

ENGINEERING MANUAL

PRESSURE STEAM HUMIDIFIERS



The LS Series is a cost effective way to provide precise humidity control, especially in facilities with existing steam boilers. NORTEC offers a wide variety of distributor lengths and multi-distributor arrangements to meet specific project requirements.

■ PRINCIPLE OF OPERATION

Single and multiple distributor humidifiers operate on the same basic principle. Steam and condensate enter the humidifier at the inlet. The steam then circulates through the steam jacket around the dispersion tube. This process preheats the dispersion tube to ensure only condensate-free steam exits the orifices of the dispersion tube.

The steam then flows from the steam jacket into the separator. The steam is directed into a circular vertically rising flow, around the internal baffle. This causes the condensate to fall out. The condensate drains through the steam trap and can be returned to the boiler.

When there is a call for humidity the steam valve opens and allows steam to flow into the dispersion tube where it is discharged. If any condensate is formed when passing through the control valve, it is re-evaporated inside the preheated dispersion tube.

In the case of the multiple distributor configuration, the steam source is split after the strainer. One line feeds all the steam jackets around the dispersion tubes to keep them hot and the other feeds to the separator control valve assembly.

Multi-distributor units are ideal when larger capacities of steam are required for humidification in a single location.

Figure #1
Directional Flow

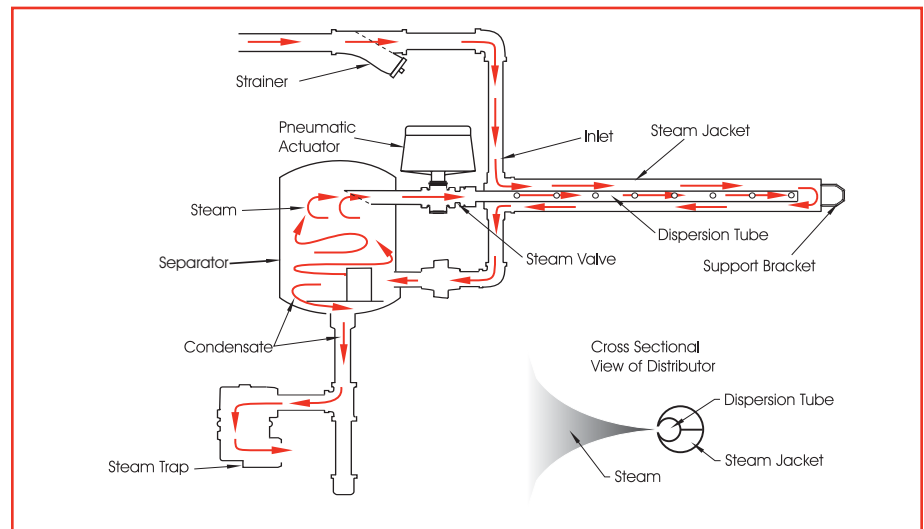


Figure #2
Multi-Distributor Application

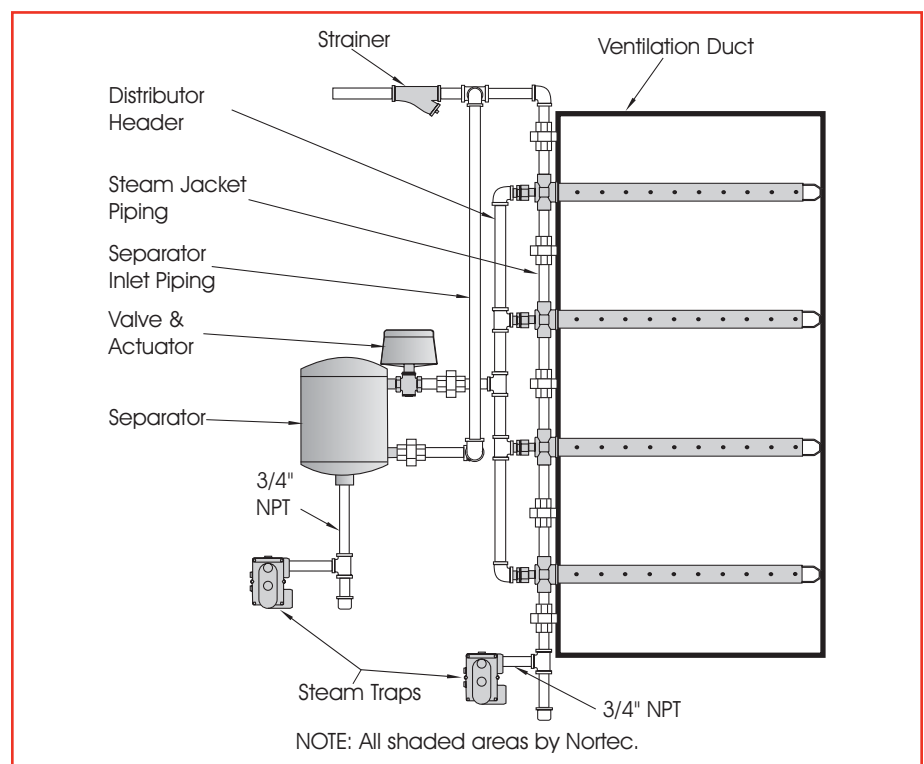


Table #1
Model Selection for Single Distributor Humidifiers in lbs/hr (kg/hr)

