Armstrong®

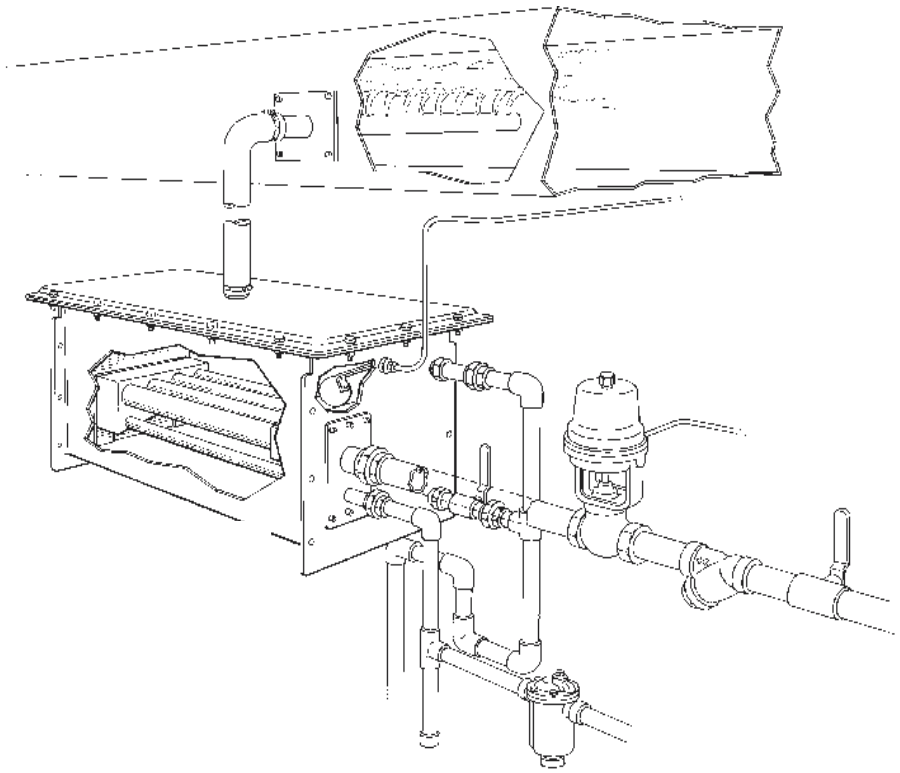
Installation and Maintenance

Series CS Steam-to-Steam Humidifiers

PLEASE READ AND SAVE THESE INSTRUCTIONS

The Armstrong Series CS-10 steam-to-steam humidifiers use existing steam to produce new, pure steam at atmospheric pressure via a heat exchanger. The vapor is discharged into a duct of an air-handling system.

To allow Series CS steam-to-steam humidifiers to function to their full capability, be certain to install in accordance with the following Armstrong recommendations.



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Pre-Installation

1) **Check Shipment**
A claim should be filed with the transportation company (and reported to Armstrong) if any items are missing or damaged.

Two complete sets of installation instructions have been shipped with your unit. One is for the installer's use, the second is for the owner's files.

2) **Check Local Codes**
Series CS-10 Humidifiers should be installed in accordance with **ALL** applicable building, plumbing, and electrical codes.

3) **Site Selection**

Do not place the CS-10 Steam-to-Steam humidifiers above false ceilings or in locations where unusual instances or malfunctions of the humidifier or the system might cause damage to non-repairable, unreplaceable,or priceless property.

CS-10 humidifiers should be installed in locations that allow routine inspection and accessibility for maintenance operations. The control box for the series CS should be mounted in a location where it can be serviced.

The mounting surface should be a wall capable of supporting the maximum humidifier operating weight or a (recommended) suitable floor space. The unit may be suspended from a duct, but accessibility for maintenance purposes is necessary. The location chosen should be indoors with a minimum ambient temperature of 40°F (4°C) and a maximum of 130°F (54°C).

The location should be close enough to the air duct so that the length of steam hose or pipe is as short as feasible. A length of 10 feet (3.4 m) or less is ideal; the maximum recommended length for running copper tube is 40 feet (12 m) equivalent piping distance.

Table 3-1. Weights

Model Number	CS-11	CS-12	CS-13	CS-14	CS-15
Approximate Shipping Weight	85 lb / 39 kg	145 lb / 66 kg	160 lb / 73 kg	400 lb / 181 kg	520 lb / 235 kg
Maximum Operating Weight*	183 lb / 83 kg	398 lb / 180 kg	413 lb / 187 kg	920 lb / 417 kg	1840 lb / 834 kg

*Less steam trap, strainer, control valve, dispersion tube(s) and fittings.

The unit should have ready access to a supply of water, electrical service for the optional drain valve or the control panel, and a sewer into which the drain valve and overflow connections can discharge hot (212°F/100°C) water. In addition, steam supply, condensate return, and control air supply (if used) must be accessible to the unit.

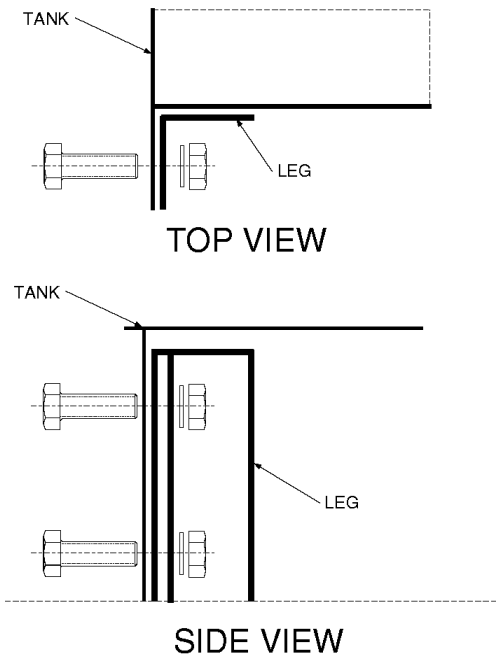
NOTE: Ordinary tap water can be used. However, reduced maintenance and cleaning will be required if softened, demineralized, or deionized water is used. For demineralized and deionized water applications, the unit must have a special coating on the heat exchanger to resist corrosion from the ultra-pure water— **CONTACT FACTORY**. Do not use brackish or contaminated water.

Installation

1) **Mounting the Humidifier**
Regardless of installation type, the humidifier chamber must be installed level. The standard Series CS-10 unit is supplied with 3/8" (9.5 mm) mounting holes to assist in installation. The CS-14/15 unit is supplied with 11/32" x 0.50 oblong-round (8.75mm x 13 mm) mounting holes to assist in installation.

To further assist in the installation of the Series CS-10, Armstrong offers an optional set of installation legs. If legs are being used, please refer to Figure 4-1 to aid with installation. Use the nuts, bolts and washers provided.

Figure 4-1.



2) **Water Fill Supply**
Connect the unit to the building water supply (15-75 psig/1-5 bar pressure). Install a shut-off valve near the humidifier. Connection to the water supply on the fill valve adapter is 1/8" NPT.

3) **Chamber Drain**
The chamber drain connection is ¾" NPT and is intended to be piped to a contractor supplied manual valve (see illustration on the front cover). The Series CS optional automatic drain valve is a ¾" NPT motorized, timer actuated ball valve. It should be installed at the same location as the manual valve when used. In

addition, the ¾" manual valve should be installed from a tee prior to the automatic valve to facilitate manual draining. Be sure the drain line is 1" (25 mm) copper pipe pitched 1" (25 mm) per foot. Do not use PVC pipe because the drain water is hot. Drain the water where it will not present a hazard to personnel. Check local codes.

4) **Overflow Drain**
The chamber overflow connection is ¾" NPT and should be connected to the chamber drain connection downstream of any valves. A loop seal of 6" (152 mm) or greater should be used after connecting to the chamber drain.

