiologically controlled areas (RCAs) if so required by the Radiation Work Permit (RWP).
9. Secure the area at the end of each work shift to assure safe conditions.

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	Core Boring and Drilling Permit		Attachment 2

Core Boring and Drilling Permit

ATI / Design Engineer: _____ **Date:** _____

Penetration Number: _____

ECN#: _____

WP#: _____

Procedure #: _____

Reference Drawing(s): _____

Cost Center: _____ **Work Package:** _____ **Job:** _____

PENETRATION LOCATION & DESCRIPTION

Site: _____ **Bldg. / Area:** _____ **Floor Elevation:** _____ **Fire Rating:** _____

Nearest Bldg. Columns: _____ **Located On: Wall or Ceiling or Floor**

Type: Circular or Rectangular _____ **Sleeve: Yes or No**

Center or Bottom Elevation of Penetration: _____ **Gross Area:** _____

System(s)/Service: _____

Equipment Passing through Pen (Pipe, conduit, etc): _____

Field Walkdown Performed? Yes or No or N/A _____ **By:** _____

Required Drawings Reviewed? Yes or No or N/A _____ **By:** _____

SCHEDULE & APPROVAL

Penetration Engineer Approval to Proceed: _____

Penetration Permit No.: _____ **Date:** _____

Work to be Performed Starting (Date): _____

Duration (Days/Weeks) _____

Estimated Resealing Date: _____ **Actual Date:** _____

Field Work Performed by: _____

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	Core Boring and Drilling Field Procedure		Attachment 3

New Penetration Boring, Cutting and Drilling Procedure

For Penetration(s) _____

Prepared by: _____
ATI/Design Engineer

This procedure is for cutting and drilling of penetrations in areas **except** radiologically Controlled Areas (RCAs).

For cutting and drilling in RCAs, see the Penetration Engineer for further instructions.

1.0 SCOPE

This document describes the penetration(s) that need to be installed as described in Core Boring and Drilling Permit(s).

<u>Permit No.</u>	<u>ATI / Cognizant Engineer</u>
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This document describes how the work must be performed and lists the portions of work that are the responsibility of PPPL and those that are the responsibility of the subcontractor.

2.0 PREREQUISITES AND REQUIREMENTS

- 2.1. The mechanics performing the work must take and pass PPPL General Employee Training (GET) if penetration work is expected to last longer than 5 working days.
- 2.2. PPPL will mark the locations of penetrations on the floors and walls using 1 ½” permanent lettering.

Penetration Locations Marked _____
ATI/Cognizant Engineer Date

- 2.3. **The Coring/Drilling Installer is responsible for securing all cut out portions/plugs** to assure that they do not fall (especially ceiling/floor cut-outs). Personnel must be available on the breakthrough side of the cut at the time of breakthrough.
- 2.4. The contractor will supply and install any necessary scaffolding in accordance with the requirements of PPPL ES&H Directive 5008, Section 1, Item 1.6.2. All scaffolding must be reviewed and approved by the PPPL Competent Person for scaffolding (see <http://www-local.pppl.gov/eshis/OSHACPs.pdf>) prior to their use.
- 2.5. Water associated with the concrete core boring is to be collected and not allowed to spread beyond the work area.

2.6. PPPL will review facility drawings and survey the penetration areas with a sub-surface scanner approved by the Head of Engineering and Infrastructure to attempt to identify any embedded utilities.

<p>2.6.1 Scan Results and Comments</p> <p>Scan Completed: _____ Date: _____ <small>Qualified Individual</small></p> <p>Comments:</p>
<p>2.6.2 A.C. Power is notified and in agreement.</p> <p>A.C. Power Signoff: _____ Date: _____ <small>Power Systems Branch Head</small></p> <p>Comments:</p>
<p>2.6.3 Permission to core or drill into suspected rebar (Fabrication and Operations Division Head or the Facilities Division Head)</p> <p>Signoff: _____ Date: _____</p>

- 2.7. The cutting equipment must be grounded and plugged into a “Ground Fault Interrupter” adapter or circuit, and the mechanic must wear Class “0” electrical insulating gloves. All persons in the area must not make any other body contact with the cutting machine unless additional insulating measures are taken.
- 2.8. The work area must be wiped down and cleaned periodically during the cutting process and after the work has been completed.
- 2.9. The contractor must provide cutting tools capable of handling the rebar that exists in these locations. See comments from the rebar scan above.
- 2.10. Safety goggles and steel toed shoes must be worn by all persons near the drilling/cutting operations.
- 2.11. PPPL will install any sleeves required in the penetrations.
- 2.12. PPPL will provide temporary seals for the penetrations if needed.
- 2.13. QA should be used to monitor the work in progress.
- 2.14. Penetration permits, and where applicable Flame Permits shall be obtained by PPPL personnel prior to starting each penetration.
- 2.15. If previously undocumented conduit is discovered, a STOP WORK must be immediately enacted and Policy P-012 must be followed.

