Different pretreatment chemistry/residence time combinations are possible using these multiple horizontal-tube reactors.

Each tube is indirectly and directly steam heated to temperatures of 150°C to 210°C.

Residence time is varied by changing the speed of the auger that moves the biomass through each tube reactor.

Tubes are used individually or in combination to achieve different pretreatment residence times.

Smaller tubes made from Hastelloy, an acid-resistant material, are used with more corrosive chemicals and residence times from 3 to 20 minutes.

Larger tubes made from 316 stainless steel are used for residence times from 20 to 120 minutes.