Processing Times (rough estimates)

CNC Operations

Operation	Time	Setup
Turn down diameter	0.3 min/cm	30 min
Face off end	0.3 min/cm	30 min
Drilling	0.5 min/hole	30 min
Tapping	0.5 min/hole	30 min
Sawing	0.3 min/cm^2	15 min
Grinding	0.3 min/cm^2	30 min
EDM	2.0 min/cm^2	60 min

Injection Molding

$$\text{Processing time} = \frac{5 + th^2/\alpha}{\#cavities}$$

Where

5 is the mold open and pack time in seconds
α is the material thermal diffusivity
th is the nominal part wall thickness (mm)

Setup time per lot:

1 hour for a 25 to 125 ton press
2 hours for 500 ton press
4 hours for 600+ ton press

Die Casting

$$\text{Processing time} = \frac{10 + 200th}{\#cores}$$

Where

10 is the die open and fill time in seconds
200 is a conduction rate factor
th is the nominal part wall thickness (mm)

Setup time per lot is 1-3 hours

Powder Metallurgy

$$\text{Processing time} = t_{pack} + 0.9T_m \frac{L_{oven}W_{oven}}{L_{part}W_{part}} + t_{finish}$$

Where

t_{pack} is the time to pack the fill into a green compact (typically about 15seconds per cycle, but factor by the number of cavities)

Tm is the required time to fire a material (also referred to as “sintering time”)

L_{pack} and W_{pack} are the length and width dimensions of the part

L_{oven} and W_{oven} are the length and width of the continuous belt-driven firing oven. Typically ovens are 75 ft. x 3 ft.

t_{finish} is the time (in seconds) for any subsequent operations such as deburring, surfacing and coining.

Setup time is 2-6 hours per lot

Typical Bulk Material Costs (1998)

Material	Typical Cost ($/lb)
Plastics (virgin pellets)	
Polyethylene terephthalate (PET)	$0.40 - $1.00
Polypropylene (PP)	$0.30 - $0.50
Polycarbonate (PC)	$0.80 - $2.00
Polystyrene (PS)	$0.40 - $0.60
Polyvinyl chloride (PVC)	$0.30 - $0.40
Acrylonitrile butadiene styrene (ABS)	$0.50 - $1.40
Phenolic	$0.60 - $0.80
Nylon	$1.10 - $2.00
Rubber	
Butyl	$1.50 - $3.00
Latex	$1.00 - $3.00
SBS	$1.00 - $2.00
Silicone	$4.00 - $8.00
Metals (sheet or bulk)	
1014 carbon steel	$0.40 - $0.80
304 stainless steel	$1.00 - $2.00
1100 aluminum	$1.00 - $2.50
copper	$1.00 - $2.00
Glass (sheet)	
Fiberglas™	$2.00 - $5.00

Direct Labor Costs*

Process	Processing Cost ($/hr)
Injection Molding	$35.00
Die Casting	$35.00
General Machining	$60.00
Powder Metallurgy	$47.00
Sheet Metal	$35.00
Manual Assembly	$35.00
Electrical Work (assembly, PCB)	$35.00
Finishing (painting, labeling)	$35.00

*Adjusted for inflation

Do not include fixed costs such as tooling and equipment