

SECTION 11 71 02
LABORATORY WASHING AND STERILIZING EQUIPMENT

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project.
2. Delete other items or paragraphs in section that are not applicable and renumber the paragraphs.
3. Add additional detail and requirements as needed to meet the specific criteria of the installation.

PART 1 - GENERAL

1.1 DESCRIPTIONS

- A. This section specifies Laboratory Washing and Sterilization Equipment including laboratory glassware and utensil washers, steam sterilizers, drying ovens, cage and cart washers, animal water bottle washers/fillers, animal cage and rack washers, animal bedding dispensers, animal bedding disposal equipment, glassware dryers, ice machines, exhaust hoods, flushing rack systems, steam guns, instrument washer, detergent dispensing units, and water purification systems.

1.2 DEFINITIONS

- A. Glassware and Utensil Washer: An automated washing unit that uses high-temperature water and detergent to clean and disinfect instruments and lab glassware.
1. Under-counter Model - Single chamber washer/disinfector.
 2. Counter-top Model - Single chamber washer/disinfector.
 3. Free standing Model - Multiple chamber washer/disinfector.
- B. Steam Sterilizer: A machine used to sterilize instruments and equipment by subjecting them to high-pressure steam up to 135 degrees C (275 degrees F). Sterilizers are available in both cart-loading and counter-top models. They can be either freestanding or recessed, with single or double doors (pass-thru). Steam sterilizers are also known as autoclaves. More efficient models employ a vacuum pump to remove air from the chamber prior to a sterilization cycle, thus providing more efficient steam sterilization. In animal facilities or other high throughout environments, autoclaves with very large floor-level chambers capable of accepting "roll-in" racks of cages or other items may be needed.

- C. **Drying Oven:** Freestanding cabinet used to dry equipment with forced, filtered air and variable temperature settings. There are single door and pass-thru units available.
- D. **Cage, Utensil & Cart Washer:** An automated washing unit that uses high-temperature water and detergent to clean and high-level disinfect cages, utensils and carts. Units are generally large enough to readily roll entire racks or carts directly into the washing chamber.
- E. **Water Bottle Filler:** Used for efficiently filling animal water bottles placed in specially designed baskets such that an entire basket is filled at one time.
- F. **Counter-top Sterilizer:** A counter top mounted or free-standing machine used to sterilize instruments.
- G. **Sterilizer Enclosure Panels:** Removable Stainless Steel metal panels used to fill the gaps between the tops and sides of freestanding sterilizers to the surrounding walls and ceilings while allowing service access.
- H. **Glassware Dryer:** Unit for the post-wash drying of laboratory glassware and utensils.
- I. **Ice Machine:** Machine capable of making, holding, and dispensing ice. Volume production, total storage capacity and type of ice to be specified to meet the specific project demands.
- J. **Exhaust Hood:** Exhaust canopy hood for venting heat, steam, moist air, and odors. Frequently placed over autoclave doors and entry/exit locations on other equipment when moisture or steam is expected to enter the environment from the equipment.
- K. **Animal Housing Rack Manifold Flushing System (Manifold Flusher):** provides hardware to sanitize automatic watering pipes (the "manifold") installed in animal housing racks for use with automatic watering systems. Some equipment also incorporates fittings to sanitize flexible recoil hoses used to attach manifolds in animal racks to automatic watering supply pipes in the animal room (if not, a separate recoil hose sanitizing "station" may be needed).
- L. **Steam Gun:** Hand held hose and high pressure steam spray wand used in manually washing cages, carts, and other large containers.
- M. **Bedding Dispenser:** Unit for the dispensing of bedding for laboratory animal cages. Some units can be integrated into the cage wash workflow such that dry cages exiting a washer automatically pass through the dispenser to be filled with a preset amount of clean bedding.

- N. Bedding Disposal Unit: Unit for the disposal of bedding from laboratory animal cages. These units typically incorporate both a pre-filter and a HEPA filter to remove potential pathogens from exhaust air; to provide optimal odor and allergen control, they should be directly vented to the room exhaust.
- O. Detergent Dispensing System: A mechanical system that dispenses measured doses of detergent or other chemicals directly to washer disinfectors and cart washers.
- P. Water Treatment System: A mechanical system for use with steam sterilizers, washer/disinfectors and cart washers, that decreases contaminants in the domestic water to reduce boiler scaling and instrument spotting.
- Q. Tunnel Washer: A multiple chamber automated washing unit that uses high-temperature water and detergent to clean and disinfect cages, and utensils.
- R. Recoil Hose Flush Station: A manifold system for flushing multiple recoil hoses simultaneously.
- S. Chlorine Injector Station: For automatically injecting chlorine into water used for Recoil Hose Flush Stations, Reverse Osmosis Systems, and other applications.
- T. Rack Manifold Chlorine Flush Station: A system to chlorine sanitize and flush the internal surfaces of automated watering manifold racks.
- U. Central Compressed Air System: A system to provide 'oil free' and contaminate free compressed to equipment where compressed air is an optional feature.
- V. Bedding Dump Station: Unit for the disposal and packing of bedding and animal waste from laboratory animal cages. These units typically incorporate both pre-filters and a HEPA filters to reduce aerosolized contaminants and minimize personnel exposure to air borne particulate.

1.3 RELATED WORK

- A. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
- B. Section 22 11 00, FACILITY WATER DISTRIBUTION: Plumbing Connections.
- C. //Section 22 13 00, FACILITY SANITARY AND VENT PIPING: Plumbing Connections.
- D. Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS: Connections to Compressed Air System.
- E. Section 22 31 11, WATER SOFTENERS.
- F. //Section 22 40 00, PLUMBING FIXTURES.//

- G. //Section 22 66 00, CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES: Plumbing Connections. //
- H. Section 22 67 19.16, REVERSE OSMOSIS WATER EQUIPMENT.
- I. Section 22 67 21, WATER DEALKALIZING SYSTEM.
- J. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- K. Section 23 08 00, COMMISSIONING OF HVAC SYSTEM
- L. //Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Remote monitoring of the Steam Sterilizers. //
- M. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING: Steam Connections//, Steam Gun//.
- N. Electrical Connections: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 PERFORMANCE REQUIREMENTS

SPEC WRITER NOTE: Check with user to verify service characteristics required for equipment.

- A. Equipment shall have built-in monitoring for timed cycles, and control devices for temperature and pressure. Equipment shall have a printer, either integrated or remote, for recording cycle time, temperature, and pressure.
- B. Manufacturer safeguards must be provided with the equipment to protect the operator from harm during normal operation of the equipment.
- C. As needed in the application, provide a means of preventing accidental tampering with cycle times and parameters, via electric or physical safeguards.
- D. Provide water use reduction cycles and features where available. For instance, equipment utilizing steam should scavenge steam instead of wasting cold water to condition hot water/steam prior to entering drains.
- E. Provide energy use reduction cycles and features where available.

1.5 QUALITY CONTROL

- A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC: Quality Assurance 1.3.D - Products Criteria.
- B. Mechanical, electrical, and associated systems shall be safe, reliable, efficient, durable, easily and safely operable, maintainable, and accessible. Such equipment shall be appropriate protected from failures due to moist environments, as appropriate to use.

- C. Standard Products: Material and equipment shall be the standard products of the selected manufacturer, and they should be regularly engaged in the manufacture of such products for at least 3 years. The design, model and size of each item shall have been in satisfactory and efficient operation in a similar installation environment (e.g. laboratory setting, or an animal facility) on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer workstations, shall be the current generation of technology and basic design at the time of purchase, which has a proven satisfactory service record of at least three years.
- D. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
- E. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- F. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
- G. Installer Qualifications: For sterilizers, installer is authorized representative of sterilizer manufacturer and employs factory-trained personnel to install sterilizers. For other equipment, installer shall be licensed as may be necessary by regulatory organizations. For all equipment, installer shall meet the qualifications of ANSI/ASSE Standard 6010.
- H. Steam Sterilizers: Comply with the most current version of ANSI/AAMI ST8 or ST55.

1.6 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Include the following:
 - 1. Illustrations and descriptions of laboratory washing, cleaning, filling, drying, sterilizing, and sanitizing equipment.
 - 2. Optional auxiliary equipment and controls.
 - 3. Catalog or model numbers for each component.

