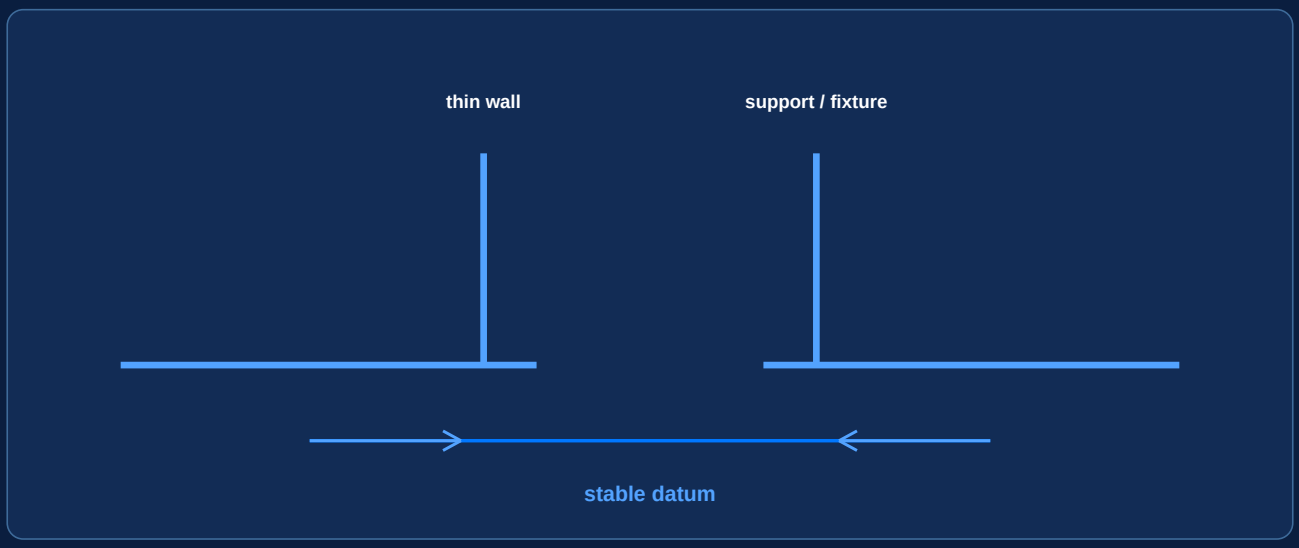
BAOSONG PRECISION

WALL THICKNESS & TOLERANCE GUIDE

A practical engineering reference for aluminum CNC machining, extrusion and die-cast parts



USE THIS GUIDE TO

choose practical wall thickness, select tolerances by feature and prepare a supplier-ready drawing review.

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DESIGN LOGIC AND CONTENTS

How to use this guide before drawing release

ENGINEERING REFERENCE

START WITH FUNCTION

Use the minimum wall, tolerance and inspection condition needed for function. Then confirm the process route, fixture support and finish build-up with the supplier.

FOUR-STEP DESIGN LOGIC

01 Function

What must fit, seal, locate or remain cosmetic?

02 Process

Can the chosen process hold the wall and tolerance?

03 Setup

Where are datums, supports, tools and gauges?

04 Release

What evidence is required before approval?

GUIDE MAP

Section	Topic	What you will get
01	Wall thickness as a process variable	Starting ranges and mass-transition rules
02	CNC machining of thin walls	Datums, clamping, tool access and deflection controls
03	Aluminum extrusion profiles	Flow balance, web support and die-review questions
04	Aluminum die casting	Draft, ribs, parting line and machining stock
05	Tolerance selection by feature	Practical starting values and feature drivers
06	Datums and fixture repeatability	Support strategy and setup sequence
07	Finish and coating build-up	Inspection condition and cosmetic zones
08	Flexible walls and inspection	Free-state, restrained-state and measurement rules
09	Drawing review checklist	Customer-ready release checks
10	RFQ / release worksheet	Fields to send for engineering feedback

REFERENCE RULE The drawing, purchase order and approved inspection plan remain the controlling documents.

Wall thickness is a process variable

Uniform sections are easier to fill, machine, support and inspect.

