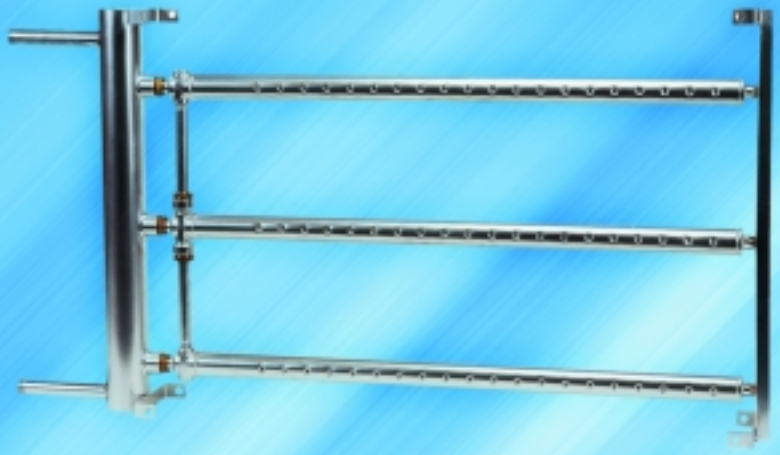
Specialized Steam Dispersion Methods

improved steam / air mixing length

pre-assembled manifold packages



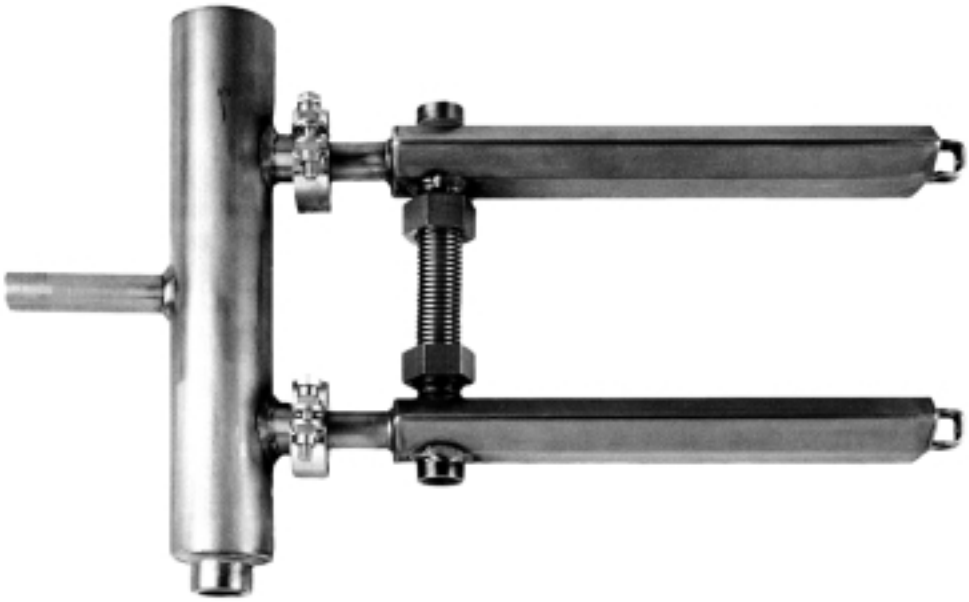
direct injection of steam on hygroscopic materials

Armstrong

Armstrong®
Intelligent System Solutions™
STEAM • AIR • HOT WATER

Armstrong AMCC

Steam Distribution Manifold Assembly



The Armstrong Multi Clamp Concept offers a pre-assembled, steam jacketed, distribution manifold bank specifically designed for air handling units.

The AMCC is for applications requiring a direct steam injection humidifier (i.e. Series 9000/1000) with multiple steam jacketed distribution manifolds. It is designed for time-saving and ease of installation.

Features

- Pre-dimensioned to reduce installation time.
- Convenient mounting tabs for easy attachment.
- All stainless steel steam supply header, steam jacketed distribution manifolds, and interconnecting flexible hoses, with a choice of 304 SS or brass compression fittings.
- No black iron piping.
- Optional all stainless design for D.I. service.
- Standard, interchangeable replacement parts.
- Field convertible from left hand to right hand mounting.
- Custom tube spacing above 150 mm minimum.

Table 100-1. List of Materials

Description	Material
Header Assembly Steam Jacketed Distribution Manifolds Interconnecting Flexible Hose	304 Stainless Steel
Header and Manifold Compression Fittings	Brass or 304 Stainless Steel

Table 100-2. Physical Data

Steam Supply Inlet	
91 Size Humidifier	1/2"
92 Size Humidifier	3/4"
93 Size Humidifier	1"
94 Size Humidifier	2"
Steam Condensate Drain	
All Sizes	3/4"
Steam Jacket Inlet & Condensate Drain	
91 Size Manifold	1/2"
92 Size Manifold	3/4"
93 Size Manifold	1 1/4"

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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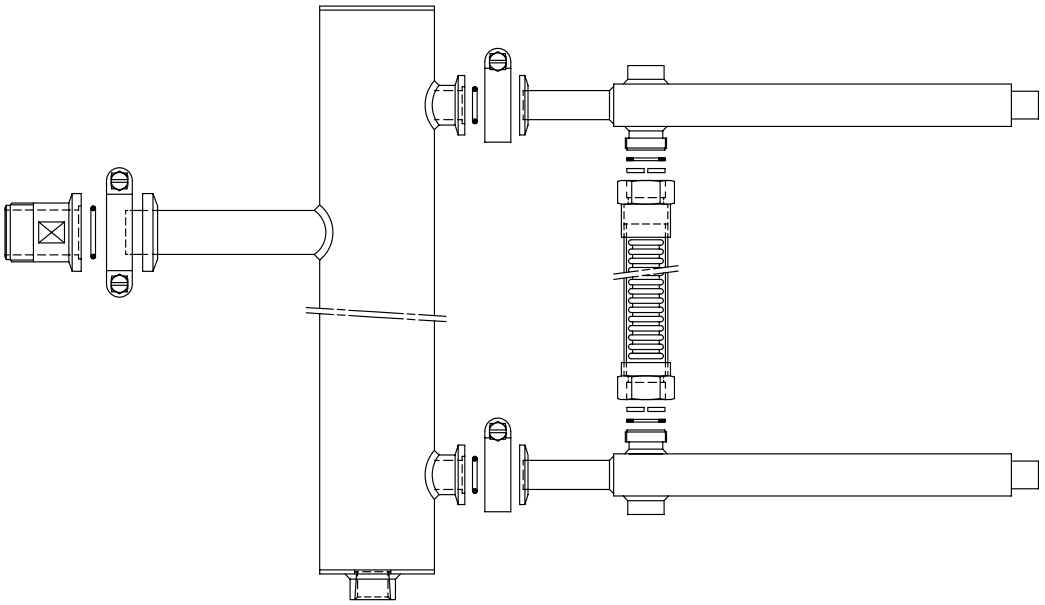


Components

The Armstrong Multi Clamp Concept (AMCC) is a tailor-made design meant to perfectly match the specific requirements of an air handling system. Our HVAC specialists will size the system in order to make sure that the design rules are respected and to guarantee the trouble-free operation of the system. The AMCC is composed of several elements:

- **Header:** its diameter varies from DN50 to DN150, depending on the steam load. As standard, the steam inlet and the manifold connections are on the opposite sides of the header, the condensate being drained from the bottom. On request, the steam inlet might be on the bottom, thus any condensate that might form flows back to the humidifier where it is re-evaporated. The header is connected to the humidifier and to the manifolds by means of clamps, allowing quick and easy installation and disassembly.

- **Manifolds:** Armstrong steam jacketed manifolds guarantees that only dry steam is discharged in the duct. More than 10 manifolds having length up to 4 meters might be connected to the steam header. A minimum distance between the manifolds should be respected and in some cases the drainage of their jackets should be made by several steam traps. The clamp system allows to quickly connect them to the header.

- **Stainless steel hose:** makes the connection between manifolds and allows the steam to preheat several manifolds before arriving to the steam trap. The pressure drop in the manifold jackets should be taken in consideration in order to determine whether the drainage will be made by one or several steam traps.