5) **Strainer**
The supplied Armstrong "Y" Type Strainer should be the same connection size as the Steam Control Valve. Clean all threaded areas of pipe thoroughly before installing strainer. Use pipe dope or Teflon® tape sparingly. Leave the end thread exposed to avoid introducing the sealant into the system. Install the strainer in the steam supply pipe before the control valve.

6) **Control Valve**
The Armstrong Control Valve is installed in the steam supply line after the "Y" Type Strainer and supplies steam to the heat exchanger within the humidifier chamber. Piping of air supply to the pneumatic control valve is discussed on Page 11. Figures 11-1, 11-2 and 11-3.

7) **Heat Exchanger**
The heat exchanger pipe connections are 1¼" (32 mm) NPT for steam supply and ½" (15 mm) NPT for condensate discharge.

8) **Steam Trap**
The steam trap should be mounted 10" to 12" (254 - 304 mm) below the heat exchanger with a dirt pocket of at least 6" (152 mm). An Armstrong Inverted Bucket Steam Trap is supplied with ½" (15 mm) NPT connections. The trap discharge should be piped to a suitable condensate return. Care should be exercised to ensure that the back pressure or vertical lift after the trap is not too great for the available steam pressure.

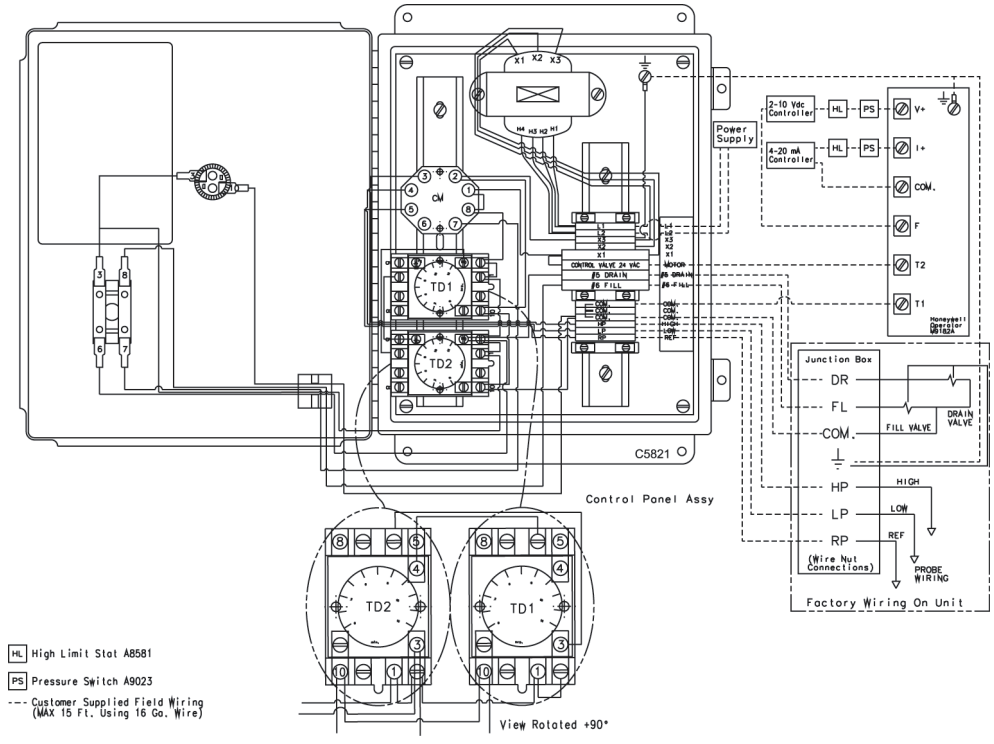
9) **Steam Dispersion Tube**
Please refer to the dispersion tube section of this manual on Pages 12 and 13.

Installation of the CS-10-C or S Models

1) **Control Panel Wiring**
The control panel should be mounted in a location where it can be easily serviced. The electrical supply is either 120 or 240 VAC. Wiring for the unit consists of electrical supply voltage, wiring from control panel to the junction box that controls the fill and drain valves, and wiring to the control valve. The control panel should not be mounted more than 15 feet (4.5 m) away from the humidifier, 16 gauge wire shall be used for all wiring. All wiring installations must be made in accordance with local codes and the wiring diagram found inside each control panel. See Figure 6-1 for wiring schematic. The electrical disconnect or outlet supplying power to the control panel should be **within sight of the humidifier.**

2) **Water Fill Supply**
Connect the unit to the building water supply (20-75 psig/1.4-5 bar pressure). Install a shut-off valve near the humidifier. Connection to the water supply on the fill valve adapter is 1/8″ NPT.

Figure 6-1



3) **Chamber Drain**
The unit has a built in solenoid drain with timing circuits in the control box. The timing circuit consists of two dials: one for frequency of drain, and one for duration of the drain. The drain frequency dials can be set from 0-12 hours and the duration can be varied from 0-30 minutes. Drain time and frequency are factory preset to a 10 minute drain every 4 hours. Other timing options are available, please contact factory.

4) **Overflow Drain**
The CS-13/14/15 overflow and the drain valve are pre-piped, and drainage of the unit only requires the installation of a 10-18″ (255-455 mm) "P" trap from the provided 3/4″ (20 mm) hard copper connection.

It is recommended that a manual drain be installed for the ease of cleaning. This is done by removing the plug from the end of the drain tee, piping in a fully ported ball or gate valve, and then run piping to the drain.

5) **Strainer**
The supplied Armstrong "Y" Type Strainer should be the same connection size as the Steam Control Valve. Clean all threaded areas of pipe thoroughly before installing strainer. Use pipe dope or Teflon® tape sparingly. Leave the end thread exposed to avoid introducing the sealant into the system. Install the strainer in the steam supply pipe before the control valve.

6) **Control Valve**
a) Pneumatic: Please refer to Page 11 Figures 11-1, 11-2 and 11-3.
b) Electric: Power to the electric Honeywell M9182A actuator can be supplied from the control panel of the unit. Please refer to Figure 6-1 for proper wiring.

7) **Heat Exchanger**
The CS-13 heat exchanger connections are 1-1/4" (32 mm) NPT for steam supply and 3/4" (20 mm) NPT for condensate discharge.

The CS-14/15 heat exchanger pipe connections are 1-1/2" (40 mm) NPT for the steam supply and condensate discharge.

8) **Steam Trap**
The steam trap should be mounted 10" to 12" (254 - 304 mm) below the heat exchanger with a dirt pocket of at least 6" (152 mm). An Armstrong Inverted Bucket Steam Trap is supplied with 1/2" NPT (15 mm) connections for the CS-13 Model. The CS-14 is supplied with Armstrong Inverted Bucket Steam Trap Model 812 with 3/4" (20 mm) connections. Finally, the CS-15 model is supplied with two Armstrong Inverted Bucket Steam Trap Model 812 with 3/4" (20 mm) connections, one for each

