

CERAMTUFF™ HA9S Firing Cycle Guidelines: Large Parts

CERAMTUFF™ HA9S is supplied without binder and is hot-press ready. The following should be considered guidelines for processing CERAMTUFF™ HA9S. They may need to be tweaked based on equipment, part dimensions, and application. Processing guidelines for small parts on page 2.

Segment	Time (hh:mm)	Temperature (°C)	Rate (°C/min)	Pressure (kPa)	Atmosphere
1	0:00	20	0	0	Vacuum
2	0:05	20	0	1000	Vacuum
3	2:00	1400	20 - 25	1000	Nitrogen
4	0:15	1400	Hold	3500	Nitrogen
5	0:45	1600	4.5	3500	Nitrogen
6	1:00	1850	4 - 4.5	8000	Nitrogen
7	0:45	1850	Hold	8000	Nitrogen
8	0:15	1750	(6.5 - 7)	400	Nitrogen
9	1:00	1400	4 - 4.5	400	Nitrogen
10	-	20	-	400	Nitrogen
	5:20 Plus Cooling				

Hot-Press Cycle Explanation

Segment	Description
1-2	Apply vacuum to eliminate air and apply 1,000 kPa pressure to compact powder.
3	Ramp to 1400°C as fast as possible. Most presses can do so in two hours.
4	Hold at 1400°C and increase pressure to 3,500 kPa.
5	Ramp temperature from 1400°C to 1600°C at a rate of 4.5°C/min.
6	Ramp temperature from 1600°C to 1850°C at a rate of 4-4.5°C/min. Simultaneously, ramp pressure from 3,500 kPa to 8,000 kPa immediately.
7	Hold at 1850°C and 8,000 kPa for 45 minutes.
8	Decrease temperature to 1750°C at a rate of 6.5-7°C/min. Simultaneously, decrease pressure to 400 kPa.
9	Decrease temperature to 1400°C at a rate of 4-4.5°C/min.
10	After 1400°C temperature is reached, turn off all heat and start natural cool down. Keep pressure at 400 kPa until temperature falls to a safe level to open the die.

CERAMTUFF™ HA9S Firing Cycle Guidelines: Small Parts

Segment	Time (hh:mm)	Temperature (°C)	Rate (°C/min)	Pressure (kPa)	Atmosphere
1	0:00	20	Hold	0	Vacuum
2	0:05	20	Hold	1,500	Vacuum
3	0:20	1000	50	10,000	Nitrogen
4	0:10	1000	Hold	10,000	Nitrogen
5	0:10	1400	40	20,000	Nitrogen
6	0:10	1400	Hold	20,000	Nitrogen
7	0:20	1850	22.5	30,000	Nitrogen
8	0:20	1850	Hold	30,000	Nitrogen
9	0:10	1400	(45)	30,000	Nitrogen
10	-	20	-	0	Nitrogen
	1:45 Plus Cooling				

Hot-Press Cycle Explanation

Segment	Description
1-2	Apply light pressure to compact powder and apply vacuum to eliminate air. Then backfill with nitrogen to a slightly positive pressure and open a vent to allow nitrogen to flow while pressing.
3	Ramp temperature from 20°C to 1000°C at a rate of 50°C/min. Simultaneously, ramp pressure from 1,500 kPa to 10,000 kPa.
4	Hold at 1000°C and 10,000 kPa for 10 minutes.
5	Ramp temperature from 1000°C to 1400°C at a rate of 40°C/min. Simultaneously, ramp pressure from 10,000 kPa to 20,000 kPa.
6	Hold at 1400°C and 20,000 kPa for 10 minutes.
7	Ramp temperature from 1400°C to 1850°C at a rate of 22.5°C/min. Simultaneously, ramp pressure from 20,000 kPa to 30,000 kPa.
8	Hold at 1850°C and 30,000 kPa for 20 minutes.
9	Decrease temperature to 1400°C at a rate of 45°C/min. Hold pressure at 30,000 kPa.
10	Release pressure completely and turn off all heat to start natural cool down. We recommend allowing the press to cool to at least 300°C before removing the die and starting a new cycle.