JAQUENT ENGINEERING | CONTROLLED RELEASE DOCUMENT

Jaquent CNC Machining Design and Engineering Guide

A procurement-first reference for process fit, drawing risk, inspection planning and RFQ readiness.

REV E | RELEASED | 4 OCTOBER 2026

Select the route from geometry, access and functional relationships

3-AXIS MILL	5-AXIS MILL	TURNING	TURN MILL	WIRE EDM
Prismatic geometry, open faces and stable locating surfaces.	Multi-direction access where fewer re-clamps protect relationships.	Rotational geometry organized around a functional axis.	Turned and cross features that benefit from datum continuity.	Conductive through-profiles, narrow slots and low cutting force.

Purpose

This guide helps buyers and engineers screen manufacturability, sourcing risk and evidence needs before quotation or production release.

It does not define unconditional capability. Final acceptance follows the quoted drawing, approved DFM record, process route and inspection plan.

Use it before release

- Separate critical interfaces from general geometry.
- Confirm material condition and post-process dimensions.
- Define inspection evidence and record approved DFM changes.

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HOW TO USE THIS GUIDE

Choose the reading path that matches the decision you need to make, then confirm drawing-specific requirements during DFM review.

Procurement fast path

Read pages 3 to 6, then use the procurement checklist on page 24. These pages establish the contracting and production boundary, evidence options, RFQ inputs and the questions that must be answered before commercial release.

Decision: Is the quotation based on the same geometry, material, quality evidence, quantity and delivery assumptions that your team intends to order?

Engineering review path

Read pages 7 to 23 for the interactions among geometry, stiffness, access, datum strategy, finishing and inspection. Use page 24 before drawing release or after an approved DFM revision.

Decision: Can the chosen process manufacture and verify the functional relationships without relying on hidden assumptions?

EVIDENCE CATEGORIES Company capability is confirmed per drawing. Recommended starting points are review prompts, not acceptance limits. External published values are identified as examples from the named source. These categories are not interchangeable.

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What this guide can do

- Expose requirements that change process, setup or inspection scope.
- Separate function from inherited drawing habits.
- Make quotation assumptions and deliverables visible.

What it cannot do

- Replace a controlled drawing, model or purchase order.
- Approve substitution, deviation or process change.
- Guarantee a tolerance without drawing-specific review.

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PROCUREMENT DECISION AND CAPABILITY BOUNDARY

A technically complete quotation begins by aligning the functional part, the commercial assumptions and the evidence package.

Confirm five things before RFQ release

1. The process naturally fits the dominant geometry and required access directions.
2. Critical interfaces are separated from general geometry and cosmetic preferences.
3. Material grade, condition, stock form, finish and substitution rules are explicit.
4. Every acceptance requirement has a practical inspection method and record expectation.
5. The supplier has confirmed drawing-specific capability, production route, evidence scope and lead time.

Evidence category	What it means	How to use it
Drawing-specific confirmation	A quoted route tied to the submitted revision, material, quantity and inspection scope.	Use for release and acceptance.
Recommended starting point	A review cue that helps identify risk before supplier feedback.	Use to prepare questions, not limits.
External published example	A named supplier, toolmaker or material producer statement.	Use only in the stated source context.

Who you contract with

Jaquent is the international trade interface of Shenzhen Jiancang International Trading Co., Ltd. Precision CNC work placed under manufacturing-and-trading authorization JAQ-AUTH-20260919-001 is produced by the Dongguan manufacturing facility named in that authorization.

Approved specialist suppliers may support finishing or project-specific processes. The production route, inspection scope and applicable supplier responsibilities are confirmed for each drawing.

Capability is conditional

When a metal drawing does not specify a general tolerance, ±0.10 mm is a common quotation and delivery basis. Drawing-specific review may support selected features at ±0.01 mm or ±0.005 mm, subject to material, geometry, process control and inspection.

Approval gate: Technical sign-off is required before public release.

RELEASE RULE Do not treat a capability table, machine label or previous part as approval for a new drawing. Release follows the quoted revision and its controlled DFM and inspection records.

Questions that expose hidden commercial risk

Route

Which operations are internal, which are approved special processes, and who owns coordination and nonconformance response?

Change

What requires written approval: material source, setup, fixture, toolpath, subcontractor, finish route or inspection method?

Evidence

Which records are standard release evidence, customer deliverables, optional quoted work or retained supplier records?

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QUALITY, INSPECTION AND EVIDENCE SELECTION

Specify evidence with the RFQ so manufacturing and verification can be planned as one controlled route.

Evidence option	Use it when	Define before quotation
Internal pre-shipment inspection	Standard dimensions and workmanship need release confirmation.	Acceptance criteria and internal record retention.
First-article inspection	New part, revision, tooling, fixture or process route requires a documented first build.	Characteristic list, report format, ballooned drawing and approval step.
CMM report	Geometric relationships or dense feature sets need coordinate evaluation.	Datum alignment, probe access, evaluation method and reported results.
Material documentation	Grade, condition, heat or lot identity affects function or compliance.	MTR or CoC type, heat/lot traceability and approved source rules.
Functional gaging	Fit or assembly behavior is better verified by a controlled functional interface.	Gauge ownership, calibration, master, wear and pass/fail rule.
Sampling plan	Repeated production permits risk-based sampling of selected characteristics.	Lot definition, rate, escalation and reaction to failure.
Specified 100% inspection	A named critical characteristic requires every unit to be checked.	Characteristic, method, record, handling and nonconformance action.