Armstrong AMCC, continued…

Steam Distribution Manifold Assembly

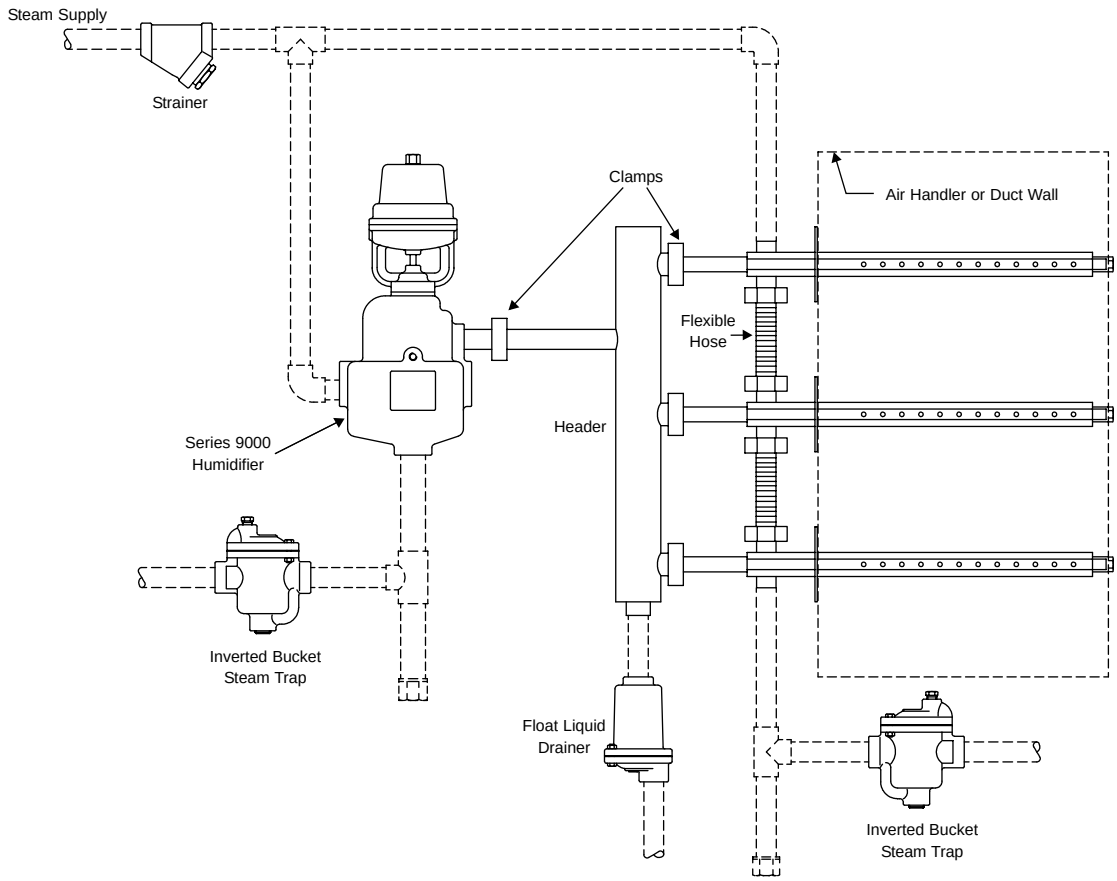
Application Considerations

The AMCC is designed for applications where it is desirable to use multiple steam distribution manifolds to achieve a downstream mixing length distance (i.e. “vapor trail”) as short as 90 cm.

For mixing length distances less than 90 cm, the Armstrong HumidiPack® or HumidiPackPlus® should be considered. Calculation of the mixing length distance can be performed with the Armstrong Humid-A-ware™ Humidification Sizing & Selection Software which can be ordered on www.armstrong.be.

Steam jacketing is desirable because it improves steam quality and reduces the chance of spitting or dripping condensate into the air handling system. For applications that are sensitive to duct heat gain, it is advisable to keep steam jacketing pressures below 1,3 barg.

Suggested Piping



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Suggested Specification for AMCC

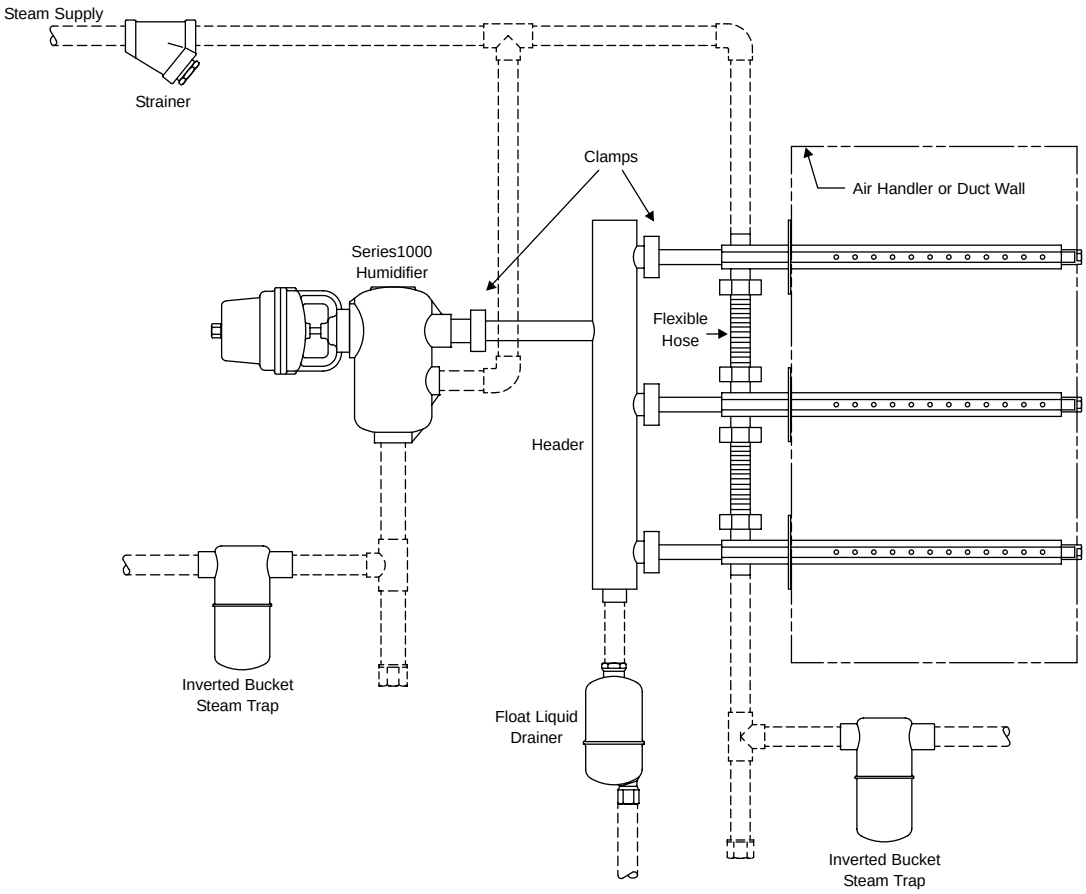
Steam injection into air handling system for humidification purposes shall be by means of a pre-assembled, steam jacketed, multiple manifold bank. The header assembly and steam-jacketed distribution manifolds shall be 304 Stainless Steel. Use of black iron piping shall not be permitted.

The multiple manifold bank shall be capable of distributing up to 4 barg steam from a direct steam injection humidifier without dripping or spitting.

The multiple manifold bank shall be field repairable with standard interchangeable parts and shall be field convertible from left handed header configuration to right handed header configuration.

Required Ordering Information

1. Specify steam pressure and capacity required.
2. Determine steam injection humidifier size, manifold size, and manifold quantity as determined by Armstrong's Humid-A-ware Humidification Sizing and Selection software. Visit www.armstrong.be to order.
3. Specify duct dimensions.
4. Specify required steam header orientation (i.e. left-handed or right handed).
5. Specify required materials of construction (i.e. brass and 304 stainless steel or all 304 stainless steel).
6. Consult Armstrong's HVAC Application Engineering Department for vertical airflow applications.



Steam Shower Humidifiers

Conditioned-Steam Showers

Armstrong Steam Showers are designed to create a stratum of high humidity in close proximity to a fast moving sheet, film or product. The objective may be to prevent accumulation of troublesome static electricity, or the shower may be used to prevent loss of moisture from the sheet or film.

If the sheet or film is hot, as it very likely may be, it tends to give up its moisture very quickly. The properly sized and installed steam shower, by creating a laminar zone of high humidity adjacent to the sheet or film, prevents this loss to maintain the desired moisture content.

In virtually all applications, however, it is essential that the steam be discharged in a "dry" state – that is, with no water droplets or liquid spray. The unique design of Armstrong Steam Showers assures this.

Separator-control units are identical in design and operation to equivalent humidifier models. The distribution manifolds have been especially modified to operate under slight pressure to meet the specific requirements of steam shower service.

Electrically controlled and pneumatically controlled models are offered in two sizes.

Figure 104-1. Armstrong Steam Shower Manifold

Standard Package

The complete "package" includes the following:

1. Steam shower with integral operator.
2. Distribution manifold.
3. "Y" type strainer.
4. Armstrong inverted bucket steam trap.
5. Temperature switch to prevent humidifier from operating before cold startup condensate is drained. (Cannot be incorporated on manually controlled steam showers.)

Note: Steam humidifiers (or other products) should be installed in locations that allow routine inspection and accessibility for maintenance operations. Armstrong recommends that steam humidifiers not be placed in locations where unusual instances of malfunction of the humidifiers or the systems might cause damage to non-repairable, unreplaceable, or priceless property.

Selection and Installation Notes

1. Armstrong Steam Showers are suitable for pressures up to 4 bar. Lower steam pressures (0,15 to 0,7 bar) are recommended for normal installations.

2. 91 size units are adequate for most showers up to 1,8 m span. 92 size showers should be used for longer spans or where larger volumes of steam are desired at very low pressures. For information on even larger models, consult factory.

3. Most commonly, the dispersion manifold is installed 150 to 200 mm from the object of the shower – no more than 300 mm.

4. A pressure-reducing valve should be installed in the steam supply to control the maximum volume of steam to the shower.

5. Dimensions are the same as for corresponding humidifier models.

STEAM SHOWER HUMIDIFIERS

Table 104-1. Physical Data and Capacities, Steam Shower Bodies and Operators

	On-Off Electrically Controlled†		Modulating Pneumatically Controlled	
Model No.	**DSA-91-SM***	**DSA-92-SM***	**AM-91-SM***	**AM-92-SM***
Shipping Weight in kg (less manifold)	11	18	12	19
Inlet & Strainer Size	1/2"	3/4"	1/2"	3/4"
Drain Connection Size	1"	1"	1"	1"
Drain Trap Model	800	800	800	800
Trap Connection Size	3/4"	3/4"	3/4"	3/4"

* Full nomenclature includes length of manifold in feet as a suffix to the Model No.