		Steam Pressure to Humidifier's Supply Connection in psig (kPa)																				
Model	Valve	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40	45	50
	Cv	(14)	(21)	(28)	(34)	(41)	(48)	(55)	(62)	(69)	(76)	(83)	(90)	(96)	(103)	(138)	(172)	(207)	(241)	(276)	(310)	(345)
200 LS1	0.1	3 (1)	3 (1)	4 (2)	4 (2)	5 (2)	5 (2)	5 (2)	6 (3)	6 (3)	6 (3)	6 (3)	7 (3)	7 (3)	7 (3)	8 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	16 (7)
	0.22	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)	9 (4)	10 (5)	11 (5)	11 (5)	12 (5)	12 (5)	13 (6)	13 (6)	14 (6)	16 (7)	18 (8)	20 (9)	23 (10)	25 (11)	27 (12)	30 (14)
	0.4	7 (3)	9 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	15 (7)	16 (7)	16 (7)	17 (8)	18 (8)	18 (8)	19 (9)	22 (10)	25 (11)	29 (13)	32 (15)	35 (16)	38 (17)	41 (19)
	0.75	13 (6)	16 (7)	18 (8)	21 (10)	23 (10)	24 (11)	26 (12)	28 (13)	29 (13)	31 (14)	32 (15)	33 (15)	34 (15)	36 (16)	42 (19)	48 (22)	54 (24)	60 (27)	66 (30)	72 (33)	78 (35)
	1.3	22 (10)	27 (12)	31 (14)	34 (15)	38 (17)	41 (19)	44 (20)	46 (21)	49 (22)	52 (24)	54 (24)	56 (25)	58 (26)	60 (27)	70 (32)	80 (36)	90 (41)	100 (45)	110 (50)	120 (54)	130 (59)
	2.2	34 (15)	41 (19)	48 (22)	53 (24)	58 (26)	63 (29)	67 (30)	71 (32)	75 (34)	80 (36)	83 (38)	86 (39)	89 (40)	92 (42)	108 (49)	123 (56)	139 (63)	154 (70)	170 (77)	185 (84)	201 (91)
	2.8	40 (18)	49 (22)	57 (26)	63 (29)	69 (31)	75 (34)	80 (36)	85 (39)	90 (41)	95 (43)	99 (45)	102 (46)	106 (48)	110 (50)	128 (58)	147 (67)	165 (75)	184 (83)	202 (92)	221 (100)	239 (108)
	4.4	47 (21)	59 (27)	69 (31)	78 (36)	87 (39)	95 (43)	102 (46)	109 (49)	116 (53)	122 (55)	128 (58)	134 (61)	139 (63)	145 (66)	170 (77)	193 (88)	214 (97)	233 (106)	251 (114)	268 (122)	284 (129)
300 LS2	5.5	72 (33)	91 (41)	107 (49)	121 (55)	135 (61)	147 (67)	159 (72)	170 (77)	180 (82)	191 (87)	200 (91)	210 (95)	219 (99)	228 (103)	268 (122)	305 (139)	339 (154)	370 (168)	399 (181)	427 (194)	454 (206)
	7.5	79 (36)	100 (46)	119 (54)	136 (62)	152 (69)	166 (76)	180 (82)	193 (88)	206 (94)	218 (99)	230 (104)	241 (110)	252 (115)	263 (119)	312 (142)	357 (162)	398 (181)	436 (198)	473 (215)	507 (230)	540 (245)
450 LS3	10	105 (48)	136 (62)	162 (74)	187 (85)	209 (95)	230 (105)	250 (114)	269 (122)	287 (131)	305 (139)	322 (146)	338 (154)	354 (161)	370 (168)	442 (201)	508 (231)	569 (259)	626 (285)	681 (309)	732 (333)	782 (355)
	12	111 (51)	145 (66)	175 (80)	203 (92)	228 (104)	253 (115)	276 (125)	298 (135)	319 (145)	340 (154)	360 (163)	379 (172)	398 (181)	416 (189)	503 (228)	582 (264)	656 (298)	725 (330)	792 (360)	855 (389)	916 (417)
600 LS3	20	144 (65)	187 (85)	226 (103)	261 (119)	294 (134)	325 (148)	355 (161)	383 (174)	410 (186)	436 (198)	462 (210)	487 (221)	511 (232)	534 (243)	644 (293)	745 (339)	839 (381)	927 (421)	1011 (460)	1092 (496)	1170 (532)
	28	168 (76)	217 (98)	259 (118)	298 (136)	334 (152)	368 (167)	400 (182)	431 (196)	460 (209)	488 (222)	516 (234)	542 (246)	568 (258)	593 (269)	709 (322)	816 (371)	914 (416)	1007 (458)	1094 (497)	1178 (535)	1258 (572)

■ SINGLE DISTRIBUTOR HUMIDIFIER SELECTION

To select a single distributor humidifier complete the following steps:

1. Calculate humidification load as per NORTEC manual, Form #124B.

For example, lets assume calculated humidification load is 70 lbs/hr.

2. Determine steam pressure at the inlet to humidifier (usually from the project files).

e.g.: lets assume steam pressure is equal to 10 psig.

3. To select the correct LIVESTEAM model refer to Table #1 referencing the steam supply pressure and humidifier output. Read down the pressure column to the nearest larger humidifier output then find required humidifier and valve Cv in left hand side columns.

e.g.: We will read 10 psig column to 75 lbs/hr and it will point to Model 200 LS1 and valve Cv 2.2.

4. From the project files determine duct dimensions.

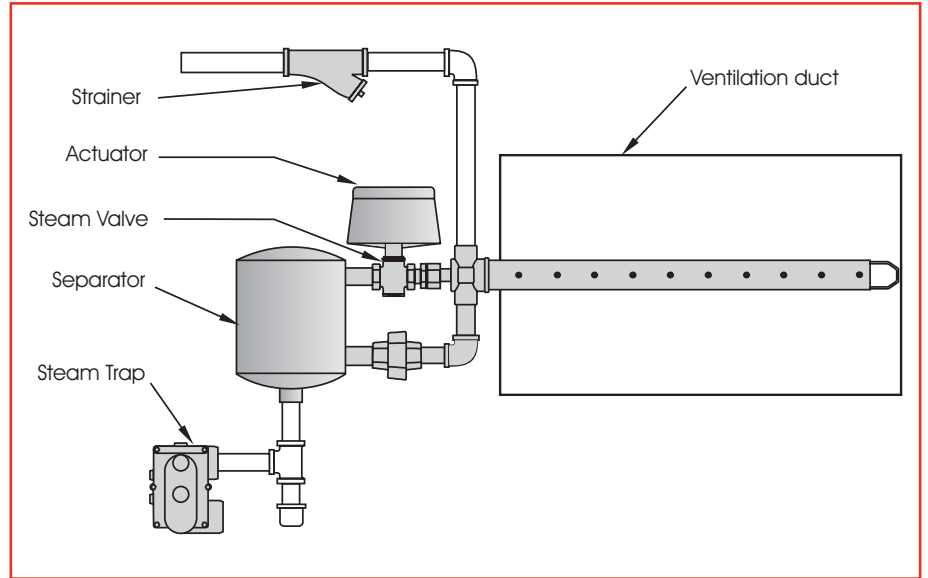
Lets assume that the height of the duct is 24" and width is 50".