Plan from the requirement backward

1. Identify the feature or relationship that protects function.
2. Choose a method with suitable access, resolution and repeatability.
3. Define datum alignment and free-state or restrained-state conditions.
4. Specify the record: numeric result, pass/fail, image, certificate or signed report.
5. Set the inspection rate and the reaction plan for a failed result.

Quality questions for buyers

- Which characteristics are critical to function, safety, sealing, fit or assembly?
- Which result must accompany the shipment and which may be retained by the supplier?
- Can the selected method measure the feature without changing its shape?
- Who approves a deviation, repair, rework or substitute inspection method?
- What changes trigger a new first article or additional validation?

EVIDENCE BOUNDARY Jaquent performs internal pre-shipment inspection on all outgoing parts. This does not mean that every characteristic on every unit receives a recorded dimensional measurement. Any characteristic requiring specified 100% inspection, shipment records, FAI, CMM reporting or a defined sampling plan must be identified and quoted before release.

Feature
What protects function?

Method
Can it be accessed and resolved?

Record
What evidence is delivered?

Rate
Sample or specified 100%?

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RFQ PACKAGE, NDA AND RESPONSE TIMING

A complete RFQ reduces quotation assumptions and gives engineering enough information to plan process, inspection and evidence.

RFQ input	Preferred content	Why it matters
3D model	STEP or STP preferred; Parasolid or approved native/neutral formats may support review.	Defines nominal geometry and supports tool-access review.
Marked 2D drawing	Controlled revision with datums, tolerances, notes, finish and critical-characteristic marks.	Controls acceptance and resolves model-versus-drawing precedence.
Material	Exact grade, temper or condition, stock form, substitution rule and documentation need.	Changes cutting behavior, distortion, finish and traceability.
Commercial basis	Prototype and expected production quantity, lot size, delivery target and split-shipment allowance.	Drives setup, material purchase, inspection rate and unit economics.
Finish and assembly	Process, color, masking, final-size condition, assembly details, packaging and cleanliness.	Prevents dimensional and cosmetic assumptions after machining.
Evidence	FAI, CMM, MTR/CoC, photographs, sampling, specified 100% characteristic checks, shipment records and retention needs.	Lets inspection cost and lead time be quoted with production.

Website upload

Attach no more than five files with a combined size of **25 × 1024 × 1024 bytes**. Keep the model and drawing revision synchronized. Do not place acceptance requirements only in an email when the drawing or purchase order should control them.

Submit at jaquent.com/free-quotation/.

Response expectation

With a complete package, Jaquent typically responds within one working day. Complex multi-process work may require one to two working days for technical and supply-route review. This is a planning expectation, not an unconditional quotation promise.

Identify the required quotation date and any immovable delivery event.

NDA and drawing flow

- Use the current Mutual NDA when confidentiality terms are required.
- State authorized recipients, approved production route and any geographic or data-handling restriction.
- Use revision-controlled filenames and identify the controlling model/drawing pair.
- Require written approval before forwarding data to a special-process supplier not already authorized.

Quotation alignment check

- Material, finish, evidence and quantity match the intended order.
- Tooling, fixture or NRE ownership and reuse are explicit.
- Freight, packaging, taxes and shipment basis are stated.
- Exclusions, assumptions and supplier questions are resolved in writing.

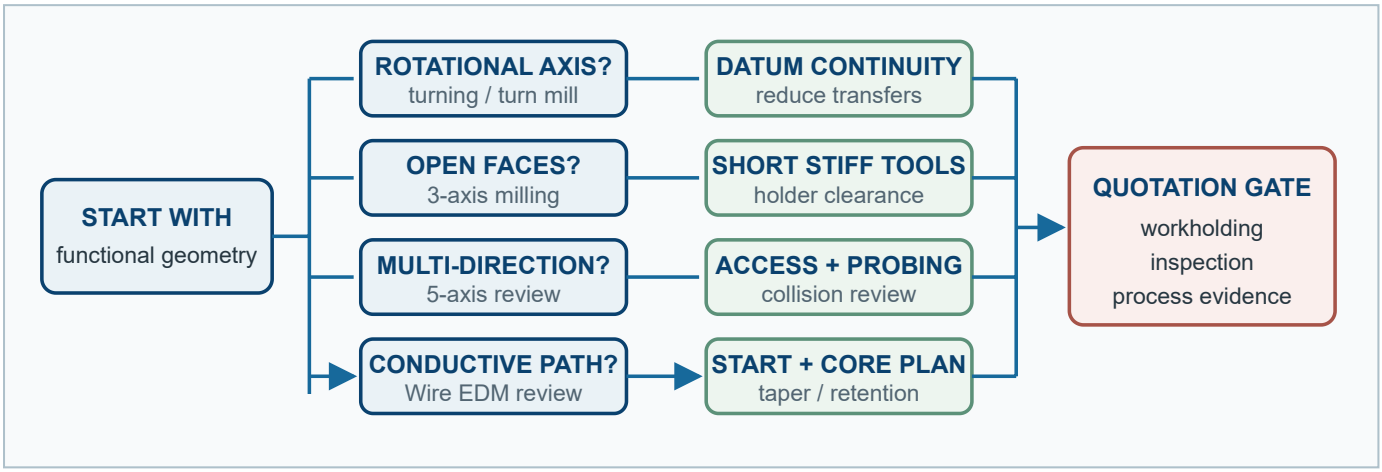
NEXT STEP For drawing-specific DFM review, use Request a Quote or email support@jaquent.com.

