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Technical Requirements Specification

Cleanliness strategy

The purpose of this document is to define cleanliness requirements applicable for all contractors responsible for installation activities performed in worksite 1 (WS1).

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v1.0	Revision Required	10 Oct 2018	
v1.1	Approved	09 Nov 2018	<p>Comments from TAC1, TAC2, TAC3, A0, vacuum, CMA and General services (CMG) taken into account:</p> <ul style="list-style-type: none"> - RFE have been suppressed from the chronological strategy and replaced by description of the assembly progress - modification of intro of chapter 6.2 to develop the applicability of each cleanliness class - typo correction - Precision added for building HVAC - Clarification added to avoid misunderstanding <p>Attached word file includes the track changes</p>
v1.2	Approved	26 Apr 2019	Version changed to reflect IO's supply and maintenance of clean white clothing under a separate contract.
v2.0	Signed	09 Nov 2023	General update of the cleanliness strategy for WS1
v2.1	Approved	27 Nov 2023	Comments on draft version 2.0 taken into account.

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1 Purpose

The purpose of this document is to define cleanliness requirements applicable for all contractors responsible for installation activities performed in worksite 1 (WS1).

The WS1 is composed of the Cleaning Facility (B17), the Assembly Building (B13), the Tokamak pit and the Crane Hall (B11).

Note: the cleanliness classification (from the ITER vacuum handbook [1] and the RCC-MR RF6000) defined in the previous revision of this document is withdrawn from this version. For the sake of clarity, the highest cleanliness requirements (previously called Class A) apply to the whole volume of WS1 (B17, B13 and the Crane Hall) with the specificity of the Pit which requires to wear a hairnet (see chapter 6.2 Workers/personnel attire).

2 Scope

The ITER tokamak is composed mainly of VQC-1 and VQC-2 components assembled and operated under clean conditions in order to comply with vacuum and with the machine operation requirements (i.e. comply with thermal shield emissivity requirement).

These clean conditions apply throughout the Assembly Building (B13) and Tokamak Complex (B11 pit and crane hall).

This document details the implementation of the cleanliness strategy in the WS1 and defines the rules necessary to maintain the requested level of cleanliness. It establishes requirements regarding worker and material access, clean clothes, works (including dirty works) and housekeeping. The cleanliness strategy for in-vessel assembly (after completion of the vacuum vessel sector and port welding) will be developed at a later stage.

This document does not deal with the cleaning procedures of the components. However, some of the requirements from ITER Vacuum Handbook ref [1] are reminded in this document.

3 Definitions

Abbreviation	Definition
CMA	Construction Manager-as-Agent
FME	Foreign Material Exclusion
HEPA	High Efficiency Particulate Air/Absorber/Arrestance
HSE	Health Safety and Environment
HSPC	Health Safety Protection Coordinator
HVAC	Heating, Ventilation and Air Conditioning
IO	ITER Organization
ITP	Inspection and Test Plan
IWP	Installation Work Package
LAC	Local Air Cooler
PBS	Project Breakdown Structure
PC	Port cell
PPE	Personal Protective Equipment
TAC	Tokamak Assembly Contract
TFC	Toroidal Field Coil
VQC	Vacuum Quality Class
VV	Vacuum Vessel
VVTS	Vacuum Vessel Thermal Shield
WS*	Work Site
WS1	Composed of the Cleaning Facility (B17), the Assembly Building (B13), the Tokamak pit and the crane hall (B11)
WS2	Composed of Diagnostics building (B74), Tritium building (B14) and the galleries of the Tokamak building (B11) (so-called Tokamak Complex) Note: The Radio Frequency Heating building (B15) is also part of WS2

For a complete list of ITER abbreviations see: ITER_D_2MU6W5 - ITER Abbreviations.

*Note: worksites are defined in chapter 8 and annex A of the document reference
ITER_D_ECBZWE - Site Construction Project Management Plan.

