The Kiln Corner
Converting Minutes to Rate Per Hour

by Arnold Howard

Though I work for Paragon Industries, L.P., the information here applies to all brands of glass kilns. Feel free to send questions for this column no matter what brand of kiln you own.

Whether brands of digital controllers figure rate as degrees per hour or time needed to reach a temperature, the results will be the same.

Photo courtesy of Paragon Industries, L.P.

Some kiln controllers use rate per hour and others just work with hours and minutes. How does one convert time in minutes into rate per hour?

In a temperature controller, the amount that you raise or lower the temperature per minute or hour is called rate. Paragon's controllers measure rate in degrees per hour. To raise the kiln's temperature by 100 degrees in one hour, the rate is 100 degrees per hour.

Instead of degrees per hour, some glass firing schedules are written as minutes needed to raise or lower the temperature (for example, raise the temperature from 540ºC to 675ºC in 30 minutes). Below are the steps needed to convert minutes to degrees per hour. The formulas work with Fahrenheit and Centigrade.

- Step 1. Subtract a heating segment's beginning temperature from the segment's target temperature. (Do the opposite with a cooling segment. Subtract the cooling segment's target temperature from its beginning temperature.)
  The segment 1 example shown below is a heating segment. 540 – 26 (room temperature) = 514
- Step 2. Multiply the number of minutes needed to reach the segment's target temperature by .0166.
  Segment 1 example: 120 x .0166 = 1.99 (rounded off to 2)
- Step 3. Divide the number in step 1 by the number in step 2.
  Example: 514 divided by 2 = 257. The rate per hour in the segment 1 example = 257 degrees per hour.

****Sample Program, Time in Minutes****
- Segment 1 time: 120 minutes; target temperature: 540ºC
- Segment 2 time: 30 minutes; target temperature: 675ºC
- Segment 3 time: 40 minutes; target temperature: 810ºC
- Segment 4 time: as fast as possible; target temperature 516ºC
- Segment 5 time: 60 minutes; target temperature: 427ºC
- Segment 6 time: 30 minutes; target temperature: 371ºC

****Sample Program Converted to Degrees Per Hour Rate****
- Segment 1 rate 257ºC; target temperature: 540ºC
- Segment 2 rate 270ºC; target temperature: 675ºC
- Segment 3 rate 204ºC; target temperature: 810ºC
- Segment 4 rate as fast as possible; target temperature 516ºC
- Segment 5 rate 89ºC; target temperature: 427ºC
- Segment 6 rate 112ºC; target temperature: 371ºC

I would like to program a rate of 4.2 degrees per hour in the Sentry 12-key controller. Is it possible to program a fraction of a degree?

The Sentry controller rate is programmed as degrees per hour in whole numbers. There is a way to program in tenths of a whole degree, however. First, the kiln manufacturer would need to configure your controller to program a rate in degrees per minute instead of degrees per hour. (At the factory, we can configure the Sentry 12-key controller rate as degrees per hour, which is the default; degrees per minute; or as elapsed time needed to reach a particular temperature.) After the controller is configured as degrees per minute, you can then program a heating rate of 0.07 degrees per minute, which is the same as 4.2 degrees per hour. **GPQ**

Arnold Howard writes instruction manuals and advertisements for Paragon Industries, L.P. His hobbies are glass fusing and karate. He also enjoys studying history and watching classic movies. You can reach Arnold at ahoward@paragonweb.com with questions for future columns. Visit www.paragonweb.com to sign up for his kiln newsletter.