† Specify voltage required. Various voltages available – consult factory.

Note: For larger sizes and capacities, consult factory.

On request: Also available Manually Controlled (MC) and Electrical Modulating (XEM) units. For more information, consult factory.

Table 104-2. Manifold Lengths and Weights, Armstrong Steam Showers

Manifold Model No.		SM-1	SM-1,5	SM-2	SM-3	SM-4	SM-5	SM-6	SM-7	SM-8	SM-9	SM-10	SM-11	SM-12
L - Length (Meters)		0,30	0,45	0,61	0,91	1,22	1,52	1,83	2,13	2,44	2,74	3,05	3,35	3,66
Shipping Weight in kg	91 Size	1	2	2	3	4	5	5	–	—	–	–	–	–
	92 Size	3	3	4	5	6	7	8	9	10	11	12	13	14

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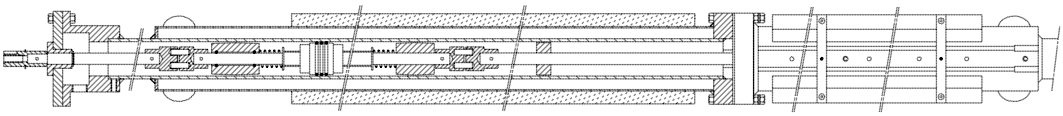
Adjustable Steam Shower Manifolds

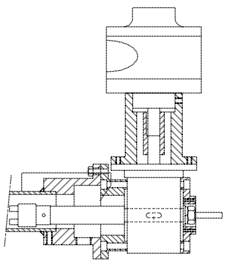
Dispersion length varies

Armstrong's adjustable steam shower manifolds allow to adapt the steam dispersion pattern to the different widths of paper or film used on the same machine. Especially useful on printing machines, where the size of the paper sheet might be changed frequently, these manifolds allow to make sure that the necessary quantity of moisture is efficiently injected into the paper and only into the paper.

A pneumatical or manual control activates the internal mechanism of the adjustable manifolds, thus opening or closing some of the dispersion nozzles. The steam load is discharged by the nozzles remaining open, adapting the dispersion length to the width of the paper sheet.

The Armstrong's adjustable steam shower manifolds are not available in standard sizes, they are always tailor-made according to the machine dimensions. Our HVAC specialists will size the system in order to make sure that the design rules are respected and to guarantee the trouble-free operation of the system.





HumidiPack® and HumidiPackPlus® Steam Humidifier Systems

Importance of Mixing Length Distance
Mixing length distance is an important consideration in the proper application of steam humidification equipment. Shorter distances simplify the job of the design engineer by allowing proper placement of temperature and humidity controllers and other components without fear of inaccurate readings or moisture damaged equipment. Air handling unit manufacturers concerned about the "footprint" of their units and end users with limited space in mechanical rooms also benefit.

HumidiPack®
The Armstrong HumidiPack® is a pre-fabricated steam humidifier system that is ready for insertion into the duct. The HumidiPack consists of a separator/header and multiple tube dispersion assembly when supplied for use with Armstrong steam generators. A steam supply control valve, strainer, steam trap, and a header drain trap are added when HumidiPack is used on pressurized steam. The HumidiPack accepts steam, separates entrained moisture from it, and admits it into a duct or air handler air stream via the dispersion assembly in a manner which substantially reduces mixing length distance when compared to traditional humidifiers.

HumidiPackPlus®
HumidiPackPlus® combines the mixing length distance shortening performance of HumidiPack with the additional feature of **steam jacketed** "active" tubes. The result is a dry, uniform discharge of steam for nearly any application with a steam source from a pressurized, central supply.

Simplified Installation
The HumidiPack and HumidiPackPlus dispersion assemblies slide neatly into ductwork or air handling units. This frequently reduces the time and labor required for field installations. Units with horizontal tubes and vertical headers offer all piping on one side of the ductwork or air handler to simplify piping.

Stainless Steel Construction
HumidiPack and HumidiPackPlus rugged designs offer stainless steel construction of wetted parts including the header/separator and dispersion assembly for a long trouble-free operating life. Tube to header joints consist of welded stainless steel rather than assembled plastic adapters with o-rings, minimizing service requirements.

Compatible With Many Steam Sources
HumidiPack may be used with Armstrong Steam-to-Steam, gas and electric steam generating humidifiers, also with some systems including packaged boilers or central steam supply to 4 bar. HumidiPackPlus may be used with packaged boilers or central steam supply to 4 bar.

Application Flexibility
Many sizes and configurations of HumidiPack and HumidiPackPlus are available to meet new installation or retrofit needs.

Reduced Heat Gain to Duct Air from HumidiPack
Since no steam is admitted to the manifold assembly unless there is a demand for steam output, there is no heat gain to duct air when HumidiPack is not in use.

Figure 106-1. HumidiPack

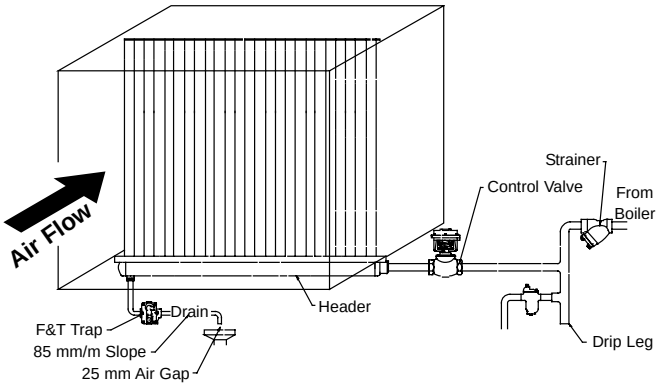
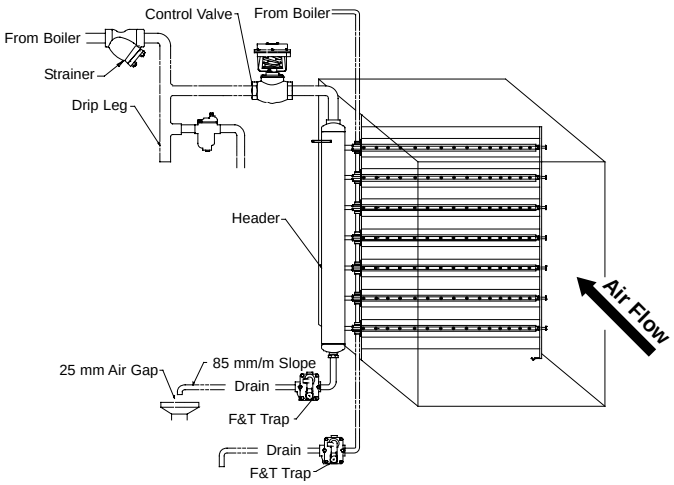


Figure 106-2. HumidiPackPlus



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Mixing Length Distance Considerations

Mixing length distance is an important issue in the proper design and installation of steam humidification equipment. In the humidification process, steam is discharged from the manifold as a “dry” gas. As it mixes with the cooler duct air, some condensation takes place resulting in water particles becoming entrained in the airstream. After a distance these droplets are dispersed by and absorbed into the airstream. Until they are absorbed, these particles can impinge upon any equipment they contact, adversely affecting its operation or service life.

Many applications can be satisfactorily addressed by using a single manifold with a direct steam injection humidifier (See Figure 107-1) or single dispersion tube with a steam generator (See Figure 107-2). Frequently, however, performance and practicality dictate the use of multiple manifolds or dispersion tubes. These are field assembled (See Figure 107-3).

When mixing length distance parameters or size limitations do not allow the use of multiple manifolds with Armstrong Series 9000 or 1000 humidifiers or multiple dispersion tubes with Armstrong steam-to-steam or electronic humidifiers, the Armstrong HumidiPack or HumidiPackPlus is used.

Please consult with your Armstrong Representative with questions regarding selection of any of these humidification products.

How HumidiPack Shortens Mixing Length Distances

Conditioned steam enters each of the dispersion tubes and flows through steam nozzles (not required on HumidiPackPlus) which extend from the center of each tube, before discharging through orifices into the airstream.

Air flow approaching the HumidiPack first encounters baffle tubes (See Figure 107-4) which influence its flow pattern and increase its velocity. Air traveling around each set of baffle tubes encounters an opposing flow of steam exiting the orifices. The result is more uniform distribution and faster absorption of moisture into the air, resulting in shorter mixing length distances than experienced with traditional manifolds or dispersion tubes.

Armstrong Steam Distribution Options for Air Handling Systems

Figure 107-1.

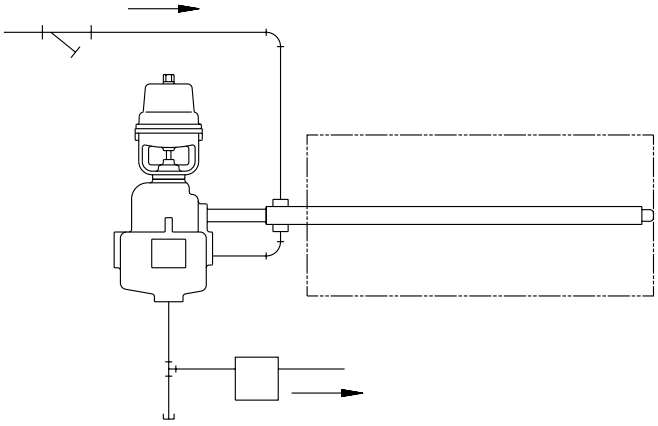


Figure 107-2.

