

**ELEVATE QUANTUM a CONSORTIUM INCLUDING
OCTAVE PHOTONICS &
COLORADO SCHOOL OF MINES**



**REQUEST FOR PROPOSALS (RFP) FOR DESIGN, INSTALL, AND
PROCESS ENGINEERING SERVICES**

For the

ELEVATE QUANTUM NANOPHOTONICS CLEANROOM

Key Dates:

20 Dec 2024: RFP Released on Elevate Quantum Website
9 Jan 2024: Information Session
24 Jan 2025: Deadline for Submission of Bids
3 - 5 Feb 2025: Interviews with Finalists
7 Feb 2025: Final Selection Announced

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2. GENERAL INFORMATION

2.1. INTRODUCTION / PROJECT DESCRIPTION

Introduction

Elevate Quantum is a nonprofit organization dedicated to establishing the Mountain West as the global epicenter for quantum technology development. As a U.S. Department of Commerce Designated Tech Hub, Elevate Quantum (EQ) will aid in accelerating the transformation of cutting-edge quantum research into world-changing technologies while building a diverse and inclusive workforce to support the future of this industry.

Three primary goals of Elevate Quantum include:

1. A globally unique lab and fabrication facility to enable rapid prototyping and low-volume manufacturing that is right-sized to the quantum industry and delivered at world-class speed.
2. Workforce activities to close the gap of three open quantum jobs for every one qualified person.
3. A range of entrepreneurial support activities to speed the commercialization process of quantum technologies.

The Quantum Commons will rapidly transform into a globally leading technology transfer hub – the “Quantum Silicon Valley” – providing facilities critical to accelerating the speed of progress in the quantum industry. A new nanofabrication building (Fab building) is currently being designed by the Colorado School of Mines (CSM), an EQ consortium partner. Within the Fab building, the cleanroom facility will support a critical need for quick-turnaround production of photonic chips while bridging the connection between academic research and high-volume production.

Project Description

New Cleanroom for Nanophotonic Fabrication

Developing a nanofabrication facility will be one of the first steps to realizing the goals of the EQ Tech Hub. This facility will support a critical need for quick turnaround production of photonic chips while bridging the connection between academic research and high-volume production. The project described in this RFP is for a turnkey cleanroom that will reside within the new Fab building being constructed by CSM. This Fab building will also house supporting spaces such as gowning, offices, break room, loading dock, and others related spaces. The Fab building and cleanroom are intended to be designed with a mindset for the desire to expand in the future without compromising continuous operations in the existing cleanroom.

In collaboration with a team of nanofabrication experts at Octave Photonics, Elevate Quantum (EQ) intends to select a Cleanroom Team (CR Team) who will design, build, and

implement process engineering services of a turnkey cleanroom that is ready to connect process tools for fabrication of nanophotonic circuits located at EQ's newly established campus owned by The Colorado School of Mines and located in Arvada, Colorado (Quantum Commons). **For avoidance of doubt, this RFP is not for the Fab building itself, it is limited to the design and installation of the cleanroom and associated process engineering to ensure efficient and cost effective operation.**

EQ and Octave Photonics (CLIENT) seeks a collaborative partner with experience expediting the design, procurement, and installation processes to deliver this critical project as quickly as possible and for the lowest cost achievable. **The selection process is for both cleanroom design/install and process engineering services. Prospective applicants that have expertise in only portions of the requested scope are strongly encouraged to team together (subcontract) with other organizations to present a complete solution in response to this RFP.** The preferred CR Team will have expertise in speed-to-market delivery and cost management as well as technical design, engineering, and construction to support the fabrication processes housed within the cleanroom. Further, the ideal team will embrace a delivery model that is highly collaborative, framed by trust and transparency, and exemplified by recent project experience as a team.

The CLIENT has recently engaged nanofabrication cleanroom consultants to create design criteria for the cleanroom. These design criteria will be used by the selected CR Team to establish the scope of the project and execute the design and construction phases. Additionally, a design/build team has been contracted to construct the Fab building in which the cleanroom will be housed. It is expected the CR Team will work in close collaboration with the Fab design/build team to guarantee smooth, timely, and cost-efficient completion of the combined projects.

Functionality is the priority. The main function of this cleanroom will be to establish a unique nanofabrication facility which will produce photonic integrated circuits, addressing the critical industry need for quantum technology utilized in communications, defense, and remote sensing. The facility will utilize tooling and supporting systems typically used for small-scale semi-conductor R&D and fabrication. The primary design considerations are rapid construction and ensuring safety. The expected size for the cleanroom is 5,000 to 7,000 square feet

2.2. CONTACT INFORMATION

All questions and submissions related to this RFP are to be directed to the RFP initiators below:

Primary RFP Contact

Name: Elevate Quantum RFP

Company: Elevate Quantum

Email: rfp@elevatequantum.org

2.3. RFP LIMITATIONS

The RFP represents the team’s best understanding at the time of this writing, as well as learnings from prior cleanroom experiences. The CLIENT looks to this RFP awardee as a technical partner to work through the myriad details in a real-time, interactive design/install activity that will produce a working facility on time and on budget. For the purposes of bidding, assume that the specifications outlined in this document represent the final facility requirements. In reality, we acknowledge that the complexity of this project may necessitate future modifications in scope or contracts as the cleanroom design and installation process moves forward in coordination with the Fab building team.

3. SCOPE OF WORK

Proposals shall be submitted based on the following assumptions:

- 3.1. This project has an approximate budget of \$2.0 million for the cleanroom and process engineering of a cleanroom space for the fabrication of nanophotonic devices. The scope of work does not include commissioning or certification. We are open to the inclusion of these services as separate line items in the bid. Bids exceeding the allocated budget will be considered, but reasonable considerations for value engineering should be included from the outset.
- 3.2. This RFP emphasizes the tool utility matrix that together comprises the process flows and hazardous processed materials over the specific fabrication method of the walls.
- 3.3. Applicants may choose to subcontract a portion of the proposed work. Bidders who have participated as a team with subcontractors shall submit an MOU with the matrix of responsibilities among the prime bidder and their corporate partners.
- 3.4. The building in which the cleanroom will reside is currently being designed. Suppliers will need to work in close coordination with the building firm to ensure appropriate layout and connections between the two structures (e.g. electrical, water, PCW, HVAC, acid neutralization, design & detailed engineering, and supply, installation, testing, final superclean and commissioning of cleanroom, HVAC systems, BMS/TGMS/Man-down sensing and notification, gas distribution and exhaust system, gas leak detection and gas abatement system, electricals, fire detection & protection system, tool hook-up, process heat exchanger connection to PCW, etc.).
- 3.5. Desired cleanroom to cover 5,000 sq ft.
- 3.6. The scope of work comprises bay/chase construction. A proposed schematic layout of the cleanroom facility is provided in Appendix A, for illustrative purposes. Note that this layout concept is intended to serve as inspiration for prospective bidders and will be reviewed through the design process
- 3.7. Space list includes:

Space	Est. Dimensions (min)	Notes
Nanolithography bay	44’ x 20’ x 10’	
Etch bay	44’ x 20’ x 8’	
Deposit bay	38’ x 20’ x 8’	
Chases	8’ wide	Separating each bay
Future expansion*		

* unfinished space for future internal expansion with an external knockout wall and utility stub extensions for possible future facility expansion.

- 3.8. A list of currently identified integration points is provided below. **We do not expect engineering solutions to these items at time of bid, but we request that bidders provide documentation to convey a plan to adequately address and communicate considerations like these.**
- 3.9. Consideration for seamless expansion of the cleanroom footprint by knocking out one wall and extending utility stubs into the expansion space, including placement of specific utility stubs so that this engineering project takes into account minimum impact on future operations.
- 3.10. This RFP intends to manage non-halogen containing acid waste (beakers of used acid, acid wet bench drain and SRD rinsate) through a limestone chip neutralization pit. The future expansion may require a dedicated AWN system. This requires a high level of coordination between the Fab building and CR teams related to plumbing design and utility stubs.
- 3.11. For informational purposes: The interior dividing wall between H- and B-class occupancy will be built by the Fab building team.
- 3.12. Similarly, the Fab building team is responsible for supplying all utilities to the perimeter point of the cleanroom (electrical, city water, PCW, Power, fire suppression, etc.) based on the loads plus a safety factor as determined by the awarded CR team, from the tool-utility matrix provided in Appendix C.
- 3.13. Cleanrooms typically separate (by code) the solvent exhaust from the acid exhaust. Cost saving efforts will be made by sizing and locating exhaust systems appropriate to the minimum path from process to abatement system (scrubber) to exhaust air handler. (any energy scavenging from these systems will also have to take into account the nature of the exhaust). Trunk slopes must account for any collection of condensates, and location of exhaust trunk condensate drip drops (drain points with sight glasses) need to be smartly located in order not to interfere with tool placement.
- 3.14. Make-up air needs to be appropriately sized to the exhaust and the air changes to maintain the positive pressure in the cleanroom. In the event of power outages, care must be taken to avoid the inability to open cleanroom doors from the inside, preventing emergency exit.
- 3.15. The BMS needs to be integrated with the TGMS- Toxic Gas Monitoring System. These should be designed at the same time for full integration and be fully part of the Fab building team's scope. We will monitor for toxic materials at multiple points both in the working spaces and in tool chassis, and downstream of POU abatement systems. We will also use waterbugs for sensing potential leaks. Due to the limited number of people working in the cleanroom at any given time, accommodation needs to be made for workers alone in the facility. Worker-down lanyards and their notification systems must be integrated with the BMS system. All alarm signals need to be available in real time to Mines/EHS/Fire Marshall

as well as CLIENT principals.

- 3.16. Electrical panels and drops, along with switches, sensors, fire annunciators and extinguishers need to be smartly located with a foreknowledge of planned tool placement, or else precious wall space is wasted or costly rework is required prior to tool placement.
- 3.17. The cleanroom Team will work with the Fab D/B team to produce a coordinated design for one fire suppression system.
- 3.18. Siting of electron column tools (EBL, SEM) with their power and utility drops will depend on assessment of lowest vibration coupling, lowest RF interference, furthest from furnaces (electrical relays in resistive heating furnaces create spurious EMI events), easiest path to dedicated earth ground.
- 3.19. E-Beam evaporator and RF-powered process (etch, dep) tools will require a low-impedance chassis connection to ground to protect operators from an electrified chassis.

4. RFP SUBMISSIONS

4.1. SCHEDULE

Action	Due By (5pm MT)
RFP Document Release	12/20/2024
Pre-Submission Information Session	1/08/2024
Submit Clarification Questions	1/14/2025
Respond to Clarification Questions	1/17/2025
Submit Proposal	1/24/2025
Notify Selection of Finalists	1/28/2025
Presentations and Oral Interviews with Finalists	2/3 – 2/5/2025
Selection Announced	2/7/2025

4.2. PRE-SUBMISSION CLARIFICATIONS Q&A

Bidders are welcome to submit clarification questions up to the due date outlined in the schedule above. Responses to all submitted clarification questions will be sent out to all bidders who have provided a Notification of Intent to Bid. The published RFP may be amended to address any identified discrepancies or inconsistencies.

All clarification questions must be submitted in electronic format to the following individuals:

Name: Elevate Quantum RFP

Company: Elevate Quantum
Email: rfp@elevatequantum.org

4.3. PROPOSAL CONTENT

Proposals must be submitted in accordance with the following instructions. Proposals not complying with these instructions may be rejected by CLIENT.