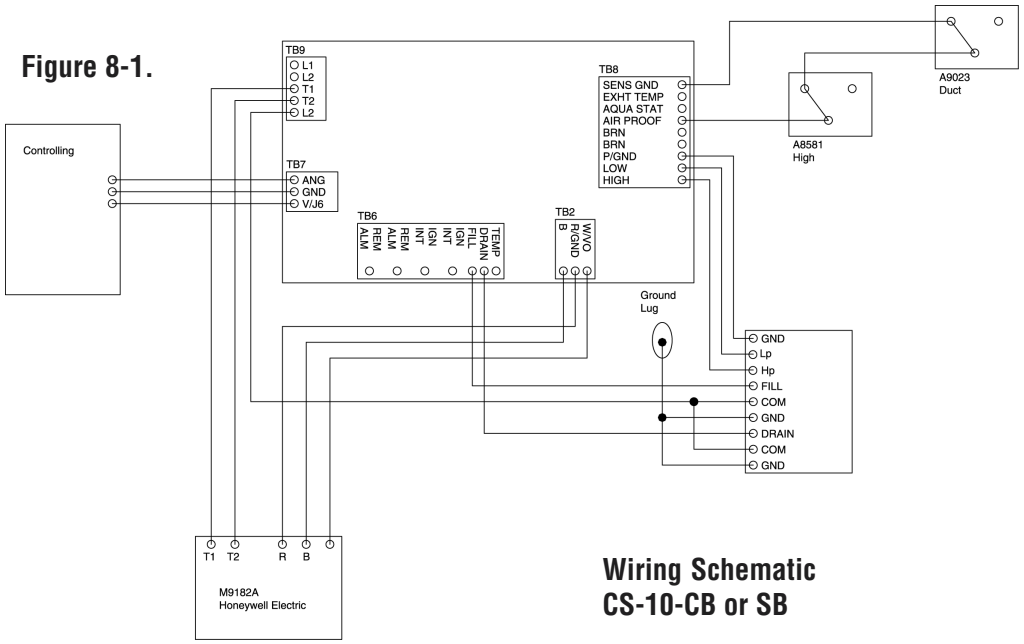
condensate connection of the heat exchanger. The trap discharge should be piped to a suitable condensate return. Care should be exercised to ensure that the back pressure or vertical lift after the trap is eliminated.

9) **Steam Dispersion Tube**
Please refer to the dispersion tube selection section of this manual (Pages 12 and 13).

Installation of the CS-10-CB, or SB Models

1) **Control Panel Wiring**
The control panel should be mounted in a location where it can be easily serviced. The electrical supply to the control panel is 120 VAC (240 VAC option available). Wiring for the unit consists of electrical supply wiring from control panel to the junction box on the tank assembly and wiring to the control valve. The control panel should not be mounted more than 15 feet (4.5 m) away from the humidifier, 16 gauge wire shall be used for all wiring. All wiring installations must be made in accordance with local codes and the wiring diagram found inside each control panel. See Figure 8-1 for schematic. The electrical disconnect or outlet supplying power to the control panel should be **within sight of the humidifier.**

Figure 8-1.



Wiring Schematic
CS-10-CB or SB

2) **Control Wiring**

Figure 9-1.

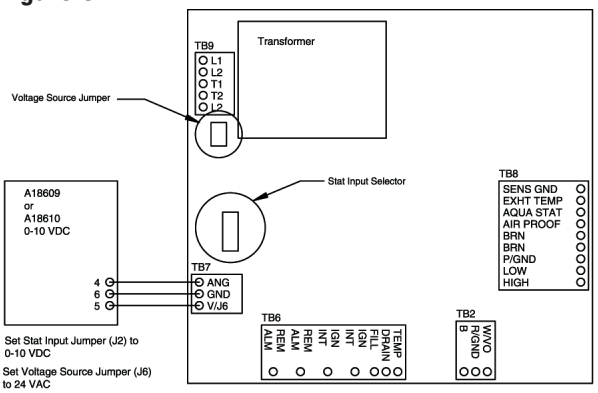


Figure 9-2.

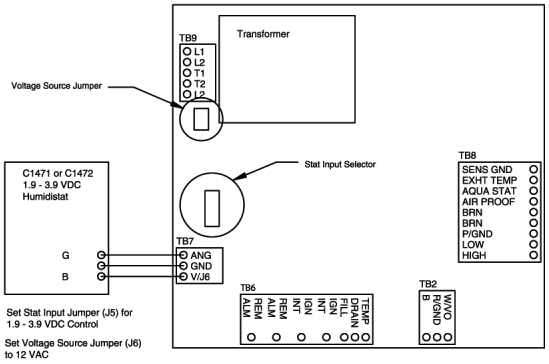
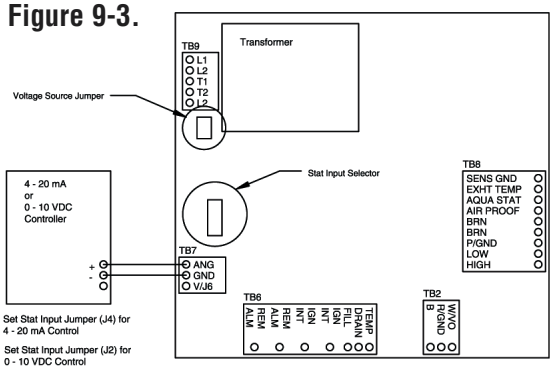


Figure 9-3.



3) **Water Fill Supply**
Connect the unit to the building water supply (20-75 psig/1.4-5 bar). Install a shut-off valve near the humidifier. The water supply connection on the fill valve is 1/8" NPT.

4) **Chamber Drain**
The unit has a built in solenoid drain with timing circuits in the control box. The timing circuit consists of two dip switches. The drain frequency and duration are determined by the DIP switch settings, please see Page 26 for this information. Drain time and frequency are factory preset to a 10 minute drain every 4 hours.

5) **Overflow Drain**
The CS-13/14/15 overflow and the drain valve are pre-piped, and drainage of the unit only requires the installation of a 10-18" (255-455 mm) "P" trap from the provided 3/4" (20 mm) hard copper connection.

It is recommended that a manual drain be installed for the ease of cleaning. This is done by removing the plug from the end of the drain tee, piping in a fully ported ball or gate valve, and then run piping to the drain.

6) **Strainer**
The supplied Armstrong "Y" Type Strainer should be the same connection size as the Steam Control Valve. Clean all threaded areas of pipe thoroughly before installing strainer. Use pipe dope or Teflon® tape sparingly. Leave the end thread exposed to avoid introducing the sealant into the system. Install the strainer in the steam supply pipe before the control valve.

7) **Control Valve**
a) Pneumatic: If a pneumatic valve is to be used, the control panel will have a 4 – 11 psi transducer installed. The output of this transducer is controlled by the PC Board, and will be used to control the pneumatic actuator. An electronic signal must be provided to control panel even if pneumatic control valve is to be used.

b) Electric: Power to the electric Honeywell M9182A actuator can be supplied from the control panel of the unit. Refer to Figure 8-1 for proper wiring. Other actuators may be used. Please consult factory

8) **Heat Exchanger**
The CS-11/12/13 heat exchanger connections are 1 1/4" (32 mm) NPT for steam supply and 3/4" (20 mm) NPT for condensate discharge.

The CS-14/15 heat exchanger pipe connections are 1 1/2" (40 mm) NPT for the steam supply and condensate discharge.

Table 10-1. Spring Ranges

Model Number	Armstrong Control Valve	Adjustable Start Points	Operating Range
CS-11	ACV-02-AM	3 psi - 6 psi / .2 - .4 bar	10 psi / .6 bar*
CS-12	ACV-03-AM	3 psi - 6 psi / .2 - .4 bar	10 psi / .6 bar*
CS-13	ACV-03-AM	3 psi - 6 psi / .2 - .4 bar	10 psi / .6 bar*
	ACV-04-HAM	Fixed Start	4 - 11 psi / .2 - .7 bar
CS-14	ACV-06-HAM	Fixed Start	4 - 11 psi / .2 - .7 bar
CS-15	Honeywell 2" - HAM	Fixed Start	4 - 11 psi / .2 - .7 bar

* 5 psi / .3 bar spring optional. **Note:** AM control valves come factory set a 3 psig / .2 bar start point.

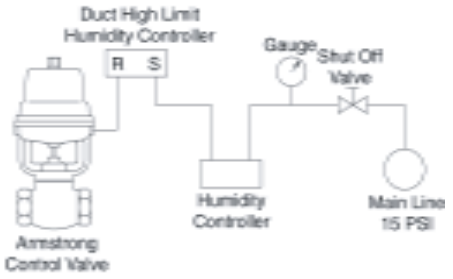


Figure 11-1.
Standard compressed air hookup for all pneumatically operated valves.