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CNC PROCESS SELECTION

Choose the initial route from geometry and functional relationships, then confirm access, restraint and inspection before quotation.

DECISION FLOW FROM GEOMETRY TO QUOTATION GATE



Functional geometry branches to turning, 3-axis, 5-axis or Wire EDM screening; all routes merge before the quotation gate.

Process family	Geometry it favors	Primary review	Question before release
3-axis milling	Prismatic parts, planar faces and open pockets.	Tool/holder access, re-clamping and stable locating surfaces.	Can every critical feature be reached with a short, stiff tool?
5-axis milling	Multi-face, angled or compound geometry.	Collision clearance, datum continuity, probing and machine kinematics.	Does fewer re-clamps improve the required relationships?
CNC turning	Diameters, faces, grooves and axial features around a common axis.	Grip land, support, runout, slenderness and chuck distortion.	Which surfaces establish the functional axis?
Turn mill	Shaft-like parts with turned and milled cross features.	Maintaining axis-to-cross-feature relationships in one route.	Does one controlled route reduce datum transfer?
Wire EDM	Conductive through-profiles, narrow slots and low-force cutting.	Start access, corner behavior, taper, core movement and surface condition.	Can the wire pass through the required profile?

Mixed-route parts

A part may use more than one process. Turning can establish a functional axis before milling cross features; machining may establish datums before Wire EDM; finish grinding may follow heat treatment. Mixed routes are justified by the required relationship, not by the number of machines available.

Do not confuse fewer setups with accuracy

Fewer setups can reduce datum-transfer opportunities, but accuracy still depends on machine behavior, workholding, thermal control, tool condition, probing, process sequence and inspection. A single setup is not automatically the lowest-risk plan.

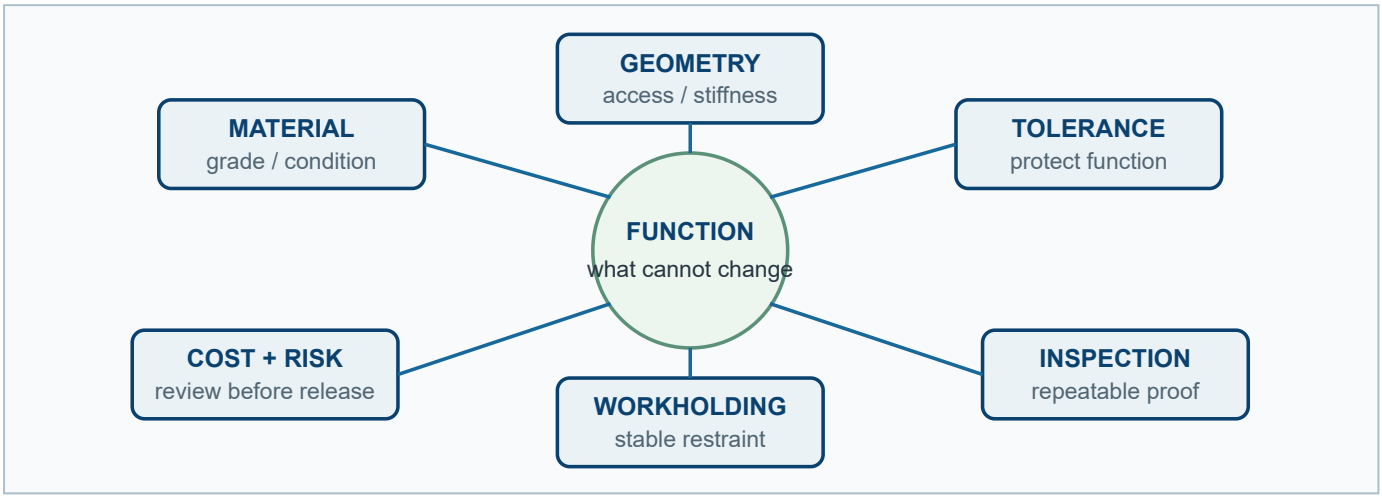
BUYER QUESTION Which drawing requirements force a different process, special fixture, additional validation or longer lead time, and which requirements could change without affecting function?

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DFM RISK REVIEW

DFM is a controlled conversation among function, material, geometry, workholding, tolerance, inspection and cost - not a list of isolated minimums.

FUNCTION-CENTERED DFM INTERACTION MAP



Unarrowed connectors show reciprocal review between function and six linked DFM factors.

Review sequence

1. Lock the interface, load path, sealing, motion, alignment or other function that cannot change.
2. Identify material and condition effects on force, heat, distortion, burrs and measurement.
3. Check cutter, holder, probe and deburring access before geometry is frozen.
4. Separate critical features from general dimensions and cosmetic zones.
5. Choose a datum and restraint strategy that manufacturing and inspection can reproduce.
6. Confirm the evidence and sampling needed to release the part.