DESIGN PRINCIPLE

PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Uniform section	Keep adjacent walls within a practical thickness band and use gradual transitions.	Abrupt mass changes create sink, porosity, distortion or long cycle time.
Minimum wall	Mark the thinnest wall and its exact location on the drawing.	A general tolerance cannot protect an unknown flexible zone.
Ribs over mass	Use ribs, gussets and cored bosses to add stiffness without heavy blocks.	Heavy pads increase shrink concentration and machining stock.

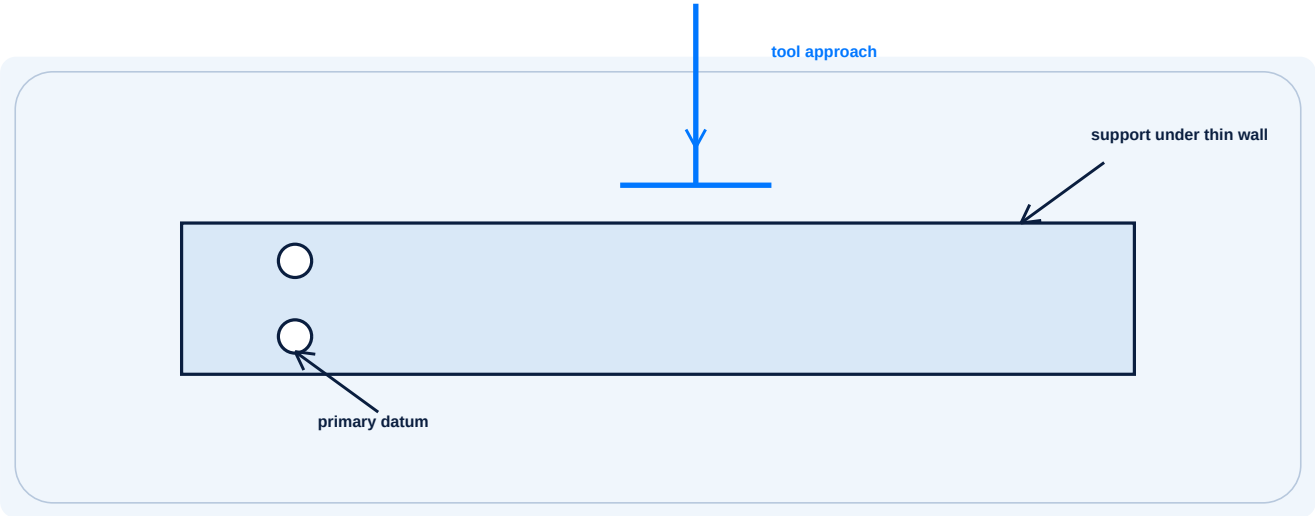
PROCESS CONTROL

Treat wall thickness as a process variable, not an isolated nominal. Confirm alloy, span, support and inspection method before tightening the tolerance.

CNC machining: protect thin walls

Clamping and tool load can move a part before the measurement is taken.

DESIGN PRINCIPLE



PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Primary datum	Locate from a broad, stable profile face before machining holes or pockets.	A thin lip or cosmetic edge can shift between setups.
Wall support	Add pads, soft jaws or ribs under flexible walls.	Clamp force can create a false size that disappears after release.
Tool access	Use standard cutters and keep approach paths clear for tools and gauges.	A feature reachable in CAD may be blocked in the fixture.

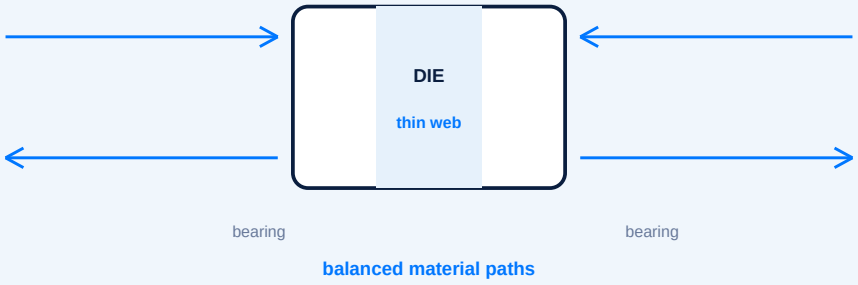
PROCESS CONTROL

For critical features, confirm fixture support, cutter access and the final inspection datum with the supplier before release.

