

# ENGINEERING DESIGN GUIDE

## Alloys & Mechanical Properties

Aluminum Alloy	Temper	UTS (ksi / MPa)	Yield (ksi / MPa)	Elongation (%)	Modulus (msi)	Density (g / cc)	Conductivity (W / mK)	Thermal Expansion (ppm / °C)	Heat Capacity (cal / gK)
357	T5	42 / 289	29 / 200	7	10.5	2.68	152	21.6	0.23
357	T6	48 / 331	38 / 262	10	10.5	2.68	152	21.6	0.23
A356	T5	38 / 262	27 / 186	10	10.5	2.69	159	21.5	0.23
A356	T6	46 / 317	35 / 241	12	10.5	2.69	159	21.5	0.23
366	T5	44 / 303	39 / 269	5	10.5	2.68	152	21.6	0.23

\*Above data is typical but may be adjusted for specific applications to balance strength versus ductility.

## Dimensional Control

Linear dimensions up to 1" / 25.4mm	±0.002 / 0.05mm
Additional tolerance per additional inch/mm	+0.001 / 0.025mm
Additional tolerance across parting line	+0.004 / 0.102mm
Additional tolerance for moving die components	+0.010 / 0.254
Draft requirements	1° to 2° per side preferred. 1/2° based on application
Flatness tolerance up to 3" / 76.2mm	0.005 / 0.13mm
Additional flatness tolerance for each additional inch/mm	0.002 / 0.05mm
Surface Finish	~ 64 rms or better
Minimum Wall Thickness	0.060 / 1.5mm depending on geometry
Thick to thin tolerance	Reasonable

## Part Size, Tooling & Order

Part Weight	5 grams – 3 kg (0.01 - 7 pounds) geometry-dependent
Part Projected Area	125 square inches max, geometry-dependent
Tooling	Premium grade H-13 steel. No disposable cores; undercuts machined.
Economic Order Quantity	500-1,000 pieces typical

## Tooling Detail

### FILLETS / RIBS

- Intersecting surfaces forming junctions are best joined with fillets to avoid high stress concentrations in both the part and the die.
- Fillets projected in a direction normal to the parting line require draft – the deeper the pockets, the larger the draft.
- Sharp inside surface junctions, acute angle corner conditions and delicate, deep and closely spaced ribs will be reviewed closely.
- Ribs are often used to increase the stiffness of, or add strength to, a part.

### EJECTOR PINS

- Moveable ejector pins must be used to eject a part uniformly from the die and will result in either a raised or depressed mark (±0.15"). Location should be discussed to optimize part forming and surface cosmetics.

### FLASH

- Nominally +0.010"/0.254mm. Secondary operations to remove flash may include de-gating, trimming, machining, tumbling, and/or blasting.

### LETTERING / ORNAMENTATION

- Options include raised, depressed, or raised in depressed panel, although raised lettering will result in lower die construction and maintenance costs.

## Secondary Processing

### ONSITE

- Heat treatment T5 & T6
- CNC milling, turning, 3 & 4-axis, vertical & horizontal
- Surface preparation, finishing, vibratory tumbling
- Stainless steel shot and glass bead blasting
- Light assembly

### TIERED

- Anodizing: functional, cosmetic black
- Plating: chrome, electroless nickel
- Painting: powder coat, E-coat and wet