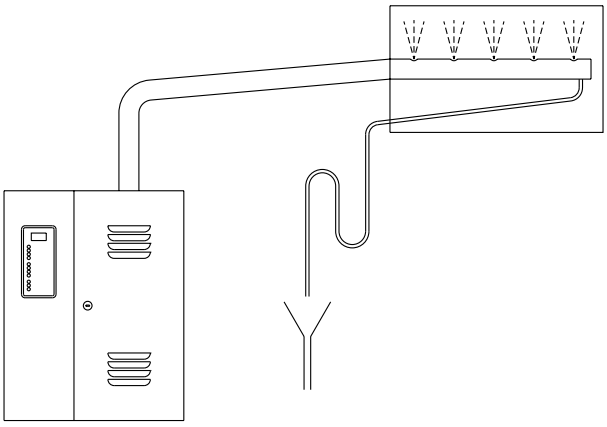


Figure 107-3.

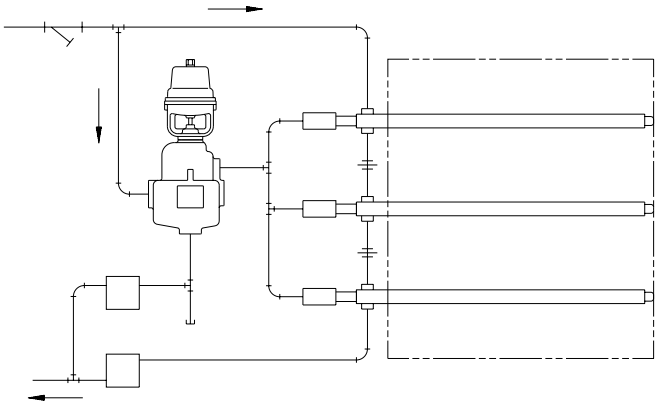
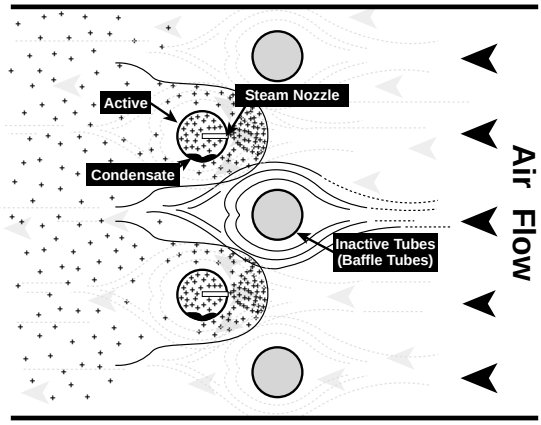


Figure 107-4. Mixing of Air and Steam (HumidiPack shown)



HumidiPack® and HumidiPackPlus® Capacities

Note: Maximum operating pressure is 4 bar saturated steam. Consult factory if velocities are below 2 m/s.

Table 108-1. Capacities in kg/h for 2-2,5 m/s velocity - Series R and Series P (Low Velocity)

	Active Tube Length (cm)																						
Header	**30**	**46**	**61**	**76**	**91**	**107**	**122**	**137**	**152**	**168**	**183**	**198**	**213**	**299**	**244**	**259**	**274**	**290**	**305**	**320**	**335**	**351**	**366**
30	9	14	18	23	27	32	36	41	45	50	54	59	63	68	73	77	82	86	91	95	100	104	109
46	9	14	18	23	27	32	36	41	45	50	54	59	63	68	73	77	82	86	91	95	100	104	109
61	14	20	27	34	41	48	54	61	68	75	82	88	95	102	109	116	122	129	136	143	150	156	163
76	18	27	36	45	54	63	73	82	91	100	109	118	127	136	145	154	163	172	181	190	200	209	218
91	23	34	45	57	68	79	91	102	113	125	136	147	159	170	181	193	204	215	227	238	249	261	272
107	27	41	54	68	82	95	109	122	136	150	163	177	190	204	218	231	245	259	272	286	299	313	327
122	32	48	63	79	95	111	127	143	159	175	190	206	222	238	254	270	286	302	317	333	349	365	381
137	36	54	73	91	109	127	145	163	181	200	218	236	254	272	290	308	327	345	363	381	399	417	435
152	41	61	82	102	112	143	163	184	204	224	245	265	286	306	327	347	367	388	408	429	449	469	490
168	45	68	91	113	136	159	181	204	227	249	272	295	317	340	363	385	408	431	454	476	499	522	544
183	50	75	100	125	150	175	200	224	249	274	299	324	349	374	399	424	449	474	499	524	549	574	599

Note: Use of Series R is limited to duct widths of 91 cm.

Table 108-2. Capacities in kg/h for 2,5-5 m/s velocity - Series R and Series P (Medium Velocity)

	Active Tube Length (cm)																						
Header	**30**	**46**	**61**	**76**	**91**	**107**	**122**	**137**	**152**	**168**	**183**	**198**	**213**	**299**	**244**	**259**	**274**	**290**	**305**	**320**	**335**	**351**	**366**
30	14	20	27	34	41	48	54	61	68	75	82	88	95	102	109	116	122	129	136	143	150	156	163
46	14	20	27	34	41	48	54	61	68	75	82	88	95	102	109	116	122	129	136	143	150	156	163
61	20	30	41	51	61	71	82	92	102	112	122	132	143	153	163	173	184	194	204	214	224	234	245
76	27	41	54	68	82	95	109	122	136	150	163	177	190	204	218	231	245	259	272	286	299	313	327
91	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391	408
107	41	61	82	102	122	143	163	184	204	224	245	265	286	306	327	347	367	388	408	429	449	469	490
122	48	71	95	119	143	166	190	214	238	262	286	309	333	357	381	405	429	452	476	500	524	547	571
137	54	82	109	136	163	190	218	245	272	299	327	354	381	408	435	463	490	517	544	571	599	625	653
152	61	92	122	153	184	214	245	275	306	337	367	398	429	459	490	520	551	581	612	641	673	704	734
168	68	102	136	170	204	238	272	306	340	374	408	442	476	510	544	578	612	646	680	714	748	782	816
183	75	112	150	187	224	262	299	337	374	411	449	486	524	561	598	636	673	711	748	785	823	860	898

Note: Use of Series R is limited to duct widths of 91 cm.

Table 108-3. Capacities* in kg/h for >5 m/s velocity - Series P (High Velocity)

	Active Tube Length (cm)																						
Header	**30**	**46**	**61**	**76**	**91**	**107**	**122**	**137**	**152**	**168**	**183**	**198**	**213**	**299**	**244**	**259**	**274**	**290**	**305**	**320**	**335**	**351**	**366**
30	21	31	42	52	63	73	83	94	104	115	125	136	146	156	167	177	188	198	209	219	229	240	250
46	21	31	42	52	63	73	83	94	104	115	125	136	146	156	167	177	188	198	209	219	229	240	250
61	31	47	63	78	94	109	125	141	156	172	188	203	219	234	250	266	282	297	313	328	344	360	376
76	42	63	83	104	125	146	167	188	209	229	250	271	292	313	334	355	376	396	417	438	459	480	501
91	52	78	104	130	156	182	209	234	261	287	313	339	365	391	417	443	469	495	522	547	574	600	626
107	63	94	125	156	188	219	250	282	313	344	376	407	438	469	501	532	563	595	626	657	688	720	751
122	73	109	146	182	219	255	292	328	365	401	438	474	511	547	584	620	657	693	730	766	803	839	876
137	83	125	167	209	250	292	334	376	417	459	501	542	584	626	668	709	751	793	834	876	918	960	1 001
152	94	141	188	234	282	328	376	422	469	516	563	610	657	704	751	798	845	892	939	989	1 033	1 080	1 127
168	104	156	209	261	313	365	417	469	522	574	626	678	730	782	834	887	939	991	1 043	1 095	1 147	1 200	1 252
183	115	172	229	287	344	401	459	516	574	631	688	746	803	860	918	975	1 033	1 090	1 147	1 205	1 262	1 320	1 377

*** Note:** HumidiPack maximum capacities may be reduced, depending upon the application.
The capacity tables indicate that 183 x 366 cm is the maximum size HumidiPack or HumidiPackPlus dispersion assembly. However, HumidiPack and HumidiPackPlus are designed to allow for stacking of fabricated banks or placement side by side for applications of greater size.

