

SPECIAL SPECIFICATION

SECTION 01110S

CLEANROOM CONSTRUCTION PROTOCOL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes:

1. Defines Protocol at each Construction Stage.
2. Defines typical project activities in each Construction Stage.
3. Defines Cleanliness required by all contractors during each Construction Stage.
4. Describes Gowning Procedures and Protocols.
5. Describes Clean construction procedures.

1.02 RELATED WORK

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Project Specification Sections apply to this section:
1. Section 01111S – Cleanroom Construction And Cleaning Procedures
 2. Section 01112S – Cleanroom Certification And Acceptance
 3. Section 13037S– Cleanroom Access Flooring
 4. Section 13036S – Cleanroom Wall System
 5. Section 13020S– Cleanroom Ceiling System

1.03 REFERENCES/DEFINITIONS

- A. Stages of Construction Cleanliness: Defined as clean stages in construction schedule where cleaning requirements in building are more stringent and type and methods of work are more restrictive.
 - 1. Normal Clean.
 - 2. Very Clean.
 - 3. Ultra Clean.
- B. Thorough Clean-Up: Defined as three passes starting at ceiling level and working down to the subfab level.
 - 1. Cleanroom Protocol: Defined as the philosophy of clean construction and the commitment to following the Procedures outlined in this section.

1.04 SUBMITTALS

- A. Submit in accordance with Conditions of Contract and Section 01300

1.05 QUALITY ASSURANCE

- A. Clean Working Protocol Requirements

The following describes general cleanroom protocol, which has to be followed only during the ultra-clean stage. During the other construction stages different protocols are applied, which are described in the relevant procedures. There are a few general rules which shall be followed by all personnel :

- 1. Only lint-free notebooks and paper are allowed in cleanroom.
- 2. No pencils **or pens other than cleanroom approved style are** to be used in the cleanroom. This is not required in unclassified areas.
- 3. Visitors should not enter the cleanroom, unless necessary. The QA group of the Owner and/or, if approved, the QAR will be responsible and authorized to permit entry.
- 4. The wearing of cosmetics in the cleanroom is strictly prohibited.
- 5. No eating, drinking or smoking is permitted in the cleanroom area, both classified and unclassified.

6. If a ISO classified area is entered, the door should be open not longer than the necessary time to enter and exit, if there are no air locks.
7. Do not allow both doors of the cleanroom and of the smock area to be opened at the same time.
8. No hydrocarbon lubricants, natural nor synthetic, are permitted in the cleanroom area.
9. Everyone has to ensure that his/her hair will be covered completely by the hair cover.

B. Gowning

1. Garments: Hard hats and safety glasses are required in the building and in the construction area, but not the cleanroom. In ISO classified cleanroom areas, it is necessary to wear complete cleanroom garments as described below. Each person entering the cleanroom has to wear a head cover, facemask, jumpsuit, and designated footwear. A serviceable garment will be free of holes and tears. Head and face covers should be of a type that covers all the hair on an individual's head except their eyebrows and eyelashes. Face covers must be worn to cover the nose at all times. Properly fitting or rubber disposable gloves are required. Each person entering an ISO unclassified area will wear a head cover, jumpsuit, and special shoes cover. It is not required to wear a face cover. Each person has to check the condition of their cleanroom garments. In the case of a torn garment or a broken zipper, the garment should be put in a bin to be repaired as needed. All personnel will use safety glasses before entering designated areas.
2. Gloves: Properly fitting vinyl or rubber disposable gloves are required. Gloves will be put on immediately before entering the cleanroom area, as described by the gowning procedure. Caution is necessary to prevent puncturing gloves. If a puncture should occur, the gloves must be replaced immediately. This should be done in the smock area. If gloves become contaminated with body oil, chemicals, or other materials, they must be changed immediately. Writing on cleanroom gloves is not permitted. Gloves used for cleaning equipment and work stations must not be worn for manufacturing operations.
 - a. Gowning Procedure: The smock areas will be provided with shelves for leaving hard hats and building shoes before entering. The smock areas before entering the cleanroom will also be provided with hangers where, when the employees leave, they must hang their jumpsuits, head covers and face covers. The smock areas will be provided with a set of shelves for the booties. At the end of the work day, clean-up garments are to be placed in the bins to be washed and the cleanroom garments are to be left in the hangers. There has to be different shelves for building shoes and booties.