4 Applicable document

- [1] ITER_D_2EZ9UM - ITER Vacuum Handbook
- [2] ITER_D_23K25U - Cleaning and Cleanliness Preservation Guidelines for ITER Superconducting Magnets and Related Components during Construction
- [3] ITER_D_MBXPP3 - ITER Vacuum Handbook Attachment 2 - Cleanliness Requirements Relating to the Assembly of Vacuum Equipment
- [4] ITER_D_2EL9Y6 - Appendix 2 Environmental Cleanliness
- [5] ITER_D_27Y4QC - Appendix 3 Materials, refer to database on EDB
- [6] ITER_D_2ELN8N - Appendix 4 Accepted Fluids, refer to database on EDB
- [7] ITER_D_2ELUQH - Appendix 13 Cleaning and Cleanliness
- [8] ITER_D_66Z84A - Construction Foreign Material Exclusion (FME) Procedure
- [9] ITER_D_97WRFP - Environmental requirements
- [10] ITER_D_RW25TC - Procedure for Issue of Components from IO Storage
- [11] ITER_D_3JXTG5 - Clean Build Protocol - Personnel Entry & Exit Procedure

5 Building description regarding cleanliness

The buildings structures are of prime importance to limit the dust contamination from the outside environment and from the worksite 2. The HVAC systems have to maintain the temperature, humidity level, overpressure and to filter particules. Details of these buildings and systems are given hereafter.

5.1 Cleaning facility (B17)

The Cleaning Facility, Building 17 has three main functions:

- Protection of the clean environment inside the Tokamak pit and hall (11) / Assembly Building (13) during transit of components into the building (necessitating the opening of the large door in the south wall of the assembly building): it acts as an airlock, separating from the external environment when the very large building door is open.
- Cleaning, receipt, unpacking, temporary storage and incoming inspection of major components
- Provision of entry, exit and changing facilities for assembly operatives in a manner that protects the internal clean room environment.

To perform these functions, Building 17:

- is equipped with large entry doors (32.5 m x 12.0 m high),
- provides changing facilities for persons working in the clean zones in B11, B13 and B17
- is dedicated to inspection of incoming Tokamak machine components. Building 17 is equipped with the services to enable cleaning of components when required
- supplies electric power, service fluids (clean compressed air, demineralized water)
- is equipped with high integrity vehicle exhaust extraction systems
- HVAC system is available
- will be equipped with electrical lifting/moving means (such as trailer mover).

These utilities are provided by the IO in building 17.

The HVAC and local control room, and changing / entry facilities are external annexes to the main structure, to avoid compromising the serviceability of the cleaning facility. At the west and east elevations of the building, the internal layout is arranged to enable personnel access/exit from ground level.

HVAC

The HVAC system for this building enables control of the enclosed air quality in terms of temperature, humidity and cleanliness to that of the Assembly Building (B13) prior to the opening of the doors between the two buildings. The opening of B17 main door (South) shall be managed in coordination with the one of B13 to avoid having both opened at the same time. The coordination team manages this.

This adjustment can be achieved in 2 hours.

Building No. 17	Location: Main Cleaning Hall – doors closed (Note3)	
Room Dry Bulb Temperature (°C)		
Max	Min	Control Tolerance
<= 25	>= 20	+ 2
Room Relative Humidity (%)		
Max	Min	Control Tolerance
<= 70	No Control	Not applicable
Minimum Air Change Rate (AC/Hr)	Minimum Fresh Air Requirements (litres / second / person)	
Note 1	8 (Note 2)	
Room Pressure relative to outside environment	Minimum Filtration Efficiency: Filter Class (base on EN 779)	
Positive	G4/F7	

Compressed Air

Compressed air is supplied from a compressor and air distribution pipes are available for distribution of compressed air inside B17 and B13. In these building, several connection points are available for the Contractors' tools and instruments.

The air quality is defined in the document *Terms of Service for the temporary operations of the Compressed Air (LCA)*, IDM reference [7THVRM](#).

Potable water

Potable water is only provided for worker welfare purposes in the west annex of the cleaning facility (changing room).

Raw water

Raw water (not treated water) is delivered outside B17 to feed wheel washing systems and to perform the pre-cleaning of transporters and their packing before entering B17.

Demineralised Water System

Demineralised water is supplied from the site demineralised water distribution system. The Building 17 provides Demineralized water for distribution at several points around the facility for components cleaning.

The Contractor is required to provide IO/CMA with an estimate of demineralized water volume on a weekly basis.

For information, Water Chemistry Specification is given in *System Requirements Document SRD 65-00-DW Demineralized Water*, IDM reference [2EFXUH](#).