For applications with greater capacity requirements than shown for a specific size bank, options include:
1. An expanded duct section to allow for a sufficiently larger HumidiPack matching the capacity requirements.
2. Use of two HumidiPacks in series (where psychrometrics allow) or a primary and booster humidifier arrangement. Reference the Humidification Handbook section of this catalog or contact your Armstrong Representative for assistance.
3. Custom Series A units which are specially designed for each applications needs.
4. Use of Series 9000 direct steam injection humidifiers with an appropriate number of jacketed manifolds.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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HumidiPack® and HumidiPackPlus® Orientation

Figure 109-1. Vertical HumidiPack (Left Steam Supply)

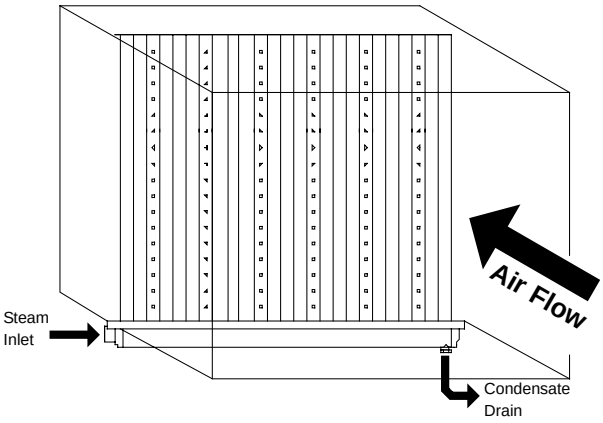


Figure 109-2. Vertical HumidiPack (Right Steam Supply)

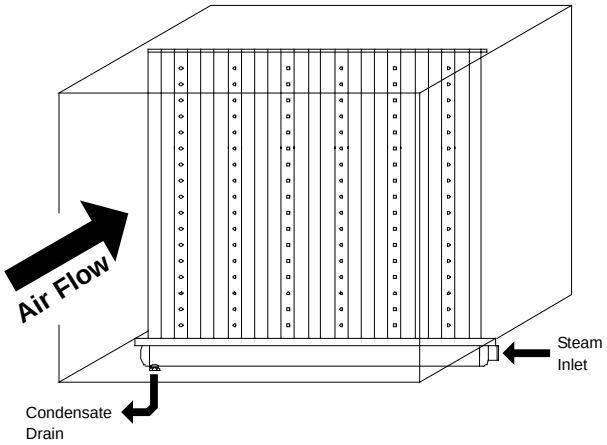
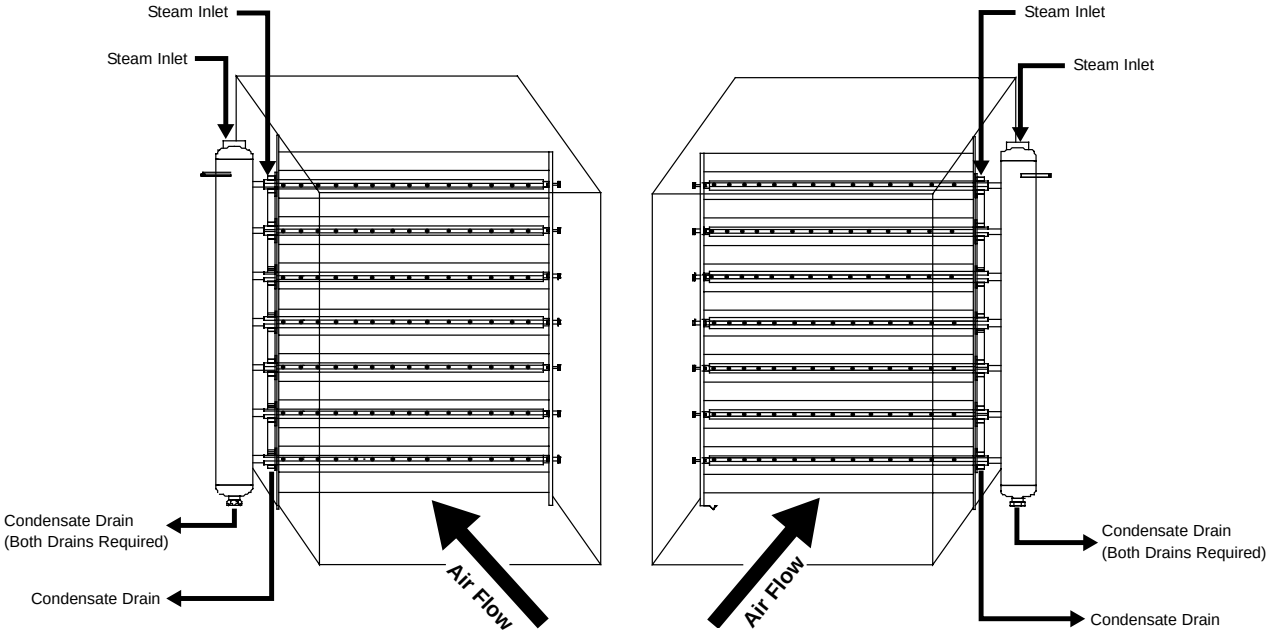


Figure 109-3. Horizontal HumidiPackPlus (Left Steam Supply)

Figure 109-4. Horizontal HumidiPackPlus (Right Steam Supply)

Note: Horizontal HumidiPack orientation similar.



HumidiPack and HumidiPackPlus Selection and Ordering Procedure

If the parameters of your application are outside the ranges for Series R or Series P in terms of capacity, the Series A units may meet your needs. Custom Series A units are specially designed for the needs of specific applications. Please consult your local Armstrong Representative with the requirements of your application.

Steps In Selection

1. Identify the steam capacity required. Please see the Humidification Handbook section of this catalog and Armstrong's Humid-A-ware™ Humidification Sizing and Selection software, or contact your local Armstrong Representative for assistance.

2. After determining the airflow velocity (m/s), consult the appropriate HumidiPack capacity table. (See Page 108) Ensure that HumidiPack Series R or HumidiPackPlus Series P offers sufficient capacity for the specific duct height and width of your application. If not, a custom Series A is required.

3. Verify that the mixing length distance and air pressure drop are acceptable by contacting your local Representative or by ordering Humid-A-ware at www.armstrong.be.

How To Order

Information required includes the following:

- Height and width of multiple tube bank
- Air flow velocity (m/s)
- Maximum required steam capacity
- Maximum allowable air pressure drop (if specified)
- Duct air temperature
- Final duct relative humidity
- Mixing length distance available

Control Valve (If Applicable)

You may size the valve with the information found on Page 116 or Armstrong will size the valve if you supply the following:

- Steam pressure
- Required humidification load
- Specify type of control:
  Pneumatic, Electric, Electronic and Input Signal

HumidiPack Orientation

Model Number

R **H** **L**

Indicates the Series

R Series (HumidiPack)
P Series (HumidiPackPlus)
A Series (Custom)

Tube/Air Flow Orientation

H = Horizontal Tubes/Horizontal Air (Figures 109-3, 109-4, Page 109)
V = Vertical Tubes/Horizontal Air (Figures 109-1, 109-2, Page 109)
D = Horizontal Tubes/Vertical Air Down
U = Horizontal Tubes/Vertical Air Up

***Header Location/Steam Inlet Location**

R = Right Handed Header if Horizontal Tubes (Figure 109-4, Page 109)**, Right Handed Steam Inlet if Vertical Tubes or Vertical Air Flow** (Figure 109-2, Page 109)

L = Left Handed Header if Horizontal Tubes (Figure 109-3, Page 109)**, Left Handed Steam Inlet if Vertical Tubes or Vertical Air Flow** (Figure 109-1, Page 109)

Standard HumidiPack includes (when steam source is plant steam) a strainer and inverted bucket trap for steam supply, control valve, and one header drain trap for the separator/header. HumidiPackPlus includes an additional trap to drain the dispersion tube jackets.

* For all horizontal air flows, right and left handed orientations are determined with air flow at your back. For all vertical air flows, right and left steam inlet locations are determined by looking at the unit with airflow at your back.

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HumidiPack Dimensional Drawings and Physical Data

Table 111-1. Physical Data			
Horizontal HumidiPack - See Figure 111-1			
	mm	**Min. mm**	**Max. mm**
A	–	305	1 829
B	–	305	914
C	216	–	–
D	127	–	–
E	–	432	1 041
F	158	–	–
Vertical HumidiPack - See Figure 111-2			
	mm	**Min. mm**	**Max. mm**
A	–	305	1 829
B	–	305	1 829
C	216	–	–
D	127	–	–
E	–	432	1 956
F	158	–	–

Table 111-2. List of Materials	
Fabricated Separator/Header and Multiple Tube Dispersion Assembly	Stainless Steel*
Mounting Frame (Optional)	Carbon Steel
Air Side Gaskets	ASTM D-2000-90

* Armstrong reserves the right to supply non-wetted parts of aluminized steel.

Suggested Specification for HumidiPack

Armstrong HumidiPack shall be a packaged steam injection type humidifier or multiple tube dispersion assembly ready for insertion into the duct.

HumidiPack includes a fabricated separator/header and multiple dispersion tube design of all stainless steel construction wetted parts; No o-rings or slip couplings are required. Each active tube is fitted with a series of nozzles which extend from the center of the tube. The nozzles are sized and spaced to accept steam from the separator/header and provide a dry and uniform discharge of steam.

Each HumidiPack segment is designed for simplified duct mounting including stacking of header/separator/dispersion tube segments when necessary.

HumidiPack includes (when appropriate) a steam supply control valve utilizing a parabolic plug design offering immediate response and precise modulation of flow throughout the 19 mm valve stroke. The control valve is protected by a steam supply strainer and inverted bucket drip trap. A float type drip trap will be used to drain the separator/header. For application with horizontal dispersion tubes, all piping is on one side of the duct or air handling unit.

