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The Importance of Sizing Whole-House Humidifiers Based on the Home, not the Output.

Choosing between wetted-media or steam-based humidifiers is more than the output ratings on the box.

Legend:
Wetted-Media = Bypass and fan flow-through with evaporative pad

Steam-Based = Water is converted to steam with electrical energy using electrodes or resistance heating elements

With the multiple humidifier styles and sizes available to distributors and contractors, it can be difficult to discern which model provides the best solution for the homeowner. The most common and simplest method of rating the humidification capacity is to state the output in terms of gallons per day (GPD). However, that rating can be misleading since wetted-media and steam-based products can perform differently depending on the operating conditions.

Wetted-Media

GPD rating is based on the amount of moisture the humidifier can deliver if it - along with the furnace - is running continuously over a 24 hour period with plenum air temperatures of 120F passing through the wetted pad. This rating does not account for periods when the furnace is off, and cooler plenum temperatures and duct air flow may impact performance.

Steam-Based

GPD rating is based on the amount of water evaporated by heating the water. These units are typically installed so that they turn on the HVAC fan when there is a need for humidity so they are not dependant on furnace run time. Steam is delivered to the air duct regardless of plenum temperatures.

It is important to understand the difference between these two as it directly affects which product is best for each home. For example, a wetted-media fan-powered humidifier rated for 18 GPD that is installed in a home where the furnace and fan only run 8 hours (33%) of any given day may actually be delivering only 5.8 GPD of humidity. If that furnace air temperature is less than 120F, that delivery rate will be even less – perhaps closer to 4 GPD.

One of the distinct advantages of using steam-based humidifier designs is that there are no dependencies on air temperature or furnace operation in order to deliver its rated GPD. For example, the TrueSTEAM HM506, which is rated at 6 GPD will deliver 6 GPD regardless of furnace operation or air temperature. This makes steam based designs ideal for moderate climates where the furnace doesn't run as often, as well as for homes that have high-efficiency or multi-stage (heat pump) equipment that run less frequently and at lower air temperatures.

There are situations, however, where wetted-media products can meet and in some cases exceed the delivery rates of smaller steam-based units. This becomes relevant with gas/oil conventional furnaces that have plenum air temperatures over 120F and in colder climates where the furnace may run 50-75% of the time. As established earlier, the TrueSTEAM HM506 will deliver 6 GPD regardless of furnace run time. The HE225 wetted-media has a 12 GPD rating, which if applied to a conventional (gas/oil) furnace in a colder climate where the furnace and fan run for 12 hours (50%) can deliver up to 6 GPD – equal to the TrueSTEAM HM506.

The following table provides reference based on furnace temperature, runtime, as well as whether the system fan is running intermittently or continuous. These factors play a critical role in the GPD output of each humidifier style and model.