Hot water and Chilled water

Hot and Chilled Water are supplied to the cleaning facility. However, this supply is not available for the Contractors. Hot and chilled waters are only intended to be used for HVAC.

Low Voltage Distribution

The Building is supplied with Steady State Electrical Power, which is distributed for utilities including lighting, HVAC, overhead gantry cranes and general power.

Industrial water drainage

A water collection system is implemented in B17.

All along the assembly phases, the Contractor is required to:

- Manage the chemical products that will be used according to [9] (Environmental requirements) and provide to IO/CMA a volume estimation of each of these products before the works,
- Wait for acceptance of the chemical products from IO/CMA,
- Provide IO/CMA with the daily spending of these products.

Industrial waste water (e.g. from cleaning process) shall be piped directly from the gullies to Industrial Water Drainage systems.

The volumes of industrial water are limited to 60 m³ a day for the whole ITER site, therefore water consumption shall be limited as much as possible.

When it is identified that an important volume will be needed, a specific declaration shall be submitted to IO/CMA.

5.2 Assembly Building (B13)

The Assembly Building is a structure designed to provide space for the assembly of large components for the Tokamak Complex in a controlled environment.

The Assembly Building directly abuts the Tokamak Complex. As the former is a fixed building and the latter is a seismically isolated building, the interface between the two (seismic gap) is designed to accommodate this.

HVAC capacities (overpressure, air quality, air renewal rate):

Building No. 13	Location: Assembly Hall	
Room Dry Bulb Temperature (°C)		
Max	Min	Control Tolerance
<= 25	>= 20	+ 2
Room Relative Humidity (%)		
Max	Min	Control Tolerance
<= 70	No Control	No control
Minimum Air Change Rate (AC/Hr)	Minimum Fresh Air Requirements (litres / second / person)	
Note 1	8 (Note 2)	
Room Pressure relative to outside environment	Minimum Filtration Efficiency: Filter Class (base on EN 779)	
Positive	G4/F7	

The HVAC system has been designed to provide an environment suitable for the occupancy levels and equipment loads during assembly phase.

The HVAC systems supply the Assembly Building as well as the Tokamak Crane Hall as they constitute a single volume for the transfer of the Tokamak components and the overhead crane systems.

It is assumed that the HVAC systems in the Assembly Building shall be continuously operated 24 hours a day / 7 days a week during the operational life of the building.

The Tokamak assembly requires that the HVAC system in this building:

- Maintains a uniform temperature distribution of 20°C (winter) to 25°C (summer) +/-2°C
- Maintains a relative humidity of RH <70%.
- Ensures filtration of air (5×10^6 particles of size $> 0.5 \mu\text{m}$ per m^3).
- Overpressure will be sufficient to enable a flow of air from B13 towards non-vented rooms.

5.3 Tokamak pit and crane hall (B11)

The tokamak building comprises 8 levels, from B2 to R1.

The cryostat base and supports are at level B2. VV sectors, complete with thermal shield and TF coil pair, are transferred from the Assembly Building by the main crane and lowered into the tokamak pit and are placed at level B1. Port cells (PC) at levels B1, L1 and L2 correspond to the lower, equatorial and upper levels of the vacuum vessel respectively. The port cells will afford access to the tokamak pit and, when the port structures are in place, will allow routine access and exit from the VV. In the absence of the ports structures, temporary walkways / bridges will be required. IO will provide walkways for personnel access and emergency escape from the VV. Routine access should be through Equatorial PCs 14-13-15.

In addition to the permanent HVAC system available in B13 and in crane hall, a temporary/intermediate HVAC system is installed to vent the different volumes of the pit. The objective is to create an overpressure sufficient to enable a flow of air from the pit towards non-vented rooms.

6 Access and attire

6.1 Main access and changing rooms

IO provides a changing room in west annex of B17 for the personnel/workers of B17, B13, Tokamak pit and crane hall in B11. This changing room will be equipped with lockers for the use of personnel requiring access to WS1.

In each changing room, a fixed number of lockers is allocated to each main Contractor at the beginning of the work.

In addition, for personnel needing access to WS1 not having their own clean clothes, temporary use of clean clothes is possible in west annex of B17 as well.