First, put on the head cover and face cover than adjust them ensuring all hair and nose are covered.

Second, put on the jumpsuit. Then zip up the zipper completely.

Third, put on the booties. They are of the same material as the jumpsuit.

Finally, put on safety glasses and gloves prior to entering the cleanroom.

3. The procedure for removing the garment is prescribed at follows:

- a. Remove gloves and discard them into the trash container.
- b. Remove the head cover and hang it on a hanger.
- c. Remove the booties and put them into the opposite shelf.
- d. Remove the jumpsuit and hang it on a hanger.
- e. Wear your building shoes, hard hat, and safety glasses.

C. Cleaning

The cleaning procedures are described in Section 01111S.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Special Handling: All items being transported into the cleanroom are to be cleaned in such a way as to remove all obvious dirt, loose particles, and contaminants while located in the equipment engineering support area (or equipment air lock). All the equipment designated to enter the cleanroom must be accepted by Quality Assurance Personnel. All wafer transport boxes, test equipment, tool cases, etc., are to be blown off with a filtered air gun immediately prior to entering the cleanroom in the engineering support area. Items known or suspected as particle generators such as cardboard boxes, dry mops, etc., are not permitted in the cleanroom. Production material or the equivalent (engineering test wafers) which must be transported between manufacturing through a non-cleanroom environment must be transported in a closed carrier to prevent the accumulation of particles or contamination on the content.

1.07 PROJECT/SITE CONDITIONS OR SPECIAL CONDITION

TYPICAL CONSTRUCTION ACTIVITIES BY STAGE:

A. Normal Clean Stage:

1. Pipe rack.
2. Sprinkler mains and laterals.
3. HEPA filter ceiling grid support structure.
4. Carbon steel pipe.
5. Concrete curbs/equipment pads.
6. House Vacuum system.
7. Coating/painting.
8. Drywall partitions.
9. Exhaust systems.
10. Power distribution/grounding.
11. Non-process utility piping.
12. Floor tile (other than raised floor)
13. Mechanical systems.

B. Very Clean Stage:

1. Recirculation Air Handling Units
2. HEPA filter ceiling grid.
3. Raised floor.
4. Make-Up air fans and ductwork.
5. Fab lighting.
6. Sprinkler head installation.
7. Plenum and floor partitions.

8. Chemical double containment piping.
9. D.I. Water plant and piping.
10. Gas cabinet installation and piping.
11. Chemical supply systems and piping.
12. Interior walls.
13. Controls and detection systems.
14. High purity piping should start near the end of this stage. If started earlier, exercise extreme protective measures.

C. Ultra Clean Stage:

1. Filter sealant pour.
2. Install HEPA filters.
3. Air shower.
4. System certification.
5. Manufacturing equipment installation.

1.08 SCHEDULING

- A. Cleanroom Protocol Training: Coordinate, schedule and lead training classes for all site contractors.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Signs: Provided by Clean Room Contractor; illuminated if required.
- B. Task Lighting: Provided by each Contractor or Subcontractor for their work.
- C. Portable electric lights with safety guards.
- D. Provide one 50 gallon trash container per 5000 square feet. Provide two large trash gondolas per floor.
- E. As required to construct temporary clean staging areas and gown rooms.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Provide Cleanroom Protocol classroom training for all workers employed by contractors and subcontractors entering work site. Provide identification for attendees completing training. Training class will contain but not be limited to following:
 - 1. Site orientation.
 - 2. Clean room protocol.
 - 3. Confirm location of emergency exits, fire extinguishers, and emergency gathering place.
 - 4. Hazardous Communication awareness.
 - 5. Hazardous Materials awareness.
- B. Upon completion of any portion of work, clean and wipe down affected areas.
- C. Restrict number of entrances to wafer fab. Location of entrances may change during construction due to construction schedule.
- D. Locate trash containers throughout building interior. Empty daily or more often if required.

- E. Workers to display identification badge at all times clearly identifying themselves and their company.
- F. Provide two cleanroom garments for all employees required to enter the cleanroom, subcontractors and Owner Project Team including shoes, smocks, face masks, gloves, and other garments. Clean garments every two days. Contractor is responsible for cleaning above garments
- G. Provide shoe covers at beginning of very clean stage at all building entrances for all contractors and subcontractors.
- H. Ensure employees and subcontractors follow Owner's cleanroom protocol, including wearing cleanroom garments in designated areas and changing to cleanroom and building shoes, as construction progresses to ultra clean stage.

