NATIONAL HIGH MAGNETIC FIELD LABORATORY

NHMFL

FLORIDA STATE UNIVERSITY

SAFETY PROCEDURE

SP-18

TITLE: ELECTRICAL AREA

CONTROLLED ACCESS PROCEDURE

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1.0 PURPOSE

1.1 This document establishes policy and procedure to control access to areas of this facility where electrical hazards exist from exposed electrical conductors or high voltage capacitors.

1.2 NHMFL's policy is to provide and maintain a safe and healthful working environment. The safety and health of employees and users are the inherent responsibilities of each employee, management, and all levels of supervision.

1.3 This procedure defines the specific entry and exit procedures and actions required by NHMFL personnel, contractors, vendors, visitors, and users to access the Bus Tunnel, Capacitor Yard, and the Hybrid Power Supply Mezzanine.

2.0 SCOPE

2.1 This Safety Procedure shall be used by everyone (employees, contractors, vendors, visitors, and users) at the NHMFL.

2.2 This procedure shall be used in conjunction with all other applicable operating and safety procedures.

3.0 RESPONSIBILITIES

3.1 OPERATORS

The Senior Control Room Operator is responsible for controlling access to the electrical areas known as the Bus Tunnel, Capacitor Yard, and Hybrid Power Supply Mezzanine.

The Senior Control Room Operator shall keep in the Control Room the key allowing access to all these areas.

This key may be logged out to people needing access to these areas.

Before loaning this key the Senior Control Room Operator shall verify the person or persons wishing to gain access to these areas is familiar with this procedure and it's requirements.

The Senior Control Room Operator shall ensure the requirements of the NHMFL

Operations Procedure OP-8, Capacitor Bank Operation, are followed prior to granting access to the area known as the Capacitor Bank Yard.

3.2 PERSONS ENTERING CONTROLLED ACCESS ELECTRICAL AREAS

All visitors to these areas shall ensure that safety and occupational precautions are observed while within these areas.

All visitors to these areas shall ensure that they understand and follow the guidelines presented in this procedure.

3.3 NHMFL

The NHMFL will ensure that anyone entering a Controlled Access Electrical Area is provided with the proper tools, equipment, protective clothing, training, and any other items or information necessary to provide a safe environment for the purpose of any visit in any area.

The NHMFL Safety Officer shall ensure that distribution of the key for access to these areas is limited to two keys, one in the NHMFL Central Key Bank and one in the OPMD Control Room.

4.0 GENERAL INFORMATION AND PRECAUTIONS

4.1 BUS TUNNEL

The Bus Tunnel is located in the OPMD building on the second floor. It is accessible from the Power Supply Rooms and from the Bus Viewing Room on the second floor at the north end of the OPMD building.

The Bus Tunnel has several hazards associated with it. The most severe is electrical shock from exposed electrical conductors. A second significant physical hazard is injury from pneumatic, remote operated, bus disconnect switches.

The Bus Tunnel contains the resistive magnets power supply bus bars. Each power supply has two (2) buses, a positive and negative bus. Each bus is made of four 1x14 inch aluminum bars. These bus bars run the length of the room. Each DC power supply is capable of 500 volts and 20,000 amps. These buses are exposed and severe injury is possible from contact with this equipment when it is energized. There are two (2) flashing red warning lights, mounted on the ceiling, at the south and north ends of the Bus Tunnel, which indicate when **any** DC Power Supply is turned on and one or more of these bus bars are energized.

There are 128 remote operated bus disconnect switches. They run the length of the Bus Tunnel and are located at floor level on either side of the room. These switches are open or exposed and severe injury is possible if an employee is in close proximity and they are opened or a body part is between the contacts of these switches while they are closed.

There are 4 Emergency Power Off (EPO) button switches in the bus tunnel. There

is one at each end of the tunnel and one on each side of the tunnel. These buttons will simultaneously trip all 4 power supplies off line, deenergizing the DC buses.

4.2 CAPACITOR YARD

The Capacitor Yard is located at the south east wing of the facility, between the front parking lot and Cooling Tower. It is a locked, fenced enclosure. There are four (4) banks of high voltage, single phase, power capacitors. The electrical voltage present is 12.4 kV.

The capacitor banks are exposed to the elements and personnel. They are highly charged and close proximity or direct contact could result in a discharge of electrical energy resulting in severe injury or death.

4.3 HYBRID POWER SUPPLY MEZZANINE

The Hybrid Power Supply Mezzanine is located in the OPMD building on the third floor. It is accessible from the stairs outside at the north end of the OPMD building.

