



# Model SL1200 Tunnel Washer

## General Specifications

### 1.0 General Description

The Model SL1200 Tunnel Washer is a high capacity conveyORIZED spray washer capable of processing any items which can be placed inside the washing compartment. It is specifically designed to clean and sanitize animal cages, pans, water bottles and other items ancillary to the care of laboratory animals. Several sizes are available, as well as many optional features. The Model SL1200 incorporates a large number of “state-of-the-art” features to ensure thorough, efficient cleaning, as well as many features unique to our design.

### 2.0 Dimensions

	Model SL1224	Model SL1230	Model SL1236	Model SL1248
<b>Belt Width</b>	24”	30”	36”	48”
<b>Tunnel - Inside*</b>	25”W x 25”H	31”W x 25”H	37”W x 25”H	49”W x 25”H
<b>Overall</b>	41”W x 83”H	47”W x 83”H	53”W x 83”H	64”W x 83”H
<b>Length</b>	22’L	22’L	22’L	22’L
<b>Dryer Section Included in Length</b>	7’L	7’L	7’L	7’L

\*Note: Dimensions are maximum chamber opening sizes. Actual Load size must be smaller to allow for clearances. Custom chamber sizes, lengths and widths can be provided as required.

### 3.0 Spray Headers

3.1 Spray headers shall be supplied and equipped with machined jets. Jets shall deliver a solid elliptical spray pattern for optimal impact to the load. No rotating spray arms shall be utilized.

3.2 Individual spray headers shall be connected to supply manifolds by means of slip-fit couplings which shall prevent undue leakage yet shall allow headers to be removed with one hand and no tools.

3.3 Design of the header mounts shall prevent any individual header from being installed incorrectly or in the wrong space.

### 3.4 Balanced Spray Hold-Down System

3.4.1 Headers shall be equipped with throttle valves which shall allow the upper and lower sprays to be balanced such that any items placed upon the belt shall be held down by the force of the upper sprays. At start-up, factory technical personnel shall balance the sprays and set the system to operate correctly and efficiently with all items in the owner's inventory/

## 4.0 Solution Strainers

4.1 Wash solution shall be pumped through a specially designed strainer that ensures that the wash spray jets shall not be plugged by entrapped debris.

4.2 Strainer shall be designed with orifices significantly smaller than those in the jets, such that debris which is suspended in the treatment fluids and which could lodge in the jet orifices shall be trapped prior to delivery to the header system.

4.3 At selectable, timed intervals any particles that have been trapped shall be automatically flushed to drain.

4.4 Strainer shall be removable with no tools via a sanitary-style clamp. System shall be completely self-regulating and require routine inspection and maintenance no more than once per week.

4.5 In addition to the Self-Flushing wash solution strainer, each treatment station shall be equipped with an oversized drawer-type screen which will prevent large debris from entering the recirculation tanks or the drain.

## 5.0 Automatic Temperature Regulation and Guarantee

5.1 The Final Rinse, Rinse and/or Wash treatments shall be selectable as Guaranteed Temperature Phases.

5.2 Drive belt shall not run until the solution temperature of a selected treatment phase has reached the set point (typically 180 degrees F or higher), thus ensuring that the load has been subject to the proper temperature for the entire phase duration. If the temperature drops below the set point, the drive belt will momentarily pause to allow the temperature to stabilize.

5.3 Failure of any Guaranteed Temperature Phase to reach the setpoint temperature within the allotted time shall result in a Fault Condition. (Temperature Failure; see par. 6.7.4)

## 6.0 Safety and Certifications

6.1 An OSHA-style Emergency Stop button shall be installed on the operator control panel and at the exit end of the machine. These switches shall be wired to a hard-wired safety stop relay, which when de-activated shall interrupt all power to the outputs of the machine, thus satisfying OSHA standards for industrial machinery.

6.4 Magnetic safety switches on the doors shall reliably ensure that all treatments stop instantly if any door is opened.

6.5 All outputs external to the electrical box shall be low voltage DC, Intrinsically Safe by the definition of OSHA and NEC.

6.6 All devices and components which consume electrical power shall be UL listed and/or approved, and shall bear NEMA, IEC or other recognized International ratings appropriate for the use intended. The control assembly shall be produced in a UL Panel Shop and shall be UL Listed according to UL 508(A) standards.