4. Accessories and optional features which enhance equipment performance or operation.
 5. Utility requirements.
 6. Control wiring diagrams.
 7. Installation Manuals
- C. Shop Drawings: Show details of fabrication, installation, adjoining construction, coordination with mechanical and electrical work, anchorage, and other work required for complete installation.
- D. Field Test Reports: Provide certification reports from accredited service technicians or installers.
- E. Operating Instructions: Comply with requirements in specification Section 01 00 00, GENERAL REQUIREMENTS.
- F. As is appropriate (e.g. animal rack and cage washers), a statement regarding proper placement, configuration, and installation of exhaust ductwork to prevent condensation from cooling moist air from entering back into equipment.
- G. Air compressor systems (Provide certified compressor test data at start-up.):
1. Compressors: Manufacturer and model.
 2. Characteristic performance curves.
 3. Compressor operating speed (RPM).
 4. Capacity: Free air delivered at indicated pressure (L/s) (SCFM).
 5. Type of bearing in compressor.
 6. Type of lubrication.
 7. Type and adjustment of drive.
 8. Electric motors: Manufacturer, frame and type.
 9. Speed of motors (RPM).
 10. Current characteristics and horsepower of motors.
 11. Receiver capacity and rating.
 12. Air silencer: Manufacturer, type and model.
 13. Air filters: Manufacturer, type, model and capacity.
 14. Pressure regulators: Manufacturer and capacity.
 15. Dew point monitor: Manufacturer, type and model.
 16. Air dryers: Manufacturer, type, model and capacity (L/s) (SCFM).
 17. Carbon monoxide monitor manufacturer, type and model.
 18. Aftercoolers.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute/Association for the Advancement of Medical Instrumentation (ANSI/AAMI):
 - ST79-2006.....Comprehensive guide to steam sterilization
 - ST8-2008.....Hospital Steam Sterilizer, 3rd edition
 - ST55-2008.....Table-top Sterilizers
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500-06.....Metal Finishes Manual
- D. Underwriters Laboratories):
 - UL Standard 61010-1

1.8 WARRANTY

- A. Comply with FAR clause 52.246-21 in all areas except for warranty period, which shall be no less than three years for all equipment.

1.9 GUARANTEE PERIOD SERVICES

- A. Engage factory-trained authorized manufacturers' representatives to perform maintenance service on equipment during guarantee period.
 - 1. Maintenance Service:
 - a. Inspection of equipment at regularly scheduled intervals as defined by the manufacturer.
 - b. Testing, cleaning, adjusting, repairing, and furnishing and installing replacement components as required to maintain equipment in reliable working condition.
 - 2. Maintenance service does not include cleaning, adjusting, repairing, furnishing and installing replacement components required because of improper use.

PART 2 - PRODUCTS

SPEC WRITER NOTES:

- 1. Show utility service requirements for sterilizers on drawings.
- 2. Verify that dedicated exhaust service, venting directly to exterior, without recirculating, is supplied for sterilizers. Need for the dedicated exhaust system should be verified with the manufacturer and the VA Design Manual. Spent steam should be returned or recovered

2.1 LABORATORY GLASSWARE AND UTENSIL WASHER

SPEC WRITER NOTE: Chamber sizes vary.
Insert sizes based on project
requirements.

- A. Cabinet Model: Fully programmable high performance laboratory glassware washer/dryer. Capable of direct injection washing of narrow-necked glassware (with proper inserts) and providing a heated DI water final rinse cycle, detergent / neutralizer / rinse aid dosing systems, and accepts a wide variety of baskets and inserts for various laboratory glassware types. Approximately 1956 mm high by 889 mm wide by 737 mm diameter (77 inches high by 35 inches wide by 29 inches diameter).
1. Exterior/Interior: Construction:
 - a. Interior: Chamber walls, ceiling, and floor are constructed of type 316 stainless steel for corrosion resistance.
 - b. Exterior cabinet. Constructed of type 304 brushed stainless steel for corrosion-resistance
 2. Doors:
 - a. Quantity: // Single door // Double door (Pass-thru)//.
 - b. Operation: Automatic.
 3. Chamber size: Interior useable space approximately: 673 mm high by 533 mm wide by 610 mm diameter (26 inches high by 21 inches wide by 24 inches diameter).
 4. Loading: // Manual // Automatic //.
 5. Controls: Digital control system. Includes standard and service-diagnostic programs. Space is available for custom programs. Multi-language display. RS-232, infrared serial ports or more modern technology such as USB ports are provided for connection to a PC.
 6. Heat Source: // Clean Steam // Electric // Steam Pressure: 36-145 PSI.
 7. Electrical Requirements: Electrical Connection (Electric Only): 3 Phase, 208/220V, 60Hz, 30A.
 8. Standard Cycles: // Wash // Rinse // Dry //.
 9. Optional Cycles: // Prewash // Thermal Disinfection Rinse //.
 10. Temperature:
 - a. Wash Cycle: 50 - 70 degrees C (122 - 158 degrees F).
 - b. Rinse Cycle: 50 - 70 degrees C (122 - 158 degrees F).
 11. Plumbing Connections:

- a. Hot Tap Water connection: One inlet valve 50 to 70 degree C (122 degree F to 158 degree F). Supply pressure: 207 kPa to 1014 kPa (30 psi to 147 psi), 15 liters/minute (4 gallons/minute). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends.
 - b. Cold Tap Water connection: One inlet valve. Supply pressure: 207 kPa to 1014 kPa (30 psi to 147 psi), 15 liters/minute (4 gallons/minute). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends.
 - c. DI Rinse Water Connection: One inlet valve. Supply pressure: 207 kPa to 1014 kPa (30 psi to 147 psi), 15 liters/minute (4 gallons/minute). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends. Provide DI pump kit for input pressure below 690 kPa (10 psi).
 - d. Drain Connection: Two 25 mm (1 inch) O.D. flexible drain hoses for connection to 51 mm (2 inches) I.D. floor drain or standpipe.
12. Construction:
- a. Interior: Chamber walls, ceiling, and floor are constructed of type 316 stainless steel for corrosion resistance.
 - b. Exterior cabinet. Constructed of type 304 brushed stainless steel for corrosion-resistance
13. Design:
- a. Pump system: Washer circulates water through the built-in upper and lower spray arms. Second pump is rated at 401 liters/minute (106 gallons per minute) and provides circulation through direct injection baskets or baskets with spray arms.
 - b. Dispensing Systems: Detergent dispensing container(s) of approximately 19 liters (5 gallons) allow for dispensing of detergents at specified wash temperatures. Each dispensing unit includes a flow meter that precisely monitors detergent amount dispensed.
 - c. //Optional Drying System: Built-in, does not require additional floor space, features temperatures up to 115 degree C (239 degree F), HEPA-filtered forced hot air through injectors and wash chamber, allows for two time and temperature settings and a cool-down cycle, and shall perform at less than 70 dBA.//

- d. Basket System: Modular basket system allows for single or double level washing. Capable of injection washing and standard washing in a single load.
 - e. Pure Water Rinsing: Pure water is pre-heated in a tank built-in the washer, and re-circulated through spray arms and injectors at temperatures up to 95 degree C (203 degree F).
 - f. Spray arms: Include upper and lower spray arms.
 - g. Water fill: Adjustable from 11 to 30 liters (3 to 8 gallons). Fill level is monitored by flow meters and is accurate to 4 ml (0.15 oz). Standard fill level is 19 liters (5 gallons).
 - h. Pull Down Door: Features dual axis motion to minimize unnecessary wear on the gasket. Designed to support the weight of loaded baskets without additional supports.
 - i. Water temperature of any cycle is adjustable up to 95 degrees C (203 degrees F). Temperature is monitored by dual sensors with control accuracy of +/-0.5 degree.
 - j. Steam condenser: For installations where machine is indicated or required to be vented into the room or connected to an air-conditioned ventilation system.
14. Accessories:
- a. Additional chemical pump(s) to allow for injections of different chemicals during desired treatments.

SPEC WRITER NOTE: Air compressor can be an option for this one unit or tied to a central lab air compressor system serving multiple pieces of equipment. See item 2.22 in this section.
 - b. Air compressor, 'oil free', complete with automatic tank drain and pressure switch.
 - c. Barrier wall flange kit, includes six stainless steel flanges to seal the opening between the pass through washer and the wall.
 - d. Booster Heater for high temp rinse cycle.

2.2 LABORATORY STEAM STERILIZER

SPEC WRITER NOTE: Chamber sizes vary. Insert sizes based on project requirements.