Aluminum extrusion: balance flow through the die

Profile symmetry, web support and bearing control protect repeatability.

DESIGN PRINCIPLE



balanced material paths

PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Thin webs	Use the thickest web that meets function and support it at intersections.	Thin unsupported webs raise die stress and tearing risk.
Bearing layout	Give the die designer room to tune bearing length during trials.	A frozen bearing layout can lock in flow imbalance.
First article	Measure profile, bow and twist and feed corrections into the die loop.	Visual approval can miss systematic dimensional drift.

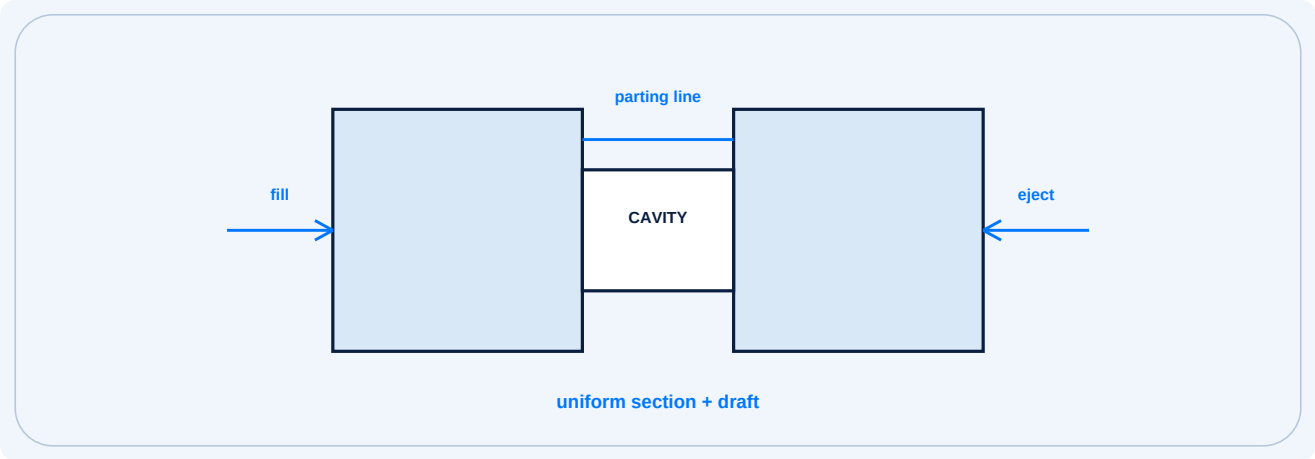
PROCESS CONTROL

Confirm profile balance, bearing layout and first-article die correction before production approval.

Aluminum die casting: use ribs and draft

Uniform walls, a clear pull direction and practical stock reduce tooling risk.

DESIGN PRINCIPLE



PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Wall and rib	Use ribs and cored bosses instead of isolated thick masses.	Heavy zones increase sink, porosity and cycle-time risk.
Draft direction	Align walls, holes and ribs with the primary opening direction.	Slides and lifters add cost, wear and maintenance points.
Parting line	Keep flash and mismatch away from seals, fits and cosmetic faces.	Late parting-line moves can change datums and tool cost.