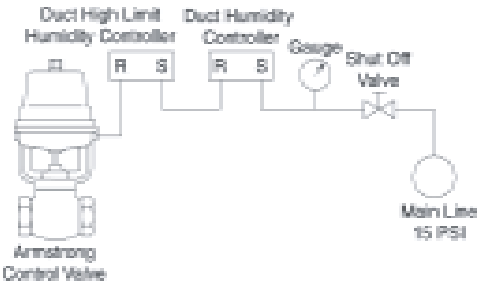


Figure 11-2.
Compressed air hookup for valves utilizing two Armstrong Controllers, one as the humidity controller, the other as a high limit controller.

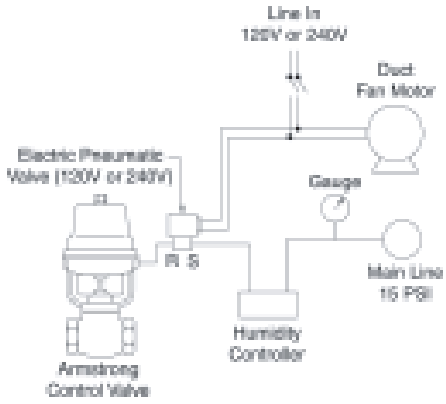


Figure 11-3.
Compressed air hookup for air operated control valves incorporating safety interlock for shut down in the event of power failure to fan.

9) **Steam Trap**
The steam trap should be mounted 10” to 12” (254 - 304 mm) below the heat exchanger with a dirt pocket of at least 6” (152 mm). An Armstrong Inverted Bucket Steam Trap is supplied with 1/2” (15 mm) NPT connections for Models CS-11/12/13. The CS-14 is supplied with Armstrong inverted bucket steam trap Model 812 with 3/4” (20 mm) connections. Finally, the CS-15 model is supplied with two Armstrong inverted bucket steam trap Model 812 with 3/4” (20 mm) connections, one for each condensate connection of the heat exchanger. The trap discharge should be piped to a suitable condensate return. Care should be exercised to ensure that the back pressure or vertical lift after the trap is eliminated.

10) **Steam Dispersion Tube**
Please refer to the dipsersion tube section of this manual (Pages 12 and 13).

Duct Safety Devices

High Limit Humidistat

A Duct mounted high limit humidistat is recommended to prevent over-saturation of the duct air. Use an on-off controller that opens on fault (high humidity). Humidistat should be set for a maximum of 90% RH. Alternately, a modulation high limit humidistat may be used on applications such as variable air volume (VAV). Located the high limit humidistat approximately 10′ (3 m) downstream of the dispersion manifold. If 10′ (3 m) is not available, consult the factory.

Airflow / Pressure Switch

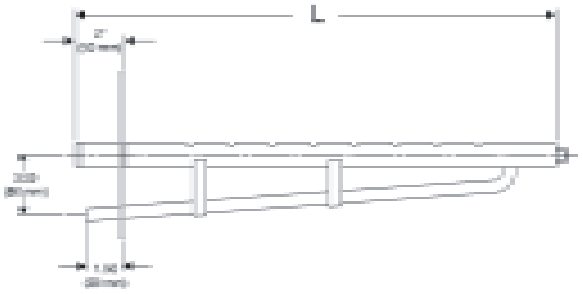
A duct mounted mounted airflow pressure switch is recommended to deactivate the humidifier when there is insufficient air flow in the duct system. The switch should open on low air flow.

Steam Dispersion Tube

a) Verify that the proper length and type of steam dispersion tube has been selected. See Table 13-1 for proper tube lengths.

When the dispersion tube capacity is greater than 40 lbs/hr (18 kg/hr), the steam flow rate is too high to allow for gravity drainage and the dispersion tube with
1/2" O.D. drain tube must be used.
See Figure 12-1.

Figure 12-1.



Duct mounted manifold with 1/2 (drain for 40 lbs/hr (18 kg/hr) or more capacity.

All dispersion tubes for the CS-14/15 will include the 1/2" (15 mm) drain. Connect the dispersion tubes to the steam generator using 2" (50 mm) nominal size hard copper tube (customer supplied) and the short hose cuffs and clamps supplied with
the humidifier. If the pipe run from the humidifier to the dispersion tube is greater than 20' (6 m), extra trapping will be necessary. The maximum allowable pipe run will be 40' (12 m) equivalent piping distance.

Dispersion tube selection should be based on the following capacity chart:

Table 12-1. Capacity and Tube Selection

Model Number	Capacity	Minimum Number of Dispersion Tubes
CS-14	Up to 180 lb/hr (82 kg/hr)	2
	Above 180 lb/hr (82 kg/hr)	4
CS-15	Up to 360 lb/hr (164 kg/hr)	4
CS-15	Above 360 lb/hr	1 tube per 100 lb/hr min.

Note: Absorption distance requirements for your application may dictate more dispersion tubes necessary than indicated in Table 12-1. Contact your local Armstrong Representative for assistance.

b) Select a location on the duct that provides adequate length for vapor mixing and the shortest connection length to the humidifier. Preferably the location should be 10' (3 m) upstream from any dampers, vanes, bends in the duct, or controllers (i.e. high limit stat).

The preferred installation of the dispersion tube is above the humidifier. (Figure 13-2) This allows for gravity drainage of condensate back to the humidifier. Figure 13-1 shows correct installation when manifold is below the humidifier.

Figure 13-3 shows the correct installation for a 2" (50 mm) copper tee used at the drain connection of the "DL" type manifolds. ("D" type manifolds would use a 1-1/2" (40 mm) copper tee.) This drain must be used when humidifier is piped as in Figure 14-1 and/or every 20' (6 m) of pipe run maximum run is 40' (12 m).

Table 13-1. Steam Dispersion Tube Selection

Steam Dispersion Tube Model	Steam Dispersion Tube		Duct Width Min.		Duct Width Max.	
	in	mm	in	mm	in	mm
D/DL - 1	12	305	11	279	16	406
D/DL - 1.5	18	457	17	432	22	559
D/DL - 2	24	610	23	584	34	864
D/DL - 3	36	911	35	889	46	1168
D/DL - 4	48	1219	47	1194	58	1473
D/DL - 5	60	1524	59	1499	70	1778
D/DL - 6	72	1829	71	1803	82	2083
D/DL - 7	84	2134	83	2108	94	2388
D/DL - 8	96	2439	95	2413	106	2692
D/DL - 9	108	2743	107	2718	118	2997
D/DL - 10	120	3048	119	3023	130	3302

Notes:
1. When unit has maximum capacity of above 40 lb/hr., use steam dispersion tube with 1/2" drain.
2. Models CS-12 and CS-13 require a minimum of two dispersion tubes each. Ref. Table 13-1 for CS-14/15.
3. Dispersion tube diameter is 2" Sch. 5 pipe for CS-12/13, 14, 15, 1-1/2" Sch. 5 for CS-11.

Figure 13-1.

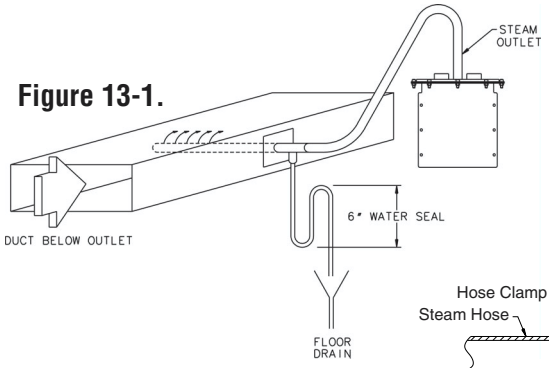
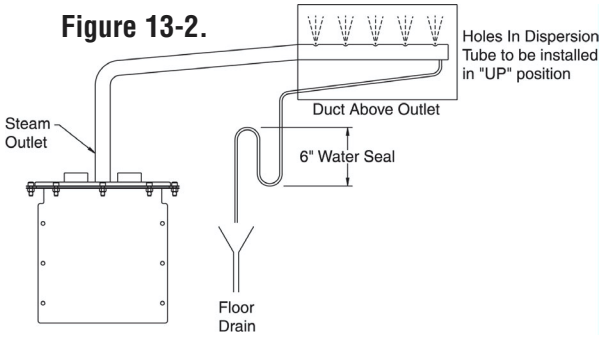


Figure 13-2.



