

# Twin Screw Extruder Operating Range

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Twin screw extruder operating range

Vol. 27 #3, December 2000

Twin screw extruders are usually run starve fed. There is an independent control of both the feed rate and the screw speed. Let us call the feed rate  $Q$  and the screw speed  $N$ . The  $Q$  is a measure of how much is added into the extruder and  $N$  is proportional to how fast it is taken away.

A wide range of  $Q$  and  $N$  values can be run, but these values must conform to a certain range of the  $Q/N$  ratio. An example for a 2.8" (71 mm ) twin screw extruder might be a feed rate  $Q$  of 900 pph and a screw speed  $N$  of 300 rpm. The  $Q/N$  would be 3.0 pph/rpm. Higher screw speeds (even up to 1000 rpm ) would give proportionally higher rates with the same 3.0 pph/rpm.

A maximum limit on  $Q/N$  is reached when the screw becomes filled, the screw speed is not high enough to take away the feed. The maximum limit can also be reached by the mechanical torque limitation of the motor, gearbox or screws. For the 2.8" example, the maximum  $Q/N$  ranges from about 2.5 to 5.0 pph/rpm depending on many other extruder factors like the torque limit of the screws and gearbox, screw design, polymer viscosity, head pressure, backflow, etc.

A minimum for the  $Q/N$  ratio is also seen. Here the screw fill will be very low because the speed is too fast for the low feed rate. This can lead to surging and overheating and unsteady operation. For a 2.8" twin screw extruder, the minimum  $Q/N$  is about 0.75 pph/rpm.

The feed rate  $Q$  or the  $Q/N$  ratio for other size extruders is proportional to the screw diameter ratio raised to about a 2.7 exponent. Going from a 2.8" (71 mm) to a 4.5" (114 mm) twin screw would increase  $Q$  and  $Q/N$  by about 3.6 times. Applying this factor to the above operating  $Q/N$  range for the 2.8" extruder would give you the operating range of  $Q/N$  for the 4.5" extruder, a low of 2.7 pph/rpm to a high of from 9 to 18 pph/rpm, the high depends on the torque limitations.

The operating range for any size twin screw extruder sizes can be determined from the above information. The only design factors that one needs to know is the maximum screw speed possible and the torque limitations for that extruder.

- Carl Hagberg, NFM/Welding Engineers

See also:

- [Measuring RPM](#)
- [Twin screw extruder screw design: one, two, three](#)
- [Twin screw extruders design and operating characteristics](#)
- [Twin screw extrusion system compounds high levels of metal fillers into polymers](#)

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