**SUBCONTRACTOR STATEMENT OF WORK FOR
NEW D-SITE AND C-SITE CORE BORING OPERATIONS**

This document is applicable for Penetration Number(s)

(List Penetration Numbers)

In Support of

(List System or Components That Pass Through Penetration(s))

Prepared by: _____
ATI/Cognizant Engineer

Reviewed by: _____
ES&H Manager

Reviewed by: _____
Quality Assurance

Approved by: _____
Penetration Engineer

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	SUBCONTRACTOR STATEMENT OF WORK FOR NEW D- SITE AND C-SITE CORE BORING OPERATIONS		Attachment 4

1.0 SCOPE

This document describes the penetrations that need to be installed for:

System / Penetrating Item

This document also describes how the work must be performed and lists the portions of work that are the responsibility of PPPL and those that are the responsibility of the subcontractor. *(This attachment is a suggested format and content that must be tailored to the specific work it is to be used for.)*

The penetration sizes and locations are:

<i>Penetration Number</i>	<i>Description</i>
<i>(list all applicable penetrations, and a short description of size and location of the penetration)</i>	

2.0 APPLICABLE DOCUMENTS

- 2.1 PPPL Environmental, Safety and Health Manual, PPPL ESH 5008 (requires compliance with OSHA regulations).
- 2.2 List of Applicable PPPL Drawings

<i>Penetration Number</i>	<i>Drawing Name and Number</i>
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	SUBCONTRACTOR STATEMENT OF WORK FOR NEW D- SITE AND C-SITE CORE BORING OPERATIONS		Attachment 4

3.0 PREREQUISITES AND REQUIREMENTS

The requirements and precautions listed below are condensed from Attachment 1. All parties involved with this particular job are responsible for reading the full list of precautions and conditions.

3.1 PPPL Responsibilities

1. PPPL will mark the locations of the penetrations on the floor and walls.
2. PPPL will install polyethylene sheeting or other measures on both sides of the cuts to protect existing equipment.
3. PPPL will provide access to 208v or 480v welding receptacles as required.
4. Water associated with the concrete core boring is to be filtered and sent directly to a liquid effluent collection system drain, or as otherwise directed by PPPL Health Physics. The plug removed from the core drilling shall be turned over to HP.
5. PPPL will review facility drawings and survey the penetration areas with a rebar meter to attempt to identify any embedded conduits. If a conduit is thought to be in the cutting area, the contractor must limit the supply of cooling water. Attempts will be made to de-energize any conduits found prior to starting drilling.
6. PPPL personnel must be available on the breakthrough side of the cut at the time of the breakthrough and equipment must be protected as specified by the cog engineer.
7. PPPL will install any sleeves required in the penetrations.
8. PPPL will provide temporary seals for the penetrations if needed.
9. QA should be used to monitor the work in progress.
10. Penetrations Permits, and where applicable Flame Permits, shall be obtained by PPPL personnel prior to starting each penetration.

3.2 Contractor Responsibilities

1. The mechanics performing the work must take and pass PPPL General Employee Training (GET) if penetration work is expected to last longer than 5 working days.
2. The contractor will supply and install any necessary scaffolding in accordance with the requirements of PPPL ES&H Directive 5008, Section 1, Item 1.6.2. All scaffolding must be reviewed and approved by the PPPL Construction Manager prior to their use.
3. The cutting equipment must be grounded and plugged into a "Ground Fault Interrupter" adapter or circuit, and the mechanic must wear Class "0" electrical insulating gloves. All persons in the area must not make any other body contact with the cutting machine unless additional insulating measures are taken.
4. The work area must be wiped down and cleaned periodically during the cutting process and after the work has been completed.
5. The contractor must provide cutting tools capable of handling the 1" rebar that exists in these locations.
6. Safety goggles and steel toed shoes must be worn by all persons near the drilling/cutting operations.
7. The contractor is responsible for securing all cut-out portions / plugs to assure that they do not fall.

PPPL

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PHYSICS LABORATORY**

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**Qualification of Individuals for the Operation of
Sub-Surface Scanning Equipment**

Attachment 5

Name: _____

Date: _____

Sub-surface scanning equipment being qualified on: _____

Document the training completed: _____

Submitted by: _____
Penetration Engineer

Date: _____

Reviewed by: _____
Fabrication, Operation and Maintenance Division Head

Date: _____

Approved by: _____
Head, Engineering and Infrastructure

Date: _____