6.7 Fault Conditions shall be annunciated on the operator interface screen, and shall be sent to the RS232 interface port for printing or data acquisition. At least four (4) fault conditions shall be so identified.

6.7.1 Emergency Stop- Depression of the Emergency Stop Button shall reset the machine and display a fault message which identifies the source of the emergency stop signal.

6.7.2 Door Open- Lack of positive door closure shall cause the machine to cease operation. Fault message shall indicate which door is at fault.

6.7.3 Heat Fault- Failure of any Temperature Guaranteed Phase to reach the desired temperature in the expected time shall cause the machine to cease operation and the screen to display the appropriate Heat Fault message.

6.7.5 Fill Fault- Fill Fault message shall be displayed and machine operation shall cease if any tank fails to fill in the allotted time.

## **7.0 Pneumatically Operated Valves**

7.1 All automatic ball valves shall be controlled by Pneumatic operators. Electric-motor-operated ball valves shall not be acceptable.

7.2 All automatic water and steam control valves shall be direct-operated pneumatic types. Pilot-operated solenoid valves or any valve which incorporates a diaphragm-type sealing system shall not be acceptable.

## **8.0 Microprocessor Control**

8.1 The treatment schedule and all other machine functions shall be controlled by a readily available, non-proprietary, industrial style modular programmable controller such as that manufactured by Koyo and sold throughout the United States by Automation Direct.

8.2 Module replacement for the I/O system shall be easily accomplished with no tools and no wiring disconnection or connection.

8.3 The control system shall be programmed in simple ladder logic.

8.4 A Color Touch Screen shall provide complete operator interface, diagnostic and programming capability. No special skills or knowledge shall be necessary to set up and control all machine functions.

8.5 Diagnostics shall be available from the Color Touch Screen which will allow direct access to all I/O points for complete diagnosis of all machine systems.

8.6 Treatment schedules and cycle phase selections shall be programmable from the Screen, and PIN screens shall be available at the discretion of the supervisor to lock out access to the cycle phase programming functions. All timers in the program, as well as all cycle phase temperatures, shall be accessible and settable through the operator interface screen, with no necessity for the connection of either an auxiliary programming device or a modem/telephone line connection.

8.7 All controls shall be of industrial design and type, in order to resist the extreme environmental demands of the washroom. All electrical wiring, operator interface controls and circuits shall be protected in accordance with NEMA, UL and NEC standards.

## **9.0 Insulated Exterior**

9.1 The exterior of the machine shall be fully insulated with 2" of rigid insulation covered by a Stainless Steel jacket for protection. This insulation shall be an integral part of the machine, designed to maintain the high temperatures required in the treatment chamber and to limit radiation loss to the surrounding air.

## **10.0 Positive Door Gasketing**

10.1 The doors shall be sealed with long-life, durable gaskets, which will ensure that vapor leakage around the door is minimized. The gaskets shall be easily replaceable with no tools. Labyrinthine seals or other gasket-less methods which allow vapor to escape shall not be utilized.

## **11.0 Welded Construction**

11.1 All body joints below the overflow point shall be welded. If site conditions necessitate a sectionalized shipment, factory installation personnel shall field weld all tank joints to ensure integrity of the tanks and cabinet. Gasketed joints below the water overflow point shall not be acceptable.

## **12.0 Manuals & Documentation**

12.1 A full set of manuals explaining machine operation and PLC operator controls shall be provided.

12.2 A hard copy of the PLC ladder diagram shall be available at no additional charge.

12.3 A complete list of purchased parts including original part numbers, where the parts were purchased, and the nearest local distributor where the parts can be purchased shall be provided as a standard part of the manual. 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.

## **20.0 Machine Operation**

20.1 Items to be cleaned shall be placed onto the belt by the operator. Items so placed shall be conveyed through each treatment in turn. Once items appear at the unload end of the machine, they shall be removed by the operator.

20.2 All cycle phase selections and other cycle options shall be available for selection from the Color Touch Screen, with optional supervisory PIN screens preserving security of standard cycle phase information. Machine memory shall allow storage of at least four (4) distinct cycles, to be recalled through simple screen selections.