Proposals shall:

- Demonstrate outstanding ability to understand intricacies of cleanroom design and construction and overall process engineering design: chemistry and abatement approaches, manual handling of liquid toxins and safe, ergonomic design of waste process flows; HPM supply and exhaust compatible materials, HPM valving, manifolding and routing strategies, TGMS control systems, tool hook-up, HPM related code compliance, superclean procedures, commissioning procedures, start-up support.
- For the purposes of bidding, RFP respondents should assume an H5 occupancy and requirements.

Bidders shall submit the following with their technical bid:

- a. Concept design drawing showing the layout of Cleanroom area, HVAC blocks, gas hook up schematic, dry abatement, other facility and utility service blocks etc.
- b. An organization chart indicating who will be participating on the project, a summary of their qualifications, relevant experience on related cleanroom projects, and their proposed effort in FTE.
- c. A proposed management response to the touchpoints identified in Section II.8 of this RFP.
- d. Gantt chart for overall project schedule.
- e. Price breakdown listing which features and capabilities can be included within the current \$2.0 M project budget. If certain requested requirements in this RFP cannot fit within this budget, they should be included as priced add-ons. See Appendix F.
- f. Provide descriptions of at least 2 successfully completed projects of similar size and scope. Include the size, cost, and facility contact information.
- g. Resumes of project team members.

Prime bidders who have participated as a team with subcontractors shall submit an MOU with the matrix of responsibilities among the prime bidder and their corporate partners.

All Proposals must be submitted in electronic format to the following individuals:

Name: Elevate Quantum RFP

Company: Elevate Quantum
Email: rfp@elevatequantum.org

Proposals are to be submitted no later than **January 24, 2025, 5p Mountain Time**. Proposals received after this date may, at the sole discretion of CLIENT, be disqualified. Proposals must not be sent to anyone else in CLIENT or any third party. The designated CLIENT representative will distribute copies of the proposal to the required personnel. All responses and parts thereof must be in English.

4.4. CLEANROOM AND PROCESS ENGINEERING TEAM SELECTION CRITERIA

CLIENT shall select the CR Team whose proposal is the most advantageous and represents the best overall value. The following evaluation factors shall be used to evaluate the proposals and capabilities of participating entities:

- Price including demonstrated creativity in effective use of a fixed budget for optimal outcome in cleanroom design, construction, and implementation.
- Plan for cost effectively managing the cleanroom-compatible floor finishes, wall finishes, and separation wall construction so that savings can be directed toward cleanroom infrastructure
- Design and technical approach to the project including the approach to addressing integration touchpoints with the Fab building
- Past performance and experience including demonstrating “lessons learned” from similar past projects.
- Project management capabilities, including financial resources, equipment, management
- Personnel, project schedule, and management plan

CLIENT will evaluate proposals upon several criteria, including but not limited to cost, quality, delivery, service, and responsiveness. Bidders are encouraged to propose creative solutions that reduce CLIENT’s costs and improve the CLIENT customer experience.

4.5. TECHNICAL PRESENTATION AND ORAL INTERVIEW

Finalists will be required to make a technical presentation of proposals and address technical questions raised by the CLIENT. The technical presentation and oral interview may be conducted virtually (e.g. Teams/Zoom/Meet) to accommodate prospective partners not located in Colorado. This meeting will be scheduled at the direction of the CLIENT after initial applicants have been scored. The top three scored teams will have the opportunity to present. Note that failure to attend the scheduled meeting will be considered as non-compliance from the Bidder and the offer will be rejected.

5. CLEANROOM LAYOUT

The tentative layout of the Cleanroom is envisioned schematically based on functional requirements including equipment being procured and available spaces. Refer to Appendix A. This layout shall be further developed and detailed by the selected Bidder for approval by

the CLIENT

5.1. CLEANROOM PARENT BUILDING AND UTILITY AREAS

The perimeter walkway around the Cleanroom shall be as per the dimensions in the drawing. All utility equipment should be placed/installed adjacent to the cleanroom in such a way to avoid sound and vibrations.

The locations of associated gas manifolds etc., shall be determined by the bidder in consultation with the CLIENT and Fab building team. The bidder shall along with their bid submit drawing indicating the placement/arrangement of utilities equipment etc. with dimensions and the utility area / size requirement. Foundation bolts, seismic restraints (as required by code) and associated finish grouting shall be in the Vendor's scope. Making all other penetrations/cut-outs required for running pipelines /cables etc., for tool connections shall be in the Vendor's scope. All pipe supports made of mild steel/RCC/GI uni-struts etc. for running utilities lines from skids /systems (generation/source) up to the parent building into the cleanroom is also in the Vendor's scope.

6. TECHNICAL SPECIFICATIONS

6.1. SPECIFICATION OF DIFFERENT FUNCTIONAL AREAS

General lab Condition	The specifications are to be maintained at full load
Class 100 Lithography Area (ISO5 equivalent)	
Temp (°C)	21 ± 0.3 for 30 minutes
ACPH	Greater than 350
Filter coverage	70% or higher
Sound pressure level	65 dB or less. The measurements to be demonstrated at rest, i.e. keeping all process equipment in rest condition, at any height
Treated Fresh air	Adequate to offset exhaust and to maintain specified RH and Pressure in the Cleanroom.
%RH	45+/-5
Lux	500 (Yellow Lighting)
Press. Wrt atm	To meet iso spec
ISO6 (Class 1000) - Temp (°C)	21 ± 2
ISO6 (Class 1000) - %RH	45+/-10
ISO6 (Class 1000) - Lux	600 (White Lighting)
ACPH	Greater than 200
Filter coverage	30% or higher
Noise level	65dB or less The measurements to be demonstrated at rest i.e. keeping all process equipment in rest condition., at any height.
Treated Fresh air	Adequate to offset exhaust and to maintain specified RH and Pressure in the Cleanroom.

ISO6 (Class 1000) - Press. Wrt atm	+14± 2Pa
ISO7 (Class 10000) Gowning Temp (°C)	23 ± 2
ACPH	Greater than 40
Filter coverage	20% or higher
Noise level	65dB or less The measurements to be demonstrated at rest i.e. keeping all process equipment in rest condition, at any height.
Treated Fresh air	Adequate to offset exhaust and to maintain specified RH and Pressure in the Cleanroom
ISO7 (Class 10000) Gowning - %RH	55± 5
ISO7 (Class 10000) Gowning - Lux	600 (White Lighting)
ISO7 (Class 10000) Gowning - Press. Wrt atm	+10±2 Pa
Flooring	Electrostatic conductive type (ESD) epoxy flooring to be provided within the cleanroom area by the CSM-selected building contractor.

6.2. CLEANROOM HVAC

The desired system is a positive pressure air-handler unit (AHU) with direct ducting to filters and return air to the AHU. A make-up air unit (MAU) will be needed to maintain positive pressure.

6.2.1. Air Handling units (AHUs) and Make-up Air Units (MAUs) for Cleanrooms

The wall shall ensure isolation of the air recirculating from the class 100 area (nanolitho bay critical process area) from mixing and cross-contaminating with the air of adjacent lower-specification spaces.

Suitable AHUs/MAUs are to be located outside the fabrication (fab) area envelope in the utility area, and fitted with cooling coil, dehumidifiers, stages of filters etc., to maintain the required temperature and RH. The required quantity of dehumidified air should be delivered through suitably sized supply air ducts from where the air is supplied to the cleanroom. The scope includes supply, installation, testing, commissioning of appropriate number of air handling units of as per design to maintain the specified environmental conditions in the Cleanroom.

Considering the stringent requirements for humidity control, vendor shall consider dedicated AHU one each for class 100 lithography lab and Class 1000 including gowning area of cleanroom. A separate AHU shall be considered for the service corridor. AHU and MAU shall be of modular construction and of draw through type.

The AHU and MAU will be built to meet or exceed industry standards for cleanroom operations. All insulation materials within the AHU and MAU will be fully enclosed to ensure no contamination of equipment or ducting.

Suitable air tight access door hatches and locks shall be provided for various AHU segments.

The casing shall incorporate thermal break profile and all other necessary design

features to ensure that condensate does not occur during all seasons.

The fresh air plant should supply enough conditioned fresh air to be mixed with the recirculated air to maintain the required environmental conditions (temperature, RH, pressure etc.).

Noise level to be < 70 dB

6.2.2. Filtration

The cleanroom construction for class 100 and class 1000 spaces and shall be comprised of a suitable numbers of filter units (HEPA or ULPA) to meet or exceed the cleanliness requirement for the respective cleanroom classification. Below is an example of implementation, the CR Team is to provide specifications towards reaching compliance.

- HEPA filter efficiency shall be better than 99.997 % down to 0.3 microns (H14), and the ULPA efficiency should be better than 99.9995% down to 0.13 microns (U15).
- Pre- filter of 10 microns at the inlet to protect the HEPA filters.
- Material - Galvanized Al-Zn alloy steel or Stainless steel
- The average velocity of air should be measured at a distance of 50 to 75 mm from the surface of filter with face guard in position and ACPH should be calculated to meet the levels specified above.
- Filters to have endless Polyurethane in D-profile rubber gasket on the air discharge side to match with ceiling grid (for both ULPA and HEPA filters). Or equivalent.

Filter should be replaceable from beneath the ceiling.

Outside filter dimensions (mm), Nominal air volume (m³/hr.), Pressure drop at nominal air volume (Pa), Tolerance pressure drop (%) to be submitted as part of the technical bid.

6.2.3. Air Distribution - Duct Insulation & Acoustic Insulation

Supply air duct - Insulated as required to meet industry standards

Return air duct: insulated as required to meet industry standards.

Sound attenuators should be installed in the supply air duct to reduce the sound to 70+/-2 dB (A).

6.3. CLEANROOM MATERIALS & ANCILLARIES

Cleanroom Materials & Ancillaries	
Fire rating	Cleanroom materials and assembly to comply with international building code and international fire code.

Walls may be constructed of steel walls with sheetrock or modular walls	Steel framed walls or modular systems will be finished with industry standard cleanroom compatible materials
Doors	Provide suitable doors as per the drawing.
	Door leaves should be complete with vision panel, pull handle, push plate, mechanical door closer without oil, door seals and all other hardware, as appropriate. All doors 42" or wider will require full roton style hinges
	Emergency exits to be provided as per safety norms at locations as indicated in the layout. All emergency exit doors shall be designed for consideration of power outage events that shut off air handling while maintaining exhaust: the sudden shift to negative pressure must not prevent emergency egress by pressurizing the doors closed.
Doors in outer periphery of service corridor	Doors with all hardware (lock, handles, SS hinges etc.), door seal. Fire check doors shall be provided with panic bar.
Windows & Door Vision Panels	Windows and door vision panel shall be specified to be in compliance with local jurisdiction.
	UV filtration film is to be applied to the ISO-5 (class 100) windows and door vision panels. And adjacent chase areas near entrance exit doors and hallway near the main entrance.
Lighting	Cleanroom lighting shall meet or exceed cleanroom specifications
	UV filtration film should be applied to the ISO 5 (class 100) lighting; Yellow lighting for Class 100. UV filtration film sleeves in Class 100 area to be cut-off for <420nm-500nm
	Each area should be provided with an uninterrupted supply or battery backup ballasting to ensure emergency illumination in the event of a mains power failure, per code requirements.
	Lighting control should be located on the walkway corridor and switch to be provided at convenient location in each room
Fire and Smoke Dampers	Fire and smoke dampers to be manufactured and installed to the requirement of international Fire Code
Access Panels/Doors in Duct Work	Access panels shall be provided with double panel type; material of construction shall be same as duct material.
	Access doors shall be adequately reinforced to prevent distortion and hinged so that internal air pressure holds the door closed. Clamping type latches and handles, which can be operated from both sides of the door, shall be provided.
	Smoke detectors in the duct should meet international fire code.

