BEAMS DIVISION ADMINISTRATIVE PROCEDURE

BDAP-11-0001

ENTRY INTO AND STARTUP AFTER A MAJOR SHUTDOWN OF THE ACCELERATOR COMPLEX

RESPONSIBLE DEPARTMENT : BDHQ

PREPARED BY _____ DATE 9/10/98
Operations Department Head

APPROVED BY S.D. Holmes DATE 9/10/98
Beams Division Head

REVISION NO. 2 REVISION ISSUE DATE 9-14-98

REVIEW AND CONCURRENCE RECORD

REVIEWED BY: _____ DATE: 9/9/98
ES&H Department Head

REVIEWED BY: Robert C. Webber DATE: 9/9/98
Proton Source Department Head

REVIEWED BY: Ralph J. Pasquinelli DATE: 9/8/98
Antiproton Source Department Head

REVIEWED BY: Philip S. Martin DATE: 9/8/98
Main Injector Department Head

REVIEWED BY: _____ DATE: 9/8/98
Tevatron Department Head

REVIEWED BY: _____ DATE: 9-8-98
Mechanical Support Department Head

REVIEWED BY: _____ DATE: 9-9-98
Cryogenics Department Head

REVIEWED BY: Dan Wolff DATE: 9/9/98
Electrical Engineering SupportDepartment Head

REVIEWED BY: Sharon Lackey DATE: 9/9/98
Controls Department Head

REVIEWED BY: _____ DATE: 9/8/98
RFI Support Department Head

REVIEWED BY: _____ DATE: 9/10/98
External Beamlines Department Head

REVIEWED BY: Michael Gerardi DATE: 9/8/98
Beams Division RSO

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1.0 PURPOSE AND SCOPE

The purpose of this procedure is to describe how the Fermilab Accelerator complex is turned back on after the extended shutdowns that occur between running periods. A major shutdown is typically greater than a month long, or the Tevatron is warmed up to room temperature, or extensive accelerator maintenance or improvement work has taken place, or a changeover between collider and fixed-target modes has been done. This procedure does not address the shorter, controlled shutdowns that occur during the course of a run for maintenance and repair of specific components, or improvements to a few specific subsystems.

1.1 POLICY

It is the Beams Division Policy that beam will not be introduced into any accelerator until

a. equipment and components are configured in a manner to safely allow acceleration of beam.

b. operational beam limits have been established consistent with the requirements of the safety envelope contained in the current Safety Assessment Document for the Accelerator Complex.

2.0 RESPONSIBILITIES

2.1 BD ASSOCIATE DIVISION HEAD FOR OPERATIONS

The BD Associate Division Head for Operations is responsible for preparing this document and updating it on an as-needed basis. If the position is unfilled, the Head of Operations will serve.

2.2 BD ASSOCIATE DIVISION HEAD FOR ENGINEERING

The BD Associate Division Head for Engineering is responsible for coordinating shutdown activities and assuring that necessary maintenance is carried out.

2.3 BD DEPARTMENT HEADS

All department heads are responsible for ensuring that the provisions relevant to their departments are carried out. In the event of a change in departmental procedure that affect accelerator startup the BD department heads are responsible for ensuring that the Division head or designee is informed. In addition the BD Department Heads (or their designees) have to sign off on the relevant restart sheets and checklists.

2.4 BD DIVISION HEAD

The BD Division Head is responsible for overseeing that the provisions of this procedure are carried out. The BD Division Head is responsible for sending the memos to the Operations Department Head to permit restart of the various systems.

The BD Division Head is also responsible for designating a major shutdown. Such a designation is accomplished by a memo to the BD Operations Department Head rescinding authorization to introduce and accelerate beam in the accelerator complex until re-authorized in writing as described in this procedure.

2.5 BD RADIATION SAFETY OFFICER

In accordance with the responsibilities assigned in the Radiation Safety Control Manual, the Radiation Safety Officer will review the Beam Permit, and the Accelerator System Startup Sign-off (see attachments 1 and 2, respectively).