5. For available distributor lengths see Table #3. Always choose distributor of equal or shorter insertion length (Dim.L) than ventilation duct width.

e.g.: From Table #3 we will find a distributor of 48" insertion length will suit our needs.

6. If required, absorption distance can be verified by using NORTEC manual, Form #163D.

Figure #3
Single Distributor Humidifier



7. Single distributor humidifiers require one strainer. Strainer sizes are stated in Figure #7.

e.g.: For Model 200 LS1 strainer size is 1/2" NPT.

8. Single distributor humidifiers require one steam trap. For available steam traps refer to NORTEC submittals.

9. Select desired actuator and accessories by using NORTEC submittals.

■ MULTI-DISTRIBUTOR HUMIDIFIER SELECTION

LS SERIES multi-distributor humidifiers include all the primary components of single distributor units. See Figure #2. To select a multi-distributor humidifier complete the following steps:

1. Calculate humidification load as per NORTEC manual, Form #124B.

For example: Lets assume calculated humidification load is 225 lbs/hr.

2. Determine steam pressure at the inlet - usually from the project files.

e.g.: Lets assume pressure is equal to 15 psig.

3. To select the correct LIVESTEAM model refer to Table #2 referencing the steam supply pressure and humidifier output. Read down the pressure column to the nearest larger humidifier output then find required separator and valve Cv in left hand side columns.

In our example, we will read 15 psig column to 228 lbs/hr and it will point to Model 300 with valve Cv 5.5.

4. From the project files determine duct dimensions.

e.g.: Assume height of the duct is 36" and width of the duct is 60".

Table #2
Separator and Valve Selection Multiple Distributor Humidifiers in lbs/hr (kg/hr)

Model	Valve Cv	Steam Pressure to Humidifier's Supply Connection in psig (kPa)																				
		2 (14)	3 (21)	4 (28)	5 (34)	6 (41)	7 (48)	8 (55)	9 (62)	10 (69)	11 (76)	12 (83)	13 (90)	14 (96)	15 (103)	20 (138)	25 (172)	30 (207)	35 (241)	40 (276)	45 (310)	50 (345)
200	0.10	3 (1)	3 (1)	4 (2)	4 (2)	5 (2)	5 (2)	5 (2)	6 (3)	6 (3)	6 (3)	6 (3)	7 (3)	7 (3)	7 (3)	8 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	16 (7)
	0.22	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)	9 (4)	10 (5)	11 (5)	11 (5)	12 (5)	12 (5)	13 (6)	13 (6)	14 (6)	16 (7)	18 (8)	20 (9)	23 (10)	25 (11)	27 (12)	30 (14)
	0.40	7 (3)	9 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	15 (7)	16 (7)	16 (7)	17 (8)	18 (8)	18 (8)	19 (9)	22 (10)	25 (11)	29 (13)	32 (15)	35 (16)	38 (17)	41 (19)
	0.75	13 (6)	16 (7)	18 (8)	21 (10)	23 (10)	24 (11)	26 (12)	28 (13)	29 (13)	31 (14)	32 (15)	33 (15)	34 (15)	36 (16)	42 (19)	48 (22)	54 (24)	60 (27)	66 (30)	72 (33)	78 (35)
	1.30	22 (10)	27 (12)	31 (14)	35 (16)	38 (17)	41 (19)	44 (20)	47 (21)	49 (22)	52 (24)	54 (24)	56 (25)	59 (27)	61 (28)	71 (32)	81 (37)	91 (41)	101 (46)	112 (51)	122 (55)	132 (60)
	2.20	35 (16)	43 (20)	50 (23)	56 (25)	61 (28)	66 (30)	71 (32)	75 (34)	79 (36)	84 (38)	87 (39)	91 (41)	94 (43)	97 (44)	114 (52)	130 (59)	146 (66)	163 (74)	179 (81)	195 (88)	212 (96)
	2.80	43 (20)	53 (24)	62 (28)	69 (31)	75 (34)	81 (37)	87 (39)	92 (42)	97 (44)	103 (47)	107 (49)	111 (50)	115 (52)	119 (54)	139 (63)	159 (72)	179 (81)	199 (90)	219 (99)	239 (108)	260 (118)
	4.4	61 (28)	76 (35)	90 (41)	102 (46)	113 (51)	123 (56)	133 (60)	142 (65)	151 (69)	159 (72)	167 (76)	175 (80)	182 (83)	190 (86)	223 (101)	253 (115)	280 (127)	306 (139)	330 (150)	353 (160)	374 (170)
300	5.5	77 (35)	98 (44)	116 (53)	132 (60)	147 (67)	161 (73)	174 (79)	187 (85)	199 (90)	210 (96)	221 (101)	232 (105)	242 (110)	252 (115)	299 (136)	341 (155)	380 (173)	416 (189)	450 (204)	482 (219)	513 (233)
	7.5	86 (39)	111 (51)	133 (61)	153 (70)	172 (78)	189 (86)	206 (94)	222 (101)	237 (108)	252 (114)	266 (121)	280 (127)	293 (133)	306 (139)	367 (167)	422 (192)	473 (215)	522 (237)	567 (258)	611 (278)	653 (297)
450	10	125 (57)	160 (73)	190 (86)	217 (99)	243 (110)	266 (121)	289 (131)	310 (141)	330 (150)	350 (159)	369 (168)	387 (176)	405 (184)	422 (192)	502 (228)	575 (261)	642 (292)	705 (320)	764 (347)	820 (373)	874 (397)
	12	127 (58)	165 (75)	199 (90)	230 (105)	259 (118)	286 (130)	312 (142)	337 (153)	361 (164)	384 (175)	407 (185)	428 (195)	450 (204)	470 (214)	567 (258)	656 (298)	738 (336)	816 (371)	890 (405)	961 (437)	1030 (468)
600	20	238 (108)	300 (136)	354 (161)	402 (183)	446 (203)	487 (222)	526 (239)	563 (256)	598 (272)	632 (287)	664 (302)	695 (316)	725 (330)	754 (343)	889 (404)	1011 (459)	1122 (510)	1226 (557)	1323 (601)	1415 (643)	1504 (683)
	28	266 (121)	335 (152)	394 (179)	448 (204)	497 (226)	543 (247)	585 (266)	626 (285)	665 (302)	702 (319)	738 (335)	772 (351)	805 (366)	838 (381)	987 (449)	1121 (509)	1243 (565)	1358 (617)	1465 (666)	1567 (712)	1664 (756)
800	40.0	538 (244)	659 (299)	761 (345)	850 (386)	932 (423)	1006 (456)	1076 (488)	1141 (518)	1203 (546)	1275 (578)	1324 (601)	1374 (623)	1424 (646)	1473 (668)	1721 (781)	1969 (893)	2217 (1006)	2465 (1118)	2713 (1231)	2961 (1343)	3209 (1456)