- A. Chamber:
 - 1. Interior: Type 316 Stainless steel.

2. Chamber Sizes: // Small 0.13 to 0.27 cubic meter (4.6 to 9.7 cubic feet) // Medium 0.30 to 0.59 cubic meter (10.5 to 20.7 cubic feet) // Large 1.12 to 2.04 cubic meters (39.6 to 72 cubic feet) //.
 3. Chamber Pressure: up to 45 PSIG.
 4. Chamber Temperature: 110 - 135 degrees C (230 - 275 degrees F).
- B. Doors:
1. Quantity: // Single // Double (Pass-thru) //.
 2. Operation: // Manual // Power //.
 3. Configuration: // Vertical sliding // Hinged door // Front opening // Back opening (Pass through) //.
- C. Standard Cycles: Gravity.
- D. Heat Source: // Steam // Electric //.
- E. Electrical Requirements: // 110V // 208V // 480V //.
- F. Loading: Manual.
- G. Recorder: // Integrated Printer // Remote printer //.. Verify that integrated printer hardware is protected from moisture, and readily accessible for repairs and paper changes.
- H. Control Options: // Integrated controls // Remote controls //..//Provide remote monitoring of the steam sterilizer via the DDC control system. Coordinate interface with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.//
- I. Installation Options: // Floor mount // Pit mount //.
- J. Accessories: //Loading rack and two shelves // Loading car and transfer carriage //
- K. If a loading cart assembly will be used, verify appropriate model for sterilizer.

2.3 EQUIPMENT DRYING OVEN

- A. For Drying large quantities of glassware, plastic ware and metal goods. Unit is approximately 914 mm wide x 813 mm diameter x 2032 mm high (36 inches wide x 32 inches diameter x 80 inches high).
- B. Cabinet Exterior: Type 304 Stainless Steel
- C. Interior Chamber:
 1. Interior: Type 304 Stainless steel.
 2. Capacity: Up to 5 shelves.
- D. Doors:
 1. Quantity: // Single // Double (Pass Through) //.
 2. Operation: Manual.

3. Configuration: // Side hinged // Front opening // Back opening (Pass Through) //.

E. Loading: Manual.

F. Controls: Digital with adjustable cycle time and temperature controls.

G. Heat Source: Electric.

1. Cabinet Temperature: Adjustable up to 260 degrees C (500 degrees F).

2.4 2. Drying Time: 0 - 99:59 hours.

A. Electrical Requirements: // 240V, 3-Phase, 3-Wire // 208V, 3-Phase, 4-wire //.

B. Cabinet Filtration: HEPA filtered air.

C. Recirculation Blower: minimum 1/3 HP motor

2.5 CAGE, UTENSIL & CART WASHER

SPEC WRITER NOTE: Chamber sizes vary. Insert sizes based on project requirements. Note: larger research programs will use a separate tunnel washer to wash smaller cages like rodent cages. In these larger programs, the cage/cart washer will be used for racks and larger cages that cannot enter the tunnel washer.

A. Interior: Stainless steel.

1. Chamber Capacity: // 100 std.// 150 std.// 200 std.// Mouse Cage.

B. Doors:

1. Quantity: // Single (Pass-thru) // Double (Pass-thru) //.

2. Operation: // Automatic // Manual //.

SPEC WRITER NOTE: Some equipment is capable of interfacing with remote PC based controls for system override and remote diagnostics. Determine whether this feature is requested by the facility.

C. Controls: // Integrated, Programmable, Microprocessor // Remote PC Based Interface// with paper printer //.

D. Heat Source: // Clean Steam // Electric //.

E. Electrical Requirements: // 208V // 380V // 480V // 600V //.

F. Standard Cycles: // Wash // Rinse // Dry //.

G. Optional Cycles: Thermal Disinfection Rinse.

H. Installation Options: // Floor mount // Pit mount //.

I. Temperature:

1. Wash Cycle: 49 - 82 degrees C (120 - 180 degrees F).

2. Rinse Cycle: 82 - 90 degrees C (180 - 194 degrees F).

J. Loading: Manual

K. Jet spray system: Two main types are in use, spinning spray arms fixed in the enclosure walls, ceiling, and cabinet, cabinet and jet spray assemblies mounted on an oscillating manifold on each side the washer. Due to the higher water pressure generally achieved with fixed arms and the increased rate of repairs for manifold spray systems outside of warranty periods (due to more moving parts), fixed spray arm configurations are generally preferred.

L. Automatic self-flushing debris strainer

M. Accessories: //Pan rack // Feeder bottle washing system // Universal wash cart // Custom designed racks// Booster heater for high temp rinse cycle //.

N. Complete list of purchased parts, including original equipment manufacturer part numbers, shall be provided. All purchased machine components such as jets, valves, PLC modules, pneumatic system parts, etc., shall be entirely non-proprietary and available for purchase freely and widely through normal industrial supply outlets.

SPEC WRITER NOTE: Air compressor can be an option for this one unit or tied to a central lab air compressor system serving multiple pieces of equipment. See item 2.22 in this section. As needed, specify steam recovery line to scavenge any excess steam generated as part of water-heating process.

O. Option: Air compressor, 'oil free', complete with automatic tank drain and pressure switch.

P. Specific instructions on placement and configuration of exhaust ductwork to prevent run-back of condensation into enclosure.

Q. Details of any pit or floor modification needed prior to installation.

2.6 ANIMAL WATER BOTTLE FILLER

A. Shall be a manually operated, manifold-type filler designed for filling basket loads of water bottles used in the care of laboratory animals. Unit is approximately 2438 mm wide x 762 mm diameter x 1600 mm high (96 inches wide x 30 inches diameter x 63 inches high).

B. A basket load of clean bottles with bottle retaining cover removed shall be placed on a low-friction conveyor surface and pushed under the manifold filler to the basket stops. Operator shall open valve, filling all bottles simultaneously. If Automatic Operation option is

selected, operator shall momentarily depress fill button, which shall energize filling system and automatically fill all bottles to the set level.

- C. The drain pan and legs shall be constructed of 14-gauge type 304 Stainless Steel with a no. 3 finish. Drain pan and legs shall be integrally welded with watertight welds.
 - D. The filler manifold shall be constructed of type 304 Stainless steel square tubing with individual machined jets for each bottle.
 - E. Quick operating fill valve shall be a 1/4 turn ball valve of brass or stainless-steel construction with Teflon seals and seats.
 - F. Conveyor shall consist of stainless-steel rollers, conveyor frame, and adjustable legs.
 - G. Utility Requirements:
 - 1. Water Supply - 19 mm (3/4 inch) FPT
 - 2. Drain Connection 32 mm (1-1/4 inch) FPT/DWV
 - 3. Electrical 110v, 3A, 60 hz
 - H. Interchangeable Filler Manifold: Filler shall be supplied with a quick disconnect attachment for filler manifold and an additional manifold(s) for accommodating different bottle sizes.
 - I. Automatic Operation: Filler shall be equipped with a solenoid water valve and a push button reset timer for automatic operation. Program shall include a 'purge' cycle to flush the manifold system of any stagnant liquid.
 - J. Electrical control panel shall include main power on-off switch and push button reset timer. A 183 cm (6 foot) long power cord with 15 ampere standard plug shall be included. Plug shall be modified as needed if environment
 - K. Stainless Steel Components: Filler shall be provided with stainless steel piping, valve, and jets for use with acidified or chlorinated water.
 - L. Filler Proportioner: Unit shall be provided with an automatic filler proportioning unit which will automatically proportion and admix customer provided chemicals to be used to fill bottles
 - M. Water Reservoir tank to feed filler manifold
- 2.7 COUNTER-TOP STERILIZER**
- A. For sterilizing small utensils and handheld instruments, approximately 584 mm wide x 457 mm diameter x 457 mm high (23 inches wide x 18 inches diameter x 18 inches high).