3.0 ACCELERATOR STARTUP PROCEDURE

3.1 ACCELERATOR COMPLEX

The Accelerator Complex consists of the Proton Source, Antiproton Source, MainInjector, Tevatron and Switchyard systems.

3.2 BEAM PERMITS

During a run there is a Beam Permit form for each of the accelerator systems (Attachment 1). These permits are usually created before the beginning of a run and indicate the maximum beam power allowed in the appropriate accelerator system. The beam power limits are determined by the Division Head in consultation with the ES&H Section Head and are contained within the Safety Envelope limits. In general the operational beam permit limit will be less than or equal to 90% of the Safety Envelope limit. Beam permits are reviewed by the BD Operations Department Head the BD Systems Department Head for the accelerator in question, the BD Radiation Safety Officer, and the BD Associate Head for Operations, and approved by the BD Division Head. These permits are read and signed by the Operations Department personnel, to indicate that they have understood the beam power limits, and can be viewed in the BD Main Control Room.

The complete list of beam permits are

a. Linac Beam Permit

b. Booster Beam Permit

c. Antiproton Source Beam Permit

d. Main injector Beam Permit

e. Tevatron Beam Permit

f. Switchyard Beam Permit

3.3 SIGN-OFFS & CHECKLISTS

The complete list of sign-off and checklists needed for this procedure are

a. Accelerator System Restart Sign-off Form (Attachment 2)

b. BD Mechanical Support Department Procedure BDDP-ME-0101 "Mechanical Support Department Quality Assurance Sign-off for Maintenance and Upgrade Tasks on the Accelerator Complex"

c. BD Cryogenics Department Procedures

BDDP-CR-9203	"Cryogenic Checklist Following Cold Tevatron Component Change Procedure"
BDDP-CR-9204	"Cryogenic Checklist Following Cold Proton Bend Component Change Procedure"
BDDP-CR-9205	"Cryogenic Checklist Following Cold Muon Bend Component Change Procedure"
BDDP-CR-9206	"Cryogenic Checklist Following Cold Meson Bend Component Change Procedure"

d. BD EE Support Department Procedures

BDDP-EE-4011	"TEV QPM End of Shutdown Start-up Procedure"
BDDP-EE-4013	"Low Beta QPM End of Shutdown Start-up Procedure"
BDDP-EE-4014	"Low Beta 1 kA Quad End of Shutdown or End of Repair Start-up Procedure"

A valid Beam Permit and a valid Accelerator System Restart Sign-off (see Attachments 1 and 2) are required to be completed before a given accelerator system may accept and/or accelerate beam.

By their signatures they are indicating that the work was indeed completed and that to their knowledge the system is ready to accept beam. In addition, the signature of the department head responsible for a particular system indicates that the radiation shielding for the system is configured as described in the current shielding assessment.

3.4 SYSTEM TURN-ON

3.4.1 Generic Conditions

A valid Beam Permit and a valid Accelerator System Restart Sign-off (see Attachments 1 and 2) are required to be completed before a given accelerator system may accept and/or accelerate beam.

System startup is initiated by a memo that is sent by the BD Division Head to the BD Operations Department Head indicating that it is ready for beam transport. The memo will also indicate the maximum beam power that can initially be run through the system. If this beam power is not that given in the system Beam Permit, the conditions that will have to be fulfilled before the beam permit becomes fully operational are included in the memo.

3.4.2 Tevatron

In addition to the generic conditions given above, the following specific conditions apply to the Tevatron.