20.3 Standard cycle phases shall consist of:

20.3.1 Pre-rinse - Water salvaged from the rinse treatment phase shall be sprayed onto the inside surfaces of the load in order to flush excess debris from these surfaces prior to load entering the wash treatment chamber. Spent water shall be conducted to drain through a large drawer-type strainer.

20.3.2 Wash - Detergent solution shall be sprayed over all surfaces of the load, under pressure from the main wash pump. All solution shall be strained through the drop screen and the self flushing debris strainer before being conducted to the jets. Temperature of the detergent solution shall be maintained at the desired setpoint, up to 190 degrees F, by the fully submerged sump steam coil.

20.3.3 Rinse - Rinse water shall be sprayed over all surfaces of the load, under pressure from the rinse pump. Rinse solution shall be strained through the drop screen before being conducted to the jets. Temperature of the rinse solution shall be maintained at the desired setpoint, up to 190 degrees F, by the fully submerged sump steam coil.

20.3.4 Final Rinse - Fresh hot water from the customer's hot water supply shall be sprayed over all load surfaces at a guaranteed set point temperature up to 205 degrees F, thus ensuring proper sanitation and adherence to AALAC guidelines.

## **30.0 Details of Construction**

## 30.1 General

30.1.1 All wetted parts shall be of Type 304 Stainless Steel or appropriate polymeric materials.

30.1.2 All electrical assemblies, piping assemblies and mechanical apparatus shall be designed for, and be appropriate for use in, a high temperature sanitary wash-down environment. All components shall be selected for their ability to perform for long periods of time in the adverse and high production environment of the laboratory washroom. Each purchased part and each engineered part and sub-assembly shall be scrutinized and all specific design decisions shall be made in the light of these basic criteria.

30.1.3 All purchased components shall be un-modified, off-of-the-shelf items available to the owner in his locality, should he need them.

30.1.4 Original manufacturers' part numbers and descriptive information for all purchased parts shall be made an integral part of the service manual information provided at time of installation, and every effort shall be made throughout the life of the machine to assist the owner in acquiring any parts needed.

30.2 The cabinet, tanks and supports shall comprise one welded assembly. The tanks shall be constructed of 12 gauge T304 Stainless Steel, and the upper cabinet shall be 14 gauge T304 Stainless. All exterior finishes shall be #3, fully polished. The top and sides of the machine shall be fully insulated with a 2" thick blanket of rigid fiberglass, completely enclosed in a 20 gauge T304 Stainless jacket with #3 polished exterior. Adjustable legs of sanitary design shall be provided for leveling. Stainless and Neoprene Rubber baffles between sections shall minimize treatment solution carry-over.

30.3 The doors of the washer shall be of double-walled stainless steel construction, 2" thick, and filled with insulation. The door hardware and gaskets shall ensure that there are no significant leaks of solution or vapor during normal operation. Door safety switches shall ensure that the machine cannot operate with the doors open.

30.4 Conveying surface shall consist of a Stainless Steel flat wire belt of at least 11 gauge thickness, tensioned by catenary sag and requiring no belt tensioning devices. Sprockets shall be used at both ends of the belt to ensure consistent tracking. Belt shall be supported by a system of Stainless Steel runners which will provide extreme long and trouble-free life. No replaceable wear strips shall be acceptable. Belt shall be driven by an AC Variable Speed Motor and inverter, selected to allow operator selection of belt speeds from ~4 fpm to ~10fpm. Belt speed shall be adjustable from the Color Touch Screen Interface, behind a PIN security screen.

30.5 The wash and rinse tanks shall be equipped with stainless steel steam coils, fully welded in accordance with ASME Section VIII standards for Unfired Pressure Vessels and fabricated from Stainless Steel materials designed to carry steam at the rated pressures. No structural parts will be acceptable. The coils shall be easily removed for cleaning or maintenance.

30.6 Temperatures shall be controlled directly by the PLC. Temperature sensors shall be Type J Thermocouples, connected directly to the analog inputs of the PLC and requiring no periodic calibration.

30.7 Steam controls shall be included for 30-80 psi dry steam. No diaphragm-type steam valves shall be acceptable. Condensate traps shall be disc/thermodynamic type only.

30.8 Water level shall be maintained by electronic level controls with removable and easily cleaned probes. Probes shall be removable for cleaning with no tools required, such as with a sanitary-type clamp fitting.

