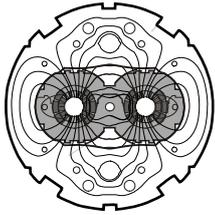


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the
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Operational Safety Procedure

PROCEDURE FOR PATROLLING THE LHC

Abstract

This document describes the procedure to be followed for patrolling an LHC sector (in a machine or service area).

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History of Changes

<i>Rev. No.</i>	<i>Date</i>	<i>Pages</i>	<i>Description of Changes</i>
	2008-04-09	All	First version
	2008-06-23	All	Added references, general patrol techniques Added details about objective of the patrol Added example for setting patrol mode ON and OFF
0.1	2009-06-08	All	Submission for engineering check
	2009-09-02	7-11	Removed example
0.2		All	Sent for approval
1.0	2009-11-24	All	Released version
1.1	2009-11-24	7	End of patrol mode before exiting the sector being patrolled

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1. OBJECT OF THE PATROL

The patrol is used as a means to ensure the access system and the LHC machine are in a condition to receive beam. The patrol is to be performed following certain changes of state of the access system, for example following a general access period (shutdown period) or after an access system element has changed state (e.g. door forced open, search box fallen).

The main objective of the patrol is to ensure personnel safety, to ensure that nobody remains in the interlocked areas while conditions allow beam and that the perimeter of the controlled area cannot be penetrated without following the correct access procedure or causing a beam inhibit.

The patrol is also used as a final verification of the machine state. The patrol should perform a visual check, paying special attention to equipment which has undergone recent interventions. The visual inspection should incorporate the following:

- Water leaks
- Disconnected cabling
- Equipment, tools, etc..., resting on or near beam equipment.

Finally, the patrol should also ensure all ventilation doors are closed.

A full and thorough patrol is a critical step in ensuring personnel safety in the LHC, both with and without beam.

The LHC (machine and experiments) is sectorized as documented in 6.1. A patrol ensures the readiness of a given sector to take beam. All LHC sectors (in the machine and the experiments) have to be patrolled before the LHC is ready to receive beam.

2. PATROL TEAM

The patrol team consists of a patrol leader and one or more patrol members. The number of patrol members depends on the sector to be patrolled as described in the documents detailing patrol circuits (see section 6.3).

3. TOOLS REQUIRED FOR A PATROL

When performing a patrol in the LHC (tunnel areas, service areas or experimental areas), there is certain equipment which should be carried:

- Tools:
 - One patrol key bundle including a patrol key (reference AM 445380) and a LEP10000 master key. The patrol key bundles can be found in the CCC safe box close to the PS island of the CCC (ask the LHC Engineer in Charge on shift or the TI operator to open it for you and give you a patrol key bundle if you do not have the access rights to the key safe box).
 - In addition, when patrolling UX45 or UX65, a special key bundle ("Clefs cadenas accès ponts roulants") is required (to be found in the CCC safe box).
 - Emergency exit rearming tools (to be found in CCC safe box).
 - Seals for sealing emergency exit handles.
- Safety equipment:
 - Personal dosimeter (including biometric identification).

- Personal safety equipment (safety shoes, helmet, biocell, torch).
 - Ear protections useful for some sectors (as stated in documents describing patrol circuits).
 - Mobile phone mandatory for patrol leader, suggested for other patrol members.
 - After first beam an operational dosimeter per patrol team is also required.
- A bike may be taken in case the patrol occurs in a long tunnel zone.
 - The document describing the patrol circuit to be followed.

4. PATROL TECHNIQUES

If possible, the patrol should be performed either following a night or a weekend with the interlocked areas in restricted access mode to ensure that there has been enough time for people to exit the area.

Before the patrol can take place, the operator in the CCC should check that the zone is a priori empty.

The integrity of the perimeter of the entry point should be established before the patrol can take place. This ensures that personnel cannot enter the zone to be patrolled without the authorization from the LHC operations team in the CCC.