High-risk combinations

- Thin wall + deep cavity + small internal radius.
- Long bore + tight straightness + limited inspection access.
- Heat treatment + asymmetric removal + flatness.
- Flexible material + tight size + undefined restraint.

Risk class	Typical signal	Required output
Geometry access	Deep reach, hidden feature, small corner or blocked probe path.	Annotated DFM image and accepted geometry change or confirmed route.
Stability	Thin section, slender shaft, residual stress or heavy asymmetric removal.	Sequence, support strategy and free/restrained inspection condition.
Acceptance	Tight tolerance without a practical datum or instrument path.	Revised requirement or measurement method tied to the drawing.
Supply route	Special finish, heat treatment, insert installation or outside process.	Named responsibility, change control and evidence package.

DFM RECORD Record the submitted revision, proposed change, function preserved, commercial effect, approval owner and final accepted drawing. An email suggestion without revision control is not a production definition.

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METALS, CONDITION AND CERTIFICATION

The material family is not enough: grade, temper, heat treatment, stock form and certification affect machining behavior and dimensional stability.

Material and condition	Machining behavior to review	Drawing and RFQ emphasis
6061 aluminum	Usually machines readily, but lower stiffness and higher thermal expansion than steel affect thin features and measurement.	Temper, stock form, burr control, cosmetic zones and dimensions after anodize.
7075 / 7050 aluminum	High strength with good machinability; residual stress and asymmetric removal can still move the part.	Temper, plate direction, rough/rest/finish sequence and flatness after unclamping.
304 / 316 stainless	Work hardening, low thermal conductivity and burr formation can raise force and heat.	Short tool reach, positive cutting action, deburring access and stable finishing passes.
17-4PH stainless	Machining response and final size depend on heat-treatment condition and sequence.	State condition, heat-treatment owner, allowance, distortion review and final inspection stage.
Ti-6Al-4V	Low thermal conductivity and lower modulus increase heat, springback and stability concerns.	Avoid unnecessary reach, protect thin walls and define finishing and surface-integrity needs.
Tool steels	Hardness and heat-treatment route can change tool wear, distortion and finishing process.	Annealed/pre-hardened/final hardness, heat-treatment sequence, grinding or EDM allowance.

Required material decisions

- State exact alloy, condition, stock form and substitution rule.
- Identify who owns heat treatment and finishing.
- State whether dimensions apply before or after each process.
- Define any grain direction or cosmetic-surface requirement.

Certification and traceability

- MTR, CoC, heat/lot traceability and country-of-origin are different deliverables.
- A certificate name does not define required data or chain of custody.
- Marking and packaging must preserve identity without damage.

STABILITY MECHANISM Large or asymmetric stock removal can release residual stress. A risk-controlled route may include balanced roughing, an intermediate rest or stabilization step, re-datuming and a final finish pass. The actual sequence must be material- and geometry-specific.

EVIDENCE BOUNDARY This page is qualitative engineering guidance. Project-critical properties and conditions must come from the controlled specification or data sheet for the ordered material.

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ENGINEERING PLASTICS AND MEASUREMENT

For plastics, exact stock grade, reinforcement, conditioning, temperature and restraint can matter as much as nominal polymer family.

Named stock grade	Published context	Machining and inspection emphasis
Ensinger TECAPEEK natural (unfilled PEEK)	High-performance semi-crystalline PEEK; long-term service temperature published up to 260 °C for the named grade.	Stock history, heat, creep and residual stress still matter for close tolerances.
Ensinger TECATRON natural (unfilled PPS)	Low moisture uptake and high-temperature PPS stock shape.	Unfilled grades can be brittle; filled variants are not interchangeable and may be abrasive.
Ensinger TECAFLON PTFE natural	Low-friction PTFE with low stiffness and high thermal expansion.	Restraint, creep, tool sharpness and measurement temperature dominate precision behavior.
Ensinger TECAFORM AH natural (POM-C)	Unfilled acetal copolymer with low published moisture absorption for the named grade and test method.	Often machines cleanly; review stock stress, heat, wall flexibility and conditioning.

Measurement condition is part of the requirement

Flexible parts can change shape under clamp, probe or gauge force. Hygroscopic materials can change with conditioning; all plastics change with temperature. If a dimension matters in free state, state how the part is supported and when it is measured. If the assembly restrains the part, define the functional fixture rather than allowing an arbitrary inspection clamp.

Control	Define
Environment	Measurement temperature, conditioning time and humidity where relevant.
Restraint	Free state, gravity support, fixture, fastener torque or simulated assembly.
Timing	After machining, stress relief, moisture conditioning or thermal stabilization.
Method	Contact force, optical method, gauge geometry and repeat measurements.

Do not generalize data

Supplier values apply to the named grade, source, test method and conditioning. Do not transfer a value from an unfilled grade to glass- or carbon-filled material, or compare absorption values obtained under different standards as if they were the same test.

Stock and process questions

- Extruded, compression-molded or other stock form?
- Unfilled or reinforced exact trade grade?
- Supplier-recommended stress relief or conditioning?
- Burr, fuzz, cleanliness or cosmetic acceptance?
- Thread insert or assembly load after machining?