- B. Chamber:
 1. Interior: Stainless steel.
 2. Chamber Size: 279 mm diameter x 457 mm diameter (11 inches diameter x 18 inches diameter).
 3. Chamber Pressure: up to 45 PSIG.
 4. Chamber Temperature: 110 - 135 degrees C (230 - 275 degrees F).
- C. Single door
- D. Standard Cycles: Gravity
- E. Electrical Requirements: 115V, 15A, 1-Phase
- F. Loading: Manual.
- G. Recorder: Integrated Printer.
- H. Water reservoir: 4 liters (1 gallon).
- I. Trays: two large, two small

2.8 STERILIZER-ENCLOSURE PANELS (MODULAR WALLS):

- A. Design and custom fabricate to conceal from view body, wiring, piping, and other appurtenances, and to confine water vapor, gases, and heat in the enclosed area:
 1. 1. Size panels and support members to extend from floor to finished ceiling.
- B. Panels: Fabricate panels of not less than 1.27 mm (0.050-inch) thick type 304 stainless steel, with corners welded. Insulate with 13 mm (1/2-inch) moisture-resistant, sound-deadening, material bonded to surface of back side.
- C. Support Columns: Fabricate of not less than 1.52 mm (0.060 inch) thick, stainless-steel tubing, not less than 38 mm (1-1/2 inches) square, with mounting plates welded to top and bottom.
 1. Location: At each side of doors and at each vertical panel extending from floor to finished ceiling.
- D. Louvers: Stainless steel, located in panels above sterilizer doors, and with minimum clear opening area equal to 76 square mm/mm (3 square inch/inch) of sterilizer width.
- E. Canopies: Locate above sterilizer doors.
 1. Securely attach canopies to modular wall panels to produce a tight fit.
 2. Join canopies, front and side panels by welding. Fabricate of same material and finish as modular wall panels.
 3. Apply moisture- and corrosion-resistant coating on interior surfaces.

4. Type: Sloping.
 5. Overhang: Overhang sterilizer doors a minimum of 305 mm (12 inches).
 6. Coordination with Air-Intake: Include air-intake opening in modular wall panel within canopy, sized to meet airflow requirements indicated on drawings.
- F. Louvered Doors: Fabricated from not less than 13 mm (0.5 inch) thick stainless steel; double pan construction; with internal stiffeners and sound-deadening insulation.
1. Equip door with heavy-duty hinges and locks.
 2. Center louvers and locate them within 152 mm (6 inches) of bottom of doors.
 3. Size louvers to produce clear opening of not less than 25 square mm/mm (1 square inch/inch) of sterilizer or aerator width.
 4. Equip with spring-hinged, non-louvered, access doors at wall openings above rack return conveyor.
- G. Scribe Strips: Stainless-steel closures to fit assembly to wall or ceiling.
1. Maximum Width: 102 mm (4 inches). Use panels to close spaces greater than 102 mm (4 inches).
- H. Finish: No. 4 finish (bright, directional polish) complying with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" Finish after welding.
- I. Bio-membrane for sealing autoclave wall penetrations. If installation of a two-door (pass-through) autoclave will be in an area where biological agents must be contained (eg Biosafety Level 3 facilities), a sealing membrane system must be specified to prevent cross-contamination of air from one space to another around or through the equipment (when both doors are closed).

2.9 EQUIPMENT AND GLASSWARE DRYING CABINET

- A. For Drying large quantities of glassware, plastic ware and metal goods. Unit is approximately 914 mm wide x 813 mm diameter x 2032 mm high (36 inches wide x 32 inches diameter x 80 inches high).
- B. Cabinet Exterior: Type 304 Stainless Steel
- C. Interior Chamber:
1. Interior: Type 304 Stainless steel.
 2. Capacity: Up to 5 shelves.
- D. Doors:
1. Quantity: // Single // Double (Pass Through) //.

- 2. Operation: Manual.
- 3. Configuration: // Side hinged // Front opening // Back opening (Pass Through) //.
- E. Loading: Manual.
- F. Controls: Digital with adjustable cycle time and temperature controls.
- G. Heat Source: Electric.
 - 1. Cabinet Temperature: Adjustable up to 115 degrees C (240 degrees F).
 - 2. Drying Time: 0 - 99:59 hours.
- H. Electrical Requirements: // 240V, 3-Phase, 3-Wire // 208V, 3-Phase, 4-wire //.
- I. Cabinet Filtration: HEPA filtered air.
- J. Recirculation Blower: minimum 1/3 HP motor

2.10 ICE MACHINE

- A. Freestanding ice and water dispenser with removable // air // water //cooled icemaker, approximately 533 mm (21 inches) wide x 609 mm (24 inches) diameter x // 1575 mm (62 inches) high for 11 kg (25 pounds) capacity // 1676 mm (66 inches) high for 23 kg (50 pounds) capacity.

SPEC WRITER NOTE: Sizes vary. Volume production, total storage capacity and type of ice to be specified to meet the specific project demands.
- B. Exterior: Stainless steel frame with stainless steel panels.
- C. Storage Capacity: // 11 kg (25 pounds) // 23 kg (50 pounds) //.
- D. Production: Approximately 181 kg (400 pounds) of compressed nugget ice in a 24-hour period.
- E. Dispenser Controls: // Push lever // Infrared sensor// activated.
- F. Electrical Requirements: // 115V, 60 Hz, 1 phase, 14 amp // 220V, 60 Hz, 1 phase, 6.5 amp // 230V, 60 Hz, 1 phase, 6.5 amp //.
- G. Coordinate with electrical to provide GFCI protection.
- H. Provide 2 m (7 foot) cord and NEMA 5-20 90-degree hospital-grade plug.
- I. Dispenser to have automatic storage bin level control to start and stop icemaker and to allow dispensing to continue with icemaker removed.
- J. Icemaker to use environmentally-friendly R404A refrigerant, and be easily removed for service and maintenance.
- K. Controls: Microprocessor controls with diagnostics program for servicing.
- L. Storage bin to be insulated with high-density, foamed-in-place polyurethane.

- M. Storage bin to be easily accessed for manual loading of back-up ice.
- N. Energy consumption: maximum of 5.7 KWH per 45 kg (100 pounds) ice produced.
- O. Water Consumption: 49 liters (13 gallons) of potable water usage per 45 kg (100 pounds) of ice produced.
- P. Installation:
 1. Coordinate with Mechanical for water supply and drains.
 2. Coordinate with electrical for GFCI protection and receptacle compatibility.

2.11 EXHAUST HOOD

- A. The canopy exhaust hood, when installed and connected to a blower of the proper size, shall be capable to collecting and exhausting heat, steam and odors from the work area located directly beneath the hood.
- B. Canopy Exhaust Hood, sloping top, // wall-mounted //ceiling-mounted//, for collection and removal of steam, moist air, and odors.
 1. Size: // 914 mm wide x 914 mm diameter x 610 mm high (36 inches wide x 36 inches diameter x 24 inches high) // 914 mm wide x 1829 mm diameter x 610 mm high (36 inches wide x 72 inches diameter x 24 inches high) // Custom size //.
- C. Construction: Canopy hoods shall be fabricated in single section units, for ease and convenience in handling and installation. A 152 mm (6 inch), wide fascia shall be on front and both ends with roof sloping three ways to a 25 mm (1 inch) high, circular exhaust outlet. A watertight condensation gutter shall surround interior perimeter of canopy Fabricate of not less than 1.27 mm (0.050-inch) thick type 304 stainless steel, with corners welded and ground smooth.
- D. Baffles: The underside of hood shall have a removable two-piece baffle, set up, 76 mm (3 inches) with a 25 mm (1 inch) slot around the entire perimeter. Hoods ranging in length from 1524 to 2438 mm (5 to 8 feet) shall have two baffles. Shorter hoods shall have one baffle. In all cases, baffles shall be sized to allow a 25 mm (1 inch) slot around the inner perimeter of the hood. When dual baffles are required, they shall be separated by a 25 mm (1 inch) slot
- E. Exhaust collar connection 305 mm dia. (12-inch dia.), connect to building mechanical exhaust system. Exhaust duct, furnished by others, shall be connected to the canopy hood and shall provide the proper exhaust in cfm. as needed to ventilate the environment, based upon the specific application.

- F. Electrical Requirements: 115V, 60 Hz, 1-phase, 6-amp.
- G. Finish: No. 4 finish (bright, directional polish) complying with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" Finish after welding.
- H. Criteria for testing the effectiveness of the installation shall be specified, incorporating smoke or other air flow directional testing at appropriate distances from the canopy.

