Housing and Dining Facilities (HDS) has adopted amendments for all HDS facilities. Confirm applicable standards with Project Representative on a per Project basis. Refer to HDS amendments here – https://housing.colostate.edu/about/construction/.

DIVISION 11 – EQUIPMENT

11 00 00 – GENERAL INFORMATION

A. Fixed and Movable Equipment:

1. Fixed equipment shall generally be furnished and installed by the Contractor as part of the Agreement.

2. Movable equipment shall, as a rule, be a separate bid item not included in the General Agreement.
    a. Provisions for installation however, (mechanical, electrical and plumbing), may be included in the Agreement.

11 10 00 – VEHICLE AND PEDESTRIAN EQUIPMENT

A. Vehicle Service Equipment:

1. Fuel islands must have high volume pumps and be capable of pumping diesel fuel.

2. Pumping stations for Alternative Fuels to include cascade pumping with pressure control.

3. Pumping stations shall meet NEC, NFPA–30 and UFC 79.

B. Bicycle and Pedestrian Counter – Infrared Detector and Inductive Loops:

1. The bicycle and pedestrian counter collects counts bi–directionally using an infrared ‘pyro’ sensor for pedestrians and a combination of the pyro sensor and inductive loops placed in the trail or road surface.
    a. The information collected is binned in 15–minute intervals which is uploaded via the cell network daily to the cloud for analysis.

2. Installation:
    a. The counter is installed by insetting and cutting inductive loop into shared use trail or bicycle lane.
    b. Rainbird housing is set at grade below surface of trail and connects with inductive loop and pedestrian counter (pyro sensor) is installed adjacent to trail/lane.

3. Vendor:
    a. Eco–Counter

4. Model:
    a. Urban Zelt with Pyro Sensor

5. Features:
    a. Rainbird housing
    b. Battery
    c. Counter
    d. Cellular

e. Inductive loop
f. Pre–fabricated post with pyro sensor

11 11 36 – VEHICLE CHARGING EQUIPMENT

A. Campus vehicle chargers shall be dual pedestal (or wall) style with Level 2 power charging (208V, 1ph, 30A) with a minimum circuit and overcurrent rating of 40 amperes.

B. New Construction and Additions:

1. Provide sufficient capacity in an electrical panelboard to accommodate four dual Level 2 chargers.

2. Provide sufficient conduit runs from the electrical panelboard in (a) to a “future EV” area as designated by Project Representative/Project Team.
   a. Conduit shall be able to accommodate four 40A circuits.

3. Provide minimum 1/2” conduit for future telecommunications wiring routed from Building telecom room to “future EV” area.

C. Retrofit of Existing Buildings:

1. Provide future infrastructure, as outlined under New Construction section, where the retrofit or renovation of an existing building permits the simple facilitation.

11 40 00 – FOODSERVICE EQUIPMENT

A. Foodservice Equipment:

1. All food service equipment and installation shall be approved by Colorado State University (CSU) Environmental Health Services (EHS) and shall be coordinated with the Project Representative.

2. All food service equipment shall be approved and stamped with National Sanitation Foundation (NSF) numbers.

3. Food service equipment shall be ENERGY STAR rated, where possible.

11 53 00 – LABORATORY EQUIPMENT

A. Storage Cabinets:

1. Approved storage cabinets shall be provided to eliminate the storage of chemicals in fume hoods.

2. Storage cabinets may be vented into laboratory dedicated Exhaust Systems.
   a. Consult with EHS regarding the venting of storage cabinets.
   b. PVC is not permissible for ducting of flammables cabinets.

3. PVC shall be used for venting of acid and other chemical storage cabinets.
   a. Vent ducting for flammable storage cabinets must be of the same or greater gauge as the cabinet.
   b. Do not provide cabinet fans.
   c. Typical exhaust rates shall be <50 cfm, or as indicated by the Manufacturer.

4. Provide adequate space in room layout for storage cabinets;
    a. If this is not possible, provide storage bases for fume hoods.

B. Sterilizing Equipment:

1. Sterilizers shall be provided with new steam generators.

2. Natural gas, electric or plant steam may be used as primary energy source.

3. Do not use plant steam directly for sterilizing due to potential future changes to water treatment chemicals.
    a. Plant steam can be used with water–to–steam heat exchangers.

4. Provisions may be necessary for separate piping to building steam supply with a dedicated steam regulator for water–to–steam heat exchangers.