5. For available distributor lengths see Table #3. Always choose distributor of equal or shorter insertion length (Dim.L) than ventilation duct width.

e.g.: Proper selection is distributor of 60" in length.

6. For the recommended quantity of distributors, based on the duct dimensions, refer to Table #5.

e.g.: Two distributors are recommended.

7. For the recommended distributor capacities refer to Table #4. Divide humidifier output by the number of distributors required. Then find the distributor model which will have recommended output equal or greater than calculated number.

e.g.: Calculated output per distributor will be 228 lbs/hr divided by 2 equals 114 lbs/hr. From Table #4 we see that distributors LS1 will suit our needs.

8. Select wye strainer using Table #6.

e.g.: In Table # 6 read the row 15 psi to the nearest larger strainer capacity than required capacity of humidifier (228 lbs/hr). Refer to upper row for strainer nominal diameter. Strainer will be 1" nominal diameter.

9. Multiple distributor humidifiers usually require two steam traps. Some larger systems could require up to 3 steam traps (refer to the submittal drawings for details). For available steam traps refer to NORTEC submittals.

10. Select distributor header size using Table #7.

e.g.: Header size will be 1 1/4".

11. If required, absorption distance can be verified using NORTEC manual, Form #163D.

12. Then select desired actuator and accessories using NORTEC submittals.

DI WATER APPLICATIONS

In certain applications the use of pure water is required to ensure there is no chemical or mineral carry-over to the process. Clean rooms, electronic manufacturing, and operating rooms are examples where pure water is commonly used. For these applications NORTEC offers LS SERIES humidifiers for use with deionized (DI) water.

With NORTEC LIVESTEAM for DI applications all wetted parts are manufactured from 304 stainless steel. Refer to the previous chapters for selection method. For a single tube application refer to Table #8 to select your Stainless Steel valve and separator. For a multiple tube application refer to Table #9.

ELIMINATING HEAT EXCESS FROM LIVESTEAM HUMIDIFIERS

Heat generated by a distributor in the duct during non-humidifying periods may not be desirable in certain applications. If heat gain is a concern consider the following solutions:

1. Manual shut off valve (by others). This is an inexpensive way of disconnecting humidifier from the steam source during non-humidifying periods. Manual shut off valve has to be installed between humidifier's wye strainer and steam main to allow maintenance without shutting down the entire steam system.
2. Automatic shutoff valve (by others). Installed on the humidifier

steam supply line in addition to the manual shut off valve (refer to the local building code). Upon activation it will disconnect humidifier from the steam source during non-humidifying periods.

3. Distributor insulation (NORTEC option). Minimizes heat gain from distributor(s) during humidification and non-humidification seasons. Insulation changes the outside dimension of the distributor causing larger air pressure drop across the distributors. It also increases absorption distance because distributor has to discharge in the direction of the air flow.

CONDENSATE RETURN PIPING

If condensate from humidifier cannot be returned to the boiler by gravity it is possible, in certain cases, to lift condensate. Figure #4 shows the typical condensate return installation.

In theory, one pound of pressure can elevate condensate 28 inches. Taking into consideration pressure drop on the steam trap and check valve, pipe friction and back pressure in the condensate return main a more realistic value would be 10-14 inches per 1 pound of steam pressure at the steam trap. Refer to ASHRAE handbook for detailed calculation method.

Table #3
Available Insertion Length

DIM. L		LS1	LS2	LS3
inch	m			
12	0.305	X	X	
18	0.457	X	X	
24	0.610	X	X	X
30	0.762	X	X	X
36	0.914	X	X	X
48	1.219	X	X	X
60	1.524	X	X	X
72	1.829	X	X	X
84	2.134	X	X	X
96	2.438	X	X	X
108	2.743	X	X	X
120	3.048	X	X	X
132	3.353	X	X	X
144	3.658	X	X	X