The packaged humidifier shall provide a mixing length distance of no more than ___mm downstream of the active tube segment while maintaining conditions of ___% relative humidity at a minimum temperature of ___°C in the duct airstream. Air pressure drop across dispersion tube segment shall not exceed ___mm W.C. at a duct air velocity of ___ m/s.

Figure 111-1. Horizontal HumidiPack

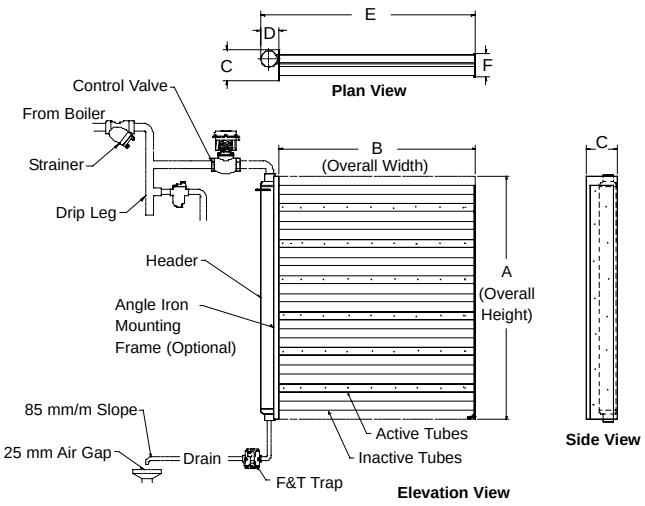
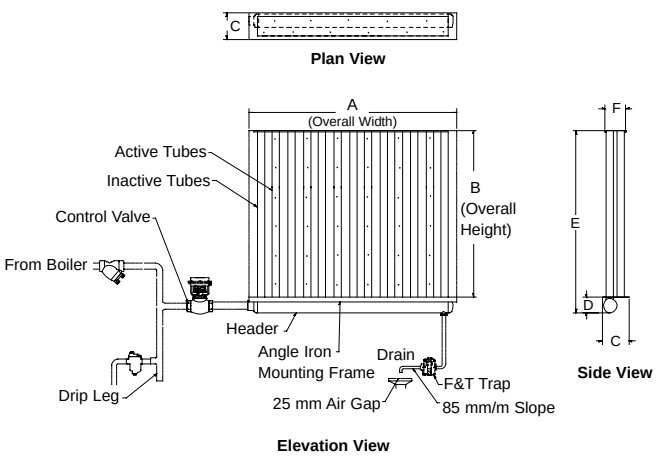


Figure 111-2. Vertical HumidiPack



All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

HumidiPackPlus Dimensional Drawings and Physical Data

Table 112-1. Physical Data			
Horizontal HumidiPack Plus - See Figure 112-1			
	mm	**Min. mm**	**Max. mm**
A	–	305	1 829
B	–	305	3 658
C	216	–	–
D	–	127	200
E	–	432	3 835
F	158	–	–
Vertical HumidiPack Plus - See Figure 112-2			
	mm	**Min. mm**	**Max. mm**
A	–	305	3 658
B	–	305	1 829
C	216	–	–
D	–	127	200
E	–	432	3 835
F	158	–	–

Table 112-2. List of Materials	
Fabricated Separator/Header and Multiple Tube Dispersion Assembly	Stainless Steel*
Mounting Frame (Optional)	Carbon Steel
Air Side Gaskets	ASTM D-2000-90

* Armstrong reserves the right to supply non-wetted parts of aluminized steel.

Suggested Specification for HumidiPackPlus

Armstrong HumidiPackPlus shall be a packaged steam injection type humidifier assembly ready for insertion into the duct.

HumidiPackPlus includes a fabricated separator/header and multiple steam jacketed dispersion tube design of stainless steel wetted parts. No O-rings or slip couplings are required. Discharge orifices are sized and spaced to accept steam from the separator/header and provide a dry and uniform discharge of steam.

Each HumidiPackPlus segment is designed for simplified duct mounting including stacking of header/separator/dispersion tube segments when necessary.

HumidiPackPlus includes a steam supply control valve utilizing a parabolic plug design offering immediate response and precise modulation of flow throughout the 19 mm valve stroke. The control valve is protected by a steam supply strainer and inverted bucket drip trap. A float type drip trap will be used to drain the separator/header and a second trap will drain the dispersion tube jackets.

For application with horizontal dispersion tubes, all piping is on one side of the duct or air handling unit.

The packaged humidifier shall provide a mixing length distance of no more than ___mm downstream of the active tube segment while maintaining conditions of ___% relative humidity at a minimum temperature of ___°C in the duct airstream. Air pressure drop across dispersion tube segment shall not exceed ___mm W.C. at a duct air velocity of ___ m/s.

Figure 112-1. Horizontal HumidiPack Plus

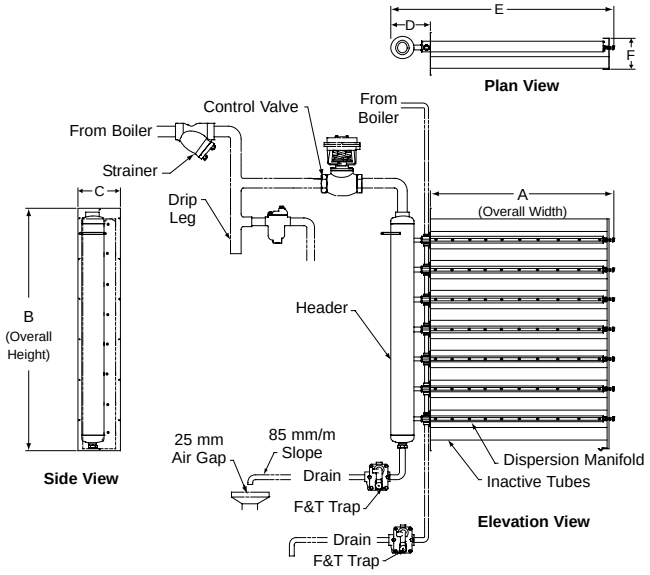
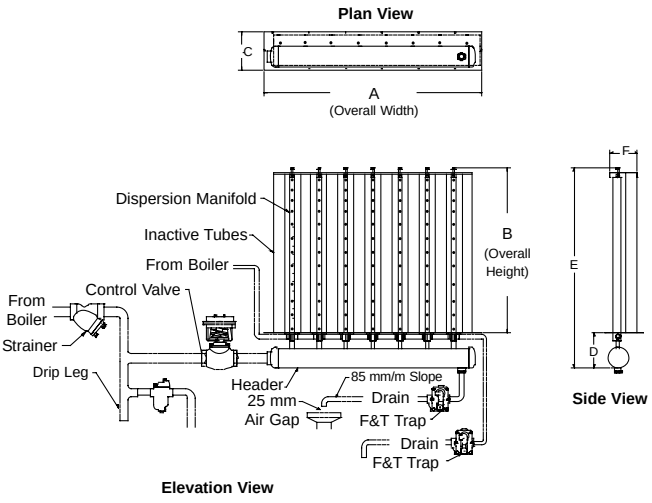


Figure 112-2. Vertical HumidiPack Plus



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Typical Duct Installations

See Installation Bulletin No° 560 for detailed information. Shown below is HumidiPack. Orientation of HumidiPackPlus in duct is similar

Figure 113-1. Horizontal Unit Left Handed Header

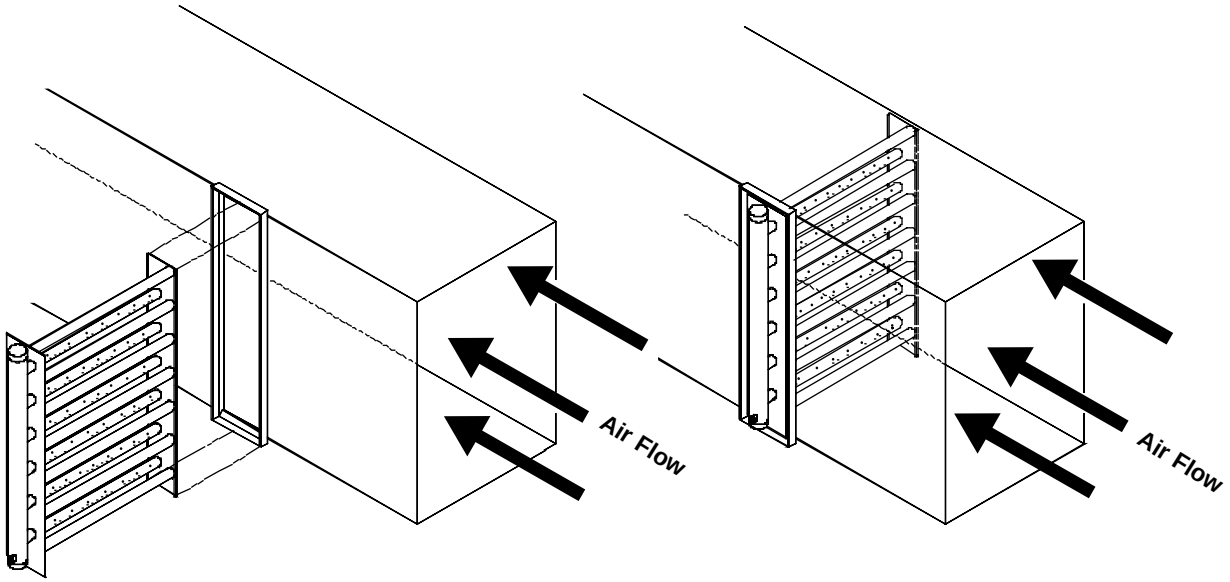
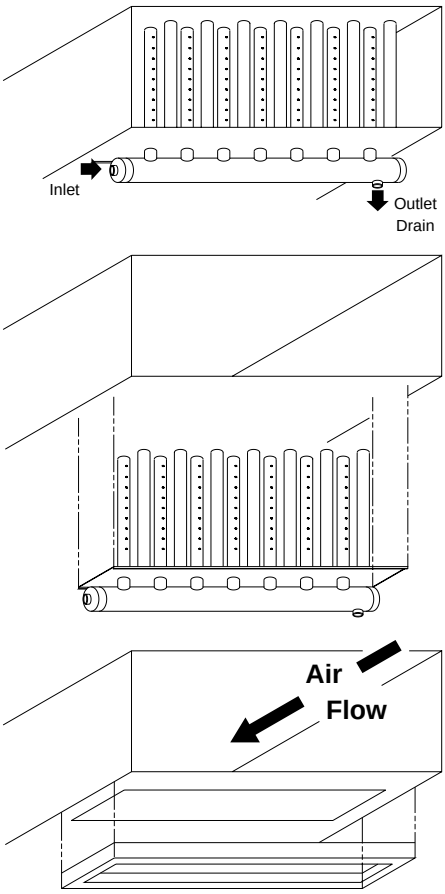