6.4. PROCESS EXTRACTION SYSTEMS

Process Extraction Systems
Vendors are to design and install corrosion resistant, soundproof and vibration free (less than 70 dB) systems for DRY & WET exhaust venting. Vendors to demonstrate compliance with applicable standards and codes for extraction of process gases connected to a suitable blower for all the equipment, HVAC, equipment in Cleanroom etc.
The Exhaust System comprises ducting, casing to be of corrosion resistant material of construction (MOC) to handle the respective (acid, solvent, general) gases/fumes that do not mix until exiting the building.
Exhaust distribution system from process equipment for acid exhaust to be SS316 L or equivalent. Fan shall be constructed of MS with FRP lined or equivalent. Shaft shall be of material sufficient for the uses required.
GI for solvent and heat exhaust along with control dampers / magnehelic gauges (that report to the BMS) and flexible ducting wherever required. Suitable exhaust fan to be provided for solvent, acid, and heat exhausts.
Ducting exposed to ambient to be firmly supported with galvanized brackets & tie rods.
Flammable gas exhaust shall meet fire code and/or ISO standard
Similar equipment exhaust to be clubbed inside
The system to be soundproof in nature (< 70db) and vibration free.
Proper exhaust should be available for all cabinets, gas pods, pumps, wet and dry benches as per the requirements
Magnahelic gauges will be provided for exhaust monitoring: one gauge will be provided on each of the inlet and outlet side of the primary and secondary filters and following the HEPA/ULPA filter in order to determine end-of-life for each filter. HEPA vs. ULPA will be recommended by the engineering team. Additional Magnahelic gauges will be required at the inlet of each branch.
ISO – 6 (Class 1000) Wet Bench Area to exhaust above building with sufficient velocity to ensure dispersal above roof line.
Vendor shall provide suitable drainpipes from wet chemical bench and solvent bench to neutralization limestone chip pit, to be coordinated with the Fab building team.

6.5. CENTRAL UTILITIES

Central utilities listed in this section may be shared between the cleanroom, the exterior building, or the adjacent laboratory building, see Appendix D. While distribution piping *within* the cleanroom walls is clearly in scope for this RFP, the main equipment in each category (e.g. chilled water skid, nitrogen generator, etc) may be shared between other campus activities and therefore fall outside the scope of this project. Final determination of utility scoping will be determined in coordination between the Fab building team, CLIENT, and the CR Team. **However, for the purposes of bidding, we request that allowances for these utilities be included as separately priced line items in submitted bids.**

Chilled water Distribution	To be distributed through appropriate management system in pipe and fittings with required isolation valves including flow measuring devices, pressure, temperature gauges, and filters/strainers etc. as per the requirement of the facility/cleanroom.
	Complete chilled water lines to be duly insulated using approved insulation material and clad with aluminum sheet as per the standard practice and specifications.
Pneumatic systems support by site-generated nitrogen, not CDA. (No CDA system needed)	<p>All tool pneumatics will be operated using dry nitrogen with POU filters (0.2 microns rating). An on-site nitrogen generation system will be specified and installed that meets or exceeds the combined usage and flow requirements for N2/CDA based on the supplied tool and utility matrix in Appendix C.</p> <p>The nitrogen distribution system will be constructed of 316 SS, cleaned for ACR and coupled with swagelok fittings. All cutting will be by portaband saw and deburred inside and out. No oil will be used on any pipe cutting operations. No tubing cutters will be allowed.</p> <p>Commissioning will validate that</p> <ol style="list-style-type: none"> 1) all gas lines are oil and particulate free. 2) no pressure drop at full flow
	Pressure regulators and valves required at each tool location
Acid wet bench neutralization	Effluent from the acid bench will be managed by, a) manual collection of any F- or I-containing substances (HF, iodine-based gold etch) for reclaim or hazardous disposal; and b) other acids and rinsate in the sink will be flushed to a neutralizing limestone/marble chip pit before being disposed to the sanitary sewer. See Appendix B Chemical Inventory for use and disposal rates for non halogen-containing acids.
Ultra-Pure Water	Ultra-pure water will need to meet SEMI and ASTM standards. A full-cleanroom system or point-of-use units will be considered.

Central Utilities (Electrical)	Appropriate location adjacent to the fabrication building.
	All conduit and fittings must be de-greased prior to use in the cleanroom spaces.
Motor Control Centers	Motor control centers should be provided complete with all associated isolators, contactors terminal, overloads, selector switches and indicating lamps
	The operational mode of the connected device should be selected from the front panel of the motor control center by the associated three position selector switch
	MCC should have provisions to start/stop all the drives from remote location (FCMS)

Variable Frequency Drives	Supply and exhaust fans should be controlled via variable frequency drives for the benefits of managing energy consumption and automatic system control and respond and report to the BMS system.
Grounding	All metallic components of the central utilities should be grounded to a building earth point under the supervision of CSM and Elevate Quantum. Dedicated grounding will be needed on the E Beam Lithography tool and the Scanning Electron Microscope.
Power Distribution	The main electrical distribution panel will be located near the cleanroom area
	CLIENT shall provide power to the panels at a location near the cleanroom walls. Vendor shall provide further distribution comprising of cables, MCC, MCBDBs, wiring, lighting etc. for powered items (e.g. tooling) within the cleanroom boundary.
	All critical utilities including BMS / TGM S safety systems and emergency illumination shall be on UPS power or battery backup applicable to life safety standard.
	The bus-bar systems will incorporate MCB's at the power take off points for local protection/isolation
	Power shall be distributed suitably in the service corridor and for equipment support tools like chillers, vacuum pumps etc.
	120V convenience outlets shall be placed at regular intervals throughout the cleanroom, including all process bays and chases. Coordinate exact numbers and placements with the CLIENT.
	Electrical cabling to be laid out from the main panel to the tools, Cleanroom ancillaries and utilities is within scope of the vendor.
	Additional 20% future space for electrical connections shall be provided in the distribution system.
Life, Safety and Security Systems	
Local Fire Suppression System	Fire suppression is water based. Cleanroom areas will need a pre-action system. Shall be coordinated with the Fab building team

Emergency Showers	Emergency personal drench shower(s) with eyewash should be provided in close proximity to the wet chemical processing benches, in compliance with applicable codes
Emergency Lighting	Emergency lighting should meet applicable codes.
Local Area Network	Local area network infrastructure cabling shall be provided within the cleanroom connecting to a patch panel and switch within the control room.
Facility Control & Monitoring Systems	Vendor shall design or procure Building Control and Monitoring systems (BMS) for all the utility systems/plants based on their control philosophy. All HPM's shall be monitored by chemistry and local use by distributed sensors according to code (TGMS) and to be integrated with the BMS. The system shall have complete detector hardware, control electronics and software etc. to control critical parameters as Temperature, RH etc., automatically through BMS.
	Data pertaining to all BMS/TGMS safety events, man-down alarms, exhaust failure, fire /smoke detection alarms, etc., to be reviewable and controllable in the fire room where the servers are located, and at a user station or online inside the building, and at a secondary secure location in the Lab building, and as accessible to remote personnel.
	Vendor to provide detailed scheme/configuration and control philosophy to automatically control Temperature, RH etc. in the Cleanroom from BMS, for CLIENT review.

6.6. GAS AND PIPING EQUIPMENT

6.6.1. Nitrogen

All tool pneumatics will be operated using dry nitrogen with POU filters (0.2 microns rating).

The nitrogen distribution system will be constructed of 316 SS, cleaned for ACR and coupled with swagelok fittings. All cutting will be by portaband saw and deburred inside and out. No oil will be used on any pipe cutting operations. No tubing cutters will be allowed.

6.6.2. Distribution Pipeline Network for specialty gases:

1. All distribution pipeline network for the process gases (exclusive of house-generated N2) to be of seamless SS 316L, internal electro polished 10Ra micro inches (RMS) pipes/tubes. All valves shall be orbital weldable, packless bellows type rated at 200 psi and provided with 316L stainless steel bodies, Kel-F seats. Valves in the main headers / laterals shall have integral purge ports downstream of seat with VCR type

fitting caps.

2. Vendor to build distribution pipeline network from each gas cabinets and gas distribution panels to various process tools with appropriate components like Valve Manifold Boxes and valves, regulators, non- return valves etc, as required with appropriate end connection.
3. Vendor to use Seamless Stainless-Steel pipes/tubes of grade 316L, eletropolished 10Ra micro inches (RMS) and Face-Seal fittings.
4. Vendor to build Co-Axial pipelines for all hazardous gases (viz. DCS, SiH₄, NH₃) with vacuum switches. Distribution shall be through SS316L EP Co-axial tubing. Inner tubing shall have less than 10 Ra finish.
5. For other process gases (viz. CF₄, SF₆, CHF₃ & C₄F₈) vendor shall install single SS 316L EP <10 Ra tubing from the gas panels up to the tools and make the tool-hook-up per the connection size /type on the tool port.
6. One spare Nitrogen gas line connection of SS316 L Seamless, ¼" size with requisite isolation valve & pressure regulator to be provided in each bay.
7. One spare CDA / nitrogen line of SS316 L Seamless, ½" size with requisite isolation valve & pressure regulator to be provided in each bay
8. Vendor to use compatible components/ materials to build bulk and process gases facilities.
9. Vendor to erect equipment and distribution lines with appropriate supports /trays/pipe racks as per P&I diagrams adhering to the Cleanroom protocols.
10. Vendor to label the gas facilities according to the gases.
11. Vendor to test, purge, analyze and certify the facilities as per SEMI standards.
12. Rigid vacuum line between tools and pumps as per the requirements
13. Some flexible pipe working has to be considered during tools installation.
14. The supports/hangers for the distribution lines shall be 'Unistrut type'.

6.6.3. Gas Monitoring, Tool Hook-Up and Toxic/Hazardous Gas Monitoring System:

Vendor to provide separate cost for gas monitoring systems

Gas monitoring and Safety Sensors	Gas cabinets, VMBs and process tool gas boxes to be monitored by Toxic/Hazardous gas monitoring. All alarms to be connected by hard wire to the Toxic/Hazardous Gas Monitoring system and to the control room.
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	<p>There should be appropriate annunciators installed at acceptable distances for gas alarm.</p> <p>All Toxic/Hazardous gases should be isolated</p>
<p>Toxic Gas Monitoring (TGM) / Toxic Gas Leak detection system.</p>	<p>Vendor shall provide a toxic gas leak detection system (fixed gas detector electrochemical type) for monitoring accidental gas leak in Cleanroom/Process tools/Gas cabinets/ VMB(s). The system shall include installation of gas sensor at strategic locations in the downstream of the scrubber (per gas one sensor), Gas cabinet and VMB. Any detection of the gas shall raise an alarm and the data of continuous monitoring shall be available at a separate workstation/PC.</p> <p>Quantities shall be computed for each gas for Gas cabinet, Valve Manifold Box and Exhaust of Process tool. For each gas cabinet one gas sensor per gas type shall be provided, Valve Manifold Box (VMB) and Exhaust of Process Tool.</p>
<p>NH3 gas detector</p>	<p>Ammonia [NH₃] vapor detector system) having a solid state instrument panel and sensor capable of sensing ammonia concentrations of 25 to 800 ppm shall be installed in Class 1000 Cleanroom & service bay for environmental monitoring. This is in addition to the detectors provided in Gas cabinet, Valve manifold box and process exhaust. Detailed specifications as below:</p> <ol style="list-style-type: none"> a. NH₃ detector shall detect any accidental gas leak. b. The NH₃ detector shall have a progressive LED light tree display. c. The detector shall have relays for early warning (pre-alarm), Alarm and auxiliary equipments/alarm. d. Power requirements of the system shall be 230V 50Hz AC & 16V AC or 24V DC e. The detector shall not contain any radioactive materials. f. The system shall have a non- adjustable early warning set point at 250ppm and adjustable alarm set point at 500ppm.