Figure #4
Condensate Return Piping

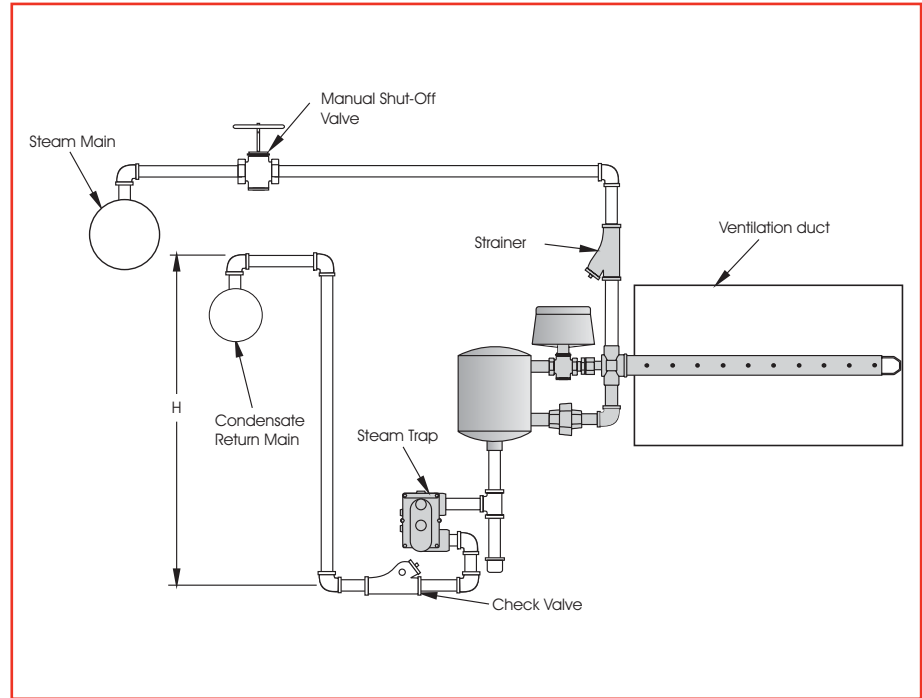


Table #4
Recommended Distributor Capacities

Distributor Length	MODEL					
	LS1		LS2		LS3	
	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr
Shorter than 48"	100	45	150	68	400	182
Longer than 48"	150	68	250	114	550	250

Table #5
Recommended Distributor Quantity

Duct Height	Recommended Quantity of Distributor
up to 24"	1
25" to 36"	2
37" to 48"	3
49" to 72"	4
73" to 96"	5
97" and above	6
Final duct relative humidity, air velocity, and available absorption distance will affect the quantity of distributors required. Refer to Absorption Distance Manual, Form # 93-163D.	

Table #6
Wye Strainer Size

Steam Pressure		Strainer Nominal Diameter in Inches											
		3/4		1		1 1/4		1 1/2		2		2 1/2	
psig	kPa	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr
2	14	105	48	182	83	255	116	346	157	638	290	912	414
5	34	124	56	215	98	301	137	409	186	753	342	1075	489
10	69	155	70	270	123	378	172	512	233	944	429	1348	613
15	103	186	85	324	147	454	206	616	280	1135	516	1621	737
20	138	218	99	379	172	530	241	720	327	1326	603	1894	861
25	172	249	113	433	197	607	276	824	374	1517	690	2167	985
30	207	281	128	488	222	683	311	927	421	1708	776	2440	1109
35	241	312	142	543	247	760	345	1031	469	1899	863	2713	1233
40	276	343	156	597	271	836	380	1135	516	2090	950	2986	1357
45	310	375	170	652	296	912	415	1238	563	2281	1037	3259	1481
50	345	406	185	706	321	989	450	1342	610	2472	1124	3532	1605

Table #7
Header Sizing

Header capacity	Header capacity	Header nom. diameter
lbs/hr	kg/hr	inch
96	43	3/4
155	71	1
244	111	1 1/4
366	166	1 1/2
602	274	2
860	391	2 1/2
1327	603	3
1775	807	3 1/2
2285	1039	4
3591	1632	5

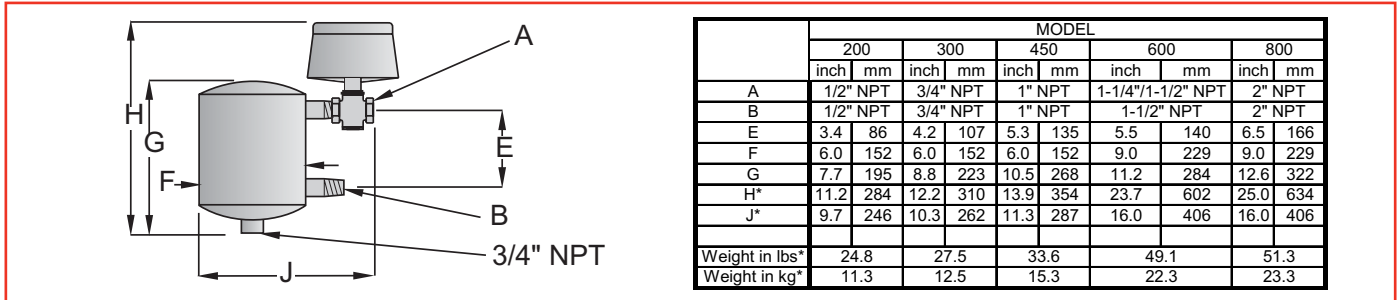
Table #8
Stainless Steel Valve Single Distributor