Furnace Run time per day	Air Temp	System Fan (70F)	HE225 Bypass	HE265 Bypass	HE365 Fan	HM506 TrueSTEAM	HM509 TrueSTEAM	HM512 TrueSTEAM
				Wetted-media			Steam-based	
5 hrs (20%)	120F	100%	6.7	9.5	10.1	6.0	9.0	12.0
	110F	100%	6.5	9.1	9.7	6.0	9.0	12.0
	100F	100%	6.2	8.8	9.3	6.0	9.0	12.0
	90F	100%	5.9	8.4	8.9	6.0	9.0	12.0
	120F	33%	3.8	5.4	5.7	6.0	9.0	12.0
	110F	33%	3.6	5.0	5.3	6.0	9.0	12.0
	100F	33%	3.3	4.7	4.9	6.0	9.0	12.0
	90F	33%	3.0	4.3	4.6	6.0	9.0	12.0
	120F	Intermittent	2.4	3.4	3.6	6.0	9.0	12.0
	110F	Intermittent	2.1	3.0	3.2	6.0	9.0	12.0
	100F	Intermittent	1.9	2.7	2.8	6.0	9.0	12.0
	90F	Intermittent	1.6	2.3	2.4	6.0	9.0	12.0
8 hrs (33%)	120F	100%	7.6	10.8	11.4	6.0	9.0	12.0
	110F	100%	7.2	10.1	10.7	6.0	9.0	12.0
	100F	100%	6.7	9.5	10.1	6.0	9.0	12.0
	90F	100%	6.3	8.9	9.4	6.0	9.0	12.0
	120F	33%	5.2	7.3	7.8	6.0	9.0	12.0
	110F	33%	4.7	6.7	7.1	6.0	9.0	12.0
	100F	33%	4.3	6.1	6.5	6.0	9.0	12.0
	90F	33%	3.9	5.5	5.8	6.0	9.0	12.0
	120F	Intermittent	4.0	5.7	6.0	6.0	9.0	12.0
	110F	Intermittent	3.6	5.0	5.3	6.0	9.0	12.0
	100F	Intermittent	3.1	4.4	4.7	6.0	9.0	12.0
	90F	Intermittent	2.7	3.8	4.0	6.0	9.0	12.0
12 hrs (50%)	120F	100%	8.7	12.3	13.1	6.0	9.0	12.0
	110F	100%	8.0	11.4	12.1	6.0	9.0	12.0
	100F	100%	7.4	10.5	11.1	6.0	9.0	12.0
	90F	100%	6.7	9.5	10.1	6.0	9.0	12.0
	120F	33%	6.9	9.8	10.3	6.0	9.0	12.0
	110F	33%	6.2	8.8	9.3	6.0	9.0	12.0
	100F	33%	5.6	7.9	8.4	6.0	9.0	12.0
	90F	33%	4.9	7.0	7.4	6.0	9.0	12.0
	120F	Intermittent	6.0	8.5	9.0	6.0	9.0	12.0
	110F	Intermittent	5.3	7.6	8.0	6.0	9.0	12.0
	100F	Intermittent	4.7	6.6	7.0	6.0	9.0	12.0
	90F	Intermittent	4.0	5.7	6.0	6.0	9.0	12.0

In addition to the GPD differences highlighted above, other criteria specific to the home must be taken into account to select the best humidifier option for the home. The Air-Conditioning and Refrigeration Institute (ARI) Guideline for Selection, Installation and Servicing of Residential Humidifiers lists the following factors to consider when determining humidity capacity requirements:

- Indoor and outdoor temperature and humidity conditions (I recommend making this general statement since the guidelines allow for calculations based on various design conditions).
- Size and physical characteristics of residence. Space volume and infiltration are added together.
- Conditioned space volume
- Tightness of structure, insulation, storm windows and doors.
- Quantity of outside air entering the conditioned space
- Mechanical and natural ventilation
- Fireplace dampers (ARI ratings are based on these being closed)
- Internal load requirements
- This includes bathing, laundry habits, cooking, number of occupants. 2 gallons per day is factored off the GPD figures below to account for internal sources of humidity (based on a family of four)

Taking these considerations into account, ARI recommends the following humidity capacity ratings (GPD) for the size and type of building construction:

Humidity Requirements, GPD*						
Type	**Size of building, sq. ft [m²]**					
	500 [46.45]	**1000 [92.90]**	**1500 [139.35]**	**2000 [185.80]**	**2500 [232.25]**	**3000 [278.80]**
Tight	.01	2.2	4.4	6.5	8.6	10.7
Average	1.3	4.5	7.8	11.1	14.3	17.6
Loose	2.6	7.2	11.8	16.4	21.0	25.6

*Based on 8-ft ceiling height, indoor conditions of 70F and 35%RH, outdoor conditions of 20F and 70%RH.

Summary

Many factors must be considered when choosing the right humidifier for the particular application. This technical brief is meant to serve as a guide for not only choosing the right humidifier style and size for the home's equipment and runtime, but also to convey the importance of understanding the nuances in output ratings as they relate to the particular home. Applying these recommendations to the home's you install whole-house humidification into will lend not only to the optimized comfort of the home's occupants, but also help them to conserve energy and save money. All of which serve to increase your bottom line through reduced callbacks, and repeat business.

Works Cited

1. 2007 Guideline for Selection, Installation, and Servicing of Residential Humidifiers. ARI Guideline-F, 2007.

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