5. Sterilizers shall be specified based on the required operational temperature needed for the particular research program using the lab.

6. The Project Team shall notify, through the Project Representative, Facilities Management (FM) Operations to set up outside Service Agreement.

11 53 13 – LABORATORY FUME HOODS

A. Laboratory Fume Hoods:

1. Acceptable types of fume hoods include bypass with constant volume and conventional with variable air volume control.
    a. Unacceptable types include conventional and auxiliary air.

2. Fume hoods marketed and certified through testing by Manufacturer as “High Performance”, “Low–Flow”, “High Efficiency” or similar model identification are preferred specification.
    a. Hoods not marketed and/or tested as such shall be required to operate at higher values and may be discounted or deemed not acceptable due to energy inefficiencies.

3. Biological safety hoods are not fume hoods and have a different set of design parameters, but generally follow the same design process.
    a. Biological safety hoods and fume hoods cannot be connected with common ductwork or fans.

4. Other types of exhaust devices such as canopy hoods, storage cabinets, slot hoods, snorkels, flow benches etc. shall not be accepted as substitutes for fume hoods.

5. Design and installation of fume hoods is strictly controlled according to the following procedures:
    a. User identifies to Project Representative requirements for fume hoods which include type (horizontal or vertical sash, bench or floor mount), size, number, and list chemicals and compatibilities.
    b. Project Representative submits requirements and chemical list to EHS for review.
    c. All new hood installations must be capable of sustaining the utilization of highly toxic chemicals/ materials.
    d. Hood performance and testing data shall determine acceptable uses for the fume hood and required face velocity.
    e. The Classification and chemical list shall be submitted to Mechanical Engineer to use in

designing the Exhaust Duct and Fan System and selection of suitable materials.

6. Fume hoods require outside air makeup through the Central System or with dedicated HVAC Systems.
   a. Fume Hood Exhaust Systems shall not be connected to general Building Exhaust Systems.
   b. However, Exhaust Systems dedicated to the laboratory where hood is located can be connected to hood exhaust.

7. Bypass Type Fume Hoods are specified unless the total accumulated exhaust flow in air exchanges per hour exceeds the industry standard for that conditioned space.
   a. At that point it shall be necessary to provide VAV control to maintain the face velocity on the fume hood at prescribed or specified levels (determined by hood performance ratings and data and recommendations of EHS), without the aid of a by–pass section on the hood.

8. All fume hoods shall have face velocity audible and visual alarms.

9. Integral vacuum breakers for faucets are required but are not permitted inside of the hood.

10. Other standards for the Exhaust System, ductwork, air balance, controls and utilities are identified in Division 23 – HVAC.

11. The Manufacturer shall guarantee all materials and workmanship provided for a period of one year from date of Notice of Acceptance.
   a. Any defects due to the use of improper material or workmanship on the part of the Manufacturer occurring within that time shall be promptly rectified, by repair or replacement of the defective materials or correction of defective workmanship by Manufacturer at their own expense, after notification by the Project Representative.

B. Submittals:

1. Product Data:
   a. Submit Manufacturer's data for each component and item of laboratory equipment specified.
   b. Include component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements indicate location, size and service requirements for each utility connection.
   c. Refer to Division 01 – General Requirements for additional requirements.

2. Test Data:
   a. Submit test reports on each size and type of chemical fume hood verifying point of manufacture conformance to test performances specified below:
      i. American Society of Heating, Refrigerating and Air–Conditioning Engineers (ASHRAE) 110 – Latest edition
   b. Sound level compliance of the following maximum criteria:
      ii. Test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. All readings taken 3’–0” in front of full open sash at 110 fpm face velocity.

3. ASHRAE 110 test report (as manufactured) for each fume hood type
   a. Test one fume hood of each type and size specified in accordance with the method prescribed in ANSI/ASHRAE 110.
   b. The minimum overall performance rating of each test shall be 4.0 AM 0.05 pm with 4.0

equal to liters per minute of tracer gas release, AM identifying as manufactured test, and 0.05 indicating the level of tracer gas control in parts per million.

i. Test shall be performed at 50 fpm face velocity with the sash at 28" open or greater (fully open position).

c. Hood test shall take place in the Manufacturer's test facility with testing personnel, samples, apparatus, instruments, and test materials supplied by the Manufacturer at no cost to the buyer.

d. All submittals shall include numerical and graphical data showing the relationship between Containment, cfm, face velocity and sash height from 12" to fully open position.
   i. Test requirements shall meet or exceed the standards of ASHRAE–110.

e. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.
   i. Hood shall achieve a rating of 4.0 AM 0.05 PPM or better containment and indicate conditions and volume of leakage at the point of failure.

f. Submit a test report, for each hood tested for the following in addition to ASHRAE–110 test results.
   i. Set condition A:
      a) 18" sash height/face velocity 80 fpm
   ii. Set condition B:
      a) 18" sash height/face velocity 95 fpm
   iii. Provide sash height where face velocity drops to 60 fpm for both set conditions.
   iv. Provide face velocity at full open sash for both initial and final set conditions.
   v. Provide face velocity and sash height measurements indicating performance conditions that fail to meet ASHRAE 110 minimum containment standards.
   vi. Operation and Maintenance Manuals:
      a) Submit two copies of written instructions for fume hoods.

C. Quality Assurance:

1. Single Source Responsibility:
   a. Laboratory fume hoods shall be manufactured and/or furnished by a single laboratory supplier.
   b. Proposals from brokers, multiple suppliers or Manufacturers shall not be accepted.

2. Manufacturer:
   a. Design of chemical fume hoods are based on high performance products manufactured by Fisher Hamilton, Inc., Kewaunee and Labconco.
   b. Equal or better products may be proposed for substitution by another Manufacturer, provided they meet applicable industry standards such as indicated by Scientific Equipment and Furniture Association (SEFA) and ASHRAE for product design and performance.
   c. In all cases, chemical fume hoods shall be the product of one Manufacturer for any one construction project.

3. Experience:
   a. The supplier shall have furnished installations of equal or larger size and requirements within the last five years.
   b. The supplier shall provide products of established Manufacturers with production facilities that include test facilities in the manufacturing plant, and with ten years or more experience in manufacture of laboratory and equipment of type specified.

4. Required testing shall be validated by a third–party.

5. UL 1805 testing and certification shall be performed by a UL certified testing laboratory.

D. Design and Performance Requirements:

1. Fume hoods shall function as ventilated, enclosed work spaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

2. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20% of the average face velocity at any designated measuring point as defined in this section.

3. Fume hood shall be designed to minimize static pressure loss with adequate slot area and bell–shaped exhaust collar configuration.

4. Provide testing as required by SEFA – Latest edition "Laboratory Fume Hoods, Recommended Practices."

Face Velocity – full open sash	Measured S.P.L. (W.G.)
100 FPM	.36 inches
80 FPM	.23 inches
60 FPM	.13 inches

5. Metal finish performance requirements:
   a. Manufacturer shall provide verification of metal finish performance.
   b. Testing to be performed by independent testing agency, which adheres to SEFA 8 requirements.

E. Fume Hood Type:

1. Bypass Type Fume Hoods are specified unless the total accumulated exhaust flow from the conditioned space in air exchanges per hour exceeds the industry standard.
   a. Constant volume type with built–in automatic compensating bypass to maintain constant exhaust volume regardless of sash position.
   b. Fume hoods must be capable of maintaining 80 fpm (high performance models) or 105 fpm (standard models) minimum face velocity through the sash opening with the sash door at 18", measured from the top of the air foil.
   c. Provide sash stops located 18" above working surface and with override release.
   d. Bypass:
      i. Positive in action and controlled by the sash operation
   e. Low impedance, directionally louvered panel provided in the bypass area. Designs which require all bypass air to enter hood over front solid panel shall not be acceptable.
   f. As sash is lowered to 6", bypass design shall limit the increase in face velocity to maximum of three times the average face velocity with the sash fully open.

2. VAV type fume hood control shall be specified to maintain the face velocity on the fume hood at 80 fpm at 18'–0" (high performance models as marketed and officially tested by manufacture) or 105 fpm at 18" (standard performance hoods failing to meet accepted or expected containment values as compared to High Performance Low Flow counterparts) without the aid of a by–pass section on the hood if the total accumulated exhaust flow from the conditioned space in air exchanges per hour exceeds the industry standard.

3. Pressure independent air valve duct exhaust devices equal to or exceeding Phoenix Controls

shall be acceptable VAV devices.
   a. Substitutions shall only be accepted with prior approval from FM Engineering.