Model	Valve Cv	Steam Pressure to Humidifier's Supply Connection in psig (kPa)																				
		2 (14)	3 (21)	4 (28)	5 (34)	6 (41)	7 (48)	8 (55)	9 (62)	10 (69)	11 (76)	12 (83)	13 (90)	14 (96)	15 (103)	20 (138)	25 (172)	30 (207)	35 (241)	40 (276)	45 (310)	50 (345)
200 LS1	0.1	3 (1)	3 (1)	4 (2)	4 (2)	5 (2)	5 (2)	5 (2)	6 (3)	6 (3)	6 (3)	6 (3)	7 (3)	7 (3)	7 (3)	8 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	16 (7)
	0.22	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)	9 (4)	10 (5)	11 (5)	11 (5)	12 (5)	12 (5)	13 (6)	13 (6)	14 (6)	16 (7)	18 (8)	20 (9)	23 (10)	25 (11)	27 (12)	30 (14)
	0.4	7 (3)	9 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	15 (7)	16 (7)	16 (7)	17 (8)	18 (8)	18 (8)	19 (9)	22 (10)	25 (11)	29 (13)	32 (15)	35 (16)	38 (17)	41 (19)
	0.75	13 (6)	16 (7)	18 (8)	21 (10)	23 (10)	24 (11)	26 (12)	28 (13)	29 (13)	31 (14)	32 (15)	33 (15)	34 (15)	36 (16)	42 (19)	48 (22)	54 (24)	60 (27)	66 (30)	72 (33)	78 (35)
	0.95	16 (7)	20 (9)	23 (10)	26 (12)	29 (13)	31 (14)	33 (15)	35 (16)	37 (17)	39 (18)	41 (19)	42 (19)	44 (20)	45 (20)	53 (24)	60 (27)	68 (31)	76 (34)	83 (38)	91 (41)	98 (44)
	1.3	22 (10)	27 (12)	31 (14)	34 (15)	38 (17)	41 (19)	44 (20)	46 (21)	49 (22)	52 (24)	54 (24)	56 (25)	58 (26)	60 (27)	70 (32)	80 (36)	90 (41)	100 (45)	110 (50)	120 (54)	130 (59)
	1.75	28 (13)	34 (15)	40 (18)	44 (20)	49 (22)	53 (24)	56 (25)	60 (27)	63 (29)	67 (30)	69 (31)	72 (33)	74 (34)	77 (35)	90 (41)	103 (47)	116 (53)	129 (59)	142 (64)	155 (70)	167 (76)
	2.2	34 (15)	41 (19)	48 (22)	53 (24)	58 (26)	63 (29)	67 (30)	71 (32)	75 (34)	80 (36)	83 (38)	86 (39)	89 (40)	92 (42)	108 (49)	123 (56)	139 (63)	154 (70)	170 (77)	185 (84)	201 (91)
	2.8	40 (18)	49 (22)	57 (26)	63 (29)	69 (31)	75 (34)	80 (36)	85 (39)	90 (41)	95 (43)	99 (45)	102 (46)	106 (48)	110 (50)	128 (58)	147 (67)	165 (75)	184 (83)	202 (92)	221 (100)	239 (108)
3.6	47 (21)	57 (26)	66 (30)	74 (34)	81 (37)	88 (40)	94 (43)	99 (45)	105 (48)	111 (50)	115 (52)	120 (54)	124 (56)	128 (58)	150 (68)	172 (78)	193 (88)	215 (98)	236 (107)	258 (117)	280 (127)	
300 LS2	4.3	69 (31)	84 (38)	97 (44)	109 (49)	119 (54)	128 (58)	137 (62)	146 (66)	153 (69)	163 (74)	169 (77)	175 (79)	182 (83)	188 (85)	220 (100)	251 (114)	283 (128)	315 (143)	346 (157)	378 (171)	410 (186)
	5	78 (35)	96 (44)	111 (50)	124 (56)	136 (62)	147 (67)	157 (71)	166 (75)	175 (79)	186 (84)	193 (88)	200 (91)	207 (94)	215 (98)	251 (114)	287 (130)	323 (147)	359 (163)	395 (179)	432 (196)	468 (212)
	6.2	96 (44)	117 (53)	135 (61)	151 (68)	166 (75)	179 (81)	191 (87)	203 (92)	214 (97)	227 (103)	236 (107)	245 (111)	253 (115)	262 (119)	306 (139)	351 (159)	395 (179)	439 (199)	483 (219)	527 (239)	571 (259)
450 LS3	10.0	109 (50)	141 (64)	170 (77)	196 (89)	220 (100)	243 (110)	264 (120)	285 (130)	305 (139)	324 (147)	343 (156)	360 (164)	378 (172)	395 (180)	475 (216)	547 (249)	615 (279)	678 (308)	739 (336)	796 (362)	852 (387)
600 LS3	24	159 (72)	206 (94)	247 (112)	285 (130)	320 (145)	353 (161)	384 (175)	414 (188)	443 (201)	471 (214)	498 (226)	524 (238)	549 (250)	574 (261)	689 (313)	794 (361)	892 (405)	984 (447)	1071 (487)	1155 (525)	1235 (561)

Table #9
Stainless Steel Valve Multiple Distributor

Model	Valve Cv	Steam Pressure to Humidifier's Supply Connection in psig (kPa)																				
		2 (14)	3 (21)	4 (28)	5 (34)	6 (41)	7 (48)	8 (55)	9 (62)	10 (69)	11 (76)	12 (83)	13 (90)	14 (96)	15 (103)	20 (138)	25 (172)	30 (207)	35 (241)	40 (276)	45 (310)	50 (345)
200	0.10	3 (1)	3 (1)	4 (2)	4 (2)	5 (2)	5 (2)	5 (2)	6 (3)	6 (3)	6 (3)	6 (3)	7 (3)	7 (3)	7 (3)	8 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	16 (7)
	0.22	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)	9 (4)	10 (5)	11 (5)	11 (5)	12 (5)	12 (5)	13 (6)	13 (6)	14 (6)	16 (7)	18 (8)	20 (9)	23 (10)	25 (11)	27 (12)	30 (14)
	0.40	7 (3)	9 (4)	10 (5)	11 (5)	12 (5)	13 (6)	14 (6)	15 (7)	16 (7)	16 (7)	17 (8)	18 (8)	18 (8)	19 (9)	22 (10)	25 (11)	29 (13)	32 (15)	35 (16)	38 (17)	41 (19)
	0.75	13 (6)	16 (7)	18 (8)	21 (10)	23 (10)	24 (11)	26 (12)	28 (13)	29 (13)	31 (14)	32 (15)	33 (15)	34 (15)	36 (16)	42 (19)	48 (22)	54 (24)	60 (27)	66 (30)	72 (33)	78 (35)
	0.95	16 (7)	20 (9)	23 (10)	26 (12)	29 (13)	31 (14)	33 (15)	35 (16)	37 (17)	39 (18)	41 (19)	42 (19)	44 (20)	45 (20)	53 (24)	60 (27)	68 (31)	76 (34)	83 (38)	91 (41)	98 (44)
	1.30	22 (10)	27 (12)	31 (14)	35 (16)	38 (17)	41 (19)	44 (20)	47 (21)	49 (22)	52 (24)	54 (24)	56 (25)	59 (27)	61 (28)	71 (32)	81 (37)	91 (41)	101 (46)	112 (51)	122 (55)	132 (60)
	1.75	29 (13)	36 (16)	41 (19)	46 (21)	50 (23)	54 (24)	58 (26)	61 (28)	65 (29)	69 (31)	71 (32)	74 (34)	77 (35)	79 (36)	93 (42)	106 (48)	119 (54)	133 (60)	146 (66)	160 (73)	173 (78)
	2.20	35 (16)	43 (20)	50 (23)	56 (25)	61 (28)	66 (30)	71 (32)	75 (34)	79 (36)	84 (38)	87 (39)	91 (41)	94 (43)	97 (44)	114 (52)	130 (59)	146 (66)	163 (74)	179 (81)	195 (88)	212 (96)
	2.80	43 (20)	53 (24)	62 (28)	69 (31)	75 (34)	81 (37)	87 (39)	92 (42)	97 (44)	103 (47)	107 (49)	111 (50)	115 (52)	119 (54)	139 (63)	159 (72)	179 (81)	199 (90)	219 (99)	239 (108)	260 (118)
	3.60	53 (24)	65 (29)	75 (34)	84 (38)	92 (42)	99 (45)	106 (48)	113 (51)	119 (54)	126 (57)	131 (59)	136 (62)	141 (64)	145 (66)	170 (77)	194 (88)	219 (99)	243 (110)	268 (122)	292 (132)	317 (144)
300	4.3	72 (33)	89 (40)	102 (46)	114 (52)	125 (57)	135 (61)	145 (66)	154 (70)	162 (73)	172 (78)	178 (81)	185 (84)	192 (87)	198 (90)	232 (105)	265 (120)	298 (135)	332 (151)	365 (166)	398 (181)	432 (196)
	5.0	83 (38)	101 (46)	117 (53)	131 (59)	143 (65)	155 (70)	165 (75)	175 (79)	185 (84)	196 (89)	203 (92)	211 (96)	219 (99)	226 (103)	264 (120)	303 (137)	341 (155)	379 (172)	417 (189)	455 (206)	493 (224)
	6.2	100 (45)	123 (56)	141 (64)	158 (72)	173 (78)	187 (85)	200 (91)	212 (96)	224 (102)	237 (108)	246 (112)	256 (116)	265 (120)	274 (124)	320 (145)	366 (166)	412 (187)	459 (208)	505 (229)	551 (250)	597 (271)
450	10.0	138 (63)	176 (80)	209 (95)	239 (108)	266 (121)	292 (133)	317 (144)	340 (154)	362 (165)	383 (174)	404 (184)	424 (193)	443 (201)	462 (210)	549 (250)	628 (285)	700 (318)	768 (349)	832 (378)	894 (406)	952 (433)
600	24.0	310 (141)	383 (174)	445 (202)	501 (228)	551 (250)	597 (271)	640 (291)	681 (310)	720 (327)	757 (344)	792 (360)	826 (375)	858 (390)	890 (405)	1035 (470)	1163 (529)	1280 (582)	1387 (631)	1488 (676)	1582 (719)	1672 (760)