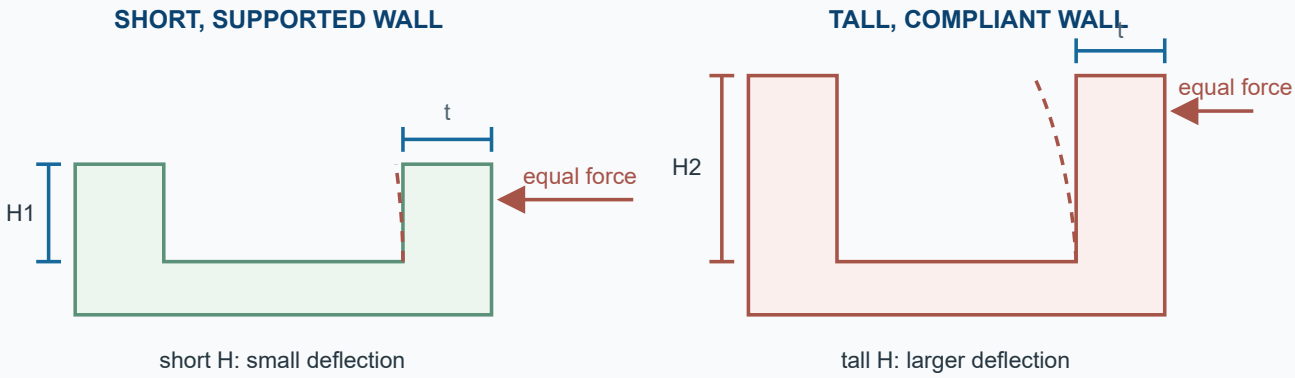
MATERIAL CONTROL Do not add a generic annealing or conditioning cycle. Coordinate any thermal treatment with the stock-shape supplier and manufacturer for the exact grade and geometry.

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WALLS, RIBS AND FLEXIBLE FEATURES

Thin-wall feasibility depends on stiffness, unsupported height, clamp load, tool reach, sequence and inspection restraint - not wall thickness alone.

WHY UNSUPPORTED HEIGHT CHANGES BEHAVIOR



Matched wall sections use the same base and thickness. Under equal lateral cutting force, the taller unsupported wall shows greater deflection.

Design condition	Risk mechanism	Review action
High unsupported H/t ratio	Stiffness falls rapidly, increasing chatter and elastic deflection.	Reduce height, increase thickness, add support or change sequence.
Thin wall beside a deep cavity	Support disappears as stock is removed while tool reach often increases.	Rough symmetrically, leave support stock and finish in controlled steps.
Broad flexible panel	Clamp and probe forces change the measured surface.	Define support points and free-state or restrained acceptance.
Isolated rib or boss	Local heat and cutting force can bend the feature or leave burrs.	Add root radius, improve access and use a stable finishing direction.

External screening example

Protolabs publishes approximately 0.5 mm as a thin-wall screening point in its own machining guidance. Treat that value only as an external service cue. It is not a Jaquent capability limit and does not account for unsupported height, material, access or inspection.

EXTERNAL PUBLISHED EXAMPLE

Design and process actions

Geometry

Increase thickness or reduce unsupported height. Add ribs, fillets or local bosses without creating inaccessible tool traps.

Sequence

Leave temporary support stock, alternate removal, rough both sides and delay final release of compliant features.

Acceptance

Define support, restraint, measurement force, temperature and whether functional assembly controls the shape.

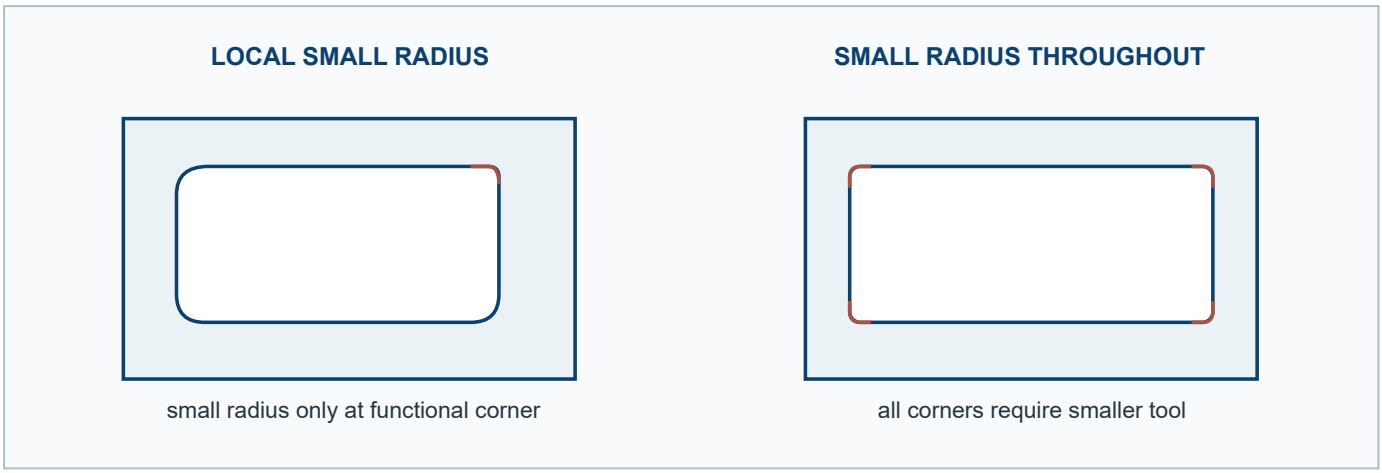
BUYER QUESTION Which wall or panel requires a special fixture, staged material removal, additional rest time or nonstandard inspection, and is that cost included in the quotation?