F. Fume Hood Construction:

1. Fume hood construction shall be in accordance with all SEFA, ASHRAE, OSHA, NEC and NFPA guidelines

2. Mechanical and Electrical Fixtures:
   a. Fume hood service fixtures and fittings and related mechanical and electrical service fixtures shall be furnished, installed and internally wired and piped for single point final connection by the Mechanical and Electrical Contractors.

3. Each hood shall be demonstrated by the Equipment Contractor to properly function in accordance with the Specifications.

G. Alarms:

1. Safety Monitor/Alarm System:
   a. Fisher Hamilton Model 54L0405, or equal
   b. Where shown or specified provide Safety Monitor/Alarm System which monitors face velocity and provides audible and visual alarm if face velocity drops below or rises above pre–set values.

2. Safety Monitor:
   a. UL listed, tamper proof, with all alarm circuits, electric components, external tubing, restrictors, and manifolds furnished complete and factory installed.
   b. Monitor shall have light emitting diode display which provides clear indication of airflow conditions.
   c. Field calibrate monitor based upon user–specified face velocity.

3. Airflow Sensor:
   a. Thermally compensated glass–beaded thermistor, factory connected to a sidewall connection.
   b. Thermistor alarms with hot wire in hood sidewall shall not be acceptable.

4. Alarm Signal:
   a. Audible signal and a visual, red, green emitting diode.
   b. Have no input or output capabilities. Low flow set point. No display.
   c. Silence push button, which disables the audible alarm for a period of five minutes, shall be accessible on the front of the Safety Monitor.
   d. Provide alternate mode in which audible alarm is silenced indefinitely but visual alarm remains activated until the alarm condition is corrected.
   e. It shall not be possible to routinely disable the alarm signal.
   f. When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor shall automatically reset and begin routine monitoring.
   g. Test circuit shall be provided to verify proper Safety Monitor operation.
   h. Maximum 12 VDC, and maximum current rating of 200MA.

H. Work Surfaces:

1. Dished Epoxy Resin Work Surface:

a. Manufacturers:
    i. Laboratory Tops, Inc.
    ii. The Durcon Company
    iii. Epoxyn Products
    iv. Or equal
b. Material shall be a 1–1/4” monolithic modified epoxy resin product and shall consist of a cast resin material formulated to provide a work surface with high chemical resistance characteristics.
c. A combination of epoxy resins and inert materials, oven–cured in molds to obtain maximum chemical resistance then removed from the molds and oven tempered to achieve maximum physical strength and stability.
d. Surfaces shall have a uniform low–sheen surface and the finished material shall be extremely hard and resistant to scratches and abrasion.

2. Cup Sinks:
    a. Oval epoxy resin cup sinks:
        i. Provide where noted on Drawings
    b. Manufacturers:
        i. Laboratory Tops, Inc.
        ii. The Durcon Company
        iii. Epoxyn Products
        iv. Or equal
    c. Oval flush mounted cup sinks shall be of molded epoxy resin and shall be flush mounted.
    d. Cup sink size shall be nominal 5–5/8" long by 2–5/8" wide by 4–1/4" deep (inside dimensions).
    e. Cove inside corners and pitch bottom to 1–1/2" NPSM outlet with 1–1/2" NPSM threaded tailpiece.

I. Base Cabinets and Tables:

1. All cabinetry supplied shall be in compliance with SEFA 8–Latest edition as a minimum standard.

J. Fume Hood Installation:

1. Installation of the fume hood and associated equipment shall be in accordance with the Engineer’s design and planned use of the equipment.

2. Field quality control, testing, and adjusting of fume hoods (as installed) are to be performed by certified personnel.

3. NEBB, ASHRAE 110 – Latest edition and SEFA–1 requirements are recognized standard for procedures and reporting methods as they pertain to TAB.
    a. These methods are to be adhered to unless prior arrangements are made with FM and EHS personnel.

4. Test Reports:
    a. Provide the Architect and Project Representative with a record of all preliminary tests, adjustments and balance information in NEBB format.

5. Testing Equipment:
    a. Properly calibrated Shortridge Airdata Model No. 860 electronic manometer and Velor grid, or equal.

b. Test Procedure shall be complaint with Manufacturer, SEFA LF–1–1992, NEBB practices, ASHRAE 110, or an alternate as agreed upon by representatives of FM and EHS.
c. Provide Project Representative with Balance Report of all TAB results.

K. References:

1. SEFA Standard 1.2, Laboratory Fume Hoods – Recommended Practices
2. ASHRAE–110
3. ANSI 2.95
4. NFPA

END OF DIVISION