2.12 FLUSHING RACK SYSTEM (MANIFOLD FLUSHER)

- A. For flushing and sanitizing animal automatic watering rack manifolds. Some units also sanitize recoil hoses that connect racks to automatic watering piping in the animal rooms.
- B. Unit is either a single purpose manifold sanitizer, a single purpose recoil hose sanitizer, or a dual-purpose unit. All units are typically wall-mounted in the cage wash area to internally flush both detachable recoil hoses and/or mobile rack manifolds used with automated-watering systems.
- C. The system shall be capable of flushing at least up to two recoil hoses simultaneously or one rack manifold.
- D. Operation: Manual or with electronic controls.
- E. Dimensions - 457 mm high x 559 mm wide x 178 mm diameter (18 inches high x 22 inches wide x 7 inches diameter).
- F. Construction:
 - 1. Back Panel - 16 GA stainless steel.
 - 2. Piping - 1/2 OD 316 stainless steel.
 - 3. Quick Disconnects - universal style.
 - 4. 316 stainless steel (wetted parts): 1) Ball Check in QD plug, 2) Ball and Check Valves - 316 stainless steel.
 - 5. Plumbing Connections: Inlet - flange/swivel nut for 1/2 MPT adapter, Outlet - 1/2 OD compression for drain line.
 - 6. Filter Housing/Mixing Chamber - polypropylene.
 - 7. Recoil Hose - Kynar (PVDF) 3048 mm (10 foot) reach, or specified as needed in local application.
- G. Utilities
 - 1. Water Pressure - potable or chlorinated: 6 liters/minute at 3-4 bars (1.5 gallons/minute at 40-60 psi).
 - 2. Water Temperature: 4 - 49 degrees C (40 - 120 degrees F).
 - 3. Compressed Air - clean, oil free, 113 liters/minute at 1-4 bars (4 cfm at 15-60 psi).

H. Includes 4572 mm of stainless steel drain piping (15 feet).

I. Suitable for potable or RO water.

SPEC WRITER NOTE: Facility may require chlorine treated feed water. Specify Chlorine Injection Station for treated water if needed. Some units have an integrated chlorine tank supplied.

J. // Chlorine Injection Station for treated water option //

2.13 STEAM GUN

A. For steam cleaning and hot water or cold water, high-pressure washing combined in a single machine. Designed for use in areas where no flame, exhaust or contamination can be tolerated.

B. // Unit, skid mounted, approximately 1270 mm long x 559 mm wide x 838 mm high (50 inches long x 22 inches wide x 33 inches high).//

C. // Unit, on wheels, approximately 1270 mm long x 559 mm wide x 914 mm high (50 inches long x 22 inches wide x 36 inches high).//

D. Pressure Washer PSI: 1,200-3,000.

E. Pressure Washer GPM: 2-4.

F. Pressure Washer Temperature: 74 or 88 degrees C (165 or 190 degrees F).

G. Steam Cleaner PSI: 250-500

H. Steam Cleaner GPM: 1-2

I. Steam Cleaner Temperature: 159-160 degrees C (319-320 degrees F).

J. Advanced Temperature Control System

K. High Temperature Limit Switch

L. Electrical System includes Watertight NEMA 4 Enclosures

M. Ceramic Multi Plunger Pump, Positive Displacement

N. Pressure Relief Valve

O. Glycerin Filled Gauge

P. Electrical Requirements: 30 - 76 KW Heating Element, // 480 Volt - 3 phase // 208 - 1 phase // 240 - 1 phase //, 60 Hz

Q. Complete with 10 mm (3/8 inch) Wire Braid Hose x 1524 cm (50 foot) long

R. Trigger type, insulated pistol grip, shutoff gun with 914 mm (36 inch) barrel lance and side grip

S. Three Spray Tips Included 0°, 15°, 25° and Steam Nozzle

T. Stainless Steel Water Inlet and Detergent Tanks

U. Heavy Duty Welded Steel Frame

V. Standards certified to UL 1776 and CAN/CSA-B140.11 M89 by ETL

W. // Explosion-proof //

2.14 BEDDING DISPENSER

- A. The unit shall be for use in animal research laboratories and facilities to dispense a consistent amount of dry, solid bedding into animal cages and shall be approximately 1041 mm wide x 762 mm diameter x 2362 mm high (41 inches wide x 30 inches diameter x 93 inches high). The bedding stand-alone dispenser unit shall automatically dispense bedding into multiple cages simultaneously when the cages are placed into the filling chamber. The amount of bedding needed per cage shall be fully adjustable and the unit shall accommodate various types of bedding materials. If supplied as a unit integrated with a tunnel washer, it must be physically located at the discharge end of the tunnel washer on the clean side of the cage washroom.
- B. Construction: The structural supports, upper and lower hoppers, and work area load grid shall be of Heavy Gauge T304 Stainless Steel welded construction. All exterior surfaces shall be #3 finish.
- C. Hopper Capacity: The bedding storage capacity shall be a minimum of .425 m³ (15 cubic feet).
- D. Automated Bedding Conveyor: The bedding material shall be conveyed from the lower storage hopper to the upper dispensing storage hoppers by a continuous paddle type conveyor, driven by a 1/3 HP (2.48 .57 W) motor equipped with a gear reducer and a safety clutch. A level control shall be provided in the upper dispensing storage hopper to ensure that the proper amount of bedding material is stored in the upper hopper.
- E. Stainless Steel Loading Grid: The work surface shall consist of a removable stainless-steel grid welded from 1 cm (3/8 inch) diameter rods. The load grid shall provide a solid workload surface for the operator and shall allow bedding spillage to fall through and be automatically returned to the upper dispensing hopper.
- F. Controls: An operator control panel providing ON/OFF switches for the bedding conveyor, main power, and the dispensing station shall be provided on the front of the unit. An adjustable reset timer shall be provided to adjust cage filling to desired levels.
- G. Automatic Dispenser: A mechanical lever and micro switch activated by the presence of a cage shall automatically cause the cage to be filled with bedding to a pre-set depth. The bedding fill depth shall be fully operator adjustable by a front panel-mounted timer to accommodate various sizes of cages and bedding depths.
- H. Electrical Requirements: 120 V, 60 Hz, 1 phase, 15 amp

- I. Powered Exhaust: 102 mm (4 inch) DIA. 650 CFM 10.16 cm 18.41 CMM
- J. Dust Collection System: The dispenser shall be provided with a dust collection system able to remove and filter dust generated by the filling operation to 50 microns and shall eliminate the need for any connection to the building exhaust. The system shall consist of a 746 watt (1.0 H.P.) blower and 159 liters (36 gallons) container connected to the vent of the dispenser. The system shall be integrally wired with the bedding dispenser and an ON/OFF switch shall be provided on the operator control panel.
- K. Options:
1. //Air Compressor: If 'oil-free' compressed air is not available at the installing site, the unit shall be supplied with a portable air compressor. This compressor shall be (// attached to the unit // or // shall be shipped separately for remote installation by the contractor//). Unit shall be capable of 6 mm (1/4 inch) FPT, 552 kPa (80 PSI), 0.028 CMM (1 SCFM) Flow Rate. 120V, 60hz, 1ph, 20A. //
 2. //Mobility Option: Unit shall be supplied with lockable swivel Stainless Steel Casters for ease of moving unit to other locations. Unit shall be supplied with 3 m (10 foot) cord and plug for wall outlet. //

2.15 BEDDING DISPOSAL UNIT

- A. Freestanding unit for disposal of bedding from laboratory animal cages, approximately 1041 mm wide x 914 mm diameter x 1067 mm high (41 inches wide x 36 inches diameter x 42 inches high). It shall be a stand-alone unit. Many models utilize a blower to force air, capable of grinding used bedding and other matter normally found in used animal caging, mixing the material with cold water and flushing the resulting slurry into the sanitary sewer. The unit shall be based upon a commercially available grinding unit manufactured by a United States manufacturer with a wide distribution and service network, such as the Insinkerator® Company.
- B. Construction: Heavy-Duty Stainless steel frame with heavy safety grating/work surface fabricated from 13 mm (1/2 inch) diameter Stainless steel rods.
- C. Disposal Capacity: // 5 hp, 3.73 kw, 635 kg, 0.25 cubic meter (1400 pounds, 9 cubic feet) // 7.5 hp, 5.59 kw, 816 kg, 0.34 cubic meter (1800 pounds, 12 cubic feet) // 10 hp, 7.46 kw, 998 kg, 0.42 cubic meter (2200 pounds, 15 cubic feet. //