To ensure that there is nobody remaining in the zone, patrols should be comprehensive to check for those who may be unconscious or intoxicated and may not respond to audible alerts. If anyone is found in the zone the person or people must be escorted out of the zone and the patrol must be restarted.

The patrol must be conducted in such a way that somebody remaining inside the zone (other than the members of the patrol team) cannot pass between areas avoiding the patrol team. The patrol should also be sufficiently thorough that hidden areas and areas above, below and behind equipment are correctly verified.

All components of the access system, i.e. doors, trapdoors, locks, search boxes, etc. must be inspected for damage or malfunction during the patrol. If any faults are noted these must be reported immediately to the access system specialists. The patrol should be abandoned until the fault has been rectified.

If an area is to be searched following an intrusion then normally only the directly affected area will need to be patrolled. This area will be indicated by fallen search boxes. All other areas will remain secure and search boxes will remain armed.

5. PATROL PROCEDURE

5.1 PLANNING THE PATROL:

A patrol of a sector or zone should be planned in order to make sure there is no intervention on going in the zone to be patrolled, and no intervention is foreseen while the patrol will be taking place.

5.2 BEFORE THE PATROL:

5.2.1 BEFORE LEAVING THE CCC:

- 1) The operator in the CCC checks that the zone is a priori empty.

- 2) The patrol leader or the operator in the CCC fills the LHC OP logbook indicating:
 - o Date and time of departure.
 - o Sectors to be patrolled.
 - o Names of patrol leader and patrol members.
 - o Identification of the patrol key bundle taken by the patrol leader.
- 3) The patrol leader or the operator in the CCC checks on the LASS supervision HMI (Human Machine Interface) which EIS (doors) should be closed and which emergency exit systems should be rearmed: a check list is filled.
- 4) The patrol leader gets the required tools.
- 5) The patrol leader takes the patrol circuits for the sectors to be patrolled (see section 6.3 and edms references therein).

5.2.2 ON SITE, BEFORE STARTING THE PATROL:

- 1) The patrol team closes all the EIS of the sector which might still be open (end of zone doors, sector doors, trapdoors, mobile shielding walls, etc...).
- 2) The patrol team rearms all emergency exit handles and seals them (on all end of zone doors, sector doors, PADs and MADs).
- 3) The patrol leader checks with the CCC (phone: 77600) that all doors are closed and all emergency exit handles are rearmed.

5.3 START OF PATROL:

The patrol leader asks the CCC operator to set the relevant sector(s) to patrol mode. As a consequence, the access mode of the corresponding access point is set to "RESTRICTED", all doors of the relevant sector(s) are locked, and all search boxes of the relevant sector(s) fall.

5.4 PATROL PROCEDURE:

- 1) The patrol team enters the sector to be patrolled.
 - o If the access to the sector to be patrolled is via an access point (PAD), the patrol team follows the normal procedure for access in restricted mode.
 - o If the access to the sector to be patrolled is via a sector door, the patrol leader unlocks the door using the patrol key, presses the green button to open the door, lets the patrol team in the sector and closes the door. The door will be automatically locked again. Note that in patrol mode a door opened for more than 40 seconds will result in the corresponding search boxes to fall.
- 2) The patrol team then
 - o Searches the sector according to the predefined patrol circuit.
 - o Calls out for people.
 - o Rearms all the patrol boxes of the sector using the patrol key.
- 3) If a person is found in the sector:
 - o The patrol leader takes note of the name of the person and the reason for his/her presence.
 - o It is up to the patrol leader to decide whether:

- The person is integrated into the patrol team and follows the instructions of the patrol leader throughout the whole patrol.
- Or the person is escorted back outside by the patrol team. In which case the patrol leader informs the CCC operator. The operator in the CCC removes the patrol mode for the relevant sector(s) (in order to force all search boxes to fall, and thus the patrol to be started from the beginning).
- In the second case, it is then again up to the patrol leader to decide whether:
 - The patrol can start again straight away, in which case the operator in the CCC sets again the patrol mode for the relevant sector(s).
 - Or, the patrol is cancelled and will have to be done at a later stage.