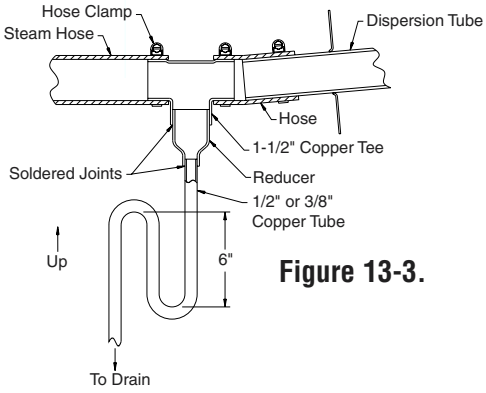


Figure 13-3.

c) Insert the dispersion tube into the duct so the holes face upward. **NEVER** install the tube with the holes facing downward. Fasten the mounting plate to the outside of the duct with sheet metal screws. If the dispersion tube is 36" (.3 m) long or more, support the outer end with threaded rod or similar means. Avoid installing standard manifold in downward flow air duct or ducts where air velocity exceeds 2000 FPM.

d) For the "DL" type dispersion tubes, connect the dispersion tube to the steam generator using 2" (50 mm) nominal size hard copper tube (customer supplied) and the two short hoses supplied with the humidifier (Figure 13-3). The "D" type requires 1-1/2" (40 mm) nominal copper tube. Insulate the copper tube to minimize condensation.

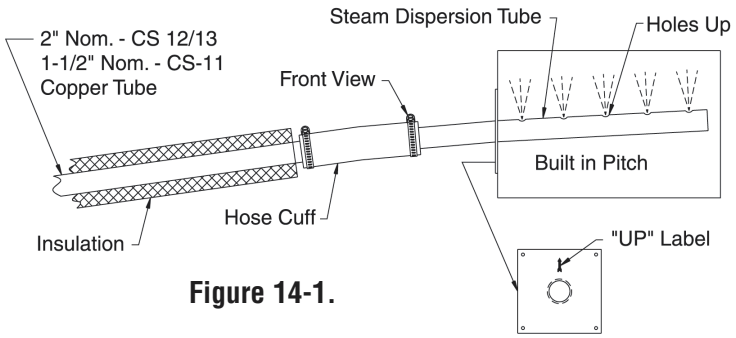


Figure 14-1.

For the CS-11, if the optional 10 foot (3 m) flexible steam hose is used, cut the steam hose to length as required. Wipe out the inside of each hose end before installing. Connect the cut end of the hose to the dispersion tube. Tighten all hose clamps.

Steam hose or pipe must be free of loops, kinks, and sags to allow for gravity drainage of condensate. (Provide pitch of 1" (25 mm) per foot.) Hose supports may be required.

Physical Data CS-11/12/13

Table 14-1. Capacities and Physical Data

Model No.		CS-11	CS-12	CS-13
Steam Pressure psi	2	2	4	5
	5	10	30	50
	10	30	80	100
	13	33	105	150
	15	35	120	180
Capacities based on steam pressure, downstream of control valve. Anticipate minimum of 2 △ psi across valve.				
Note: Use of teflon coated heat exchanger may reduce capacity. Consult Factory.				
Maximum Operating Pressure	15 psi			
Water Supply Pressure Range	15 - 115 psi			

Higher steam-to-steam humidifier capacities available from Armstrong. See Bulletin 571 and 568.

Figure 15-1.

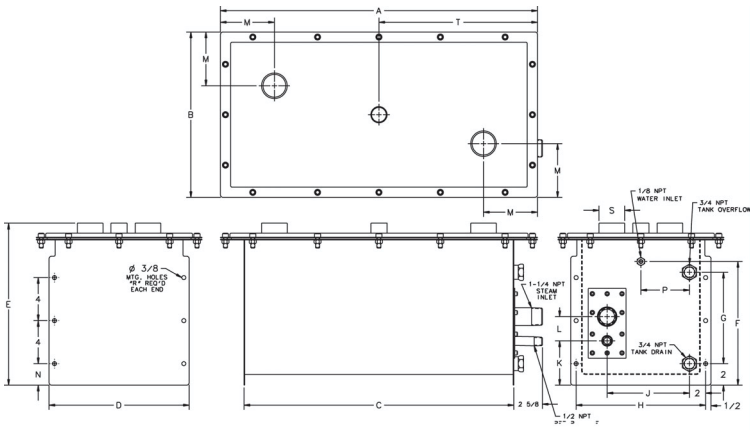


Table 15-1. Physical Data

Model No.		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
CS-11	in	31-3/8	15-3/8	27	13	15-1/16	11-1/2	8-1/2	12	7-5/8	4-1/8	2-1/4	—	2	4-1/2	6	1-1/2	15-11/16
	mm	797	390	685	330	382	292	216	305	194	105	27	—	50	114	152	38	398
CS-12	in	46-1/2	21-5/8	43	19	17-1/16	13-1/2	10-1/2	18	13-5/8	3-23/32	3-19/32	6	1	7-1/2	8	2-3/8	—
	mm	1181	549	1092	482	433	343	267	457	346	94	91	152	25	190	203	60	—
CS-13	in	46-1/2	21-5/8	43	19	17-1/16	13-1/2	10-1/2	18	13-5/8	3-23/32	3-19/32	6	1	7-1/2	8	2-3/8	—
	mm	1181	549	1092	482	433	343	267	457	346	94	91	152	25	190	203	60	—

These capacities are based on supply pressure to the control valve.

Table 15-2. Capacities

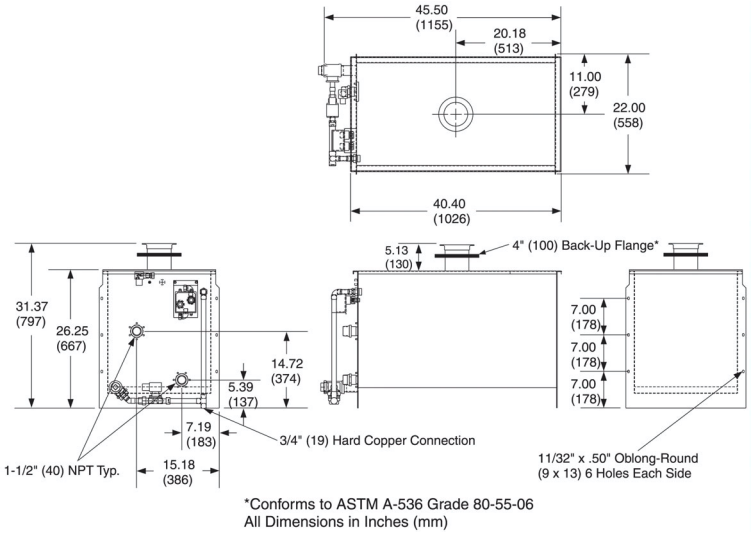
Inlet Pressure	CS-14C	CS-14S/DI	CS-15C	CS-15S
5 psig (.35 bar)	100 lb/hr (45 kg/hr)	75 lb/hr (34 kg/hr)	200 lb/hr (91 kg/hr)	115 lb/hr (52 kg/hr)
10 psig (.7 bar)	280 lb/hr (127 kg/hr)	135 lb/hr (61 kg/hr)	560 lb/hr (255 kg/hr)	270 lb/hr (123 kg/hr)
15 psig (1 bar)	400 lb/hr (182 kg/hr)	260 lb/hr (118 kg/hr)	800 lb/hr (364 kg/hr)	520 lb/hr (236 kg/hr)

These capacities are based on supply pressure to the control valve.