- D. Controls: Operator control panel shall contain all motor starters, transformers, relays and all other components necessary for operation of the machine in accordance with NEC and all local and National codes. Operator controls shall consist of disconnect and on-off switches, complete with Timer and water-saver circuitry.
- E. Electrical Requirements: // 208V, 60 Hz, 3 phase, 4 wire // 230V, 60 Hz, 3 phase, 4 wire // 480V, 60 Hz, 3 phase, 4 wire //.
- F. Cold Water: 26-30 LPM (7-8 GPM)
- G. Drain: 76 mm (3 inches)
- H. Options:
1. //Hand held spay unit on spring-loaded wand for pre-rinse and cleanup.//
 2. //Dust Collector: The disposal unit shall be provided with a dust collection system able to remove and filter dust to 50 microns generated by the operation. This system shall consist of a high-velocity downdraft duct and dust collector. Dust collector shall consist of a 746 watt (1.0 horsepower) blower and 159 liters (36 gallons) container connected to the vent of the disposer by flexible hose. Dust collector shall be integrally wired with the disposal and an ON/OFF switch shall be provided and mounted on the operator control panel. //
 3. //Hopper Integration: Unit shall be integrated with the feed end of a tunnel washer. All effluent shall be fed through tunnel washer drains. All controls shall be integrated with the tunnel washer controls. //
 4. Fused Disconnect Switch: A NEMA 4X fuseable disconnect switch shall be provided and mounted alongside the electrical enclosure.
- I. Installation:
1. Coordinate with Mechanical for water supply and drains.
 2. Coordinate with electrical for GFCI protection and receptacle compatibility.

2.16 COUNTER-TOP INSTRUMENT WASHER:

- A. Configuration: Counter-Top Mounted.

SPEC WRITER NOTE: Some equipment is capable of interfacing with remote PC based controls for system override and remote diagnostics. Determine whether this feature is requested by the facility.

- B. Controls: Integrated, Programmable, Microprocessor controls with remote PC interface control capability.

SPEC WRITER NOTE: Chamber sizes vary.
Insert sizes based on project requirements.

- C. Cabinet Model: Fully programmable high-performance laboratory glassware washer/dryer. Capable of direct injection washing of narrow-necked glassware (with proper inserts) and providing a heated DI water final rinse cycle, detergent, neutralizer, rinse aid dosing systems, and accepts a wide variety of baskets and inserts for various laboratory instrument types. Approximately 851 mm high x 902 mm wide x 699 mm diameter (33.5 inches high by 35.5 inches wide by 27.5 inches diameter).

1. Exterior/Interior: Construction:
 - a. Interior: Chamber walls, ceiling, and floor are constructed of type 316 stainless steel for corrosion resistance.
 - b. Exterior cabinet. Constructed of type 304 brushed stainless steel for corrosion-resistance
2. Doors:
 - a. Quantity: Single door
 - b. Operation: Automatic.
3. Chamber size: Interior useable space approximately: 483 mm high by 559 mm wide by 533 mm diameter (19 inches high by 22 inches wide by 21 inches diameter).
4. Loading: Manual
5. Controls: Digital control system includes standard and service-diagnostic programs, with space available for custom programs, and shall provide for Multi-language display. RS-232 and Infrared serial ports are to be included for connection to a PC.
6. Heat Source: // Steam // Electric // Steam Pressure: 36-145 PSI.
7. Electrical Requirements: Electrical Connection (Electric Only): single-phase, 208/220V, 60Hz, 30A.
8. Standard Cycles: // Wash // Rinse // Dry //.
9. Optional Cycles: // Prewash // Thermal Disinfection Rinse //.
10. Temperature:
 - a. Wash Cycle: 50 - 70 degrees C (122 - 158 degrees F).
 - b. Rinse Cycle: 50 - 70 degrees C (122 - 158 degrees F).
11. Plumbing Connections:

- a. Hot Tap Water connection: One inlet valve 50 to 70 degrees C (122 to 158 degrees F). Supply pressure: 207 kPa to 1014 kPa (30 psi to 147 psi), 15 liters/minute (4 gallons/minute). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends.
- b. Cold Tap Water connection: One inlet valve. Supply pressure: 207 kPa to 1014 kPa (30 psi to 147 psi), 15 liters/minute (4 gallons/min). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends.
- c. DI Rinse Water Connection: One inlet valve. Supply pressure: 207 kPa to 1014 kPa 930 psi to 147 psi), 15 liters/minute (4 gallons/minute). Provided inlet hose: Approx. 1524 mm (5 feet) long, 13 mm (1/2 inch) ID with 19 mm (3/4 inch) male hose thread ends. Provide DI pump kit for input pressure below 69 kPa (10 psi).
- d. Drain Connection: Two 25 mm (1 inch) O.D. flexible drain hoses for connection to 51 mm (2 inches) I.D. floor drain or standpipe.
- e. Construction:
 - 1) Interior: Chamber walls, ceiling, and floor are constructed of type 316 stainless steel for corrosion resistance.
 - 2) Exterior cabinet. Constructed of type 304 brushed stainless steel for corrosion-resistance
- f. Design:
 - 1) Pump system: Washer pump(s) provides circulation through direct injection baskets or baskets with spray arms.
 - 2) Dispensing Systems: Detergent dispensing container(s) of approximately 19 liters (5 gallons) allow for dispensing of detergents at specified wash temperatures. Each dispensing unit includes a flow meter that precisely monitors detergent amount dispensed.
 - 3) // Drying System: Built-in, does not require additional floor space, features temperatures up to 70 degrees C (158 degree F), HEPA-filtered forced hot air through injectors and wash chamber, allows for two time and temperature settings and a cool-down cycle, and shall perform at less than 70 dBA.//
 - 4) Basket System: Modular basket system allows for single or double level washing. Capable of injection washing and standard washing in a single load.

- 5) Pure Water Rinsing: Pure water is pre-heated and re-circulated through spray arms and injectors at temperatures up to 70 degrees C (158 degrees F).
- 6) Spray arms: Include upper and lower spray arms.
- 7) Water fill: Adjustable from 11 to 30 liters (3 to 8 gallons). Fill level is monitored by flow meters and is accurate to 4 ml (0.15 oz). Standard fill level is 19 liters (5 gallons).
- 8) Pull Down Door: Features dual axis motion to minimize unnecessary wear on the gasket. Designed to support the weight of loaded baskets without additional supports.
- 9) Water temperature of any cycle is adjustable up to 70 degrees C (158 degrees F), Temperature is monitored by dual sensors with control accuracy of +/-0.5 degree.
- 10) Steam condenser: For installations where machine is indicated or required to be vented into the room or connected to an air-conditioned ventilation system.

12. Accessories:

- a. Drain Water Cooling Kit
- b. Liquid Detergent Dispenser
- c. Lower Spindle Rack
- d. Lower Standard Rack
- e. Upper Spindle Rack
- f. Upper Standard Rack
- g. Utensil Holder
- h. Utensil Basket Cover
- i. Labware Inserts
- j. Labware Inserts Cover
- k. Bottle Inserts
- l. Booster Heater for high temp rinse cycle.

SPEC WRITER NOTE: Edit Accessories in quantity and configuration to satisfy users needs.

2.17 DETERGENT DISPENSING SYSTEM:

SPEC WRITER NOTE: Unit selected may require a water source.

- A. Configuration: Wall Mounted.
- B. Controls: Integrated, Programmable, Microprocessor controls with remote PC interface control capability.

SPEC WRITER NOTE: Review with facility to determine desired configuration and solution cycles.

C. Dispensing Options: // Enzymatic Solution // Detergent // Lubricant Solution //.

SPEC WRITER NOTE: Review with facility to determine desired capacity of each solution.

D. Solution Tank Options: // Enzymatic Solution // Detergent // Lubricant Solution // 57 (15) // 95 (25) // 189 (50) // X // liters (gallons) capacity.

E. Electrical Requirements: // 110V // 120V //.

F. All tubing and connections required for connection to adjacent equipment

2.18 WATER TREATMENT SYSTEM:

SPEC WRITER NOTE: Used to produce clean drinking water for lab animals, as well as reduce boiler scaling and instrument spotting during washer/disinfector and cart washer cycles. Unit can be sized and configured as a central system serving multiple applications with multiple quality outputs from drinking water for research animals to pure water rinse cycles on the washing equipment. Verify with facility the extent of the systems to be served and configure accordingly.

A. Unit is a free standing, rack mounted water filtration and purification unit.

SPEC WRITER NOTE: Confirm quality of water needed to configure unit with appropriate filters and pre-filters and determine if an automated Chlorine Injector Station is needed.