Figure #5
Separator/Valve Dimensions



Notes:

- Model 600 valve Cv = 20 has nominal diameter of 1 1/4" NPT.
- Model 600 valve Cv = 24 or 28 (depends on type of valve; stainless steel or brass) has nominal diameter of 1 1/2" NPT.
- Dimensions are based on SIEBE valve and pneumatic actuator.
- Weight includes valve, pneumatic actuator, separator, and two F & T steam traps.

Figure #6
Distributor Dimensions

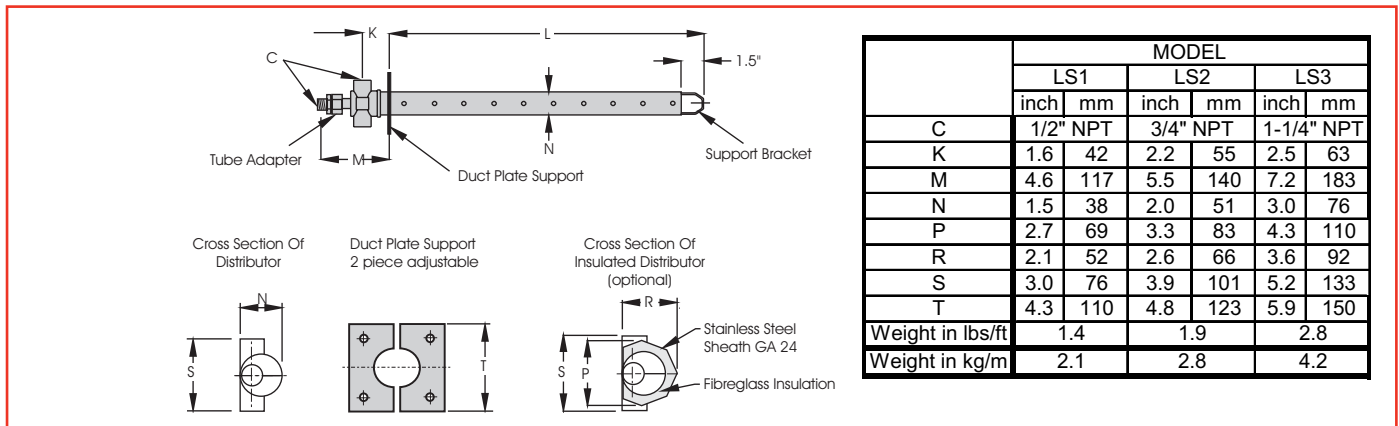
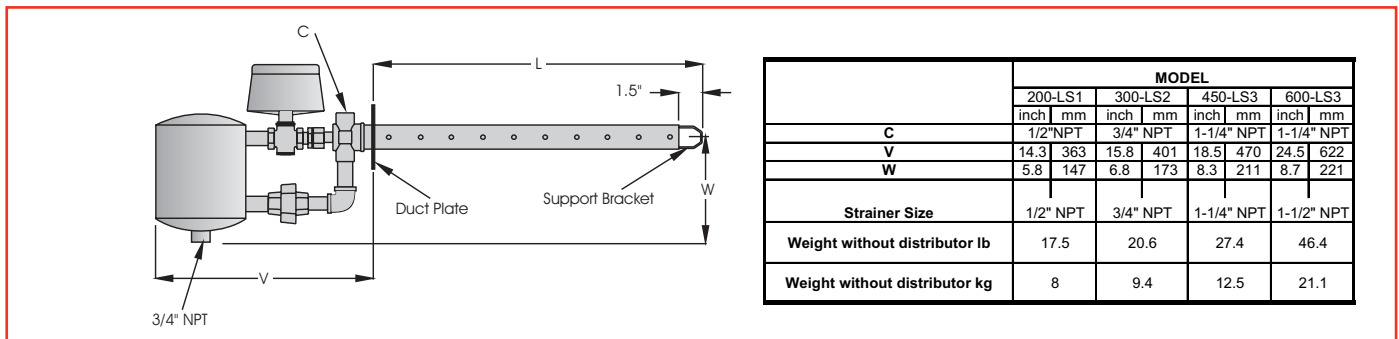


Figure #7
Single Distributor Humidifier Dimensions



Notes:

- Dimensions are based on invensys valve and pneumatic actuator.
- Weight includes valve, pneumatic actuator, separator, F & T steam trap, and strainer.
- To calculate total weight of single distributor humidifier add distributor weight (Figure #6) to weight without distributor (Figure #7).