Tank Capacity and Fill/Drain Rates

Model No.	CS-11	CS-12/CS-13	CS-14	CS-15
Tank Capacity, Gallons/Liters	10 (38)	30 (114)	52 (197)	140 (530)
Fill Rate, gpm (L/min)	2 (7.6)	2 (7.6)	2 (7.6)	2 (7.6)
Drain Rate, gpm (L/min)	2.5 (9.5)	2.5 (9.5)	2.5 (9.5)	3 (11.5)

Physical Data CS-14



*Conforms to ASTM A-536 Grade 80-55-06
All Dimensions in Inches (mm)

Physical Data CS-15

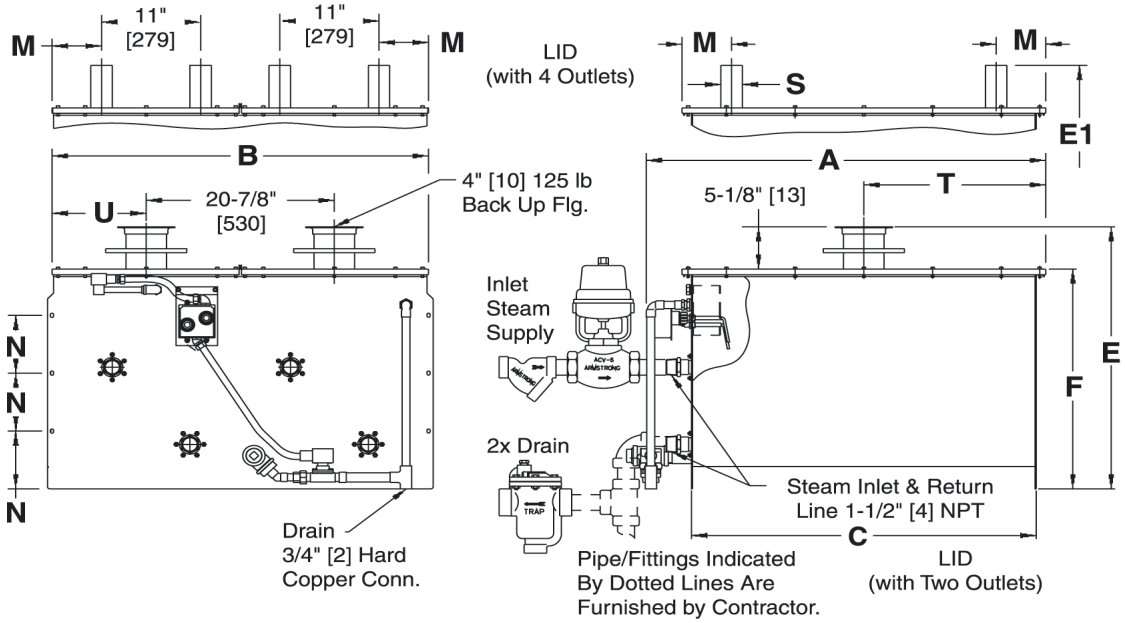


Table 16-1. Physical Data

Model No.		A	B	C	D	E	E1	F	J	K	L	M	N	S	T	U	V
CS-15C	in	45-1/2	41-3/4	38-1/4	43	31-3/8	31-11/16	26-9/16	8-5/8	5-3/8	9-11/32	5-1/2	7	2-3/8	20-1/8	11	7-3/16
CS-15S	mm	1156	1060	972	1092	797	805	675	219	137	237	140	178	60	511	279	183
Maximum Operating Weight, lb (kg)					920 (417)			Less Trap, Strainer and Control Valve.									
Shipping Weight, lb (kg)					400 (180)												

Tank Lid Options

CS-14 Tank Lid Options

The CS-14 is offered with three tank lid options. The first option will include two-2" (50 mm) connections for low capacity applications (Below 180 lbs/hr (82 kg/hr)–See Table 12-1). The second option will include four-2" (50 mm) connections built into the lid. Both the first and second option will require the user to connect the piping to the dispersion tubes directly to the outputs on the tank lid by using the hose cuffs and clamps provided.

The third lid option incorporates the use of one 4" (100 mm) Back-Up flange connection. This requires the use of a fabricated header connected to the output connection, then piped individually from the header to the dispersion tubes. Contact your Armstrong Representative or the Factory for information about this header.

CS-15 Tank Lid Options

CS-15 comes standard with (two) 4" flanged connections. Alternate lid options include (four) 2" connections where capacity required is less than 360 lb/hr (164 kg/hr).

Principles of Operation, CS Steam-to-Steam Humidifiers

The Series CS-10 Humidifiers consists of a heat exchanger submersed in a tank of water. The heat of the steam supplied to the heat exchanger raises the temperature of the tank water to the boiling point. At this point, water is converted to live steam which is, in turn, injected into an air handling duct. The result gives humidification without concern for boiler water treatment carryover.

The Armstrong Steam Control Valve is fed either a variable pneumatic or electric control signal from the controlling humidistat. This regulates humidifier output according to demand. Condensate flows from the heat exchanger to the steam trap before being discharged to the return system.

Steam output may be stopped by a duct high-limit humidistat or a fan interlock switch. These devices prevent excess moisture and condensation in the duct. Additionally, for the Series CS-10, the steam to the heat exchanger is interrupted if a low liquid level is indicated in the chamber.

Water level in the tank is controlled by a ball float valve for the Series CS-10-SF, and by electrode liquid level control for all other Series CS-10 Models. The electrode liquid level control cycles a water fill solenoid valve on/off to maintain the liquid level inside the tank.

Start-up Procedure for Series CS-10-SF Humidifiers

The following steps should be performed on all **newly** installed Series CS humidifiers to ensure that the humidifier and the entire humidification system functions properly.

1) Check for any loose connections on the humidifier chamber and in the steam, water, and drain lines.

2) Turn on water supply to the humidifier. Check for leaks. It may take 45 minutes or more for the unit to fill on its own. If this is not satisfactory, the unit may be opened and a water hose used to assist in the initial fill.

3) Fill the water seal in the piping downstream of the chamber overflow connection. If the chamber drain piping and overflow piping are joined before the water seal, the seal is filled by momentarily opening the manual drain valve.

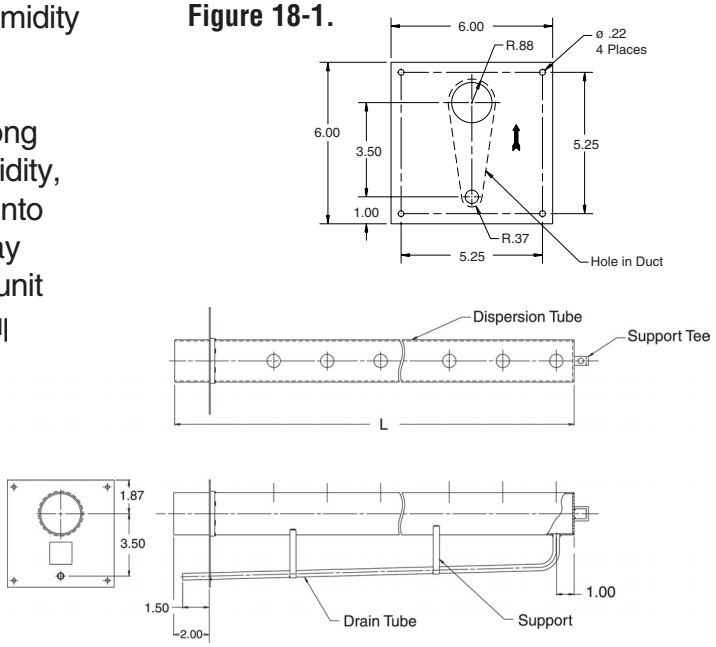
4) If the “Dispersion Tube” is equipped with a drain fitting, verify that it is working. Look at the “Tube Mounting Plate”, there is an Armstrong “A” Logo or “UP” sticker which should be pointing up. If not, the tube will not drain properly. See Figure 18-1.