B. Water Treatment Process:

1. Pre-Filtration.
2. Recirculation.
3. Deionization.
4. Final Filtration.
5. Heating.
6. Chlorine injection

C. Average Output: 21 (5,500) // X // kiloliters (gallons) per day.

SPEC WRITER NOTE: Confirm capacity and flow rate required to satisfy simultaneous demands of all equipment fed by this unit.

- D. Electrical Requirements: // 115V // 220V // 230V //.
- E. Low Voltage Controls:
 - 1. Fully Automated, Programmable, with automatic membrane flushing, alarm set points for post RO pH, and detailed monitor screens for tank level, Pre-treatment, RO machine, RO distribution permeate flow and water temperature.
 - 2. Automated daily log records percent rejection, permeate conductivity, normalized differential pressure, post chlorine, and pH.
 - 3. Remote PC access for monitoring and diagnostics.
- F. Dimensions: Approximately 1829 mm high x 1219 mm wide x 762 mm diameter (72 inches high x 48 inches wide x 30 inches diameter)
- G. Construction:
 - 1. Frame - 16 GA powder coat steel
 - 2. Piping - 3/4 OD 316 stainless steel
 - 3. Quick Disconnects - universal style
 - 4. 316 stainless steel (wetted parts):
 - a. Ball Check in QD plug
 - b. Ball and Check Valves
 - c. Solenoid Valve
 - 5. Membrane:
 - a. Cellulose Acetate (CA or CTA) Membrane (Chlorine tolerant)
 - b. Polyimide (PA) Membrane
- H. Utilities
 - 1. Water Pressure - potable or chlorinated: 6 liters/minute at 3-4 bars (1.5 gallons/minute at 40-60 psi)
 - 2. Water Temperature: 4-49 degrees C (40-120 degrees F)
 - 3. Electrical: 115 VAC, 50/60 Hz, 1 amp, requires GFI circuit
 - 4. Water Reclamation: minimum 45% of feed water

2.19 TUNNEL WASHER

- A. Tunnel Washer is a conveyORIZED, heavy duty, hydro-spray washer equipped with a programmable Logic Controller system.

SPEC WRITER NOTE: Multi-Chamber unit will vary in size based on options and configuration. Insert sizes based on

project requirements. If steam is used to heat water, scavenge it via a return line.

B. Interior/Exterior: Stainless steel construction approximately 2438 mm high x 1778 mm wide (96 inches high x 70 inches wide) x length as determined by features and configuration.

C. Utilities: Multiple connections required depending on options and configuration:

1. Hot and Cold Water
2. Clean Steam
3. Compressed Air
4. Condensate Return
5. Drain 102 mm (4inches)
6. Vent 305 mm (12 inches)

SPEC WRITER NOTE: Some equipment is capable of interfacing with remote PC based controls for system override and remote diagnostics. Determine whether this feature is requested by the facility.

D. Controls: // Integrated, Programmable, Microprocessor // Remote PC Based Interface// Ethernet port // with paper printer.

E. Heat Source: // Clean Steam // Electric //.

F. Electrical Requirements: // 208V // 380V // 480V // 3-Phase.

G. Standard Cycles: // Wash // Rinse // Dry // up to 12 programmed processing cycles in memory //.

H. Optional Cycles: Thermal Disinfection Rinse.

I. Installation Options: // Floor mount // Pit mount //.

J. Temperature:

1. Wash Cycle: 49 - 82 degrees C (120 - 180 degrees F).
2. Rinse Cycle: 82 - 90 degrees C (180 - 194 degrees F).

K. Loading: Manual

L. Oscillating jet spray header system

M. Automatic self-flushing debris strainer

N. Accessories: //Pan rack // Feeder bottle washing system // Cage rack // Custom designed racks//.

O. Options: // Barrier Wall Flange Assembly // Dryer // Unload Gravity Roller Conveyor // Powered Unload Section // Integrated Bedding Disposal Station // pH Neutralization System // Low Pressure Steam

Piping // Automatic Descaling System with pumps // Proportional Temperature Rinse Control // Enclosure Cabinet for Service Area // Roller Conveyor Rack for staging loading and unloading racks // Booster Heater for high temp rinse cycle.

- P. Complete list of purchased parts, including original equipment manufacturer part numbers, shall be provided. All purchased machine components such as jets, valves, PLC modules, pneumatic system parts, etc., shall be entirely non-proprietary and available for purchase freely and widely through normal industrial supply outlets.

2.20 RECOIL HOSE FLUSH STATION:

- A. Unit is a panel mount assembly designed to flush multiple detachable recoil hoses simultaneously.
- B. Capacity: The system shall be capable of flushing up to six (6) recoil hoses simultaneously.
- C. Operation: Manual
- D. Dimensions: Approximately 889 mm high x 635 mm wide x 165 mm diameter (35 inches high x 25 inches wide x 6.5 inches diameter)
- E. Construction:
1. Back Panel - 16 GA stainless steel
 2. Piping - 1/2 OD 316 stainless steel
 3. Quick Disconnects - universal style
 4. 316 stainless steel (wetted parts):
 - a. Ball Check in QD plug
 - b. Ball and Check Valves
 - c. Solenoid Valve
 5. Plumbing Connections:
 - a. Inlet - flange/swivel nut for 1/2 MPT adapter
 - b. Outlet - 1/2 OD compression for drain line
 6. Filter Housing/Mixing Chamber - polypropylene
 7. Recoil Hose - Kynar (PVDF) 3048 mm (10 foot) reach
- F. Utilities
1. Water Pressure - potable or chlorinated: 6 liter/minute at 3-4 bars (1.5 gallons/minute at 40-60 psi)
 2. Water Temperature: 4-49 degrees C (40-120 degrees F)
 3. Compressed Air: clean, oil free, 113 lites/minute at 1-4 bars (4 cfm at 15-60 psi)
 4. Electrical: 115 VAC, 50/60 Hz, 1 amp, requires GFI circuit
- G. Includes 15 feet of stainless-steel drain piping [4575 mm]

H. Suitable for potable or RO water

2.21 CHLORINE INJECTOR STATION:

- A. Unit is used to automatically inject chlorine into water used for Recoil Hose Flush Stations, Reverse Osmosis Systems, and other applications.
- B. Capacity: The system is adaptable to a wide range of flow rates. Solution content mixture in water is adjustable via pump settings.
- C. Operation: Manual Switch for treated or untreated water.
- D. Dimensions: Approximately 991 mm H x 940 mm w x 229 mm d (39 inches high x 37 inches wide x 9 inches diameter)
- E. Construction:
 - 1. Back Panel - 16 GA stainless steel
 - 2. Piping - 1/2 OD 316 stainless steel
 - 3. Flow Switch: plastic 1 liter/minute (.25 gallon/minute) rated
 - 4. Injection Pump:
 - a. Positive displacement type
 - b. 31 ml/min capacity
 - 5. Solution tank: 15 liters (4 gallons) polyethylene
 - 6. 316 stainless steel Ball and Check Valves
 - 7. Plumbing Connections:
 - a. Inlet - flange/swivel nut for 1/2 MPT adapter
 - 8. Mixing Chamber - polypropylene
- F. Utilities:
 - 1. Water - potable or purified
 - 2. Electrical: 115 VAC, 50/60 Hz, 1 amp, requires GFI circuit

2.22 RACK MANIFOLD CHLORINE FLUSH STATION:

- A. Unit is used to chlorine sanitize and flush the internal surfaces of automated watering manifold racks.
- B. Capacity: The system shall be capable of flushing one rack at a time.
- C. Operation: Manual with LCD display, audible alarm, start and reset buttons.
- D. Dimensions: Approximately 991 mm high x 940 mm wide x 229 mm diameter (39 inches high x 37 inches wide x 9 inches diameter)
- E. Construction:
 - 1. Back Panel - 16 GA stainless steel
 - 2. Piping - 1/2 OD 316 stainless steel
 - 3. Quick Disconnects - universal style, 316 stainless steel