	<p>g. The detector system shall have a Service mode switch for servicing, testing or calibration.</p> <p>The detector shall be capable of initiating a supervised alarm, resulting in corrective action.</p>
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<p>System configuration (Hardware and Software)</p> <p>SCADA and HMI based for Toxic Gas Monitoring and control (PLC)</p>	<ul style="list-style-type: none"> a. Human Machine Interface (HMI)- User friendly interface of the monitoring and control software. PC to be provided by the vendor. b. All hook ups from the sensors and other areas, cylinders etc under the scope of the vendor. c. Appropriate alarms and visual color codes required in the software. d. Gas cylinders to be shut off automatically in case of any leak detection, with appropriate shut off cycle followed according to the gas. e. Exhaust to Gas Cabinets and VMBs- The ductwork materials used must be compatible with intended gas as per safety standards and shall not be made from a combustible material. f. Auto changeover gas manifold with pre- purging, post-purging and of required specifications. g. All fittings to be of weld/VCR type and should include Diaphragm valve and check valve for ultra-high pure application. h. Provision for alternate and additional future connections. i. Diaphragm valves and check valves- j. Electro polished SS with roughness no more than 0.15 microns.
<p>Tool hook-up</p>	<ul style="list-style-type: none"> a. Vendor to hook up the gas facility lines and the required safety features to the process tool. b. Package of tool install as per each tool requirement. c. Vendor should have a proven experience in design and installation of the facilities for semiconductor tools.

7. TECHNICAL SPECIFICATIONS OF TOXIC EXHAUST ABATEMENT SYSTEM:

The vendor should specify, install & commission the dry scrubber shared by the PECVD and LPCVD based on exhaust volume & gas species to be scrubbed. The vendor must integrate the e.g., Jupiter Systems/CSI dry scrubber with the TGMS and the process exhausts systems. Future use of scrubbing greenhouse gases from the fluorinated etch chemistry will be a

future consideration upon capacity expansion.

Selected vendor shall carry out detailed engineering to determine actual duct routing layout, compatible materials analysis and joining design (with materials) and will submit the drawings showing slopes and drip-drops with sight glasses as shop floor drawings to CLIENT for approval before commencement of the ductwork fabrication and installation work.

8. VENDOR-PROVIDED DOCUMENTATION DURING PROJECT AND AT CONCLUSION

1.	Detailed design including design analysis & data for cleanroom, HVAC systems, utilities distribution, electrical systems and distribution, fire detection and suppression, LAN etc. for all the works covered under the scope of work of the RFP, as approved by the CLIENT.
2.	Detailed engineering drawings as approved by the CLIENT. The approved engineering drawings shall be referred to as Approved for Construction (AFC)/Good for Construction (GFC) Drawings. The work shall be executed as per the AFC / GFC drawings.
3.	On completion of the project, the vendor shall submit 'As Built Drawings' in CAD format and hard copy (three sets) of each drawing.
4	Operating and maintenance manuals for all skids, systems and hardware in hard copy and electronic format.

9. Applicable Codes, Material & Workmanship

The equipment and installation shall conform to all standards as required by the Authority Having Jurisdiction. All components should be UL listed, when applicable. See Appendix E for a list of approved state building codes.

All materials used in the work shall be of high-grade quality free from defects and imperfections and of recent manufacture and unused/new or refurbished back to factory specification. Materials used shall conform to latest specifications of the ASTM and/or other equivalent specifications. Liberal factors of safety shall be used throughout the design for various systems/equipment etc.

The contractor (vendor) shall ensure that no damage will occur during shipment or storage prior to installation under prevailing climatic conditions.

No tubing cutters will be allowed for any pipe sizing. All cutting will be by portaband saw and deburred inside and out. No oil will be used on any pipe cutting operations.

The nitrogen distribution system will be constructed of 316 SS, cleaned for ACR and coupled with swagelok fittings and terminated with VCR fittings.

QA / QC will validate all gas lines to be oil and particulate free.

All necessary fittings, assemblies, hardware, accessories such as clamps, foundation bolts,

required seismic tie-downs, terminals for electrical connections, cable glands, junction box, wall cowls, bird screen gaskets, brackets, hangers, screws, nuts, bolts, washers etc., which are useful and necessary for proper assembly and efficient working of systems shall be supplied by the contractor and the cost of the same shall be deemed to be included in their quote/offer whether specifically mentioned in specification or not. Any material and labor which may be necessary to complete the work in accordance with the intent of the specification shall be furnished by the contractor.

The contractor shall fully co-operate with the CLIENT in the mutual exchange of various drawings, dimensions and other information of related equipment supplied by sub-vendor / subcontractor, if any, so as to ensure complete co-ordination in design, arrangements, manufacture and installation of all the related process tools and supporting utilities and equipment.

10. WARRANTY AND ANNUAL MAINTENANCE CONTRACT

Vendor shall provide one year on-site comprehensive warranty for the entire installation and include the same in their base price. The warranty shall be for 1 year from the date of installation and acceptance on successful commissioning.

Vendor shall attend to breakdowns in any of the installation performed under the PO/Contract at own cost within 48 hours of intimation from CLIENT

Vendor shall also quote post warranty 5-year comprehensive annual maintenance contract price separately, as an option.

11. GENERAL CONDITIONS

Firms participating in this RFP should be technically competent and experienced in cleanroom design and installation projects for semiconductor/ MEMS/nano-fabrication facilities with the following eligibility criteria:

11.1.1. Build Clean Protocol

Entry to the work area shall be restricted to vendor's authorized personnel and Elevate Quantum concerned staff. Standard Build clean protocol during installation and testing/certification as applicable for Class 100 and Class 1000 Cleanroom shall be strictly followed by the vendor who shall arrange at their cost shoe covers, Booties, Masks, Hand Gloves etc. for vendor's workers, supervisor(s) and SCL staff. No street shoes shall be permitted in the work area. Regular cleaning of the workspace/area by deploying adequate workers and using industrial vacuum cleaners, lint free and low particulate Cleanroom wipes suitable for Class 100/Class 1000 etc. shall also be vendor's responsibility at no extra cost to Elevate Quantum. Vendor shall ensure that Tools for installation are cleaned using Class 100/1000 Cleanroom compatible tissue papers, lint free wipes, and Isopropyl alcohol wipes etc. to ensure use of clean tools & tackles.

11.1.2. Superclean

At the conclusion of the construction and prior to commissioning, an alcohol wipedown of all surfaces will be conducted by vendor using suitable lint-free cleanroom wipes.

11.1.3. Safety

Vendor shall ensure adherence to safe construction practices which shall include use of Personnel Protection Equipment (PPE) by their workmen, supervisors etc. deployed on the work. PPE viz., safety helmets, safety shoes, harnesses, safety glasses, gloves etc. shall be provided by the vendor for the safety of all the personnel at the site of work. Vendor shall take adequate measures to ensure that no damage or loss is caused to the CLIENT's buildings, equipment and personnel due to any activity carried out by the vendor relating to the performance of the Contract. Vendor shall be liable to make good the loss/damage including any consequential damage caused by them and in case of failure to do so, CLIENT shall effect financial recovery for the same from the vendor.

11.1.4. Coordination

Work shall be carried out in a coordinated manner by the vendor with all concerned contractors, owners, agency(ies) for smooth implementation of the Project.



11.1.5. Electricity

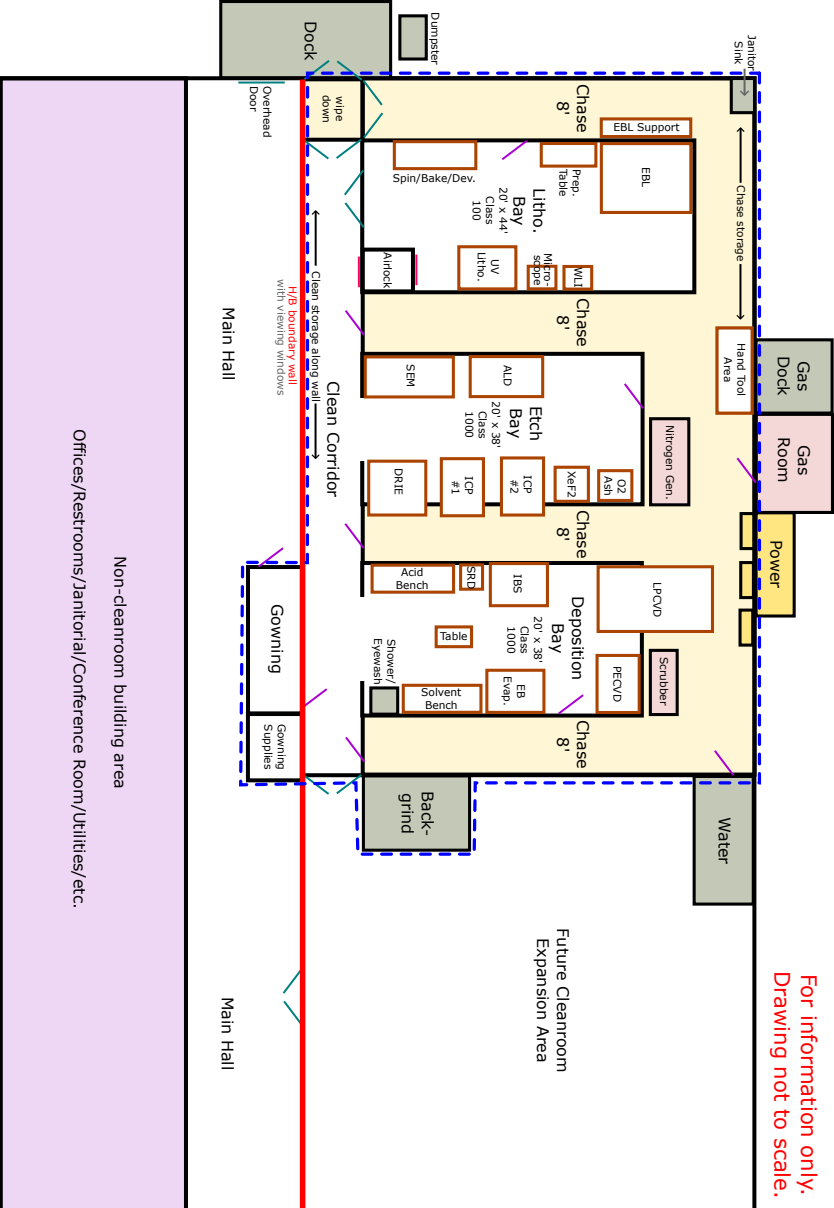
Electricity required for installation shall be provided by the CLIENT on a no charge basis to the vendor. For this, electricity connections will be provided at a single point, and further distribution shall be the vendor's responsibility. Vendor shall provide wattage of all the electrical loads required for installation and install all safety and protection devices viz., MCB/MCCB/ELCB/RCCB etc. as per the applicable electricity rules.

APPENDICIES

12. APPENDIX A. Proposed Cleanroom Layout
13. APPENDIX B. Chemical Inventory
14. APPENDIX C. Tool-Utility Matrix
15. APPENDIX D. Central Utilities Layout
16. APPENDIX E. State Building Codes
17. APPENDIX F. Cost Proposal Form

For information only.
Drawing not to scale.

- Notes:**
-  Designates Door
 -  3' wide, 7' high
 -  4' wide, 8' high
 -  Current Project Boundary



Building Expansion
Direction
→

Non-cleanroom building area

Offices/Restrooms/Janitorial/Conference Room/Utilities/etc.