30.9 The treatment pumps shall be horizontal, close coupled pumps equal to a Flowserve Model D824. Mechanical seals shall be carbon ceramic and Stainless Steel. No vertical or seal-less pumps shall be acceptable.

30.10 Spray jets shall be elliptical pattern spray jets equal to Spraying Systems Co. H1/4USS80XX. No proprietary jets shall be acceptable.

30.11 Final Rinse heat exchanger shall be of 100% stainless steel, brazed or sintered plate design. No iron, copper or other material shall be acceptable. No shell-and-tube or helical flow design shall be acceptable. Temperature regulation shall be provided by a Modulating Steam Valve, controlled by a PID loop running on the main PLC. Temperature shall be set by supervision as high as 205F, and shall be regulated within +/-4F.

30.12 Washer programmable control shall provided by a modular industrial-type programmable logic controller, programmed in ladder logic and replaceable and programmable by the customer's own personnel if necessary. No proprietary control will be acceptable. All wiring and control shall be per National Electric Code and all devices utilized shall be UL, NEMA and/or IEC-rated. All operator controls or devices shall be of standard industrial NEMA-rated types, chosen for their ability to operate over the long haul in the tough and corrosive environment of the washroom. Operator interface shall be a color touch screen. Control assembly shall be UL Listed and so labeled.

30.13 Discharge Cooling - Non Monitored: Washer shall be provided with an integral cool-down apparatus which shall ensure that all effluent is cooled to 140 degrees F. or less before gravity conduction to the customer's drain. This shall be accomplished by mixing the effluent with cold water from the owner's supply.

30.14 Dryer System: An insulated stainless steel dryer section, 7' long, shall be provided. Dryer shall be equipped with a dual drying system, having both an air knife for the outsides of the cages and a recirculating hot air dryer for the insides. The recirculating section shall be equipped with stainless steel air discharge nozzles mounted in a stainless steel plenum. The nozzles shall be calibrated to achieve optimum drying after all air and exhaust controls have been set. Air shall be moved by a 5 H.P. heavy-duty blower with quiet, backward-inclined vanes, and shall circulate

heated air through a steam heat exchanger. This air shall be circulated over all surfaces of the cages at a temperature of up to 230 degrees F to ensure even and thorough drying. The air knife section shall be equipped with a 10 HP regenerative blower capable of providing a high-velocity stream of air which will strip all water droplets from the outsides of the cages passing underneath the knife. Knife height shall be adjustable by the operator from the Touch Screen Interface, which shall continuously indicate the current height of the knife.

### 30.15 MATERIALS OF CONSTRUCTION

Item	Material
base	Angle Iron, 304 SS, mill finish
door panels	16 gauge, 304 SS - #3 finish
side and top panels	14 gauge, 304 SS - #3 finish
tank panels	12 gauge, 304 SS - #2B finish
recirculating piping	Stainless Steel
spray headers	Stainless Steel
recirculating pumps housing and impeller	Stainless Steel
recirculating valves	Stainless Steel
external water piping	copper
steam coils	Sch 40. 304 SS - #2B/mill finish
internal steam piping	stainless steel
external steam piping	schedule 40 black iron
temperature booster	304 SS
drain piping	304 SS and Sch 80 (C)PVC
barrier walls	20 gauge, 304 SS - #3 finish

### 40.0 Optional Features

- 40.1 **Knocked-Down Shipment:** Machine shall be provided in knocked-down condition, all pieces sized to suit the specific site, for reassembly at the customer's site. All joints which are below the overflow point shall be fully welded. No bolted gasketed joints shall be acceptable below the water line. No special lifting equipment of any kind shall be required to move or set the equipment portions in place.
- 40.2 **Printer:** A panel-mount printer with paper take-up shall be supplied to document all machine parameters and faults. Print interval shall be settable by supervisory personnel.
- 40.3 **Unload End Powered Conveyor:** The dryer belt shall emerge from the machine and form a powered unload section. Length of this section shall be specified by the owner, with four (4) feet being the default standard length.
- 40.4 **Conveyor Full Sensor:** A photoelectric eye assembly shall be mounted at the discharge point of the washer or the optional discharge conveyor. Whenever this sensor is blocked, belt operation shall be paused to allow the operator to remove the items from the



belt. An adjustable time delay is provided to allow items to pass through the eye momentarily without interruption of belt operation. This feature shall ensure that no loads can inadvertently fall off of the end of the conveyor.