4. 316 stainless steel (wetted parts):
 - a. Ball Check in QD plug
 - b. Ball and Check Valves
 - c. Solenoid Valve
 5. Regulator: stainless steel 1 bar (0-18 psi)
 6. Flow Switch: plastic 1 liter/minute (.25 gallon/minute) rated
 7. Injection Pump:
 - a. Positive displacement type
 - b. 31 ml/min capacity
 8. Solution tank: 15 liters (4 gallons) polyethylene
 9. Plumbing Connections:
 - a. Inlet - flange/swivel nut for 1/2 MPT adapter
 10. Filter Housing/Mixing Chamber - polypropylene
 11. Recoil Hose - Kynar (PVDF) 3048 mm (10 foot) reach
- F. Utilities:
1. Water Pressure - potable or purified: 8 liters/minute at 1-5 bars (2 gallons/minute at 25-75 psi)
 2. Water Temperature: 4-49 degrees C (40-120 degrees F)
 3. Electrical: 115 VAC, 50/60 Hz, 1 amp, requires GFI circuit

2.23 CENTRAL COMPRESSED AIR SYSTEM:

- A. System Design: The laboratory air system shall be of a modular base mounted design consisting of // multiplexed // triplex // duplex// compressor, dryer/control, and an air receiver. Each unit must be fully compliant with the latest edition of NFPA 99.
- B. Compressors: Continuous duty rated "oil-less" type with permanently lubricated, sealed bearings. Single stage design, air cooled, reciprocating type with corrosion resistant reed type valves with stainless steel reeds. Both the compression rings and rider rings shall be made from a long life, fluororesin material designed for continuous duty operation. The crankshaft shall be constructed of a durable nodular graphite cast iron and designed to be fully supported on both ends by heavy duty ball bearings permanently lubricated and sealed. The crankcase shall be constructed of gray cast iron. Maximum heat dissipation shall be achieved through cast aluminum alloy cylinders treated for optimum corrosion and wear resistance. Cylinder sleeves shall not be required. Additionally, heat transmission from the piston wall to the piston pin needle bearing shall be minimized by an

insulated "heat cut" piston pin. The connecting rod shall be of a one-piece design for maximum reliability.

- C. Compressor Drive and Motor: V-belt driven through a combination flywheel/sheave and steel motor sheave with tapered bushing and protected by an OSHA approved, totally enclosed belt guard. Belt tensioning shall be achieved by a pivoting motor mounting base that is fully adjustable through twin adjusting screws. The motor shall be a NEMA rated, open drip proof, 1800 RPM, with 1.15 service factor suitable for 208/230/460V electrical service, as specified in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT and Section 26 29 11, MOTOR CONTROLLERS.
- D. Intake Piping: Provide a pre-piped intake manifold with one "hospital type" inlet air filter with threaded opening for remote intake connection. Isolate filter housing from the intake manifold with a braided 304 stainless steel flex connector.
- E. Discharge Piping: Provide an integral air-cooled aftercooler designed for a maximum approach temperature of -11 degrees C (12 degrees F) complete with moisture separator and timed automatic solenoid drain valve with a manual drain valve by-pass. Provide each cylinder head with a pre-wired high discharge air temperature shutdown switch. Include a flex connector, safety relief valve, and check valve. The compressor discharge line piping shall be of ASTM B-819 copper tubing, brass, and/or stainless steel. The discharge flex connector shall be braided 304 stainless steel, brass or bronze.
- F. Isolation System: Isolate the compressor and monitor from the main compressor module base by means of a four-point, heavy duty, spring isolation system for a minimum of 95% isolation efficiency.
- G. Dryer/Control: The dryer/control shall include a NEMA 12, U.L. labeled control system, duplexed desiccant drying system, duplexed final line filters, duplexed final line regulators, and combination dew point/CO monitor. All of the above shall be pre-wired and pre-piped in accordance with NFPA 99 and include valving to allow complete air receiver by-pass, as well as air sampling port.
- H. Dryer: Size each desiccant dryer for the peak calculated demand and capable of producing -12 degrees C (10 degrees F) pressure dew point. Dryer purge flow shall be minimized through an on-demand purge saving control system. Include a mounted prefilter rated for 0.01 micron with

automatic drain and element change indicator on the inlet of each dryer.

- I. Control System: Mounted and pre-wired control system shall be NEMA 12 and U.L. labeled. This control system shall provide automatic lead/lag sequencing with circuit breaker disconnects for each compressor with external operators, one non-fused main disconnect with external operators, full voltage motor magnetic starters with overload protection, redundant 120V control circuit transformers, visual and audible reserve unit alarm with isolated contacts for remote alarm, hand-off-auto (HOA) lighted selector switches, automatic alternation of both compressors with provisions for simultaneous operation if required, automatic activation of reserve unit if required, visual alarm indication for high discharge air temperature shutdown with isolated contacts for remote alarm, and duplexed run time hour meters.
- J. Final Line Filters and Regulators: Fully duplexed final line filters rated for 0.01 micron with element change indicators shall be factory mounted and pre-piped, along with duplexed factory mounted and pre-piped final line regulators and duplex safety relief valves.
- K. Dew Point Hygrometer/CO Monitor: Mounted, pre-piped and wired, combination dew point hygrometer/CO monitor shall be of the ceramic type with integral chemical type CO sensor. System accuracy shall be ± 2 degrees F for dew point and 2PPM (at 10 PPM) for carbon monoxide. Dew point alarm shall be factory set at 4 degrees C (39 degrees F) per NFPA 99, and the CO alarm shall be factory set at 10 PPM. Both set points shall be field adjustable.
- L. Air Receiver: Vertical air receiver, galvanized, ASME Coded, National Board Certified, rated for minimum 150 PSIG design pressure and includes a sight gauge glass as well as a timed automatic solenoid drain valve. Provide three valve bypass on supply.//
- M. Example of an acceptable product and manufacturer: Beacon Medical Products "Lifeline Medical Air Systems".

2.24 BEDDING DUMP STATION

- A. Freestanding unit for dumping and packing of bedding from laboratory animal cages, approximately 1336 mm wide x 899 mm diameter x 1790.7 mm high (52.6 inches wide x 36 inches diameter x 70.5 inches high). It shall be capable of packing used bedding and other matter normally found in used animal caging, into container bags or plastic lined waste boxes to be sealed and removed for disposal. Unit shall utilize HEPA

filtered air to reduce aerosolized contaminants and minimize personnel exposure to particulate. The unit shall be based upon a commercially available waste management unit manufactured by a United States manufacturer with a wide distribution and service network, such as the Lab Products Inc. Company.

- B. Construction: Exterior painted steel finish with stainless steel waste chutes.
- C. Filtration: Three stage air filtration; Polyester Pre-filter, Pleated Pre-Filter, and HEPA final filter.
- D. Work area opening 1143 mm wide x 584.2 mm high (45" wide x 23" high) accessing Dual stainless-steel funnel disposal ports channel waste to containers
- E. Controls: Pre-filter and HEPA filter warning lights indicating the need to change filters when static pressure increases above .90 inches of water.
- F. Blower Motor: 1/3 hp direct drive motor
- G. Electrical Requirements: 120V, 60 Hz, 10 Amp.
- H. Maintenance: Access and change filters without tools.
- I. Options: Waste port cover plates

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units in accordance with manufacturer's documented instructions. Connect all utilities. Provide valves, connectors, and other accessories as required.
- B. Coordinate installation with related mechanical, plumbing and electrical work. Provide cutouts and openings for mechanical, plumbing and electrical work as indicated or as required by trades involved.

3.2 TESTING AND CERTIFICATIONS

- A. Field test installed equipment after water and steam systems are pressurized for proper operation.
 1. Operate each unit for six hours through repeated full cycles. During and after testing, there shall be no evidence of leaks, overheating, electrical failure, or other symptoms of failure.
 2. For units that fail testing, make adjustments and corrections to installation, or replace equipment, and repeat tests until equipment complies with requirements.

- B. Where applicable, installer shall provide certificate of compliance and/or documented cycle records validating the activation and ready-for-use status of the equipment.

3.3 PROTECTING AND CLEANING

- A. Protect equipment from dirt, water, and chemical or mechanical injury during storage, installation, and throughout the duration of the construction period.
- B. At the completion of work, clean equipment as required to produce ready-for-use condition.

3.4 SEISMIC PROVISIONS

- A. Where required by Seismic Zone Classification and/or local regulations, provide seismically approved anchors, mountings and tie-downs per Manufacturer and/or Certified Structural Engineer

3.5 DEMONSTRATION AND TRAINING:

- A. Instruct personnel and transmit operating instructions in accordance with requirements in specification Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training must be provided by the manufacturer, or manufacturer certified instructors.
- C. Orientation and Training on all equipment to be provided to a minimum of two Government-designated personnel per equipment item/system and shall certify their operational competency.

3.6 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 - COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

- - - E N D - - -