Main Hall

Main Hall

Clean Corridor

Dock

Dumpster

Wipe down

Overhead Door

EBL Support

EBL

Prep. Table

Spin/Bake/Dev.

Litho. Bay
20' x 44'
Class 100

Micro-scribe

UV Litho.

WILL

Chase 8'

Chase 8'

Hand Tool Area

Gas Room

Gas Dock

Power

Nitrogen Gen.

SEM

AID

Etch Bay
20' x 38'
Class 1000

ICP #2

ICP #1

DRTE

XeF2

O2

ASH

LP/CVD

Water

Deposition Bay
20' x 38'
Class 1000

EB Evap.

Table

Acid Bench

SRD

PECVD

Scrubber

Solvent Bench

Shower/Eyewash

Back-grind

Gowning

Gowning Supplies

Chemical	Location	Tool ID	State	Use	Quantity on hand (liq=gal, gas=cf, solid=lbs)	Amount per use (liq=mL, gas=cc)	# uses per day	Total usage per day (liq=mL, gas=cc)
Isopropanol	wafer fab	solvent bench	Liquid	Use Open	2	100	15	1500
Isopropanol	storage	Storage Cabinet	Liquid	Storage	8			0
Acetone	wafer fab	solvent bench	Liquid	Use Open	1	100	15	1500
Acetone	storage	Storage Cabinet	Liquid	Storage	8			0
Acetone	wafer fab	Spin/Bake/Dev	Liquid	Use Open	1	50	10	500
NMP	wafer fab	solvent bench	Liquid	Use Open	1	100	10	1000
NMP	storage	Storage Cabinet	Liquid	Storage	6			0
mixed solvents listed above	waste collection	solvent bench (carboy)	Liquid	Use Closed	5			0
organic waste solids (eg contaminated wipes)	waste collection	solvent bench (surface collection)	Solid	Use Open	3			0
EKC-265	wafer fab	solvent bench	Liquid	Use Open	1	100	5	500
EKC-265	storage	Storage Cabinet	Liquid	Storage	3			0
Nanostrip (sulphuric-peroxide mixture)	wafer fab	acid bench	Liquid	Use Open	1	100	5	500
Nanostrip	wafer fab	Storage Cabinet	Liquid	Storage	3			0
Transene TFA Au etchant	wafer fab	acid bench?	Liquid	Use Open	1	100	5	500
Cr-7s chrome etchant	wafer fab	acid bench?	Liquid	Use Open	1	100	5	500
TMAH-based developer (~30% TMAH in H2O, MF26A and/or MaD-525)	wafer fab	Spin/Bake/Dev	Liquid	Use Closed	2	100	10	1000
TMAH-based developer (~30% TMAH in H2O, MF26A and/or MaD-525)	storage	Spin/Bake/Dev	Liquid	Storage	5			0
NH4OH (30pct in H2O)	wafer fab	acid bench	Liquid	Use Open	1	50	5	250
NH4OH (30pct in H2O)	wafer fab	Storage Cabinet	Liquid	Storage	3			0
H2O2 (30pct in H2O)	wafer fab	acid bench	Liquid	Use Open	1	50	5	250
H2O2 (30pct in H2O)	wafer fab	Storage Cabinet	Liquid	Storage	3			0
Hydrofluoric acid	wafer fab	acid bench	Liquid	Use Open	1	100	5	500
Hydrofluoric acid	storage	Storage Cabinet	Liquid	Storage	2			0
Silane (Qty D cylinder in use and Qty1 autocrossover for spare)	Gas room	Gas Cabinet	Gas - Gaseous	Use Closed	250	1200	3	3600
Ammonia (subatmosphere delivery)	Gas room	Gas Cabinet	Gas - Liquified	Use Closed	250	30000	0.5	15000
Dichlorosilane (subatmosphere delivery)	Gas room	Gas Cabinet	Gas - Liquified	Use Closed	250	5500	0.5	2750
Sulfur hexafluoride - SF6	wafer fab	Gas Cylinder - all etchers and PECVD	Gas - Gaseous	Use Closed	150	1500	4	6000
Oxygen	wafer fab	Gas Cylinder - all etchers and PECVD	Gas - Gaseous	Use Closed	300	2000	10	20000
Helium	wafer fab	Gas Cylinder - all etchers and PECVD	Gas - Gaseous	Use Closed	300	500	10	5000
Argon	wafer fab	Gas Cylinder - all etchers and PECVD	Gas - Gaseous	Use Closed	300	1000	5	5000
CHF3	wafer fab	Gas Cylinder - FI etcher	Gas - Gaseous	Use Closed	150	500	6	3000
CF4	wafer fab	Gas Cylinder - FI etcher	Gas - Gaseous	Use Closed	150	500	6	3000
C2H4	wafer fab	Gas Cylinder - FI etcher	Gas - Gaseous	Use Closed	150	500	6	3000
C4F8 (subatmosphere delivery)	wafer fab	Gas Cylinder - DRIE	Gas - Liquified	Use Closed	150	2000	3	6000
Nitrogen	wafer fab	Gas Cylinder	Gas - Gaseous	Use Closed	150	1000	5	5000
Sulfur hexafluoride - SF6	storage	Gas Cylinder	Gas - Gaseous	Storage	300			0
Oxygen	storage	Gas Cylinder	Gas - Gaseous	Storage	450			0
Helium	storage	Gas Cylinder	Gas - Gaseous	Storage	450			0
Argon	storage	Gas Cylinder	Gas - Gaseous	Storage	450			0
CHF3	storage	Gas Cylinder	Gas - Gaseous	Storage	150			0
CF4	storage	Gas Cylinder	Gas - Gaseous	Storage	150			0
C2H4	storage	Gas Cylinder	Gas - Gaseous	Storage	150			0

Key: Blue means it will be required, but exact specs unknown
 Yellow means a guess
 Orange means some special consideration may be necessary

Tool ID #	Location	Tool Name	Use/Process	Electrical Voltage	Electrical Power	Required Power to Room	CO2	FCO2	Univ	N2 (all pneumatic)	Process gases	Vacuum	Exhaust	Exhaust Abatement strategy	Footprint	Height	Weight	Temp.	Humidity
1	manifolds	ELI Heavy, vls, stainless, 5000 lbs, 416	never contacted but parts included	Single phase 200V, 200V	6.5 VA	1 kW	70-110 psi, 2.2cfm		light	39.0cfm, 2.2cfm	N/A	dry pump	36mm pipe to pump exhaust	N/A	4.3m	2.3m	5500 lbs (2500 kg)	20-25C, stable	40%
2	manifolds	UV Lino		Single phase 200V	1.3 VA	500 W	>8" dia, 120 l/hr				N/A	Point of use ok	8" OD tube hood (540 l/min) and 8" OD tube cabinet (310 cfm)	N/A	0.943 m	1.3m			40%
3	manifolds	Spec/Isk of/Dw		Single phase 200V	6.7 VA	6 kW	70 psi				N/A				1.61m	2.1m			40%
4	manifolds	Inspection microscope		Single phase 120V	small	300 W					N/A								
5	etch	Axonic Layer Deposition		Three phase 200V, 240V	30A+40A		7 bar, 303SLM				Amalg, O2	dry pump	1-10 CFM for foreline pump, 36 CFM for cabinet	N/A	not labeled (low concentration of reactants)		1800 lbs	20 +/- 3C	40%
6	etch	SEM		Single phase 200V, 240V	2.3 VA	2 kW	70-110 psi, 2.2cfm				Amalg, O2	dry pump	roughing pump	N/A	1.40d 8m	1.4m			
7	etch	10" FT Etcher		Three phase 800V, 480V	172 VA	2 kW	70-110 psi, 2.2cfm				O2, CH4, C2H4, Ar	dry pump	roughing pump	f concentration below threshold	1.40d 8m	1.4m			
8	etch	10" FT Etcher		Three phase 800V, 480V	172 VA	2 kW	70-110 psi, 2.2cfm				O2, CH4, C2H4, Ar	dry pump	roughing pump	f concentration below threshold	1.40d 8m	1.4m			
9	etch	Standard OTE		Three phase 200V	75A	6 kW	70-110 psi				5% C2H4, Ar, O2	dry pump	roughing pump	f concentration below threshold	4.3m	1.5m	1100 kg		
10	etch	XCF Etcher (7" x 2" per v)		Single phase 120V or 240V	20A or 15A	2 kW	70-110 psi				O2	dry pump	roughing pump	f concentration below threshold	0.6d 6m	0.8m			
11	etch	O2 ziner		Single phase 120V or 240V	small	300 W	70-110 psi					dry pump	roughing pump	N/A	0.5d 6.5m				
12	Dep	UPCO Furnace		Three phase 480V	55A VA (80 VA max)		70-110 psi				continuous dry pump	dry pump	roughing pump	Disposion abatement (flow/glycolic)	1.59 x 8.0 in	82 in			
13	Dep	Ion Beam Sputter (Frc-2)		Three phase 200V, 240V							Ar	dry pump	roughing pump	Disposion abatement (flow/glycolic)					
14	Dep	autoclave work station		Single phase 120V	15A	3 gpm, 40 psi	6 dm, 35 psi				N/A	dry pump	roughing pump	acid exhaust					
15	Dep	autoclave work station		Single phase 120V	15A	3 gpm, 40 psi	6 dm, 35 psi				N/A	dry pump	roughing pump	acid exhaust					
16	Dep	SFD		Single phase 120V	15A	3 gpm, 40 psi	6 dm, 35 psi				N/A	dry pump	roughing pump	acid exhaust					
17	Dep	Acid wet bench		Single phase 200V, 240V	5 VA	6 kW	70 psi				N/A	dry pump	roughing pump	acid exhaust					
18	Dep	Solvent wet bench		Single phase 200V, 240V	5 VA	6 kW	70 psi				N/A	dry pump	roughing pump	acid exhaust					
19	Dep	PCVD		Single phase 200V	8.8VA (6A)	2 kW	70-110 psi				5% C2H4, Ar, O2	dry pump	roughing pump	acid exhaust					
20	Dep	Etcher		Single phase 200V	60A	2 kW	70-110 psi				5% C2H4, Ar, O2	dry pump	roughing pump	acid exhaust					
21	Dep	Etcher		Single phase 120V	small	300 W	70-110 psi					dry pump	roughing pump	acid exhaust					
22	Clean room	Surface prep/finisher		Single phase 120V	small	300 W	70-110 psi					dry pump	roughing pump	acid exhaust					
23	clean env[ap]	background/condensate of water/gender		Three phase 200V	12A VA (10A breaker)		70-110 psi, 5cfm	2 l/gm							4 to 6 m3/min displacement		1300 kg	20-25 C	55 +/- 15%

needs nitrogen generator
 Process CH4/Ed Water
 H2O
 H2
 Clean dry air (CMA)
 Clean room the (F/U, light, etc)

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

needs nitrogen isolation
 needs lower connection needs operation location
 not required

“BUILDING” – Core and shell structure, utility sources and distribution to outside of CR