6.2 Workers/personnel attire

IO will supply disposable clothing for visitors and IO staff. Contractors will provide and clean their own white clothing and other clean area attire.

All workers performing work on vacuum equipment with any VQC where there is a risk of coming into physical contact with the vacuum facing surfaces shall wear suitable attire (such as white gloves). Moreover, the workers shall adorn PPE defined by IO security & safety department.

All PPE shall be clean and free from surface contamination such as grease and oil. Generally speaking, PPE includes helmet (including chin strap), safety gloves, safety shoes, safety glasses and high visibility jacket. Dirty/wet PPEs are not permitted.

In some area, it may be necessary to cover also the helmet and chinstraps (or to have a clean helmet dedicated to the cleanliness category of the working zone/area)

During cleaning operations in B17, workers shall be equipped with clothes adapted to the cleaning operation (waterproof if needed) and strict access control shall be put in place. After these cleaning operations are performed, soiled clothes shall be changed in changing room before accessing to B13.

Clean clothing to be worn by workers/personnel in WS1:

- Clean suit: white, lint-free, without pocket, reusable or disposable coverall (for workers on VQC) or frock (for other workers & personnel)
- High visibility dedicated WS1 belt or jacket
- Cleanroom white shoes
- White gloves
- Hairnet cover in case of access in B11 pit

The requirements regarding authorized material concerning clean clothes are given in appendix 1.

6.3 Access Controls

Personnel working in the clean areas at IO site shall be trained in the correct procedures by IO and further supported by CMA. Access to WS1 will be given after providing a record of the cleanliness training organized by IO/CMA.

In the event of failure to respect the applicable procedure, IO/CMA will request personnel contravening the clean area requirements to be excluded from the clean area. The Contractor shall retrain and if necessary replace the offending operative.

IO/CMA will be responsible for managing coactivity and access rights to the B11/13/17 and the Contractors shall inform IO/CMA and HSPC of restricted access areas regarding cleanliness requirements and/or dirty works areas.

6.4 Visitors' access and attire

For communication purpose, regular external visitors access to WS1 using North-East entrance of B13 through an airlock and going to North-East platform only.

These visitors are authorized to wear cover shoes only (in addition to their mandatory PPEs).

7 Work preparation and execution

7.1 Work preparation

The IWP Documents, to be provided by the Contractors and reviewed by IO/CMA, shall describe how the cleanliness is taken into account during all the assembly steps.

The points that shall be studied and agreed are:

- Work area cleanliness organization and related constraints such as:
 - access controls,
 - enclosure description,
 - creation of airlocks...
- Workers' access routes,
- Components' access routes
- Unpacking procedures,
- Components protection means
- Cleanliness controls and procedures
- Cleaning procedures
- Dirty work management procedures

The ITP shall include notification and hold points related to cleanliness when necessary.

7.2 Components entrance by B17 and other routes

Main components including vacuum classified components will arrive on site packed and these components will match the VQC required level.

In most case, no additional cleaning of components will be required.

Pickling and passivation are not considered as cleaning operations to be performed in cleaning facility; they should be performed at factory premises if required. Pickling and passivation will be required as a finishing operation on site at ITER after welding is complete. It will then be detailed as part of the ITP where required.

Doors opening (B17 and B13) is managed by WS1 construction coordination team.

Before entering the Cleaning Facility:

It is required to keep the cleaning facility as dry and clean as possible. In order to limit dirt ingress to the cleaning facility and to limit the use of water (to control humidity), transporter wheels and the outer package of the component shall be cleaned to remove the majority of dirt before entering the cleaning facility. When possible, remove outer package outside (it means at least that the component was double packed).