5.5 END OF PATROL:

- 1) The patrol leader checks with the CCC that all patrol boxes are rearmed.
- 2) The patrol leader asks the CCC to remove the patrol mode for the sectors concerned.
- 3) The patrol team exits the sector.
 - If the way out of the sector is via an access point (PAD), the patrol team follows the normal procedure for exiting in restricted mode.
 - If the way out of the sector is via a sector door, the patrol leader unlocks the door using the patrol key, presses the green button to open the door, lets the patrol team out of the sector and closes the door. Note again that in patrol mode a door opened for more than 40 seconds will result in the corresponding search boxes to fall.
- 4) The operator in the CCC confirms to the patrol leader the "SEARCH" signal is now rearmed for the sectors concerned.

5.6 RETURNING TO THE CCC:

- 1) The patrol leader or operator in the CCC fills in the LHC OP logbook indicating:
 - Date and time of end of patrol.
 - Sectors patrolled (successfully or not).
 - Any comment or observation.
 - Possibly, reason for cancellation or failure of the patrol.
- 2) The patrol team returns the patrol key bundle and the patrol tools in the CCC.

6. REFERENCES

6.1 SECTORIZATION

The LHC sectorization is described in the following documents:

- LHC sectorization: LHC-Y-ES-0101 ([edms 342640](#))
- LHC sites 1 and 1.8: LHC-Y-ES-0102 ([edms 342641](#))
- LHC sites 2 and 3.2: LHC-Y-ES-0103 ([edms 342642](#))

- LHC site 3: LHC-Y-ES-0104 ([edms 342644](#))
- LHC site 4: LHC-Y-ES-0105 ([edms 342645](#))
- LHC site 5: LHC-Y-ES-0106 ([edms 342646](#))
- LHC site 6: LHC-Y-ES-0107 ([edms 342647](#))
- LHC site 7: LHC-Y-ES-0108 ([edms 342648](#))
- LHC site 8: LHC-Y-ES-0109 ([edms 342649](#))

6.2 ACCESS SYSTEM

User manuals of the LACS human-machine interface:

- “Manuel d'utilisation et d'exploitation du système - (Poste opérateur CCC/ECR/CSA)”: [edms 901012](#)
- “Mini-manuel d'utilisation et d'exploitation du système - (Poste opérateur CCC/ECR/CSA)”: [edms 1001230](#)

Tutorials on LASS and LACS human-machine interfaces:

- “Operator Training Presentation”: [edms 901170](#)
- “Operator training : LASS-LACS Human-Machine Interface”: [edms 901620](#)

The user manuals of the LASS human-machine interfaces (edms 901086 and 901088) are available in the CCC, next to the LASS console.

Videos: “LHC Access Control System tutorial”:

- English version: <http://cdsweb.cern.ch/record/1094573>
- French version: <http://cdsweb.cern.ch/record/1094572>

6.3 PATROL CIRCUITS

The patrol circuits and specificities of all the LHC sectors (machine and service areas) are described in the following documents:

- LHC sites 1 and 1.8: LHC-OP-OSP-0001 ([edms 862607](#))
- LHC sites 2 and 3.2: LHC-OP-OSP-0002 ([edms 929353](#))
- LHC site 3: LHC-OP-OSP-0003 ([edms 862610](#))
- LHC site 4: LHC-OP-OSP-0004 ([edms 862611](#))
- LHC site 5: LHC-OP-OSP-0005 ([edms 862616](#))
- LHC site 6: LHC-OP-OSP-0006 ([edms 862618](#))
- LHC site 7: LHC-OP-OSP-0007 ([edms 862619](#))
- LHC site 8: LHC-OP-OSP-0008 ([edms 862620](#))

The patrol circuits and specificities of the LHC experimental areas are described in separate documents:

- ALICE: [edms 888697](#)
- ATLAS: [edms 887042](#), [909906](#) and [909907](#)
- CMS: ?
- LHCb: [edms 868605](#)
- Survey galleries (UPS14/16 and UPS54/56): [edms 976866](#)