“CLEANROOM” – Walls, ceiling, MEP required for cleanroom envelope

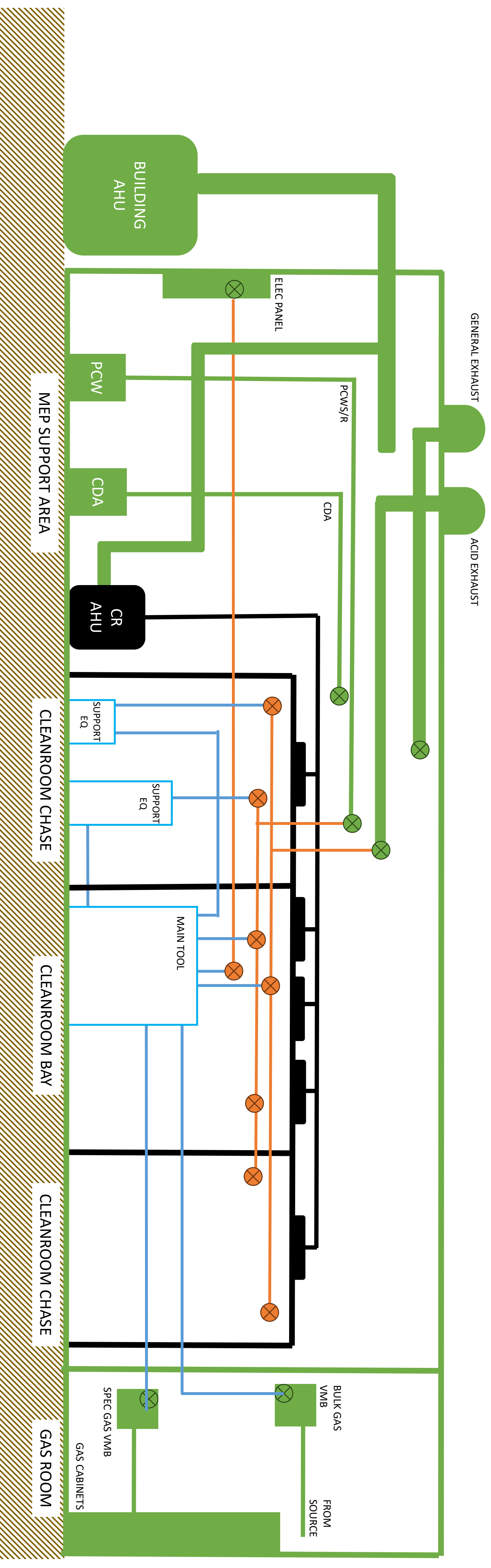
“CLEANROOM UTILITIES” – Distribution from Building POC to inside cleanroom

“TOOL INSTALL” – Rigging, placement and tool MEP connection to utility POC

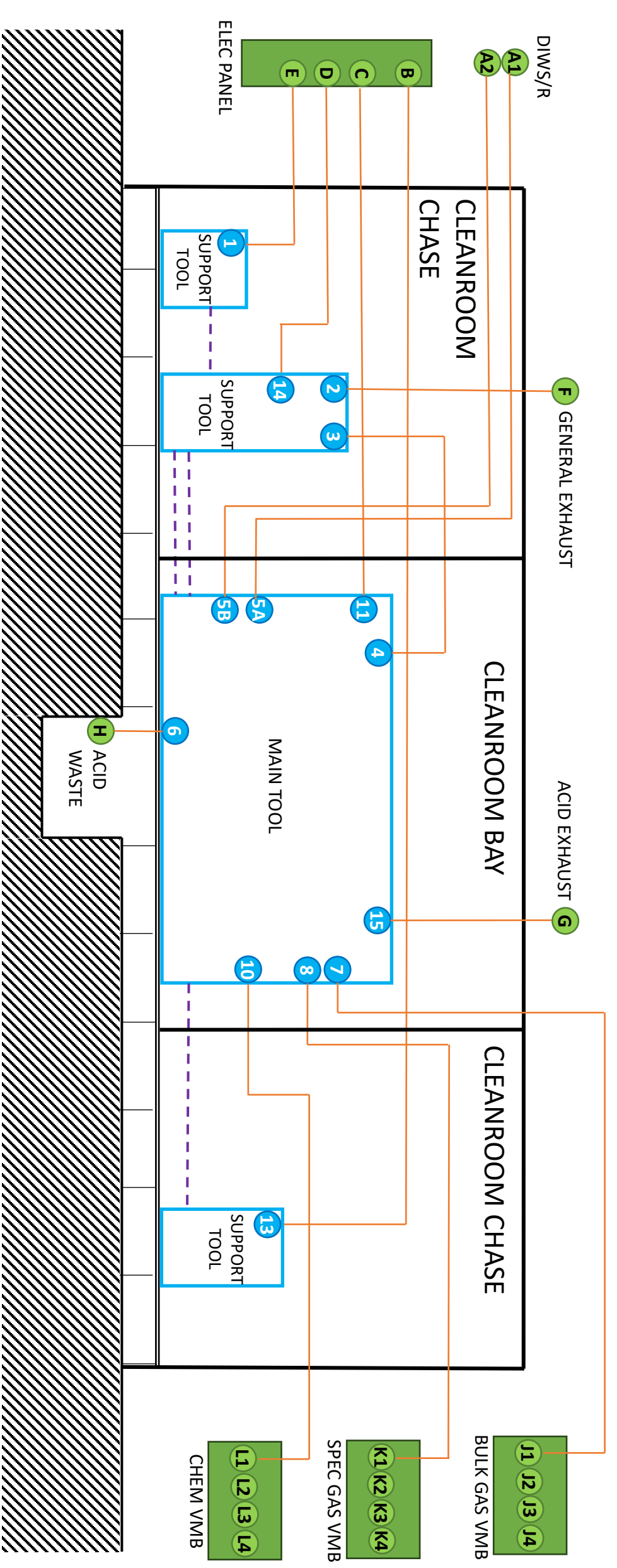
Indirect costs for each scope such as design and certification should be included in each color.

CSM QCO Scope Breakdown

CONCEPT DIAGRAM – does not represent entire scope of project



- # TOOL POINT OF CONNECTION – location, f/t/p requirements from tool vendor
- A FACILITY POINT OF CONNECTION – location, f/t/p availability per design/construction team
- TOOL HOOK-UP SCOPE – installed by contractor
- - - TOOL HOOK-UP SCOPE – installed by tool vendor



APPROVED STATE BUILDING CODES

Approved building codes and standards are adopted by the Office of the State Architect (herein referred to as State Buildings Program (SBP)) and other state authorities, and are identified below. These minimum requirements are to be applied to all construction at state agencies and institutions of higher education owned facilities.

The 2021 edition of the International Building Code (IBC)

(As adopted by the Colorado State Buildings Program as follows: Chapter 1 as amended, Chapters 2-35 and Appendices C and I).

The 2021 edition of the International Existing Building Code (IEBC)

(As adopted by the Colorado State Buildings Program as follows: Chapters 2-16, Appendices A-C and Resource A) Effective December 2020.

The 2021 edition of the International Residential Code (IRC)

(As applicable)

The 2021 edition of the International Mechanical Code (IMC)

(As adopted by the Colorado State Buildings Program as follows: Chapters 2-15 and Appendix A)

The 2021 edition of the International Energy Conservation Code (IECC)

(As adopted by the Colorado State Buildings Program and Colorado Energy Office)

Colorado Model Electric Ready and Solar Ready Code

(Published by the Colorado Energy Office) Effective July 1, 2023

The 2023 edition of the National Electrical Code (NEC) (NFPA 70®)

(As adopted by the Colorado State Electrical Board) Effective July 30, 2023

The 2021 edition of the International Plumbing Code (IPC), first printing (March 2020)

(As adopted by the Colorado Examining Board of Plumbers Effective May 15, 2023)

The 2021 edition of the International Fuel Gas Code (IFGC) first printing (August 2020)

(As adopted by the Colorado Examining Board of Plumbers Effective May 15, 2023)

The National Fire Protection Association Standards (NFPA)

(As adopted by the Department of Public Safety/Division of Fire Prevention and Control)

The 2021 edition of the International Fire Code (IFC)

(As adopted by the Department of Public Safety/Division of Fire Prevention and Control (DFPC). Projects requiring DFPC review should be designed with the most restrictive requirements)

The 2015 edition of the ASME Boiler and Pressure Vessel Code

(As adopted by the Department of Labor and Employment/Boiler Inspection Section) Effective July 1, 2017.

The 2017 edition of the National Boiler Inspection Code (NBIC)

(As adopted by the Department of Labor and Employment/Boiler Inspection Section) Effective July 1, 2017.

The 2015 edition of the Controls and Safety Devices for Automatically Fired Boilers CSD-1

(As adopted by the Department of Labor and Employment/Boiler Inspection Section) Effective July 1, 2017.

The 2015 edition of the Boiler and Combustion Systems Hazards Code, NFPA 85

(As adopted by the Department of Labor and Employment/Boiler Inspection Section) Effective July 1, 2017.

The 2019 edition of ASME A17.1 Safety Code for Elevators and Escalators

(As adopted by the Department of Labor and Employment/Conveyance Section) Effective January 1, 2021.

The 2005 edition of ASME A17.3 Safety Code for Existing Elevators and Escalators

(As adopted by the Department of Labor and Employment/Conveyance Section Effective January 1, 2021.

The 2017 edition of ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts

(As adopted by the Department of Labor and Employment/Conveyance

The current edition of the Retail Food Establishment Rules and Regulations

(As adopted by the Department of Public Health and Environment/Division of Environmental Health and Sustainability)

The Current edition of ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities

As referenced in the adopted edition of the International Building Code.

The Secretary of the Interior's Standards for Rehabilitation

(As required by the Colorado State Historic Preservation Office for designated historic properties)

Note: Additional codes, standards and appendices may be adopted by the state agencies and institutions in addition to the minimum codes and standards herein adopted by State Buildings Programs.

1. The 2021 edition of the IBC became effective on July 1, 2022. Consult the state electrical and plumbing boards and the state boiler inspector and conveyance administrator and the Division of Fire Prevention and Control for adoption of current editions and amendments to their codes.
2. Projects should be designed and plans and specifications should be reviewed based upon the approved codes at the time of A/E contract execution. If an agency prefers to design to a different code such as a newer edition of a code that State Buildings Programs has not yet adopted, the agency must contact SBP for approval and then amend the A/E contract with a revised Exhibit C, Approved State Building Codes. Please note that the state plumbing and electrical boards enforce the editions of their codes that are in effect at the time of permitting not design.
3. The state's code review agents, or the State Buildings Programs approved agency building official, shall review all documents for compliance with the codes stipulated herein. Note: The Department of Public Health and Environment, Division of Consumer Protection will review drawings for food service related projects.
4. This policy does not prohibit the application of various life safety codes as established by each agency for specific building types and funding requirements. NFPA 101 and other standards notwithstanding, approved codes will supersede where their minimum requirements are the most restrictive in specific situations. If a conflict arises, contact State Buildings Programs for resolution.
5. It is anticipated that compliance with the federal Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) and Colorado Revised Statutes Section 9-5-101 will be met by compliance with the 2015 International Building Code and ICC/ANSI A117.1. However, each project may have unique aspects that may require individual attention to these legislated mandates.
6. The 2018 edition of the International Building Code (IBC) is to be applied to factory-built nonresidential structures as established by the Division of Housing within the Department of Local Affairs.

A. Appendices

Appendices are provided to supplement the basic provisions of the codes. Approved IBC Appendices are as follows:

1. Mandatory
 - IBC Appendix Chapter C - Agricultural Buildings
 - IBC Appendix Chapter I - Patio Covers

2. Optional

Any non-mandatory appendix published in the International Building Code may be utilized at the discretion of the agency. Use of an appendix shall be indicated in the project code approach.

B. Amendments

1. International Building Code, Chapter 1 as amended
2. International Building Code Chapter 29 as amended

AMENDMENTS TO THE *INTERNATIONAL BUILDING CODE*

CHAPTER 1

SCOPE AND ADMINISTRATION

PART 1—SCOPE AND APPLICATION

SECTION 101 GENERAL

101.1 Title. These regulations shall be known as the *Building Code* of the Department of Personnel & Administration/Office of the State Architect (DPA/OSA), hereinafter referred to as “this code”.

