Condensation is Appearing on the Glass Wall of my Wine Cellar

Welcome to the club. You wanted pretty; you got pretty. But, like most things in life, beauty comes with a negative. If you own a wine cellar with at least one glass wall, the question is not if condensation will begin dripping down the glass, but when. You are not a victim. It is simple physics. Specifically, it is a condition centered on an obscure principle of water called dew-point. When the air outside the cellar reaches a certain temperature combined with a specific relative humidity, the atmosphere is no longer capable of holding water vapor. The water vapor condenses and forms water droplets on the glass.

This principle is demonstrated regularly when you drive a car. When a film begins to coat the inside of the windshield, you automatically reach for the defroster. Three things occur simultaneously. First a flow of air is directed against the inside of the windshield. Secondly, the air is heated (even on days when you are using the air-conditioning). And, third, the recycle-interior-air switch is defeated, bringing in outside air to complete the action. The cloudiness immediately begins to dissipate.

Question: Rick, I have insulated glass in my cellar walls. I was told that it would never exhibit condensation.

Answer: ***Never*** is a difficult condition to prove. Any type of glass will exhibit condensation if the conditions are right…even insulated glass. This winter when the temperature plunges below freezing, with humidity in the teens and the home heating set to rock-and-roll, check-out the area along the bottom of your bedroom windows. (House windows are usually double insulated and sometimes triple paned.) If your home humidifier is working correctly, you will find a one-inch border of condensation along the bottom edge of all the windows in your house. Insulated glass resists the formation of condensate better than single-pane; but both will show it.

Question: The glass doors on my cellar have air gaps between them and also air gaps around the hinges. If I manage to seal these perfectly, can I avoid condensation?

Answer: Nope. First, no one can seal glass doors completely in a wine cellar. Vinyl seals, (the only types available), always stretch and flex over time. Moreover, there has to be some space between the hinge and the glass for the pin-hinges to work. And even if you did completely seal the space, condensation would still appear. Condensation is not caused by air gaps. Think about your car windshield. Sealed perfectly? You bet. If it wasn't car washes would be a disaster. And

yet, condensation still appears. It's the same idea with your bedroom windows. Most are sealed brilliantly but condensation occurs.

Below are several charts I completed. The first shows a temperature range between 55^0 and 60^0 with a constant relative humidity of 60%. Note the third line (dew-point). The next four lines demonstrate what happens when humidity is raised from 60% to 65% and then 70%. Conclusion: given a constant humidity, as temperature rises, so does the dew point. As humidity rises in a stable temperature, the dew-point rises.

Temperature (F^o) (Increase one degree)	55	56	57	58	59	60
Relative Humidity (Stable at 60%)	60%	60%	60%	60%	60%	60%
Dew Point (F^o)	41	42	43	44	45	46
Relative Humidity (Stable at 65%)	65%	65%	65%	65%	65%	65%
Dew Point (F^o)	43	44	45	46	47	48
Relative Humidity (Stable at 70%)	70%	70%	70%	70%	70%	70%
Dew Point (F^o)	45	46	47	48	49	50

Now check out the next three charts below. Note the temperatures range from constant 74^0, 72^0, and 70^0. In each chart the humidity rises in 5% intervals from 40% - 65%. Now, compare the dew-points highlighted and consider the interior-glass, surface-temperature of your glass-walled wine cellar. The highlighted temperatures are possible wine cellar temperatures. (For this example, I considered wine cellar temperatures to range from 54^0 to 58^0.)

Temperature (F^o)	74	74	74	74	74	74
Relative Humidity	40%	45%	50%	55%	60%	65%
Dew Point (F^o)	48	51	54	57	59	61

Temperature (F^o)	72	72	72	72	72	72
Relative Humidity	40%	45%	50%	55%	60%	65%
Dew Point (F^o)	46	50	52	55	57	60

Temperature (F^o)	70	70	70	70	70	70
Relative Humidity	40%	45%	50%	55%	60%	65%
Dew Point (F^o)	45	48	50	53	55	58

With an outside air temp of 74^0 and a relative humidity of 55%, any glass surface inside the wine cellar that is 57^0 will show condensation. At a temperature of 72^0 and a 55% relative humidity that glass-box wine cellar kept at 55^0 may have condensation on the glass. Note also that as temperatures retreat it takes a higher percentage of relative humidity to make the water vapor in a wine cellar turn into condensation. (This only makes sense. Hotter air can hold more moisture.)

So, what can I do? My wine cellar glass is dripping water onto the floor.

You have the same three approaches that the auto engineers used when designing a defroster system. Any one of these three or all three in concert ***may*** solve the problem. (I use the term 'may' because each cellar is unique and each ambient environment is even more specialized. My parents ran their furnace at 78^0 constantly in the winter and 81^0 when they were cold. My house is a constant 67^0 in the winter and 63^0 at bedtime. My parents would not survive my home and a wine cellar in either house would face a myriad of different challenges.) I suggest the following:

1) Begin by placing a box fan inside the cellar. Turn it on high and angle it so that it blows across the glass, not directly on it. Condensation has a hard time forming on glass in a cellar where the air is moving. If this approach does not work over time, try redirecting the flow slightly.
2) Raise the temperature of the cellar. I understand that this suggestion is an anathema to all those who believe that a constant 55^0 must be maintained at all cost. Remember, the aging of wine is a chemical reaction. It's just physics. Raising the temperature by two-degrees is neither going to 'hurt' the wine nor be perceived in the taste of the wine at opening.
3) For those of you with a humidifier in your wine cellar systems, turn it off. The cooling unit will gently reduce the humidity during standard operation. It may be enough to move the dew-point.
4) Do nothing. The weather will change. Humidity will lower and the temperature will rise and fall. Open one of the better bottles, pull up a chair, look at the wine cellar, and consider this statement. When I was a kid I never thought I would ever own a wine cellar. Now I own one that I not only enjoy but right now am relishing in its beauty. Life is good.

My best, Rick

Owner, Chicago Wine Cellar Expert Inc.