5) Adjust humidistat upward to call for humidity from the humidifier.

6) Open steam supply valve to Armstrong control valve. With demand for humidity, the control valve should permit flow into the humidifier heat exchanger. It may take 20 minutes or more before the unit discharges steam from a cold start-u|

7) Check that the fan interlock switch and high limit humidistat (if used) are wired properly. The fan interlock switch allows the control valve to close on loss of airflow. The high limit humidistat closes the control valve on a high humidity condition in the duct. Check to ensure that the high limit humidistat and fan interlock switch open on fault.

Figure 18-1.



8) Check steam control valve operation to ensure it is responsive to the humidistat.

Start-up Procedure for Series CS-10-C or S Humidifiers

The following information pertains to the Series CS-10-C or S and is supplemental to the prior section on start-up information.

1) Check for any loose connections at the humidifier chamber and in steam, water, and drain lines.

   With power off check for any loose electrical connections. Using a screwdriver, **TIGHTEN ALL SCREW TERMINALS** on the terminal block in the Armstrong Control Panel.

2) Turn on power to the Armstrong Control Panel. This supplies power to the water makeup valve and the liquid level control probes inside the humidifier.

3) Turn on water supply to the humidifier. Check for leaks. It may take 45 minutes or more for the unit to fill on its own. If this is not satisfactory, the unit may be opened and a water hose used to assist in the initial fill.

4) Fill the water seal in the piping downstream of the chamber overflow connection. If the chamber drain piping and overflow piping are joined before the water seal, the seal is filled by momentarily opening the manual drain valve.

5) If the "Dispersion Tube" is equipped with a drain fitting, verify that it is working. Look at the "Tube Mounting Plate", there is an Armstrong "A" Logo or "UP" sticker which should be pointing up. If not, the tube will not drain properly. See Figure 18-1.

Start-up Procedure for the CS-10-CB or SB

1) Verify all wiring connections are tight and wired properly.

2) With the Steam Generation switch in the OFF position, apply power to the unit.

3) Cycle the three switches on the PC board to verify operation of the fill, drain, and temper valve (if used).

4) Engage unit by depressing the Steam Generation switch to the ON position.

5) Verify the fill valve engages and the unit begins to fill.

6) Once the water reaches the low electrode, the control valve should open and the unit will begin its 7 minute warm up cycle. The unit will not respond to any control signals during this time. If troubleshooting is to be done, it is very important that all control signal readings are done after this 7 minute warm up period.

7) After the 7 minute warm up period, the humidifier should go into normal operation responding to the humidistat signal.

Maintenance Schedule

Note: CS-10 Series Humidifiers must have the power to the control panel turned off prior to opening the chamber.

One Week After Start-up

1) Check unit operation.

2) Check drain piping for leaks.

3) Check water supply piping for leaks.

4) Check steam piping for leaks.

5) Observe duct low points for signs of poor humidity distribution.

6) Clean Strainer. The screen in the strainer installed in the steam supply line should be cleaned one a week after the humidifier has been in service. This should be repeated once a season thereafter—more if you find much dirt on the screen.

7) Check Trap. The steam trap used to drain the humidifier should be inspected at the same time the strainer is cleaned.

General Maintenance

The primary source of required maintenance with the CS-10 Series will be cleaning of the chamber, heat exchanger, and float mechanism or electrodes.

Frequency of cleaning will be dependent on water quality and humidifier output requirements. The use of softened water will reduce the need for cleaning. For the use of deionized, demineralized, and reverse osmosis type water, consult factory.

Inspect One Month After Start-up

Armstrong recommends a new unit be opened and inspected for solid buildup after one month of service.

Procedure for Cleaning

1) Shut down the steam supply to the control valve, and if the unit is a CS-10 or CS-13/14/15 type, turn off power to the control box.

2) Give the humidifier some time to cool down. The inside and outside of the chamber is **HOT!**

3) Manually drain the chamber. For CS-10-C or S, this is done by switching by the "Manual Drain" switch on the front of the control panel to the "On" position. If the unit has a gate or ball valve plumbed in to the chamber drain, open this to aid in draining.

4) Remove the unit's lid and flush cold water through the chamber.

5) Inspect the float mechanism or electrodes. Remove and clean if necessary.

6) If the heat exchanger is Teflon® coated, be careful not to scratch away the coating with sharp instruments.

7) All CS-10-C heat exchangers are coated with a protective electroless-nickel coating, be careful not to scratch this coating with sharp instruments. Muriatic acid can be used per chemical manufacturer's specification. Armstrong also offers RiteQuick, which is a non-caustic cleaning product. Please contact Armstrong or your local Armstrong Representative for more information.

8) Remove any accumulation of solids from the chamber at this time.

9) Inspect heat exchanger and clean if required. Removal of solids is simplified if the accumulation is moist and has been "shocked" with cold water not long after shut down.

   Experience with cleaning will serve as a guide as to how frequently cleaning will be required. The optional automatic drain valve and timer package is intended to reduce the accumulation of solids in the humidifier. For units purchased without this package, it frequently can be added in the field.

Completing a Service Life Cycle

When the 90% of the selected service time has accumulated, the "SERVICE LIFE" LED on the control panel will start to flash (blink on and off). See DIP Switch Settings Section. If HumidiClean is not serviced by replacing the ionic beds and manually depressing the reset switch, HumidiClean will continue to produce steam on demand for the remaining Service Life. During these hours of operation, the HumidiClean will display a flashing "SERVICE LIFE" LED. After 100% of the selected Service Life has accumulated, in hours of power to the heating elements, the unit will shut down by draining the tank as described above and not respond to any call for humidity.

Replacing the Ionic Beds

1. Turn off steam generation switch and allow unit to completely drain.

2. **Cut power at circuit breaker.**

3. (**Caution:** Tank will still be quite warm and should be allowed to cool.) Disconnect hose cuff piping from tank lid. Remove all tank lid screws and remove tank lid(s).

4. Unsnap ionic beds from support pins and remove all Ionic Beds.

5. Inspect tank drain outlet and heat exchanger inside the tank. Heat exchanger may need to be cleaned at this time. Please refer to Cleaning Procedure on page 20 for complete cleaning instructions.

6. Install new ionic beds, snapping them into place on the support pins. Number of beds depends upon model number as follows:

CS-13	10 Beds Required (P/N B5213)
CS-14	12 Beds Required (P/N D3337)
CS-15	24 Beds Required (P/N D3337)

7. Be sure tank gasket is lapped over all edges of tank lid connection. Replace and secure tank lid.
8. Reconnect steam dispersion hose cuff piping.
9. Turn on power at circuit breaker.
10. Depress and hold in the reset button **to the left** for 20 seconds. All the LED's will blink together indicating the accumulated hours memory has been reset to zero. The unit should now be heard filling. NOTE: The accumulated time memory can only be reset to zero when the service LED is blinking or on solid.
11. The following step should be performed after the unit has started heating and is making steam. Turn main power off and double check tank lid gasket for steam leakage. Re-tighten tank lid screws or reposition gasket if necessary.