- 40.5 Stainless Steel Exhaust Fan: A Stainless Steel tube-axial-type exhaust fan shall be provided to ensure proper ventilation in applications where the existing air handling systems are inadequate or over-taxed.
- 40.6 Windows: Tempered Safety Glass windows shall be provided in any doors to allow visual inspection of the interior with the door(s) closed.
- 40.7 Illuminated Interior: Machine shall be equipped with fluorescent strip light assemblies which shall be mounted outside the machine above the roof. Tempered glass windows shall be placed in the roof panels to allow light from the fixtures to enter the machine. Lights mounted interior to the machine shall not be acceptable.
- 40.8 Discharge Cooling: Monitored: Washer effluent shall be conducted to a stainless steel holding tank. A probe shall sense the discharge temperature and add the required amount of cold water from the owner's supply to lower the discharge temperature to below 140 F before discharging to the building drain system. The entire system shall be under the supervision of the machine PLC control.
- 40.9 Barrier Flanges for Recessing through One Wall: Stainless Steel Flanges shall be provided to fully enclose the recessed end of the unit from wall to wall and floor to finished ceiling.
- 40.10 Barrier Flanges for Recessing through Two Walls: Stainless Steel Flanges shall be provided to fully enclose the "clean" and "soiled" ends of the unit from wall to wall and floor to finished ceiling.
- 40.11 Treatment Solution pH Neutralization System: Monitored: A monitored proportional system shall be provided to automatically inject user supplied neutralization agent into the tank to neutralize acidic solutions before discharge to drain to conform to plumbing code requirements. A probe shall sense the pH of the treatment solution and a proportional amount of agent shall be injected to attain a neutral pH. A low agent reservoir level shall be annunciated to the operator.
- 40.12 Automatic Tank Drains: The wash and rinse tanks shall be provided with automatic programmable valves located at the low points on the tanks. When each valve is activated, the tank solutions shall be automatically dumped to gravity drain. The drain valve shall operate at the pleasure of the operator.
- 40.13 Descaling System: A programmable descaling system shall be provided which when operated will remove scale buildup from the interior surfaces of the chamber.
- 40.14 Seismic Restraints: Properly designed and attached seismic restraints shall be provided to comply with local codes.

- 40.15 Remote Access Programming Capable: A modem or Ethernet connection shall be included in the modular PLC package to provide for Direct Factory Accessible Programming. This option shall allow trained SMC technicians to directly access the programming of the machine from a remote location for changes or diagnostic purposes. A dedicated analog phone line or an Internet connection shall be provided by the owner if this option is selected.
- 40.16 Integral Air Compressor: An integral air compressor shall be provided to operate the drive and pneumatic valves. This option shall be chosen whenever compressed air is not available from building utilities.
- 40.17 Special Spray Configurations: Sprays shall be provided in various special configurations in order to adequately clean any troublesome items in the owner's inventory.
- 40.18 Special Cabinet Size: Cabinet shall be supplied in the exact shape and size specified to suit the owner's special needs.
- 40.19 Low Steam Pressure: The unit shall be designed for a steam pressure below 30 PSI. All coils, valves, pipes and other devices shall be sized to operate under the conditions specified.
- 40.20 Integrated Bedding Dispenser: An automatic bedding dispenser, SMC Model BD30, shall be integrated and attached to the discharge end of the unit. The BD30 series automatic bedding dispenser shall automatically dispense bedding into cages as the cages pass through the filling chamber on a powered conveyor. Cages shall be automatically transferred and inverted to the bedding dispenser conveyor directly from the washer. The amount of bedding needed per cage shall be adjustable and the unit shall accommodate various types of bedding materials.
- 40.21 Integrated Bedding Disposal Unit: A bedding disposal unit shall be integrated with the washer at the infeed end. Cages shall be manually dumped and/or scraped into the grated area of the unit, whereupon all debris will be ground and flushed to the drain. Controls shall be fully integral with the wash unit controls. Separate controls for the grinder unit shall not be acceptable. Disposal unit shall be equipped with a manual rinse wand on a flexible connection. Grinder portion shall be of Stainless Steel construction and shall be equal to Insinkerator Model SS500.

