



## COMPRESSION MOLDING USER GUIDE

### GRADE SPECIFICATION:

- a) G-PAEK 1100PF – PEK fine powder (bulk density 0.28 - 0.32 g/l.)

Above grade of fine powder need to be pre-dried for 3 hours at 150°C (302°F) or overnight at 120°C (248°F), in order to avoid the problems of porosity/bubbles. Normal G-PAEK powder or pellets can be compression-molded but granular boundary marks will always be apparent and will be a weak point for the molding. The mold tools themselves should be preferably pre-dried at around 150°C (302°F) before use.



### EASY STEPS FOR MELT COMPRESSION MOLDING:

- a) Pre-dry the materials as mentioned above.
- b) Clean the mould with acetone & keep in the oven at 100°C for 10 min. (to flash of the acetone )
- c) Calculate the required quantity of powder.
- d) Take dried powder with ~ 105% of the theoretical weight of polymer required to form the component.
- e) Calculations for theoretical weight :
  - i. (For Bush)
    - $((OD^2 \times \text{Shrinkage Factor}) - (ID^2 \times \text{Shrinkage Factor})) \times \text{Factor Density} \times L$
    - Shrinkage Factor: 1% G-PAEK 1100PF
    - Factor Density - Density  $\times (\pi / 4)$
    - (Density: 1100PF= 1.3 g/cc)
  - ii. For Rod
    - $(OD^2 \times \text{Shrinkage Factor}) \times \text{Factor Density} \times L$
- f) Mark the required height on the mold set by a marking pen. (as per volume calculation)
- g) Fill the dried powder in the mold.
- h) Apply pressure till piston reaches to 40-50% of measured height.
- i) Compress the powder for 5 to 10 mins, depending upon the thickness of the molding.
- j) Clean the dusted powder in the mold with compressed air.
- k) Transfer the mold in an air circulated oven. (Oven Temperature: 400-420°C)
- l) Baking Time depends on the thickness & size of the mold.
- m) Transfer the mold from oven to compression press & apply pressure untill piston reaches the marked height.
- n) Pressure should be maintained for 15 minutes for every 25 mm (1 in) section thickness.



- o) Eject the part from the mold after the mold temperature reaches 180-200°C.  
 p) Anneal the parts at 220 deg C (Pl. refer post annealing process in this brochure)

Sr. No.	Wall Thickness	Outer Dia.	Length	1 <sup>st</sup> Pressure (Cold Pressure)	1 <sup>st</sup> Holding Time (cold holding)	Oven Temperature	Curing Time in oven	2 <sup>nd</sup> Pressure (Hot Pressure)	2 <sup>nd</sup> Holding Time (Hot holding)
Unit	mm	mm	mm	Kg/cm <sup>2</sup>	min	°C	min	Kg/cm <sup>2</sup>	min
01	08- 10	50	50	40	10	420	180	80	10
02	10-12	60	50	40	10	420	180	80	10
03	12-16	70	50	60	10	420	210	100	15
04	16-20	70	50	80	10	420	210	110	15
05	20-25	70	50	80	10	420	210	120	15
06	70	70	30	50	10	420	240	100	15
07	Plate	245	10	100	10	420	180	120	10
08	Plate	245	20	100	10	420	210	140	15
09	Plate	245	30	120	10	420	240	140	15

## EQUIPMENT REQUIREMENTS

Press: Should be capable of delivering sufficient pressure as per the product, typically up to 800 bar (11600 psi).

Molds: Should be corrosion-resistant metals. Good results have been obtained with Stavax, Duplex (Ni/Chromium) and hard chrome-plated stainless steel; also P20 hard tool steel with a Rockwell hardness of 50 has been used with success. Mild steel and steels containing copper should not be used. Mold surfaces in the line should be polished to help ejection. A mold release agent is recommended such as one of the daichi products (without silicon) to aid ejection. Internal and external heater bands are referable but a hot air circulating oven capable of achieving at least 420°C can be used.

## COMPRESSION MOLDING UNIQUENESS

Properties of compression molded G-PAEK parts differ from injection molded parts. As a general rule the compression molded parts are more crystalline, have a higher modulus and tensile strength, are harder but have a lower ductility and can be more brittle. Very thick sections may be subject to cracking and a post processing thermal treatment (annealing) should be used to relieve stresses. Close tolerances cannot be achieved directly therefore components must be machined.

## POST ANNEALING PROCESS

After the moldings are ejected out from the mould, the parts need to be annealed in an air circulating oven (nitrogen circulation helps maintain color of the moldings) at 220 deg C for 1 hrs in a step wise manner. The oven temp is increased from 150 deg C till 220 deg C with 50deg C rise every 30 minutes and then maintained at 220 deg C for 1 hour. There after the temperature is brought down in a gradual stepwise manner with 50 Deg C drop every 30 minutes until 150 deg C is reached. After the annealing cycle is completed, the part can be removed out from oven and used. For thicker parts, 2-3 cycles of annealing is recommended.