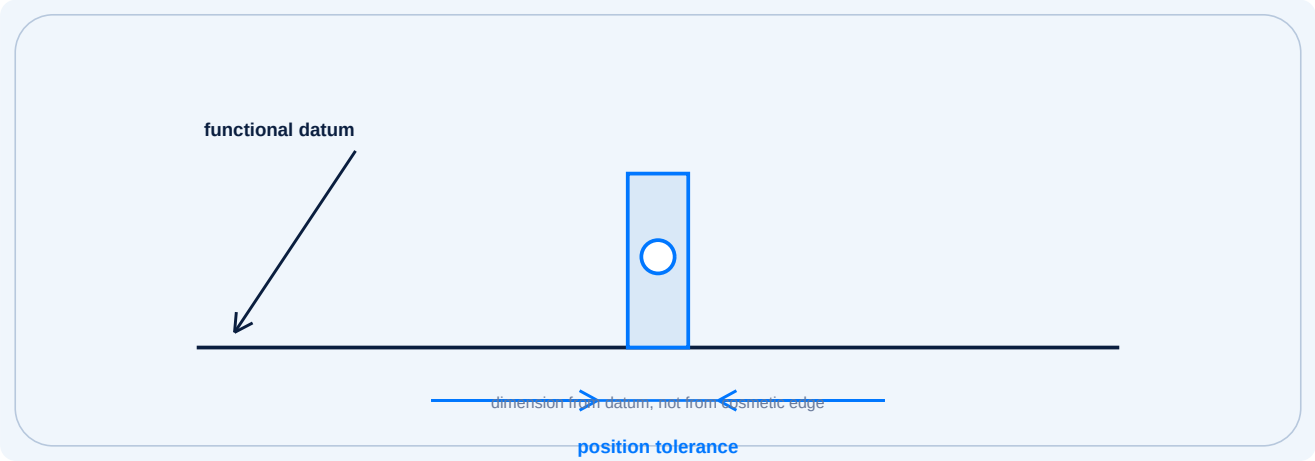
PROCESS CONTROL

Review fill-sensitive zones, draft, vents, ejectors and machining stock before die release.

Tolerance selection by feature

Tight limits belong on functional features with a defined process and measurement method.

DESIGN PRINCIPLE



PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
General linear	Start around +/-0.10 to +/-0.30 mm depending on process and span.	Do not apply the tightest limit to every dimension.
Critical fit	Use +/-0.02 to +/-0.05 mm only when tooling and inspection support it.	Thermal state, setup repeatability and gauge method become controlling.
Hole position	Start around +/-0.05 to +/-0.20 mm from functional datums.	A cosmetic edge or changing profile can create position drift.

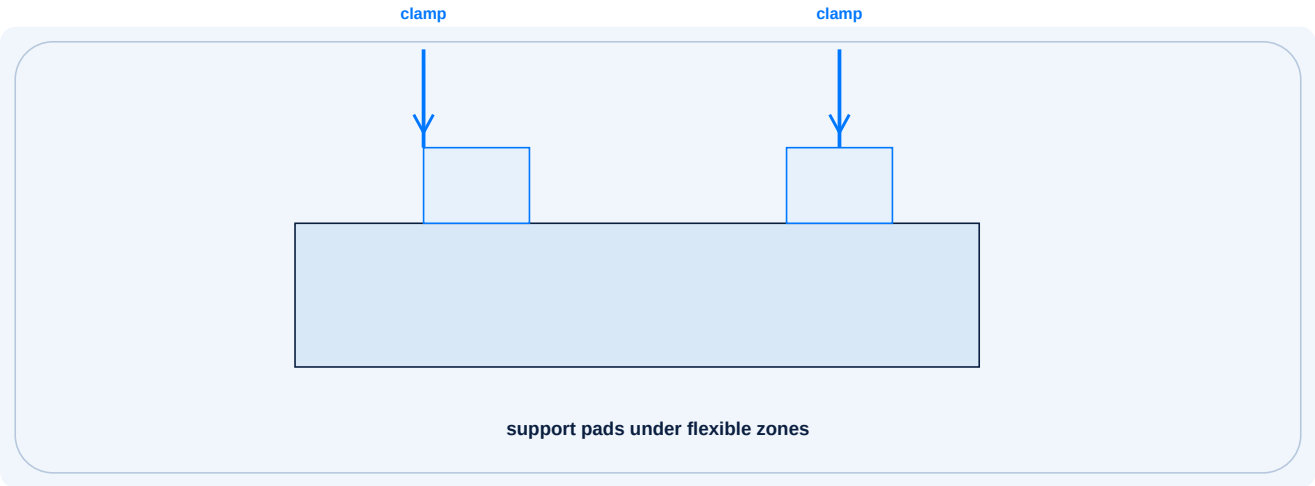
PROCESS CONTROL

Separate general and critical tolerances. Tie each critical feature to a datum, process step and inspection method.