On arrival of components in the cleaning facility, the process to be respected is:

1. Check that the door towards the B13 is completely closed and forbid its opening;
2. Open the main entrance door with the minimal opening required;
3. Bring the component in and secure it. Connect transporter exhaust to extraction system where appropriate;

4. Close the door and forbid its opening;
5. Open the outer packing and remove as much of it as possible; for the parts of outer packing that cannot be cleaned and removed, make sure they cannot spread contamination later in the process;
6. Make sure air quality inside cleaning facility is at the right level before opening inner pack and check the integrity and cleanliness of the inner pack and inspect and control the cleanliness level of the components;
7. Make sure air quality and temperature inside cleaning facility are at the right level before opening the doors toward B13;
8. Open the door towards B13;
9. Bring in the components with its transporter, using the electrical trailer mover when possible;
10. Close B13 door;
11. Depending on the components, unpack or not the inner packaging / protection. For example, VV sectors (PIC) and VVTS (silver coating protection) will come into the B13 with this inner packing;
12. Handle the component to the dedicated Layout area;
13. Open B13 door (ensuring that B17 door is closed);
14. Remove packaging and transporters;
15. Close B13 door;
16. Manage the waste and exit the transporters to outside (preferably disconnect pipes only when transporters are outside);

For transfer to B11 pit:

WS1 construction coordination team shall check the cleanliness and coordinate the material movements into B11 Pit. Material transfer shall be via a dedicated Material Transfer Tunnel located at level L1 in B11 or via the Pit lid opening at level L4 in B11 using the WS1 overhead cranes.

Note: The Material Transfer Tunnel located at B11 Level 1 is designed to be retractable to facilitate material transfers in the Work Site 2 galleries. Retraction of the tunnel (and hence temporarily restriction of material to WS1) is managed by WS1 construction coordination team.

Transfer of material in B11-L4 crane hall via the temporary cargo lift:

A Temporary Cargo Lift located in the North-East of B11 can be used to deliver material at B11-L4 Crane Hall level. The Temporary Cargo Lift has a Safe Working Load (SWL) capacity of 10,000 kg (10 tons).

The Temporary Cargo Lift is operated by a dedicated lift operator and all lift operations shall be coordinated by the construction coordination team.

Material transfer to B11-L4 Crane Hall shall be done via an airlock and the material shall respect the same cleanliness requirements than for an access by B17 (presented in this document in above chapters).

As far as possible electrical transporters/devices should be used but when combustion engines are to be used, it is required to connect the exhaust pipes to the fume extractor system.

- Pipes shall be fixed and secured to avoid disconnection risks;
- Ducts shall be long enough to enable the transfer to B13;
- Make sure no risk of tearing of the pipe remains before moving transporters;

- Preferably when entering or exiting the cleaning facility, exhaust pipes should also be connected to extract fans.

7.3 General rules or reminder of Vacuum Handbook

Vacuum classified components are sensitive to all type of contaminants and to liquid presence.

As explained in vacuum handbook ref [1] and its appendices, the following rules are reminded:

- all items (tools, jigs and fixtures etc) shall be thoroughly degreased and cleaned prior to being introduced into the clean conditions assembly area.
- the surfaces of jigs, fixtures and tools that come into contact with the vacuum classified components shall in general be constructed of stainless steel; at no time shall these items be made of carbon steel.
- lead or other low melting metals (tin, antimony, mercury, zinc, arsenic, cadmium, etc.) and their compounds or materials containing low melting metals as a basic chemical constituent shall not be used in direct contact with the surfaces of the component to be exposed to vacuum at any time. This ban includes tooling, fixtures, marking materials, dyes, fluxes, paints, coating and sealing compounds used during fabrication and installation operations.
- Only water soluble, non-halogenated, sulphur and phosphorus free machining fluids approved by ITER are permitted, but as cutting fluids need to be the exception, when they cannot be avoided, their use will be subject to IO approval in the ITP.
- Polishing activities with any abrasive techniques in clean areas should be kept to an absolute minimum and are preferably avoided.
- Overhead cranes and lifting equipment shall be arranged to avoid the dripping of oil in the clean conditions assembly area.
- No opening should be left open without surveillance. Aluminium foils or protective caps are to be put in place after work is done to prevent from contamination ingress.
- After cleaning, all surfaces shall be “metal clean” and free from oil, grease, ink, paint, dust, rust spots, abrasive particles, chips and any other gross discontinuities or imperfections as defined in EN ISO 15607 (2019). All surfaces shall show a uniform metallic colour and shall be free of evaporation patches from cleaning agents. Stainless steel surfaces shall be protected to avoid contamination.
- Only materials accepted for the relevant Vacuum Classification shall be used on ITER vacuum systems. Details of materials to be considered for acceptance shall be submitted to the ITER Vacuum Responsible Officer using the Material Approval Request Form (ITER_D_2MGWR4) prior to be used on ITER vacuum systems.