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CORNERS, POCKETS AND TOOL ACCESS

Cutter diameter, flute length, tool projection, holder clearance and chip evacuation define the practical geometry of a pocket.

LOCALIZE THE SMALL RADIUS



A small radius is kept only at the functional interface in the preferred design, while the rest of the cavity uses larger radii that support a larger cutter.

Feature	What changes the process window	Preferred review
Internal corner	Smaller radius requires a smaller cutter; depth then increases tool projection and deflection.	Use the largest radius function permits and localize any smaller corner.
Deep pocket	Holder collision, chip recutting, coolant access and flexible walls interact.	Review tool plus holder envelope, not cutter diameter alone.
Narrow slot	Width limits cutter diameter while depth drives overhang and chip evacuation.	Open the slot, shorten depth, change direction or evaluate EDM where appropriate.
Closed cavity	Entry method, floor finish, corner cleanup and trapped chips add operations.	Provide open access or a practical entry/evacuation route where function permits.
Undercut	Special tools and limited inspection access increase setup and breakage risk.	Dimension the functional undercut and confirm standard tool access before release.

Depth-to-width screening

Protolabs publishes a rule of thumb that slot-like depth should remain below about six times feature width where possible. This is an external screening cue, not a universal limit. Material, cutter family, holder, machine dynamics and required finish can narrow or widen the actual process window.

Access questions

- Can the holder clear walls, bosses and clamps at full depth?
- Can chips and coolant exit without damaging walls or floor?
- Does a probe or gauge reach the feature after machining?
- Is corner cleanup a functional need or a modeling habit?

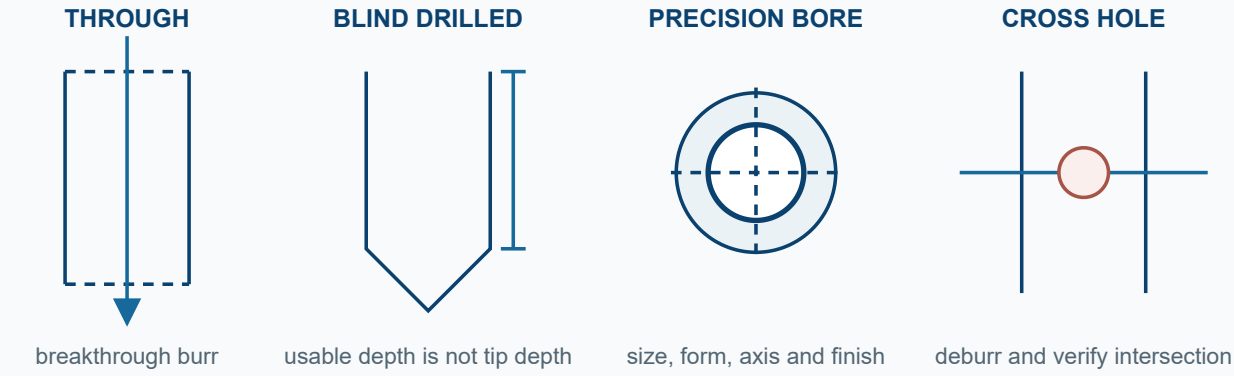
DFM OUTPUT Mark the functional corner, allowed local relief, usable depth and surfaces that must remain continuous. A note that simply says 'sharp corner' does not define a machinable or inspectable requirement.

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HOLES, BORES AND DEEP FEATURES

The drawing should communicate what the hole must do; drilling, interpolation, boring and reaming solve different size, form, finish and relationship needs.

FOUR HOLE CONDITIONS THAT REQUIRE DIFFERENT DEFINITIONS



Through, blind drilled, precision bore and intersecting-hole conditions are compared with their main deburring, depth, form and verification concerns.

Requirement	Clarify on the drawing	Verification concern
Clearance or flow hole	Through condition, edge break, burr direction and obstruction limits.	Access from both sides and internal cleanliness.
Blind drilled hole	Usable cylindrical depth versus total drill-point depth; bottom form if functional.	Depth method must not confuse conical tip with usable length.
Precision bore	Size, form, straightness, axis relationship, texture and entry condition.	Gauge or CMM method, mastering, alignment and temperature.
Counterbore / seat	Diameter, depth, seat flatness, coaxiality and edge condition.	Contact pattern and datum relationship to the fastener axis.
Intersecting passages	Intersection location, burr removal, cleanliness and flow requirement.	Internal visual, borescope, flow or other agreed evidence.

Depth raises more than cutting time

As depth increases, coolant delivery, chip evacuation, runout, wander, tool stability and inspection access become more important. Kennametal lists KSEM modular drill bodies in 3D, 5D, 7D and 10D categories, with other variants also offered. These are tool catalog categories, not universal part capability.