Table 113-1. Recommended Steam Main and Branch Line Drip Leg Sizing

Steam Main Size in Inches	Drip Leg Diameter in Inches	Drip Leg Minimum Length in mm	
		Supervised Warm-Up	Automatic Warm-Up
1/2"	1/2"	254	711
3/4"	3/4"	254	711
1"	1"	254	711
2"	2"	254	711
3"	3"	254	711
4"	4"	254	711
6"	4"	254	711
8"	4"	304	711
10"	6"	381	711
12"	6"	457	711
14"	8"	533	711
16"	8"	609	711
18"	10"	685	711
20"	10"	762	762
24"	12"	914	914

Figure 113-2. Vertical Unit Left Handed Steam Inlet



All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Figure 114-1. Typical runout less than 9 meters long.

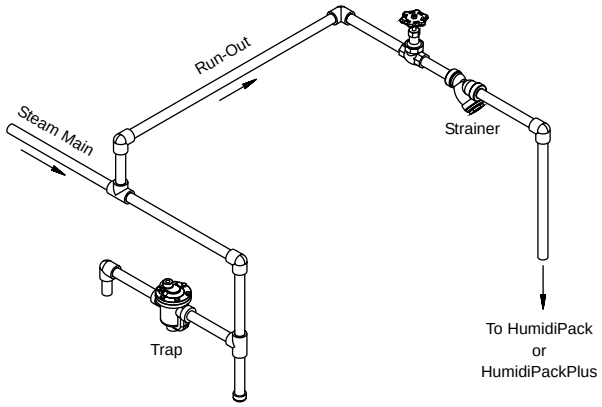


Figure 114-2. Typical long runout of 9 meters or more.

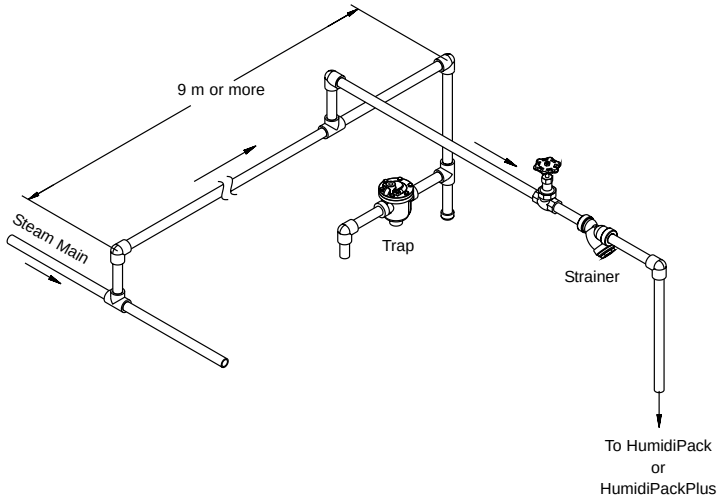
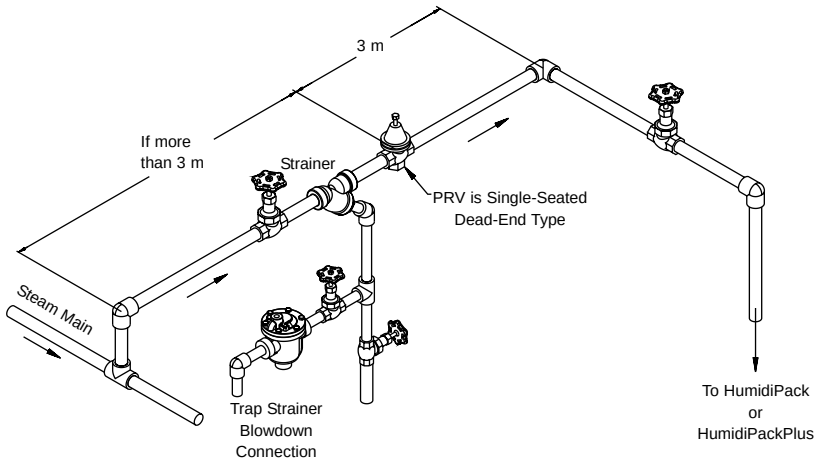


Figure 114-2. If the supply steam to the control valve exceeds the control valve pressure rating, an Armstrong pressure reducing valve may need to be installed after the Y-Type strainer as shown.



All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Condensate Drainage Options

Condensate discharged from the HumidiPack or HumidiPackPlus separator/header is at essentially atmospheric pressure. Thus the condensate must be discharged to a drain or pumped. On many applications, an attempt to lift condensate even a few inches will lead to potential flooding or spitting problems from the multiple tube bank.

Figure 115-1. Header drain trap discharging to pumped return. (HumidiPack shown)

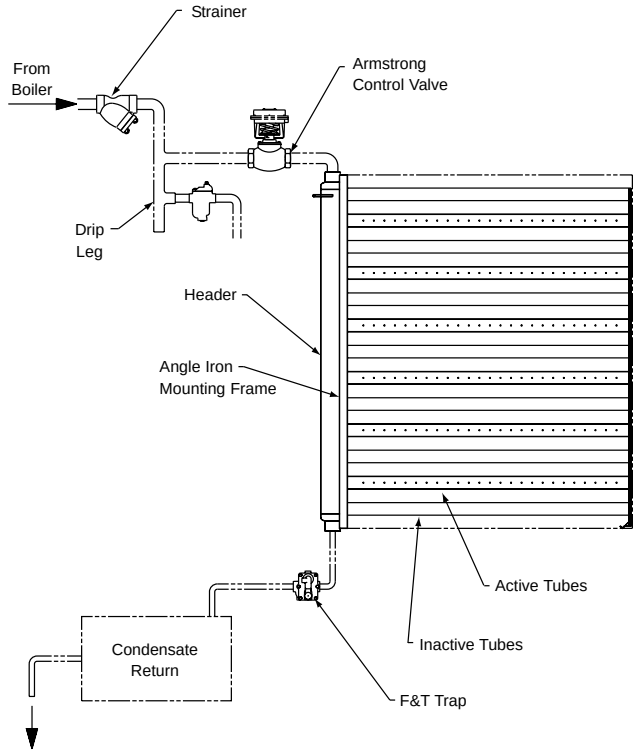


Figure 115-2. Drain trap discharging to floor drain. (HumidiPackPlus shown)

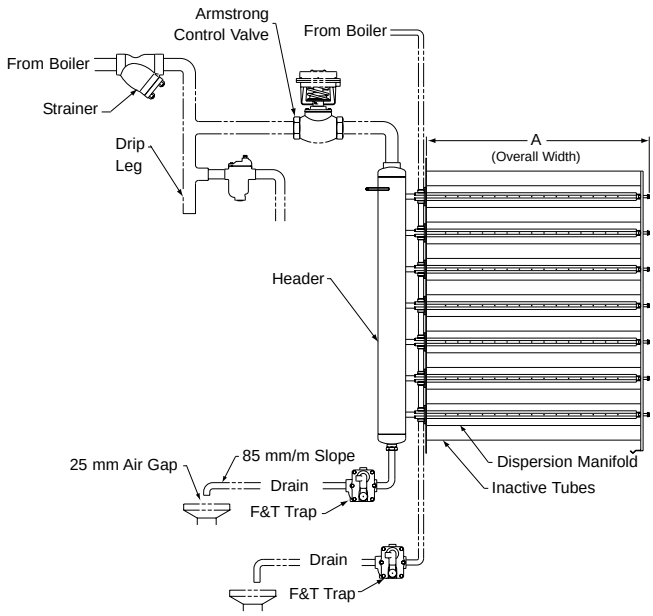
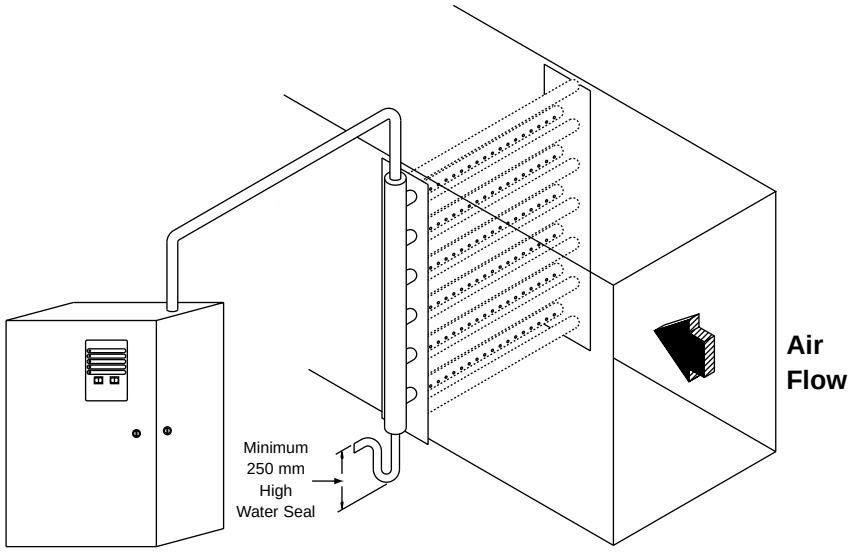


Figure 115-3. Condensate drained through piping loop seal with steam supplied from electric humidifier.