Datums, clamping and setup repeatability

The datum scheme should work in the fixture and on the inspection equipment.

DESIGN PRINCIPLE



PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Primary datum	Use the broadest stable face available and machine it first when needed.	Rocking or point contact creates setup-to-setup variation.
Clamp zones	Clamp over supported material, not directly over a flexible wall.	Over-restraint can bend the part or hide distortion.
Repeatability	Use the same datum logic for fixture, gauge and CMM inspection.	Different references can make a good part appear inconsistent.

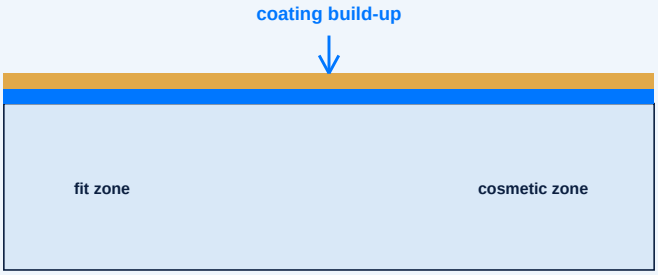
PROCESS CONTROL

Review a fixture concept before release when a feature is critical, flexible or difficult to gauge.

Surface finish and coating build-up

Finish can change fits, dimensions and the appearance of cosmetic zones.

DESIGN PRINCIPLE



inspect before or after finish - state it

PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Finish condition	State whether dimensions are checked before or after anodize, powder coat or paint.	Build-up can close a fit or change a thread condition.
Cosmetic zone	Identify visible faces, viewing distance and allowable marks.	Hidden faces should not inherit unnecessary cosmetic limits.
Machining direction	Call out toolpath direction or approved sample where appearance matters.	Random direction can create inconsistent gloss or visual flow.

PROCESS CONTROL

Define finish, build-up allowance, cosmetic zones and inspection condition before the supplier prices the part.

Flexible walls and inspection condition

Free-state, restrained-state and temperature can change the measured result.

DESIGN PRINCIPLE

PRACTICAL DESIGN CHECKS

Feature / condition	Useful action	Risk / decision
Free-state	Use free-state measurement for parts that must assemble without restraint.	A fixture can hide a spring-back problem.
Restrained-state	Use a defined fixture only when assembly loads are part of the requirement.	An undefined restraint condition is not repeatable evidence.
Temperature	State part temperature and stabilization time for critical inspection.	Thermal drift can consume a small tolerance window.

PROCESS CONTROL

Agree the inspection condition, restraint, temperature and measurement method before first-article approval.

DRAWING REVIEW CHECKLIST

Use this page before sending a part to quotation or production release

RELEASE CHECKLIST

- [ ] Minimum wall thickness and location are marked.
- [ ] Thin-wall transitions, ribs and heavy masses are reviewed.
- [ ] Critical features are tied to functional datums.
- [ ] General and critical tolerances are separated.
- [ ] Fixture support and tool access are feasible.
- [ ] Inspection condition before / after finish is stated.
- [ ] Cosmetic zones and approved samples are referenced.
- [ ] Supplier deviations have an owner and due date.
- [ ] Measurement method is repeatable for the expected volume.
- [ ] Material, process, quantity and finish are confirmed.

RELEASE PATH

DRAWING
geometry + datums

→

RFQ
quantity + finish

→

TRIAL
first article

→

RELEASE
evidence + approval

DECISION RECORD

Record the drawing revision, open question, owner, target date and final customer decision in the related checklist workbook.

RFQ / RELEASE WORKSHEET

Minimum input set for an engineering review with BAOSONG Precision

DRAWING INPUTS

Part number	Revision	Process
Alloy / temper	Quantity	Minimum wall
General tolerance	Critical tolerance	Critical datum
Finish	Inspection condition	Target date

CUSTOMER / SUPPLIER ACTION

Action	Owner	Due date	Decision / evidence

ENGINEERING SUPPORT

Send the 2D drawing, 3D model, quantity and finish requirement for a practical design review.

baosongprecision.com/contact-us/