



## Condensation and Your Enclosure

***If the case you are cooling is outside or otherwise may be affected by condensation that forms as the temperature inside the box fall below the [dew point](#) you should design your case to accommodate moisture.***

That's because cold air holds less moisture than warm air. So, the colder the surface, the less moisture it takes to show up as condensation. When air cools to the point where it can no longer hold the water in vapor form, then it condenses to a visible droplet form. That "point of condensation" is called the "dew point."

While our IP55 rated assemblies have Epoxy sealed TE modules and fans designed to operate in moist environments and will not suffer from condensation, the other electronics inside should be protected from any dripping of moisture from the TE assembly or that forms elsewhere within the case itself.

Three things you can do to reduce the potential of condensation inside the box are insulate, control the temperature and keep the air circulating.

First and most importantly, be sure to insulate with as much material as possible. We like rigid foam board ½ inch (or thicker) cut to snugly fit within the sheet metal of an enclosure. Add a barrier of DuPont™ Tyvek® if possible. Both of these products are available at most home stores. Together, they resist air infiltration and water intrusion and significantly reduce the heating effect of sunshine which makes for a more energy-efficient enclosure or panel that is easier to keep cool and keep dry.

In many situations it's a good idea to consider using a thermostat or temperature controller to keep the temperature of the (cooled) air inside the box above the dew point. In this way minimal condensation forms and you will very likely be operating more efficiently as well. We offer single set point units like our TLZ-10 for cooling and dual set-point units like TLK38, if you require both heating and cooling.

Finally, keep the air inside the enclosure circulating. Air cools off and condenses more quickly when it is motionless. Consider an additional fan or blower to assist the thermoelectric assembly with air handling.

See the following table to see the relationship between [Relative Humidity](#) and Air Temperature.



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## Dew Point Table

### Relative Humidity

Air temperature in °C	Relative Humidity														
	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	
30°C	10.5	12.9	14.9	16.8	18.4	20.0	21.4	22.7	23.9	25.1	26.2	27.2	28.2	29.1	
29°C	9.7	12.0	14.0	15.9	17.5	19.0	20.4	21.7	23.0	24.1	25.2	26.2	27.2	28.1	
28°C	8.8	11.1	13.1	15.0	16.6	18.1	19.5	20.8	22.0	23.2	24.2	25.2	26.2	27.1	
27°C	8.0	10.2	12.2	14.1	15.7	17.2	18.6	19.9	21.1	22.2	23.3	24.3	25.2	26.1	
26°C	7.1	9.4	11.4	13.2	14.8	16.3	17.6	18.9	20.1	21.2	22.3	23.3	24.2	25.1	
25°C	6.2	8.5	10.5	12.2	13.9	15.3	16.7	18.0	19.1	20.3	21.3	22.3	23.2	24.1	
24°C	5.4	7.6	9.6	11.3	12.9	14.4	15.8	17.0	18.2	19.3	20.3	21.3	22.3	23.1	
23°C	4.5	6.7	8.7	10.4	12.0	13.5	14.8	16.1	17.2	18.3	19.4	20.3	21.3	22.2	
22°C	3.6	5.9	7.8	9.5	11.1	12.5	13.9	15.1	16.3	17.4	18.4	19.4	20.3	21.2	
21°C	2.8	5.0	6.9	8.6	10.2	11.6	12.9	14.2	15.3	16.4	17.4	18.4	19.3	20.2	
20°C	1.9	4.1	6.0	7.7	9.3	10.7	12.0	13.2	14.4	15.4	16.4	17.4	18.3	19.2	
19°C	1.0	3.2	5.1	6.8	8.3	9.8	11.1	12.3	13.4	14.5	15.5	16.4	17.3	18.2	
18°C	0.2	2.3	4.2	5.9	7.4	8.8	10.1	11.3	12.5	13.5	14.5	15.4	16.3	17.2	
17°C	-0.6	1.4	3.3	5.0	6.5	7.9	9.2	10.4	11.5	12.5	13.5	14.5	15.3	16.2	
16°C	-1.4	0.5	2.4	4.1	5.6	7.0	8.2	9.4	10.5	11.6	12.6	13.5	14.4	15.2	
15°C	-2.2	-0.3	1.5	3.2	4.7	6.1	7.3	8.5	9.6	10.6	11.6	12.5	13.4	14.2	
14°C	-2.9	-1.0	0.6	2.3	3.7	5.1	6.4	7.5	8.6	9.6	10.6	11.5	12.4	13.2	
13°C	-3.7	-1.9	-0.1	1.3	2.8	4.2	5.5	6.6	7.7	8.7	9.6	10.5	11.4	12.2	
12°C	-4.5	-2.6	-1.0	0.4	1.9	3.2	4.5	5.7	6.7	7.7	8.7	9.6	10.4	11.2	
11°C	-5.2	-3.4	-1.8	-0.4	1.0	2.3	3.5	4.7	5.8	6.7	7.7	8.6	9.4	10.2	
10°C	-6.0	-4.2	-2.6	-1.2	0.1	1.4	2.6	3.7	4.8	5.8	6.7	7.6	8.4	9.2	

To use this table simply find the ambient temperature in the first column and read across until you reach the column with the percentage (%) of relative humidity and find the temperature at which occur.

For example, if the ambient air temperature is 25°C and relative humidity is 75% then the dew point is 20.3°C and condensation will occur on a surface with that temperature.