101.2 Scope. The provisions of this code shall apply to the construction, *alteration*, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

Exception: Detached one- and two-family *dwelling*s and multiple single-family *dwelling*s (*townhouses*) not more than three *stories* above *grade plane* in height with a separate *means of egress* and their accessory structures shall comply with the *International Residential Code*.

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted.

101.3 Intent. The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, *means of egress* facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

101.4 Referenced codes. The other codes listed in Sections 101.4.1 through 101.4.6 and referenced elsewhere in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference.

101.4.1 Gas. The provisions of the *International Fuel Gas Code* shall apply to the installation of gas piping from the point of delivery, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

101.4.2 Mechanical. The provisions of the *International Mechanical Code* shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

101.4.3 Plumbing. The provisions of the *International Plumbing Code* shall apply to the installation, *alteration*, repair and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances, and where connected to a water or sewage system and all aspects of a medical gas system.

101.4.6 Energy. The provisions of the *International Energy Conservation Code* shall apply to all matters governing the design and construction of buildings for energy efficiency.

SECTION 102 APPLICABILITY

102.1 General. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

102.2 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

102.3 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 and 102.4.2.

102.4.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

102.4.2. Provisions in referenced codes and standards. Where the extent of the reference to the referenced code or standard includes subject matter that is within the scope of this code or the International Codes listed in Section 101.4, the provisions of this code or the International Codes listed in Section 101.4, as applicable, shall take precedence over the provisions in the referenced code or standard.

102.5 Partial invalidity. In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

102.6 Existing structures. The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code or as is deemed necessary by DPA/OSA through its code review agent for the general safety and welfare of the occupants and the public.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION 104 DUTIES AND POWERS OF BUILDING OFFICIAL

104.1 General. DPA/OSA as the building official is hereby authorized and directed to enforce the provisions of this code. DPA/OSA shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify

the application of its provisions. Such interpretations, policies and procedures shall comply with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code. Note that Section 104 of this code is not a delegated responsibility, unless noted otherwise in the *Policies and Procedures: Basic Steps Checklists*.

104.2 Plan reviews. DPA/OSA through its code review agent shall review *construction documents* and issue compliance notices for the erection, and *alteration*, demolition and moving of buildings and structures and inspect the premises for which such compliance notices have been issued.

104.4 Inspections. DPA/OSA through its code review agent shall make all of the required inspections, or DPA/OSA shall have the authority to accept reports of inspection by *approved agencies* or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such *approved agency* or by the responsible individual. DPA/OSA is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise.

104.9 Approved materials and equipment. Materials, equipment and devices *approved* by DPA/OSA through its code review agent shall be constructed and installed in accordance with such approval.

104.9.1 Used materials and equipment. The use of used materials which meet the requirements of this code for new materials is permitted. Used equipment and devices shall not be reused unless *approved* by DPA/OSA through its code review agent.

104.10 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of this code, DPA/OSA shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative, provided DPA/OSA shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety, or structural requirements. Note, this is not a delegated responsibility. The details of action granting modifications shall be recorded and entered in the files of DPA/OSA.

104.10.1 Flood hazard areas. DPA/OSA shall not grant modifications to any provision required in *flood hazard areas* as established by Section 1612.3 unless a determination has been made that:

1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section 1612 inappropriate.

2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.

3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.

4. A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.

5. Submission to the applicant of written notice specifying the difference between the *design flood elevation* and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the *design flood elevation* increases risks to life and property.

104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where DPA/OSA through its code review agent finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability and safety.

104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from *approved* sources.

104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, DPA/OSA through its code review agent shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, DPA/OSA through its code review agent shall approve the testing procedures. Tests shall be performed by an *approved agency*.

SECTION 105 PLAN REVIEWS

105.1 Required. Any owner or authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first contact a DPA/OSA code review agent.

105.2 Work exempt from plan review. Exemptions from plan review requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Plan review shall not be required for the following:

Building:

1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet (11 m²).
2. Fences not over 6 feet (1829 mm) high.
3. Oil derricks.
4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.
5. Water tanks supported directly on grade if the capacity does not exceed 5,000 gallons (18 925 L) and the ratio

of height to diameter or width does not exceed 2:1.

6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or *story* below and are not part of an *accessible route*.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated swimming pools accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, do not exceed 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family *dwelling*s.
12. Window *awnings* supported by an *exterior wall* that do not project more than 54 inches (1372 mm) from the *exterior wall* and do not require additional support of Groups R-3 and U occupancies.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

Repairs and maintenance: Minor repair work, including the replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles.

Radio and television transmitting stations: The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.

Temporary testing systems: A plan review shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (5 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a plan review shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency, plan review information shall be submitted promptly to DPA/OSA through its code review agent.

105.2.2 Repairs. Application or notice to DPA/OSA through its code review agent is not required for ordinary repairs to structures, replacement of lamps or the connection of *approved* portable electrical equipment to *approved* permanently installed receptacles.

Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required *means of egress*, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include *addition* to, *alteration* of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

105.2.3 Public service agencies. A plan review shall not be required for the installation, *alteration* or repair of generation, transmission, distribution or metering or other related equipment that is under the ownership and control of public service agencies by established right.

105.4 Validity of compliance notice. The issuance or granting of a compliance notice shall not be construed to be an approval of any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. The issuance of a compliance notice based on *construction documents* and other data shall not prevent DPA/OSA through its code review agent from requiring the correction of errors in the *construction documents* and other data.

105.7 Placement of building inspection record. The building inspection record based on the compliance notice inspection recommendations shall be kept on the site of the work until the completion of the project.

SECTION 106 FLOOR AND ROOF DESIGN LOADS

106.1 Live loads posted. Where the live loads for which each floor or portion thereof of a commercial or industrial building is or has been designed to exceed 50 psf (2.40 kN/m²), such design live loads shall be conspicuously posted by the owner in that part of each *story* in which they apply, using durable signs. It shall be unlawful to remove or deface such notices

106.2 Issuance of notice of approval of occupancy/use. A notice of approval of occupancy/use required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.

106.3 Restrictions on loading. It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

SECTION 107 SUBMITTAL DOCUMENTS

107.1 General. Submittal documents consisting of *construction documents*, statement of *special inspections*, geotechnical report and other data shall be submitted. The *construction documents* shall be prepared by a *registered design professional* where required by the statutes of the state of Colorado. Where special conditions exist, DPA/OSA through its code review agent is authorized to require additional *construction documents* to be prepared by a *registered design professional*.

Exception: DPA/OSA is authorized to waive the submission of *construction documents* and other data not required to be prepared by a *registered design professional* if it is found that the nature of the work applied for is such that review of *construction documents* is not necessary to obtain compliance with this code.

107.2 Construction documents. *Construction documents* shall be in accordance with Sections 107.2.1 through 107.2.5.

107.2.1 Information on construction documents. *Construction documents* shall be dimensioned and drawn upon suitable material. *Construction documents* shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations.

107.2.2 Fire protection system shop drawings. Shop drawings for the *fire protection system(s)* shall be submitted to indicate conformance to this code and the *construction documents* and shall be *approved* prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

107.2.3 Means of egress. The *construction documents* shall show in sufficient detail the location, construction, size and character of all

portions of the *means of egress* including the path of the *exit discharge* to the *public way* in compliance with the provisions of this code. In other than occupancies in Groups R-2, R-3, and I-1, the *construction documents* shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.

107.2.4 Exterior wall envelope. *Construction documents* for all buildings shall describe the *exterior wall envelope* in sufficient detail to determine compliance with this code. The *construction documents* shall provide details of the *exterior wall envelope* as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive membrane and details around openings.

The *construction documents* shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the *construction documents* maintain the weather resistance of the *exterior wall envelope*. The supporting documentation shall fully describe the *exterior wall* system which was tested, where applicable, as well as the test procedure used.

107.2.5 Site plan. The *construction documents* submitted with the application for *permit* shall be accompanied by a site plan showing to scale the size and location of new construction and existing structures on the site, distances from *lot lines*, the established street grades and the proposed finished grades and, as applicable, flood hazard areas, floodways, and *design flood* elevations; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. DPA/OSA through its code review agent is authorized to waive or modify the requirement for a site plan when the application for *plan review* is for *alteration* or repair or when otherwise warranted.

107.2.5.1 Design flood elevations. Where *design flood* elevations are not specified, they shall be established in accordance with Section 1612.3.1.

107.3 Examination of documents. DPA/OSA through its code review agent shall examine or cause to be examined the accompanying submittal documents and shall ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

107.3.3 Phased approval. DPA/OSA through its code review agent is authorized to issue a compliance notice for the construction of foundations or any other part of a building or structure before the *construction documents* for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such compliance notice for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a compliance notice for the entire structure will be granted.

107.3.4 Design professional in responsible charge.

107.3.4.1 General.

The *registered design professional in responsible charge* shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.

107.3.4.2 Deferred submittals. For the purposes of this section, deferred submittals are defined as those portions of the design that are not submitted at the time of the plan review and that are to be submitted to DPA/OSA through its code review agent within a specified period.

Deferral of any submittal items shall have the prior approval of DPA/OSA through its code review agent. The *registered design professional in responsible charge* shall list the deferred submittals on the *construction documents* for review by DPA/OSA through its code review agent.

Documents for deferred submittal items shall be submitted to the *registered design professional in responsible charge* who

shall review them and forward them to DPA/OSA through its code review agent with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by DPA/OSA through its code review agent.

107.4 Amended construction documents. Work shall be installed in accordance with the *approved construction documents*, and any changes made during construction that are not in compliance with the *approved construction documents* shall be resubmitted for approval as an amended set of *construction documents*.

SECTION 108 TEMPORARY STRUCTURES AND USES

108.1 General. DPA/OSA through its code review agent is authorized to issue a compliance notice for temporary structures and temporary uses. Such compliance notice shall be limited as to time of service, but shall not be permitted for more than 180 days. DPA/OSA through its code review agent is authorized to grant extensions for demonstrated cause.

108.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, *means of egress*, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

108.3 Temporary power. DPA/OSA through its code review agent is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in NFPA 70.

SECTION 109 FEES

109.1 Payment of fees. Refer to DPA/OSA Building Code Compliance Policy.

SECTION 110 INSPECTIONS

110.1 General. Construction or work for which a plan review is required shall be subject to inspection by DPA/OSA through its code review agent and such construction or work shall remain accessible and exposed for inspection purposes until *approved*. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the holder of the notice to proceed to cause the work to remain accessible and exposed for inspection purposes. Neither DPA/OSA, its code review agent nor state agency shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

110.2 Preliminary inspection. Before issuing a compliance notice, DPA/OSA through its code review agent is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

110.3 Required inspections. DPA/OSA through its code review agent, upon notification, shall make the inspections set forth in Sections 110.3.1 through 110.3.10.

110.3.1 Footing and foundation inspection. Footing and foundation inspections shall be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete is ready mixed in accordance with ASTM C 94, the concrete need not be on the job.

110.3.2 Concrete slab and under-floor inspection. Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the subfloor.

110.3.3 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.5 shall be

submitted to DPA/OSA through its code review agent.

110.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, all framing, *fireblocking* and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are *approved*.

110.3.5 Lath and gypsum board inspection. Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or gypsum board joints and fasteners are taped and finished.

Exception: Gypsum board that is not part of a fire-resistance-rated assembly or a shear assembly.

110.3.6 Fire- and smoke-resistant penetrations. Protection of joints and penetrations in fire-resistance-rated assemblies, *smoke barriers* and smoke partitions shall not be concealed from view until inspected and *approved*.