a. The mechanical and cryogenics groups that work on the Tevatron do the walk-through following BDDP-ME-0101 and BDDP-CR-9203. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the BD Cryogenics, Mechanical Support, and Tevatron Department Heads (or their respective designees). The walk-through data is examined to ensure that all of the work was done properly and everything has been restored properly. At this point, the walk-through procedure is signed off and permission can be given to initiate Tevatron cool down. This permission, with any conditions if necessary, is formally transmitted by a memo from the BD Division Head to the BD Operations Department Head. The permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

b. The BD EE Support Department carries out an electrical walk-through inspection following BDDP-EE-4011, 4013, 4014. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the Tevatron and EE Support Department Heads (or their respective designees). The walk-through checklists and data are examined to ensure all the work was done correctly and that everything has been restored properly. At this point, the walk-through procedure is signed off and permission can be given to power the Tevatron when it is cold. This permission, with any conditions if necessary, is formally transmitted by a memo from the BD Division Head to the BD Operations Department Head. The permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

3.4.3 Switchyard

In addition to the generic conditions given above, the following specific conditions apply to the Switchyard.

The mechanical and cryogenics groups that work on the Switchyard do a walk-through following BDDP-ME-0101 and BDDP-CR-9204, 9205, 9206. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the BD Cryogenics, Mechanical Support, and External Beams Department Heads (or their respective designees). The walk-through data is examined to ensure that all of the work was done properly and everything has been restored properly. At this point, the walk-through procedure is signed off and permission can be given to initiate Switchyard cool down. This permission, with any conditions if necessary, is formally transmitted by a memo from the BD Division Head to the BD Operations Department Head. The permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

4.0 DOCUMENTATION

Copies of all Beam Permit authorization memos, Accelerator System Restart Sign-off forms, Beam Power permit forms, and cooldown forms will be retained by BD Headquarters for a period of four years. In addition the currently active Beam Power permit forms for all accelerator systems will be viewable in the Main Control Room.

5.0 EXTRA-DIVISION DISTRIBUTION

None.

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BEAM PERMIT

Linac Beam Safety Envelope

The maximum beam transmitted through the Linac accelerator is limited to 3.54 E17 particles in any one hour.

No accelerator or beam line will transmit beam without an operational beam interlock safety system.

Linac Beam Operating Limits

The operational limit for beam transmitted through the Linac in any one hour is 3.34 E17 particles.

For calculation purposes, where the pulse length is constant, the number of particles per hour may be determined by the following formula:

particles/hour = current (mA) x pulse length (μsec) x actual # pulses in one hour x 6.25 E9

Examples:

#1 33 mA of beam with a pulse length of 30 microseconds at 15 pulses per second for 1 hour.

33 mA x 30 μsec x 54000 pulses/hr x 6.25E9 = 3.34 E17 particles/hour

#2 50 mA of beam with a pulse length of 30 microseconds at 5 pulses per second for 1 hour.

50 mA x 30 μsec x 18000 pulses/hr x 6.25E9 = 1.69 E17 particles/hour

Special conditions and comments:

Prepared by_____
Operations Department Head/Date and Proton Source Department Head/Date

Reviewed by_____
Associate Beams Division Head for Systems/Date

Reviewed by_____
Beams Division Radiation Safety Officer/Date

Approved by_____
Beams Division Head/Date

Date: 8/21/98
Rev: 4.7.1

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ACCELERATOR SYSTEM RESTART SIGN-OFF

The signatures below indicate that work done on the accelerator system since the last period of accelerator operation has been completed, and that the systems are ready for restart of beam operation. Signatures that are N/A should be initialed by the system Department Head.

SYSTEM BEING SIGNED OFF: Linac Booster Anti-Proton
Main Injector Tevatron Switchyard
(Circle One)

DEPARTMENT	DATE	SIGNATURE (Department Head/Designee)
CONTROLS	_____	_____
CRYOGENICS	_____	_____
EE SUPPORT	_____	_____
RF & INSTRUMENTATION	_____	_____
MECH. SUPPORT	_____	_____
ES&H	_____	_____
OPERATIONS	_____	_____

The _____ radiation shielding meets the requirements documented in the _____ shielding assessment.

Approved by _____ _____
Department Head Date

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Comments and special conditions:

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FINAL APPROVALS

Department Head _____ Date _____

Radiation Safety Officer _____ Date _____

Beams Division Head _____ Date _____

Accelerator System Restart Sign-off Example ATTACHMENT 2