7.4 Handling of cleaned components during assembly

- Handling equipment, such as slings, hooks, etc, shall be sheathed or protected with approved plastic (e.g. polythene, polyurethane, not PVC), to avoid contact between the stainless steel pieces and carbon steel and other metallic surfaces. Metals such as aluminium alloys are acceptable. Refer to vacuum handbook for more details. Any tooling which can come in contact with the stainless steel pieces must be cleaned before use and be in accordance with the requirements of the Vacuum Handbook.

- Final cleaned pieces made of stainless steel are not to be stored directly on the ground or bare floor. They are to be stored on clean surfaces, or surfaces covered with materials such as wood, plastic (not PVC), etc.
- Wood should be avoided in WS1. When wood parts are to be used, they should be clean, wrapped in plastic foils and no nail, no resins are to be present on the wood.
- Once a component is cleaned and inspected for acceptance in compliance with document ref [2], it is handled with the utmost care to preserve the clean condition.

7.5 Foreign Material Exclusion policy

The Foreign Material Exclusion (FME) measures contribute to the cleanliness and shall be applied in accordance with procedure ref [8] Construction Foreign Material Exclusion (FME).

Following the FME risk analysis, the contractor shall define and apply appropriate measures for every assembly task, such as the following (non exhaustive list):

- Establish proper FME enclosures and post signs with specific measures to apply;
- Keep a clean work environment (pre-task and post-task cleanliness);
- Cover all unnecessary openings, inspect overhead platforms and apply retention measures if necessary;
- Keep a shift FME log of every part, tool and material taken to the work area, and react in case of any lost item;
- Avoid bringing non-essential objects to the work area;
- Avoid taking objects to the work area that can fall or infiltrate in confined spaces (helmets without jugular, safety glasses without straps, pens, phones,...);
- Physically secure all loose parts and tools (mechanical locking, lanyards);
- Make certain that all chemicals or chemical compounds introduced into the FME Area comply with site guidelines and chemical control rules.
- All pockets of clothes will be closed
- Record any FME event in the FME event log system, in order to keep a list of objects to be retrieved, in a short time or at a later stage if immediate retrieval is not possible (ticketing system at: <https://jira.iter.org/projects/FME/>)

7.6 Installation of component crossing the WS1/WS2 boundary

Some components (e.g. feeder CFT and CWS pipes) are installed in-between pit and gallery and therefore cross the boundary in-between WS1 and WS2.

In order to prepare their installation, the temporary closures of port cells, penetration stubs or door stubs will have to be modified or removed.

For these modifications, it is required that the pit stays separated from the galleries in term of cleanliness (air filtering, air control, HVAC).

The Contractor will present to IO/CMA, case by case, the organization that he intends to perform the works in the port cells taking into account the following topics:

- Cleanliness of the working area (including material used for dedicated air control/venting, air filtering...)
- Workers' access routes (from changing room in B17 to port cells and to B2 level man access)
- Access controls

- Changing room when required
- Airlocks when required
- Components access route (from workshop/warehouse to port cell)
- Components preparation (including unpacking and cleanliness control)
- Port cell preparation to meet cleanliness requirements (including temporary through-wall penetration closure)

7.7 Dirty works areas

Dirty works include all works that can impact the cleanliness of the WS1: civil engineering works, welding, grinding, machining, use of compressed oil jack and tools.

Before to start any dirty activity, the Contractor shall analyze the risk of environment pollution and set up dedicated cleanliness protection measures.

Works contractors shall submit for acceptance / approval (prior to works execution), methodologies for the execution of the works in such a way as to prevent contamination of the clean environment.

When fume extraction is needed, the Contractors shall provide a local high velocity extraction and filtration unit. Specific authorization by IO/CMA will be required: specific Hazard analysis will determine if a separate exhaust line must be used depending on the type of fumes to be extracted.