110.3.7 Energy efficiency inspections. Inspections shall be made to determine compliance with Chapter 13 and shall include, but not be limited to, inspections for: envelope insulation *R*- and *U*-values, fenestration *U*-value, duct system *R*-value, and HVAC and water-heating equipment efficiency.

110.3.8 Other inspections. In addition to the inspections specified above, DPA/OSA through its code review agent is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by DPA/OSA.

110.3.9 Special inspections. For *special inspections*, see Section 1704.

110.3.10 Final inspection. The final inspection shall be made after all work required is completed.

110.3.10.1 Flood hazard documentation. If located in a *flood hazard area*, documentation of the elevation of the lowest floor as required in Section 1612.5

shall be submitted to DPA/OSA prior to the final inspection.

110.4 Inspection agencies. DPA/OSA through its code review agent is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

110.5 Inspection requests. It shall be the duty of the holder of the notice to proceed or their duly authorized agent to notify DPA/OSA through its code review agent when work is ready for inspection. It shall be the duty of the notice to proceed holder to provide access to and means for inspections of such work that are required by this code.

110.6 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of DPA/OSA through its code review agent. The code review agent, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the holder of the notice to proceed or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code review agent.

SECTION 111 CERTIFICATE OF OCCUPANCY

111.1 Use and occupancy. No building or structure shall be used or occupied, and no change in the existing occupancy classification of a building or structure or portion thereof shall be made, until DPA/OSA has issued a notice of approval of occupancy/use therefor as provided herein. Issuance shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction.

Exception: Notices of approval of occupancy/use are not required for work exempt from plan review under Section 105.2.

111.3 Temporary occupancy. DPA/OSA is authorized to issue a temporary notice of approval of occupancy/use for discrete portions of work before the completion of the entire work provided that such portion or portions shall be occupied safely.

EXHIBIT A

CHAPTER 29

PLUMBING SYSTEMS

The following requirements take precedence over Chapter 29 of the *International Building Code*, *International Existing Building Code* and the *International Plumbing Code*.

**[P] 2904
STATE OF COLORADO REQUIREMENTS
AMENITIES FOR ALL GENDERS**

2904.1 DEFINITIONS.

- (1) "Accessible to the Public" means any indoor or outdoor space or area that is open to the public. This does not include private offices or workspaces that are generally not open to customers or public visitors.
- (2) "Certified Historic Structure" means a property located in Colorado that has been certified by the state historical society or an entity other than the owner of the property that is authorized, pursuant to section 24-80.1-105 (1), to nominate properties to the state register of historic properties as a historic structure because it has been:
 - (a) listed individually on, or as a contributing property in a district included within, the national register of historic places;
 - (b) listed individually on, or as a contributing property in a district that is included within, the state register of historic properties pursuant to C.R.S article 80.1 of title 24; or
 - (c) listed individually by, or as a contributing property within a designated historic district of, a certified local government.
- (3) "Gender-Specific Restroom" means a restroom that is designated for use by only one gender.
- (4) "LGBT Individual" means an individual who is a member of the lesbian, gay, bisexual, transgender, and non-binary community.
- (5) "Non-Gendered Multi-Stall Restroom" means a restroom with multiple toilets that is available for use by people of any gender, including a restroom with shared sinks but each toilet is in a private compartment.

- (6) "Non-Gendered Single-Stall Restroom" means a restroom that is available for use by people of any gender that is a fully enclosed room with a locking mechanism controlled by the user and contains a sink, toilet, and no more than one urinal.
- (7) (a) "Renovation of a Restroom" means construction to a restroom:
 - (I) for which a permit is required other than for a repair; and
 - (II) that includes changing the structure by:
 - (A) increasing the square footage;
 - (B) installing or modifying a plumbing or electric system;
 - (C) adding, gutting, or removing exterior restroom walls; or
 - (D) installing a heating, ventilation, or air conditioning system.
- (b) For purposes of this section, renovation does not include repairs to or replacement of fixtures or features of the restroom in order to restore something that is damaged, deteriorated, or broken in a restroom to its original function that does not meet the criteria described in subsection (7)(a) of this section.
- (8) "Public Entity" means a state department or state agency, state institution of higher education, as defined in C.R.S. 23-18-102 (10), a county, a city and county, or a municipality. A state agency does not include any building owned and operated as an education facility by the Department of Education or a school district, charter school, or institute charter school.

2904.2 RESTROOMS.

- (1) On and after January 1, 2024, a building that is wholly or partially owned by a public entity that is:

(a) Scheduled for renovation of a restroom must:

- (I) Provide a non-gendered single-stall restroom or a non-gendered multi-stall restroom where a restroom is accessible to the public;
- (II) Ensure that any single-stall restroom is not a gender-specific restroom;
- (III) Allow for the use of a multi-stall restroom by any gender if certain facility features are met pursuant to the IPC or any subsequent *International Plumbing Code* adopted as part of the *Colorado Plumbing Code* and the *Colorado Fuel Gas Code* adopted by the State Plumbing Board pursuant to C.R.S 12-155-106;
- (IV) Provide any caregiver on the gender binary that is caring for an infant access to at least one safe, sanitary, and convenient baby diaper changing station where a restroom is accessible to the public as follows:
 - (A) if only gender-specific restrooms are available, at least one changing table in each restroom;
 - (B) if a non-gendered single-stall restroom is available, at least one changing table in that restroom, and public entities are encouraged to also provide changing tables in each of the single-stall gender-specific restrooms;
 - (C) if a non-gendered multi-stall restroom is available, at least one changing table in that restroom, and public entities are encouraged to also provide changing tables in each of the gender-specific restrooms; or
 - (D) an easily accessible location with equivalent privacy and amenities as a restroom; and
- (V) Ensure that each baby diaper changing station is maintained, repaired, and replaced as necessary to ensure safety and ease of use and cleaned with the same frequency as the restroom in which it is located or restrooms on the same floor or in the same

space if the changing table is located in a restroom.

(b) A newly constructed building on each floor must:

- (I) Provide a non-gendered single-stall restroom or a non-gendered multi-stall restroom on each floor where a restroom is accessible to the public;
- (II) Ensure that any single-stall restroom is not a gender-specific restroom;
- (III) Allow for the use of a multi-stall restroom by any gender if certain facility features are met pursuant to the IPC. Or any subsequent *International Plumbing Code* adopted as part of the *Colorado Plumbing Code* and the *Colorado Fuel Gas Code* adopted by the State Plumbing Board pursuant to C.R.S 12-155-106; and
- (IV) Provide any caregiver on the gender binary that is caring for an infant access to at least one safe, sanitary, and convenient baby diaper changing station that is accessible to the public on each floor where there is a restroom accessible to the public and that includes:
 - (A) if only gender-specific restrooms are available, at least one changing table in each restroom;
 - (B) if a non-gendered single-stall restroom is available, at least one changing table in that restroom, and public entities are encouraged to also provide changing tables in each of the single-stall gender-specific restrooms;
 - (C) if a non-gendered multi-stall restroom is available, at least one changing table in that restroom, and public entities are encouraged to also provide changing tables in each of the gender-specific restrooms; or
 - (D) an easily accessible location with equivalent privacy and amenities as a restroom; and
- (V) Ensure that each baby diaper changing station is maintained, repaired, and replaced as necessary to ensure safety and ease of

use and cleaned with the same frequency as the restroom in which it is located or restrooms on the same floor or in the same space if the changing table is not located in a restroom.

(2) On and after July 1, 2025, a building that is wholly or partially owned by a public entity that:

(a) Is accessible to employees or enrolled students and that is scheduled for renovation of a restroom must:

(I) Provide a non-gendered single-stall restroom or a non-gendered multi-stall restroom;

(II) Ensure that any single-stall restroom is not a gender-specific restroom; and

(III) Allow for the use of a multi-stall restroom by any gender if certain facility features are met pursuant to the IPC or any subsequent *International Plumbing Code* adopted as part of the *Colorado Plumbing Code* and the *Colorado Fuel Gas Code* adopted by the State Plumbing Board pursuant to C.R.S 12-155-106; and

(b) Is a newly constructed building on each floor must:

(I) Provide a non-gendered single-stall restroom or a non-gendered multi-stall restroom;

(II) Ensure that any single-stall restroom is not a gender-specific restroom; and

(III) Allow for the use of a multi-stall restroom by any gender if certain facility features are met pursuant to the IPC or any subsequent *International Plumbing Code* adopted as part of the *Colorado Plumbing Code* and the *Colorado Fuel Gas Code* adopted by the State Plumbing Board pursuant to C.R.S 12-155-106.

(3) **EXCEPTIONS.** Subsections (1) and (2) of this section do not apply to the renovation of a restroom or a newly constructed building project if:

a. A local building permitting entity or building inspector determines that the installation of a baby diaper changing station in accordance with

subsection (1)(d) of this section would result in a failure to comply with applicable building standards governing the right of access for individuals with disabilities. the permitting entity or building inspector may grant an exemption from the requirements of this section under those circumstances, provided that there is documentation demonstrating that no alternative design is possible that complies with the right of access for individuals with disabilities and a good faith attempt has been made to design a restroom in a manner that would accommodate individuals with disabilities and the installation of a baby diaper changing station in accordance with subsection (1)(d) of this section.

b. The project has already progressed through the design review process, budgeting, and final approval by the governing body that has final approval over capital construction project expenditures as of the August 8, 2023

(a) The building is designated as a certified historic structure.

2904.3 SIGNAGE.

(1) Beginning July 1, 2024, but no later than July 1, 2026, subject to available appropriations for public entities that are a state agency, a building that is wholly or partially owned or leased by a public entity must ensure that signage for the building or the portion of the building leased or owned complies with the following signage requirements:

(a) Any restroom with a baby diaper changing station must have signage with a pictogram void of gender that indicates the presence of the baby diaper changing station;

(b) Any non-gendered multi-stall restroom or single-gendered or non-gendered single-stall restroom must have signage with a pictogram void of gender;

(c) Each building that is accessible to the public must include signage at or near the entrance to the building indicating the location of restrooms and baby diaper changing stations. If there is a central directory accessible to the public identifying the location of offices, restrooms, and other facilities in the buildings, that central directory must indicate with a pictogram void

of gender the location of any baby diaper changing station and the location of any non-gendered multi-stall restroom or single-stall restroom.

- (d) All buildings accessible to the public with non-gendered multi-stall restrooms or non-gendered single-stall restrooms must update signage, if necessary, to include a pictogram void of gender.

2904.4 ACCESSIBILITY.

- (1) All restrooms subject to 2904 shall comply with the current "**ADA Standards for Accessible Design**" set forth in 28 CFR 35, applicable to public entities and promulgated in accordance with the federal "Americans with Disabilities Act of 1990", 42 U.S.C. sec. 12101 et. seq., as amended.

End of Exhibit A: Amendments to the IBC

APPENDIX F

COST PROPOSAL FORM

DESIGN/INSTALL, PROCESS ENGINEERING SERVICES

Date: _____

Project Titled: Nanophotonics Cleanroom

1. Cleanroom Layout / Design	\$ _____
2. Process Engineering	\$ _____
3. Installation Cost	\$ _____
Subtotal Design / Install / Process Engineering Cost	\$ _____
4. Optional Scope #1: Toxic Gas Monitoring System	\$ _____
5. Optional Scope #2: Exhaust/Scrubber System	\$ _____
6. Optional Scope #3: N2 Generation and Distribution	\$ _____
7. Optional Scope #4: Processed Chilled Water Distribution	\$ _____
8. Optional Scope #5: Ultra-Pure Water System	\$ _____
9. Optional Scope # 6: Electrical Distribution to Tool Sites within the Cleanroom	\$ _____
Subtotal Optional Scope	\$ _____
Potential Total Cost	\$ _____