The Hybrid Magnet Power Supply is located on the Hybrid Power Supply Mezzanine. This is a low voltage DC power supply however, it is capable of high current levels. It is rated at 25 vDC, 15,000 amps.

The Hybrid Magnet super conducting coils are energized via the Hybrid Magnet Power Supply positive and negative buses. These buses are two (2) inches thick and five (5) inches wide and are made of two 1x5 inch thick copper bars. The buses are exposed and injury is possible from contact with this equipment when it is energized.

There are two load interrupting disconnect switches on the Hybrid Power Supply Mezzanine. These switches are open or exposed to personnel and injury is possible from contact with this equipment when it is energized. Electrical arcs during operation of this equipment are possible. This equipment is automatically operated at any time.

There is a high current dump resister located on the Hybrid Power Supply Mezzanine. This is open or exposed to personnel and injury is possible from contact with this equipment when it is energized. Electrical energy is discharged to this dump resistor during a magnet dump and high temperatures are generated in the resistor as a result of this electrical energy . Care should be taken to keep personnel and equipment clear of it at all times. This equipment is automatically operated at any time.

Under certain conditions the two load interrupting disconnect switches and the high current dump resister can experience voltages as high as 7.5 kV. Therefore all exposed electrical equipment shall be treated as energized, 7.5 kV gear.

5.0 PROCEDURAL GUIDELINES

5.1 BUS TUNNEL ACCESS

The key for access to the Bus Tunnel is obtained from the Senior Control Room Operator. He/she is located in the OPMD Building Control Room.

5.1.1 Bus Tunnel Access with Energized Power Supplies

Access to this area is forbidden when any of the DC Power Supplies are energized.

Exceptions can be made for qualified personnel with just cause.

Just Cause is defined as demonstrating that work on or near the exposed electrical conductors in the Bus Tunnel is necessary because de-energizing them introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

Examples of increased hazards are interruption of life support equipment, deactivation of emergency alarm systems, or removal of illumination for a work area.

Examples of unfeasibility due to equipment design or operational limitations are testing of electrical circuits which may only be done with the circuit energized or work on circuits which form an integral part of a continuos industrial process that would otherwise have to be completely shut down in order to perform the work.

When access is granted to the Bus Tunnel and any DC Power Supplies are energized, safety related work practices shall be used to protect employees who may be exposed to the electrical hazards present. Employees shall be protected against contacting any energized circuit parts directly with any part of their body or indirectly through some other conductive object. These employees must be qualified and capable of working on energized circuits and shall take special precautionary measures such as personal protective equipment (insulating clothing i.e.: flash apron, insulating gloves, face shield or eye protection), insulating and shielding materials, and insulated tools.

A two person rule applies at all times when access is granted for any reason and any DC Power Supply is energized.

A red placard with black lettering stating "Personnel in Bus Tunnel" shall be prominently placed on the operating screens of the Johnson Yokogawa (JYC) Distributed Control System operator interface units for the period of time the Bus Tunnel is occupied.

5.1.2 Bus Tunnel Access for Maintenance

When access is granted for maintenance on or near the DC buses, and the conditions for working on or near exposed energized electrical circuits in sec 5.1.1 of this procedure cannot be demonstrated, all four DC Power Supply feeder breakers shall be racked to disconnect, tagged and locked out in accordance with the NHMFL Safety Procedure, SP-1, Safety Clearance Procedure.

Other equipment will be disabled and tagged out as appropriate for the work in progress and the hazards present.

Static electrical charges may be present within the DC Power Supply buses and must be shorted to ground prior to commencing any work on or about the DC buses.

A red placard with black lettering stating "Personnel in Bus Tunnel" shall be prominently placed on the operating screens of the Johnson Yokogawa (JYC) Distributed Control System operator interface units for the period of time the Bus Tunnel is occupied.

5.1.3 Bus Tunnel Access for Visual Inspection

When access is granted for a **HANDS OFF** visual inspection of Bus Tunnel equipment or when the area is accessed for tours or the like, the Control Room EPO button shall be pushed and activated.

The DC Power Supply feeder breakers tripped position shall be verified by remote indications on the Johnson Yokogawa (JYC) Distributed Control System by a Senior Control Room Operator.

A single Senior Control Room Operator shall be stationed in the Control Room for the period the Bus Tunnel is occupied.

The Senior Control Room Operator shall act as a physical barrier to anyone resetting the EPO circuit and/or starting the power supplies from the Johnson Yokogawa (JYC) Distributed Control System.