## 60.0 Utility Requirements

	<u>SL1224/SL1230</u>	<u>SL1236</u>	<u>SL1248</u>
<b>Electrical</b>	3ph, 60hz, 27 HP	3ph, 60hz, 30 HP	3ph, 60hz, 35 HP
<b>Steam</b>	2 1/2 FPT 30-80 PSI 1800#/Hr	2 1/2 FPT 30-80 PSI 2000#/Hr	3 FPT 30-80 PSI 2400#/Hr

<b>Condensate</b>	1 FPT	1 FPT	1 FPT
<b>Hot Water</b>	1 FPT, 35 PSI 120-180 Deg. F. 6-8 gpm	1 FPT, 35 PSI 120-180 Deg. F. 6-8 gpm	1 FPT, 35 PSI 120-180 Deg. F. 8-10 gpm
<b>Drain</b>	2 FPT 140 Deg. F. Max 10 GPM	2 FPT 140 Deg. F. Max 10 GPM	2 FPT 140 Deg. F. Max 12 GPM
<b>Exhaust</b>	12" Dia. 1200 SCFM 180 Deg Saturated	18" Dia. 1800 SCFM 180 Deg Saturated	18" Dia. 2200 SCFM 180 Deg Saturated
<b>Compressed Air</b>	1/2 FPT, 80 PSI 2 SCFM	1/2 FPT, 80 PSI 2 SCFM	1/2 FPT, 80 PSI 2 SCFM
<b>Cold Water</b>	3/4 FPT, 35 PSI 3-4 GPM	3/4 FPT, 35 PSI 3-4 GPM	3/4 FPT, 35 PSI 4-5 GPM

## 60.1 Notes to Utilities Table

- 60.1.1 A disconnect switch shall be installed by others than SMC in accordance with all NEC and local electrical codes.
- 60.1.2 Condensate shall be connected by others than SMC to a non-pressurized gravity main. The maximum condensate lift shall not exceed 15'.
- 60.1.3 Steam pressure shall not exceed 80 psi. Factory shall be consulted for steam pressures below 30 psi dynamic.
- 60.1.4 Hot water temperatures of less than 120 degrees F may impact treatment cycle. Factory shall be consulted for recommendations if 120 degree F water is not available.
- 60.1.5 Drain shall be installed by others than SMC such that there is an air gap between the discharge point and the floor drain, or otherwise in strict accordance with local plumbing codes.
- 60.1.6 Exhaust connection shall be made by others than SMC using non-corroding materials, and all ductwork shall be sealed and pitched towards the machine. Any low points shall have individual drains lines installed. Effluent vapor is 180 degree F, 100% saturated air. Exhaust CFM specifications are for planning purposes only, and shall not be used for air balancing purposes. Actual exhaust draw shall be determined after installation of the unit and damper adjustments, and shall be set in concert with the balancing and conditioning of site air in order to achieve proper machine operation and clement washroom conditions.

## 70.0 Additional Engineering Information

	<u>SL1224(1230)</u>	<u>SL1236</u>	<u>SL1248</u>	<u>Dryer</u>
<b>Shipping Wgt.</b>	5500#	6800#	7400#	1500#
<b>Dynamic Wgt. (in operation)</b>	6000#	8000#	8600#	1200#
<b>Cage Capacity</b>	<b>(Based on 4'/min belt speed)</b>			
<b>Std. Mouse</b>	960/hr(1200)	1680/hr	2160/hr	
<b>Std. Rat</b>	432/hr(556)	576/hr	720/hr	
<b>Tank Capacity-</b>				
<b>Wash Tank</b>	100 Gals.	160 Gals.	160 Gals.	
<b>Rinse Tank</b>	70 Gals	100 Gals.	100 Gals.	
<b>Heat Radiation</b>				
<b>(typ. per/end)</b>	7000 btu/hr	7000 btu/hr	7000 btu/hr	10000 btu/hr
<b>(typ. svce. side)</b>	50000 btu/hr	70000 btu/hr	80000 btu/hr	1000 btu/hr
<b>(typ. blank side)</b>	1000 btu/hr	1000 btu/hr	1000 btu/hr	