For close size, form or location, define whether the process may drill, bore, ream, interpolate or use another finishing method. Do not assume one tool operation satisfies every characteristic.

Release questions

- Is the functional depth unambiguous?
- Can burrs be removed and verified?
- Does the bore need size only, or also form and axis control?
- Can the measurement system reach and align to the feature?
- What happens if a passage breaks into another feature?

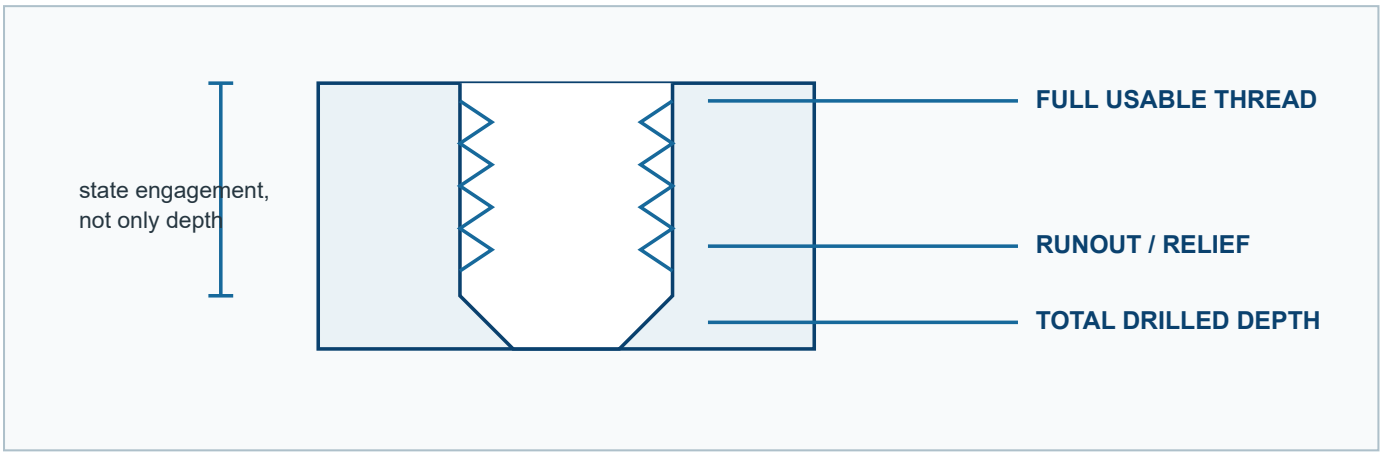
INSPECTION LINK A plug gauge may verify a functional size condition but does not report straightness, taper or the bore axis relative to datums. Match evidence to the actual requirement.

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THREADS, INSERTS AND FASTENERS

Thread manufacturability depends on entry, usable engagement, runout, bottom clearance, material behavior, coating and inspection method.

BLIND-THREAD DEPTH MUST BE DECOMPOSED



The section distinguishes full usable thread, runout or relief, and total drilled depth so functional engagement is not confused with the bottom of the drilled hole.

Design choice	Risk if unclear	Preferred definition
Full thread to blind-hole bottom	Lead-in, runout, chips and tool clearance make the callout physically ambiguous.	Specify usable full-thread depth plus bottom allowance or relief.
Excessive engagement	Long tools and added inspection do not necessarily improve joint strength.	Set engagement from joint design and material, then review process.
Thread at a sharp edge	Poor starting condition, burrs and handling damage affect assembly.	Add controlled chamfer or edge break and state coating condition.
Installed insert	Type, depth, orientation, locking method and retention evidence may differ.	Name the insert and define installed condition and acceptance.
Thread after coating	Buildup changes fit and gauges may not represent final assembly intent.	Define masking, allowance, final gauge condition and any lubricant.

Acceptance planning

- State thread designation, class or fit, handedness and quantity.
- Identify coating or surface treatment condition at final acceptance.
- Use ring or plug gauges where functional acceptance requires them; identify any master or report.
- Tie thread position or perpendicularity to the functional datum scheme when assembly depends on it.

Insert planning

- Specify supplier and part number where interchangeability is not assured.
- Define installation depth, tang condition, orientation and permitted protrusion.
- State torque, pull-out, locking or retention evidence only when function requires it.
- Clarify whether the supplier installs the insert or ships it separately.

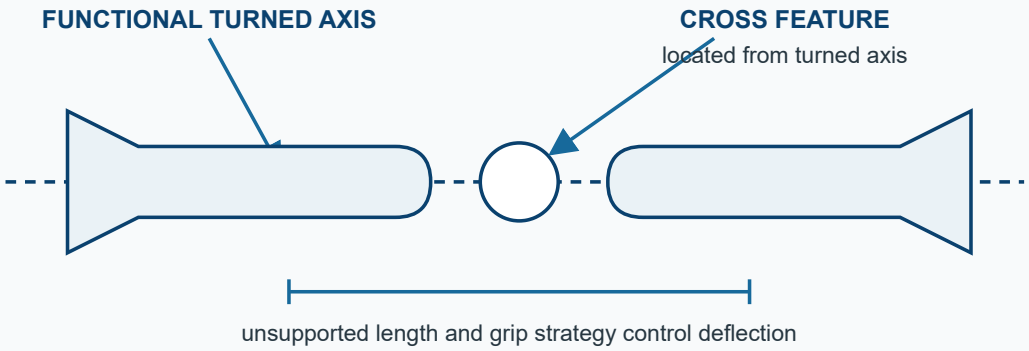
BUYER QUESTION Are thread gauges, masters, insert tooling, proof tests or installation records included in the quotation, and what event requires renewed validation?