3.02 APPLICATION

- A. Entrances to include:
 - 1. Shelves for storage of hard hats and shoes.
 - 2. Space for workers to change shoes.
 - 3. Hanging bars for smocks and method to control use of smocks.
 - 4. Sticky/tacky mats to remove dust from shoes.
 - 5. Seal entrances airtight to maintain positive pressure in building.
- B. Entrances may be temporary free standing units attached to building if space within building cannot be made available.
- C. Post signs in English, Spanish, and/or other applicable local languages at entrances explaining cleanliness procedures, including but not be limited to:
 - 1. No eating or drinking.
 - 2. No smoking.
 - 3. No tobacco.
 - 4. No sleeping.

5. No cosmetics
6. Gowning requirements
7. Gowning procedures

3.03 CONSTRUCTION

A. Normal Clean Stage

1. Upon completion of civil construction, General Contractor will complete cleaning of all building construction works.
2. General Contractor shall have completed all "normal clean" stage items under his scope of work at this time.
3. Clean Room Contractor to participate at this time and complete a "normal" clean up for those items under this contract.
4. Beginning of Normal Clean Stage (Defined by Project Milestone Chart).
 - a. Clean Shoes at entrance of the building.
 - b. No smoking, tobacco products, food or beverages are allowed in the fab building.
 - c. Entrance control for workers and materials shall be assured.

B. Very Clean Stage

Complete thorough clean-up of facility at start of very clean stage. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Clean stages of construction rules and requirements also apply to first level of fab building and interstitial space.
2. Where high purity systems are being installed, designate an area supervisor to coordinate activity and maintain area cleanliness.
3. Beginning of Very Clean Stage these additional rules must be followed (Defined by Project Milestone Chart).
 - a. All "Normal Clean Stage" rules apply, plus the following.
 - b. Furnish full time workers to:
 - (1) Keep entrances clean.
 - (2) Inform other workers and visitors about clean construction requirements.
 - (3) Ensure that only clean materials are brought into building and that cleaning materials are available at entrances to wipe down materials before proceeding into building.
 - (a) Provide special shoes or shoe covers for every person entering the building including other contractors and visitors.
 - (b) Clean with house vacuum (if available) or portable units with HEPA filters.
 - (c) Clean all tools and material before entry into the building.
 - (d) Run fresh air fan to maintain positive pressure.
 - (e) Clean working clothes are required at all areas.
 - (f) No wood or corrugated cardboard on the fab level.
 - (g) Visitors will be escorted.

- (h) Provide temporary sinks at material entrances for cleaning materials.
- (i) Remove or wrap all particle generating materials in PVC or polyethylene sheet.
- (j) Wear Identification badges.

C. Ultra Clean Stage

1. Complete another thorough clean-up of facility at start of ultra clean stage.
2. Beginning of Ultra Clean Stage these additional rules must be followed (Defined by Project Milestone Chart).
 - a. All “Very Clean Stage” rules apply, plus the following.
 - b. Clean with house cleaning vacuum system.
 - c. Do not perform dirty work (no smoke or dust generation in fab).
 - d. Wipe down material with cleanroom wipes.
 - e. Wear cleanroom garments in clean room:
3. Beginning of HEPA filter installation for room.
 - a. Begin turning on Recirculation Air Handling units fans.
 - b. Use only lint free materials in clean room.
 - c. No wood or corrugated cardboard on fab or subfab levels.

3.04 FIELD QUALITY CONTROL

- A. The purpose of this protocol is to achieve, that each employee knows, which guidelines, practices and policies they need to follow in the cleanroom area. Each employee has to read the protocol first before he starts work on site and has to sign, that he understands the guideline. The signed personnel list has to be supplied to the QAR before personnel enter the construction site. It is the task of the subcontractors and the QA group of the Employer and the QAR to control the behaviour of personnel in the cleanroom and take corrective action, if necessary. The QAR has the right to forbid personnel entrance to the clean areas after repeatedly wrong behaviour. The subcontractor has to replace such personnel. Each employee has the responsibility to insure that all policies, practices, and

procedures described in this protocol are followed. Any deviation(s) shall be reported to one's supervisor or to the QAR immediately.

3.05 CLEANING

- A. Refer to Specification 01111S for Cleaning during each protocol stage.

END OF SECTION