All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Control Valve Characteristics

HumidPack and HumidiPackPlus are supplied with the Armstrong Series ACV Control Valve for applications when central steam or steam under pressure is available. The valve utilizes our parabolic plug design offering immediate response and precise modulation of flow throughout the 19 mm valve stroke. The parabolic plug also offers high rangeabilities.

Accuracy by Design – Not by Accident

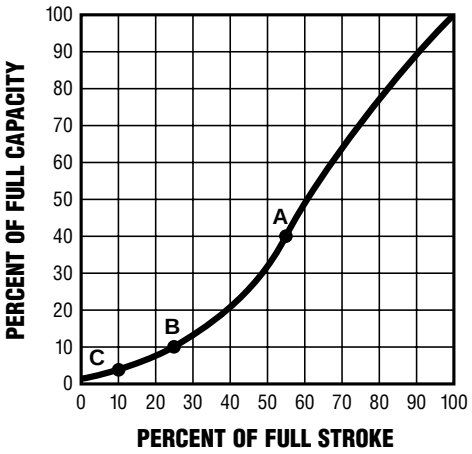
The secret of accurate control is making sure a valve's control characteristics match the application. When they do, the valve controls accurately (without hunting) and performs reliably. When there's no match, the valve simply cannot do what the application demands.

Armstrong uses a modified parabolic plug to handle exceptionally low output. The modification of true linear characteristics provides more precise control when capacity requirements are very low and the valve is just cracked off the seat. Notice in Figure 116-1 that at point A on the curve more than half the valve stroke is devoted to 40% of the unit's capacity. At point B, 1/4 of the stroke is devoted to only 10% of capacity. At point C, 10% of the stroke covers less than 5% of the unit's capacity.

How low can the unit control? Table 118-1, Page 118 tabulates this function, called rangeability. Rangeability is the ratio between the maximum controllable flow and the minimum controllable flow through the valve. The higher the rangeability of a valve, the more accurately it can control flow when low output is required. If rangeability is too low, the valve will "hunt" excessively when low output is required.

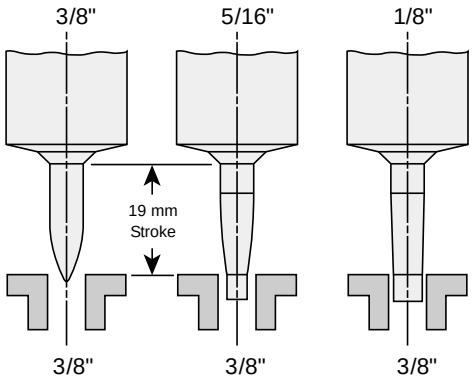
To calculate minimum flow, simply multiply Cv by the percentages shown in the table. For example, a 5/16" orifice in an ACV-02 has a Cv of 2,5. The lowest output that can be controlled is 2% of maximum flow.

Figure 116-1. Modified Linear Curve



Modified linear characteristics curve for valves used under modulating control. The modification of true linear characteristics provides more precise control when capacity requirements are very low and the valve is just cracked off the seat.

Figure 116-2. Parabolic Plug Type Valves



Parabolic plug valve configuration permits accurate modulation of flow over the complete stroke of the valve.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Control Valve Physical Data

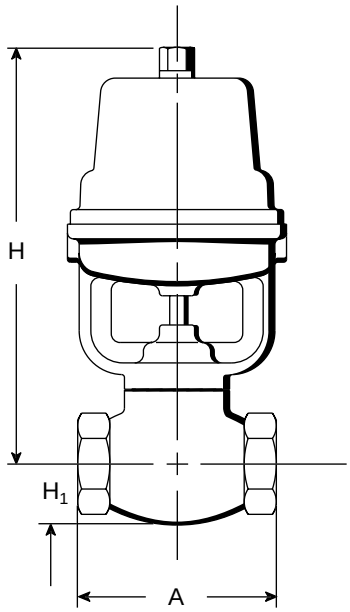


Table 117-1. Specifications						Dimensions and Weights		
Model Number	**Pipe Size in mm**	**Body Material**	**Trim Material**	**Vessel Design Limitation**	**Minimum Δ P**	**A in mm**	**H_1 in mm**	**Weight in kg**
Control Valve ACV-02 ACV-03 ACV-04 ACV-06	 1/2" 3/4" 1" 1 1/2"	Cast Iron	300 Series Stainless Steel	17 bar @ 204°C	0,14 bar	 105 108 140 203	 29 33 48 62	 4,4 4,8 5,3 10,0
ECV-02 ECV-03	1/2" 3/4"	T-316 Stainless Steel		27,5 bar @ 204°C		105 108	29 33	3,9 4,3

Table 117-2. Physical Data "H" Dimensions in mm							
Model Number	**Armstrong C-1801**	**Honeywell MP953D**	**Honeywell MP953F**	**Sauter AV42 P10**	**Honeywell ML7425A**	**Belimo AF24SR**	**Belimo NVF24-MFT-US E**
ACV/ECV-02	216	178	302	361	313	386	295
ACV/ECV-03	225	187	311	370	322	395	305
ACV-04	–	203	324	386	338	411	318
ACV-06	–	229	352	415	367	440	346

How to Order

Body Material
A = Cast Iron
E = T-316 Stainless Steel

Product Line
CV = Control Valve

Connection Size
02 = 1/2"
03 = 3/4"
04 = 1"
06 = 1 1/2"

Standard Operator Types
Pneumatic Modulating
AM = Armstrong C-1801
HAM = Honeywell MP953D and F
SRAM = Sauter AV42 P10

Electric Modulating
HEM = Honeywell ML7425A
BELEM = Belimo AF24SR
BNVEM = Belimo NVF24-MFT-US-E

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Control Valve Capacity Calculations

Table 118-1. Control Valve Rangeability (Normally Closed Valves)

Control Valve Model	Valve	Rangeability		Standard Operators						
	Equivalent Diameter in Inches	Ratio of Flow Max:Min	Flow Coefficient CV	Armstrong C-1801	Sauter AV42 P10	Honeywell MP953D	Honeywell MP953F	Belimo NVF24	Honeywell ML7425A	Belimo AF24SR
				Maximum Operating Pressure in barg						
CV-06	1 1/2"	63:1	27,0	N/A	8,6	1,7	10,3	N/A	4,1	6,8
	1 1/4"	69:1	21,0							
	1 1/8"	61:1	19,5							
	1"	53:1	18,0			2,1			5,2	8,6
	7/8"	44:1	16,0							
	3/4"	33:1	13,0							
CV-04	1"	53:1	13,0	N/A	8,6	4,8	10,3	4,1	10,3	10,3
	3/4"	33:1	10,5							
	5/8"	25:1	8,5							
	9/16"	105:1	7,0							
	1/2"	97:1	6,0							
	7/16"	75:1	5,0							
CV-03	3/4"	118:1	7,5	5,5	8,6	5,5	10,3	4,1	10,3	10,3
	5/8"	123:1	6,5							
	9/16"	105:1	6,0							
	1/2"	97:1	5,5	10,3	8,6	10,3				
	7/16"	75:1	4,0							
CV-02	1/2"	97:1	4,0	10,3	8,6	10,3	10,3	4,1	10,3	10,3
	7/16"	75:1	3,5							
	3/8"	70:1	3,0							
	5/16"	49:1	2,5							
	1/4"	31:1	1,7							
	3/16"	18:1	0,9							
	1/8"	37:1	0,45							
	1/16"	10:1	0,09							

Table 118-2. Selection Formulas

For Steam	Formula Key
For Water: $Q = \frac{0,86 \times C_v \times \sqrt{\Delta P}}{\sqrt{G}}$ **For Steam**: When $P_2 > \frac{P_1}{2}$ $W = 20 \times C_v \times \sqrt{\Delta P \times P_2}$ When $P_2 < \frac{P_1}{2}$ $W = 10 \times C_v \times P_1$	C_v = Valve flow coefficient G = Specific gravity in kg/dm³ Q = Maximum flow capacity of liquid in Nm³/h P_1 = Inlet pressure in bar(a) P_2 = Outlet pressure in bar(a) ΔP = Pressure drop (P_1 - P_2) in bar W = Maximum flow capacity of steam in kg/h

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.