A red placard with black lettering stating "Personnel in Bus Tunnel" shall be prominently placed on the operating screens of the Johnson Yokogawa (JYC) Distributed Control System operator interface units for the period of time the Bus Tunnel is occupied.

5.2 CAPACITOR YARD

The key for access to the Capacitor Yard is obtained from the Senior Control Room Operator. He/she is located in the OPMD Building Control Room.

5.2.1 Capacitor Yard Access when Energized

The Facility Engineer may access, or grant access to qualified personnel, to

this area when this equipment is energized at his discretion. No other NHMFL employee, contractor, vendor, visitor or user is allowed in this area when this equipment is energized. Appropriate safety measures shall be taken by the Facility Engineer.

Access to this area by other employees, contractors, vendors, visitors and users of the NHMFL is *NOT* allowed when this equipment is energized.

5.2.2 Capacitor Yard Access for Inspection or Maintenance

When access is granted to the Capacitor Yard area for inspection or maintenance on or near the capacitor banks, all four capacitor bank feeder isolation breakers shall be opened, racked to disconnect, and tagged out in accordance with NHMFL Safety Procedure, SP-1, Safety Clearance Procedure.

The capacitor bank grounding switches shall be closed in accordance with the NHMFL Operating Procedure, OP-8, Capacitor Bank Operation.

A second means shall be used to short all four capacitor bank neutrals to ground in accordance with the NHMFL Operating Procedure, OP-8, Capacitor Bank Operation.

Voltage measurements on all four capacitor banks shall be made by qualified personnel using an insulated measuring device (hot-stick) and personal protective equipment of the proper insulating class, as appropriate before any inspection or maintenance is begun on or near the capacitor banks in accordance with the NHMFL Operating Procedure, OP-8, Capacitor Bank Operation.

No personnel are allowed access to this area except those necessary to fulfill the requirements of this procedure and the NHMFL Operating Procedure, OP-8, Capacitor Bank Operation until the above steps have been completed in accordance with the NHMFL Operating Procedure, OP-8, Capacitor Bank Operation.

5.3 HYBRID POWER SUPPLY MEZZANINE

The key for access to the Hybrid Power Supply Mezzanine is obtained from the Senior Control Room Operator. He/she is located in the OPMD Building Control Room.

5.3.1 Hybrid Power Supply Mezzanine Access when Energized

Access to this area is forbidden when the Hybrid Magnet DC Power Supply is energized.

Exceptions can be made for qualified personnel with just cause.

Just Cause is defined as demonstrating that work on or near the exposed

electrical conductors in the Hybrid Power Supply Mezzanine is necessary because de-energizing them introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

When access is granted to the Hybrid Power Supply Mezzanine and the Hybrid Magnet DC Power Supply is energized safety related work practices shall be used to protect employees who may be exposed to the electrical hazards present. These employees must be qualified and capable of working on energized circuits and shall take special precautionary measures such as personal protective equipment (insulating clothing i.e.: flash apron, insulating gloves, face shield or eye protection), insulating and shielding materials, and insulated tools as appropriate for the work in progress.

A two person rule applies at all times when access is granted for any reason and the Hybrid Magnet Power Supply is energized.

5.3.2 Hybrid Power Supply Mezzanine Access for Maintenance

When access is granted for maintenance on or near the Hybrid Magnet Power Supply DC bus, and the conditions for working on or near exposed energized electrical circuits in sec 5.1.1 and 5.3.1 of this procedure cannot be demonstrated, the Hybrid Magnet Power Supply feeder disconnect shall be opened, tagged and locked out in accordance with the NHMFL Safety Procedure, SP-1, Safety Clearance Procedure.

Other equipment will be disabled and tagged out as appropriate for the work in progress and the hazards present.

Static electrical charges may be present within the DC Power Supply bus and must be shorted to ground prior to commencing any work on or about the DC bus.

6.0 PROCEDURE REFERENCES

6.1 OSHA CFR 1910.333, "Subpart S", sec.a.1-2, b.1-2, c.1-3,

6.2 Gilbert Power Factor Correction Capacitors and Harmonic Filters, NHMFL Technical Library, January '93 edition;

6.2.1 McGraw-Edison Company, Capacitors, Block Banks, Installation and Service Manual, March '78 revision.

6.2.3 Cooper Power Systems, Power Capacitors, High Voltage, Single Phase, Installation and Maintenance Instructions, February '90 revision.