Example of mitigation measures:

- Work area must be screened off by a tent with controlled access and exit to avoid the spread of any contamination outside of the tent.
- When components or parts that are present in the vicinity of the working area are not accessible for cleaning or for checking the cleanliness, they shall be fully protected.
- Additional screening within this tented area should be used if practical to minimize the possible spread of contamination.
- The tented enclosure shall be under depression with HEPA filtering system of at least 20Pa.
- Milling is preferred to grinding.
- Unavoidable machining works should as far as possible be conducted dry (without cutting fluids)
- Swarf and dust shall be collected as close as possible to the source in order to limit the pollution as much as possible.
- Weld fumes shall be removed immediately by local ventilation. Extraction pipes shall be placed as close as possible to the source. See chapter 5.3. Fume extraction is in addition to specific ventilation which may be needed e.g. in case of use of inert gas.
- Drilling, welding and soldering, contaminants should be cleaned off vacuum hardware by vacuuming and wiping using isopropyl alcohol (IPA) or recommended cleaning fluid from IO vacuum handbook appendix 4.
- The area must be cleaned during and at the end of each process ('clean as you go' philosophy) to minimize the amount of contamination generated.
- Cleanliness of the area (floors and surfaces) and components shall be controlled before dismounting the enclosure.

8 General requirement

8.1 Responsibilities regarding cleanliness

Common areas (not dedicated to one unique contractor) will be managed by IO/CMA regarding:

- Initial preparation of floors, walls and ceiling painting to match the cleanliness requirements
- Control of access
- Supply of a changing room
- Supply of airlock for access
- Cleaning of common areas
- Waste management in common areas
- Ventilation and filtration monitoring
- Zone guard management when necessary

Work areas will be managed by Contractor regarding:

- Setting up boundaries / protection of surfaces (when required)
- Supply of changing room and airlocks when required
- Control of access
- Setting up the local HVAC filtration and monitoring systems when required
- Complete cleaning of work area (according to the cleanliness level)
- Waste management for all its work areas

Workers' training will be performed by IO/CMA.

It is strictly prohibited to eat or smoke in WS1.

8.2 Housekeeping policy

General housekeeping of buildings will be managed by IO. This cleaning will include:

- Washing and vacuuming of:
 - Main access
 - Common areas, such as changing rooms
 - Main walkways
 - Building structures
- Bin emptying
- Maintaining stock of disposable overshoes/caps in main changing rooms
- Supply and management of sticky mats

This housekeeping will be performed at a frequency to suit the cleanliness requirements.

This cleaning will be performed by areas and will be a permanent activity.

Each Contractor shall manage the cleaning of its workstations and work areas from preparation to end of work, including at each end of shift, and in accordance with the VQC of the components:

- Actively plan and maintain a "Clean as you go" regime and a good housekeeping level;

- If an area will become inaccessible during installation, it must be cleaned and inspected to a visibly clean level before becoming inaccessible. This shall be a hold point on the work plan, with the use of temporary additional covers if necessary to maintain cleanliness;
- Upon the completion of an installation operation, spot cleanliness tests shall be carried out. If dirty, the components will be subject to a cleaning procedure involving washing with isopropyl alcohol (IPA). Cleaning will continue until all surfaces are visibly clean upon inspection.

8.3 Cleanliness monitoring

When cleaning requirements are set up in a work area, a permanent monitoring shall be put in place (i.e. as is done for monitoring of safety), in order to ensure the required cleanliness is achieved and maintained.

- Permanent monitoring will be performed at all levels of responsibility. Everyone (IO/CMA/Contractors) is encouraged to report any cleanliness issue,
- Rules shall be posted visibly,
- Training shall be repeated as needed,
- Shift leaders are responsible for cleanliness of an area and shall perform daily walk-throughs to check for violations.

9 APPENDIX 1: Requirements for clean clothes

9.1 Clean suit

Clean suit can be a reusable (washable) or a disposable coverall (for workers on VQC) or frock (for other workers & personnel). It shall be:

- white,
- lint-free,
- without pocket,
- 15% maximum cotton,
- anti-static/ESD according to EN 1149-5,
- lightweight / breathable,
- for ISO 6-8 area

9.2 Cleanroom white shoes

Cleanroom shoes can be standard shoe or boot. It shall be:

- respecting safety requirements (PPE)
- white or light grey
- with a PU sole
- anti-slip
- for ISO 8
- cleanroom classification

9.3 White gloves

White gloves shall be:

- white or light grey
- anti-cut
- anti-static ESD
- polyester