■ **SAMPLE SPECIFICATION**

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- Boiler Pressure Steam – LS Series

1.2 QUALITY ASSURANCE:

- a) Manufacturer: For each product specified, provide components by same manufacturer throughout.
- b) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction, and marked for intended use.
- c) Comply with ARI 640, “Standard for Commercial and Industrial Humidifiers.”
- d) Products shall be supported with a warranty that ensures the product will be free from defects in materials and workmanship for a period of two years after shipment.
- e) Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner’s operation and maintenance personnel, is required in cooperation with the Commissioning Authority. Project Closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Project Closeout, Section 01700, for substantial completion details. Refer to Section 01810,

Commissioning, for detailed commissioning requirements.

- f) Products specified below are to be manufactured in an ISO 9001-2000 certified facility.

1.3 SUBMITTALS:

- a) Submit product data under provisions of Section 15010. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes. Include rated capacities, operating weights, furnished specialties, and accessories.
- b) Submit manufacturer’s installation instructions.
- c) Submit operation and maintenance data.
- d) Submit coordination drawings. Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, and dispersion tubes. Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, and required clearances.
- e) Submit wiring diagrams including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- f) Submit minimum water quality requirements and water pressure requirements.

1.4 EXTRA MATERIALS:

- a) Furnish extra materials described below that match products installed and that are packaged with protective

covering for storage and identified with labels describing contents.

1.5 REFERENCES:

- a) ANSI/NFPA 70 - National Electrical Code.

1.6 COORDINATION:

- a) Coordinate location and installation of humidifiers in ducts and air-handling units. Revise locations and elevations to suit field conditions and to ensure proper humidifier operation.

XXXXX OR XXXXX

- a) Coordinate location and installation of humidifier in the space it serves with the electrical, mechanical, and plumbing contractors.

PART 2 - PRODUCTS

2.1 PRESSURE STEAM HUMIDIFIER

- a) Pressure steam humidification using a boiler steam generator as a steam source.
- b) Pre-Engineered system, for air handler/duct application, complete with steam control valve, valve actuator, steam distributor[s], and steam separator.
- c) System to be complete with:
 - 1. Operating and safety controls to ensure an automatic and fail-safe system.
 - 2. System to shut down automatically on loss of control signal even when steam pressure is maintained to system.

3. Normally closed steam control valve with equal percent flow characteristics and positive shut off against steam.
 4. Stainless steel jacketed distributor[s], allowing pressurized steam through the length of the distributor, to pre-heat the internal dispersion tube.
 5. Stainless steel, lightweight steam separator with internal baffle[s] to ensure dry condensate free steam supply to the control valve.
- d) Steam Distributor to include:
1. Stainless steel tube in tube construction to maximize jacketing of internal dispersion tube (rectangular jacketing with partial internal dispersion tube coverage, requiring plastic inserts, are not acceptable).
 2. Internal dispersion tube orifices sized to provide even distribution of the discharged steam across the entire length of the assembly.
 3. End bracket to allow parallel, perpendicular or diagonal support.
 4. Tube adapter for connection to controlled steam supply.
 5. Two piece duct plate to seal air handler/duct wall penetration[s].
- e) Control valve to be:
1. Compliant with ANSI B 16.15 class 250 pressures and temperature rating B 16.104 class IV control shut off leakage and ANSI/ISA-575.11 flow characteristics standards. requiring plastic inserts, are not acceptable).

2. Complete with stainless steel seat, stem and plug.

- f) Standard of acceptance: Nortec LiveSteam.

XXXXX OR XXXXX

- a) Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- a) Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- b) Examine roughing-in for piping systems to verify actual locations of piping connections before humidifier installation.
- c) Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- a) Install humidifiers and steam dispersion panels per manufacturers' instructions
- b) Seal humidifier dispersion-tube duct penetrations with flange.
- c) Install with required clearance for service and maintenance.

3.3 TESTING:

- a) System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Authority. Refer to section 01810, Commissioning, for system verification tests and commissioning requirements.

3.4 TRAINING

- a) Training of the Owner's operation and maintenance personnel is required in cooperation with the Commissioning Authority. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Commissioning Authority after submission and approval of formal training plans. Refer to System Demonstrations, section 01670, for contractor training requirements. Refer to section 01810, Commissioning,

for further contractor training requirements.

XXXXX OR XXXXX

- a) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain humidifiers.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 4. Schedule training with Owner, through Architect, with at least seven days advance notice.

■ **NOTES**

■ **NOTES**



■ LIMITED WARRANTY

AXAIR NORTEC INCORPORATED and/or AXAIR NORTEC LIMITED. (hereinafter collectively referred to as THE COMPANY), warrant for a period of two years from date of shipment, that THE COMPANY's manufactured and assembled products, not otherwise expressly warranted, are free from defects in material and workmanship. No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

THE COMPANY's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. THE COMPANY's factory, providing the defective part(s) is returned freight prepaid by the customer. Parts used for repairs are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to THE COMPANY until said products have been paid for in full and then said liability shall be limited to the original purchase price for the product. Any further warranty must be in writing, signed by an officer of THE COMPANY.

THE COMPANY's limited warranty on accessories, not of NORTEC's manufacture, such as controls, humidistats, pumps, etc. is limited to the warranty of the original equipment manufacturer from date of original shipment of humidifier.

THE COMPANY makes no warranty and assumes no liability unless the equipment is installed in strict accordance with a copy of the catalog and installation manual in effect at the date of purchase and by a contractor approved by THE COMPANY to install such equipment.

THE COMPANY makes no warranty and assumes no liability whatsoever for consequential damage or damage resulting directly from misapplication, incorrect sizing or lack of proper maintenance of the equipment.

THE COMPANY retains the right to change the design, specification and performance criteria of its products without notice or obligation.