Troubleshooting Guide

I. Humidifier will not discharge steam.

A. Control System Fault
   1. Control valve operator – Does the valve open and close as the control signal varies between 0% to 100%?
   2. Humidity controller – Does the control signal coming to the humidifier reflect the relative humidity set point on the controller?
   3. Connections between humidity controller and control valve – Is there continuity, and is the same signal measured at the humidifier connections and controller connections alike?
   4. Safety controls open – High limit, fan interlock, etc.

B. Steam System Malfunction
   1. Lift or back pressure after steam trap is too great for steam supply pressure resulting in a flooded humidifier heat exchanger.
   2. Strainer screen before control valve is plugged.
   3. Steam valve closed in line to humidifier—See Section I-A above for possible causes.
   4. Pressure reducing valve malfunction.
   5. Steam trap has failed closed.
   6. Low liquid level in chamber—See Section I-C on Page 23.

C. Water Supply Malfunction
   1. Low or no water pressure.
   2. Plugged valve or water strainer.
   3. Faulty water fill valve – For Series CS-10-C or S, is there power to the control box and solenoid fill valve?
   4. Electrodes possibly need cleaning.

II. Humidifier Discharges Continuously Even Though Humidity Has Reached Desired Level.
A. Humidity controller out of calibration.
B. Humidifier malfunction.
   1. Valve stem on control valve "frozen" to stem seal due to unusual chemical or corrosive conditions in steam system.
   2. Operator spring on pneumatic control valve broken.
   3. Dirt or scale between valve and seat in control valve—blow down and clean strainer.

III. Humidifier Does Not Stop Filling
A. Float mechanism may be failed open.
B. The fill valve is stuck open or does not seat properly.
C. Water pressure too high (above 75 psi).
D. The electrodes need cleaning.
E. Loose connection on wiring from control box to electrode.

IV. Low Steam Output
A. Control System.
   1. Humidity controller not calibrated or malfunctioning.
   2. Control valve faulty.
B. Steam System.
   1. Low steam pressure.
   2. Steam supply strainer plugged.
   3. Wrong steam trap used—Always use properly sized Armstrong inverted bucket steam trap.
   4. Heat exchanger needs to be cleaned.
   5. Flooded heat exchanger because of too much vertical lift after steam trap — or high back pressure in return line.
C. Water Level Control.
   1. Low water pressure.
   2. Faulty water fill valve.

V. Humidifier Discharges Water

A. Distance too great between humidifier and duct (more than 40 ft equivalent piping distance).
B. Check for improper pitch or low points in steam pipe from humidifier to duct.
C. Manifold not dripped.
D. Steam pressure too high.

For additional information on Armstrong Series CS-10-CB or SB Humidifiers only, contact Armstrong or your local Representative.

Diagnostics (Series CS-10-CB or SB only)

There are some diagnostic routines programmed into the PC board. If these routines detect a problem the unit will shut down and flash the “ERROR” LED a certain number of times, followed by a long pause.

1 Blink — The low level switch has not closed after 60 minutes of fill valve on time. This is only on initial start-up or after a complete drain down.
Check: defective fill valve, debris in fill valve inlet screen or on tank drain screen, water leakage from tank or inlet tubing, no water flow or low water pressure, drain valve stuck open or leaking, defective low water level switch (electrodes need to be cleaned).

2 Blinks — The low level switch has not closed after 12 minutes of fill valve on time. This is only after initial start-up fill and boil-down sequence.
Check: debris in water switch canister, defective fill valve, no water flow or low water pressure, drain valve stuck open, defective low water level switch (electrodes need to be cleaned).

3 Blinks — The high level switch has not closed after 20 minutes of fill on time. This is only on initial start-up or after a complete drain down.
Check: debris in fill valve inlet screen or in tank drain screen, water leaking from tank or inlet tubing, low water pressure, defective high water level switch (electrodes need to be cleaned).

4 Blinks — The high water switch is still closed 18 minutes after the fill valve has turned off upon hitting the high water level and a 10 minute drain does not drop the water below the high water level.
Check: defective high water level switch, debris in level canister, fill valve stuck open, drain valve is defective or scale buildup in drain line.

5 Blinks — The high level switch is closed and the low level switch is open.
Check: defective level switch(es), debris in electrode level canister, scale on electrodes or in float switch cannister, improper wiring of electrodes or float switches.

7 Blinks — The low water level switch has not opened after complete drain. Unit drains every 24 hours of steam generation time, duration is set by dip switch S2-5 and S2-1.
Check: defective low water level switch or electrodes, defective drain valve, debris on low water level float switch or electrodes, tank drain screen, or in drain valve.

Clearing "Error" Codes

After correcting the problem, the error state must be cleared by depressing the reset button for 5 seconds. All the LEDs will then flash. Release the reset button and the unit should resume normal operation (if the water level is above the low water, the unit will drain below the low water level and refill before energizing the contactor). Turning the power on and off will not clear the error condition.

Table 26-1. LED Status Legend

Power	Steam Generator	Error	Service Life	Definition
S				Unit is operational and is filling, draining or has no demand
S	S			Unit is operating and elements are on
S		B	S	High humidity/sail switch circuit is open
S			B	Unit has reached 90% of bed life
S			S	Unit has reached 100% of bed life and needs to be inspected and reset
S		B	B	"New unit, not initialized and must be reset"
S		1B		Fill time out to low level
S		2B		Water level dropped below level during normal operation
S		3B		Fill time out from low to high level
S		4B		Water level above high level time out
S		5B		Illegal level switch state
S		7B		Water level has not dropped below low level during an empty drain
S = Solid LED B = Blinking LED				

PC Board Dip Switch Settings					
DIP Switch 1		**Parameter**			
Marking					
S1-1	Com.	These DIP switches give the unit an addressable number when using the RS485 computer link hookup			
S1-2	Addr.				
S1-3	Prod. Test	This switch should be set in the RUN position			
S1-4	Test	This switch should be set in the RUN position			
Drain ON Time		2 min	5 min	10 min	15 min
S1-5		Off	On	Off	On
S1-6		Off	Off	On	On
S1-7	NOT USED				
DIP Switch 2		**Parameter**			
S2-1	D/A Scale 1				
S2-2	D/A Scale 2				
End of life settings		500 Hrs	1000 Hrs	2000 Hrs	3000 Hrs
S2-3		Off	On	Off	On
S2-4		Off	Off	On	On
S2-5	NOT USED				
Drain Frequency		1 Hr	4 Hrs	12 Hrs	24 Hrs
S2-6		Off	On	Off	On
S2-7		Off	Off	On	On
S2-8	NOT USED				
Stat Input Jumper		**Parameter**			
J2	0 - 10 VDC	Sets Humidistats input type to 0 - 10 Vdc			
J3	0 - 5 VDC	Sets Humidistats input type to 0 - 5 Vdc			
J4	4 - 20 mA	Sets Humidistats input type 5 - 20 mA			
J5	1.9 - 3.9 Vdc	Sets Humidistat input type to 1.9 - 3.9 Vdc			
Voltage Source (J6)		Parameter			
12 VAC		Supplies 12 VAC to V/J6 terminal of TB7			
24 VAC		Supplies 24 VAC to V/J6 terminal of TB7			
5 VDC		Supplies 5 VDC to V/J6 terminal of TB7			

Notes

Armstrong International, Inc.
Limited Warranty and Remedy

Armstrong International, Inc. ("Armstrong") warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended, that such products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation, but not longer than 15 months from the date of shipment from the factory, [unless a Special Warranty Period applies, as listed below]. This warranty does not extend to any product that has been subject to misuse, neglect or alteration after shipment from the Armstrong factory. Except as may be expressly provided in a written agreement between Armstrong and the user, which is signed by both parties, Armstrong **DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

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Special Warranty Periods are as follows:

Series EHU-700 Electric Steam Humidifier, Series HC-4000 HumidiClean Humidifier and GFH Gas Fired Humidifier with Ionic Beds:
Two (2) years after installation, but not longer than 27 months after shipment from Armstrong's factory.

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