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TURNING AND TURN MILL

Protect the functional axis, support slender geometry and keep turned and milled relationships tied to the same datum logic.

FUNCTIONAL AXIS AND CROSS-FEATURE RELATIONSHIP



A shaft-like part is organized around its turned axis, with a cross feature controlled from that axis and unsupported length shown as a stability concern.

Condition	Risk mechanism	DFM response
Long slender shaft	Cutting force, runout and vibration move the unsupported end.	Increase diameter, reduce free length, add support or change sequence.
Thin-wall sleeve	Chuck or collet pressure distorts diameter and roundness.	Provide a grip land, control clamp load and define free-state acceptance.
Deep internal bore	Boring-bar overhang raises vibration, taper and surface-finish sensitivity.	Open access, increase bar diameter, reduce depth or select damped tooling.
Cross-hole or flat	A second setup can shift the feature from the functional axis.	Locate from the axis and review turn-mill or controlled re-datuming.
Part-off and soft jaw grip	Release stress, jaw form and re-grip can change concentricity.	Plan operation order and identify the surface that controls final runout.

Tooling context from Sandvik Coromant

Silent Tools guidance recommends limiting overhang to 3 times bar diameter for solid steel boring bars and 5 times diameter for solid carbide bars. Damped steel bars may reach 5D, while carbide-reinforced damped bars may be used up to 7D in the cited guide.

These are tooling-selection references, not supplier or part capability. Bore diameter, material, entry, interruption, machine interface and required finish still control the route.

Drawing controls

- Functional datum axis and axial seating face.
- Runout or coaxiality relationship where function needs it.
- Grip land and surfaces permitted for chucking.
- Free-state condition for flexible rings or sleeves.
- Cross-feature relationship to the turned axis.

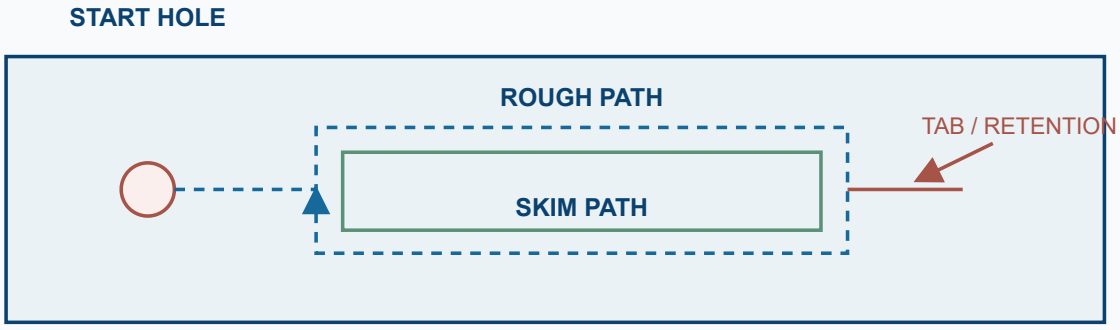
CORRECT USE Use the tooling guidance to ask whether bore access and bar choice are credible. Do not copy the ratios into a drawing as guaranteed part limits.

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WIRE EDM

Wire EDM suits conductive through-profiles and low-force cutting, but start access, corner behavior, taper, retained core and surface integrity still require planning.

START, ROUGH, SKIM AND RETENTION STRATEGY



The drawing must define start access, corner intent, taper, retained core strategy and required surface condition.

A closed conductive profile uses a start hole, a rough path, a skim path and a retained tab or core-control strategy rather than assuming the core can move freely.

Topic	Engineering implication	Define or review
Conductivity	The workpiece and cutting path must support electrical discharge machining.	Exact alloy, condition, coating and any composite construction.
Start location	A closed profile needs a wire-threading location that may leave local evidence.	Start-hole placement away from critical or cosmetic surfaces.
Corners	Wire diameter, spark gap, control strategy and work thickness affect corner result.	Functional corner radius and whether inside/outside behavior matters.
Taper	Upper and lower guide motion creates taper but changes access and calibration needs.	Angle, direction, datum relationship and inspection method.
Core movement	Released material can move, pinch the wire or damage a critical edge.	Retention, tabs, sequence, restart and slug-management strategy.
Rough and skim	The first pass and subsequent skim passes serve different geometry and surface roles.	Required final size, finish and surface-integrity validation.

What the Makino source supports

Makino describes roughing accuracy as a driver of later skim effort, identifies wire deflection and corner behavior, and explains that a part may move before skim cutting. The source supports the mechanism, not a fixed number of passes for every application.

Surface integrity

Wire EDM is a thermal process. Fatigue-, sealing- or surface-integrity-critical features may require a defined cut strategy and validation. Do not assume one universal recast-layer outcome or specify a skim count without process evidence.

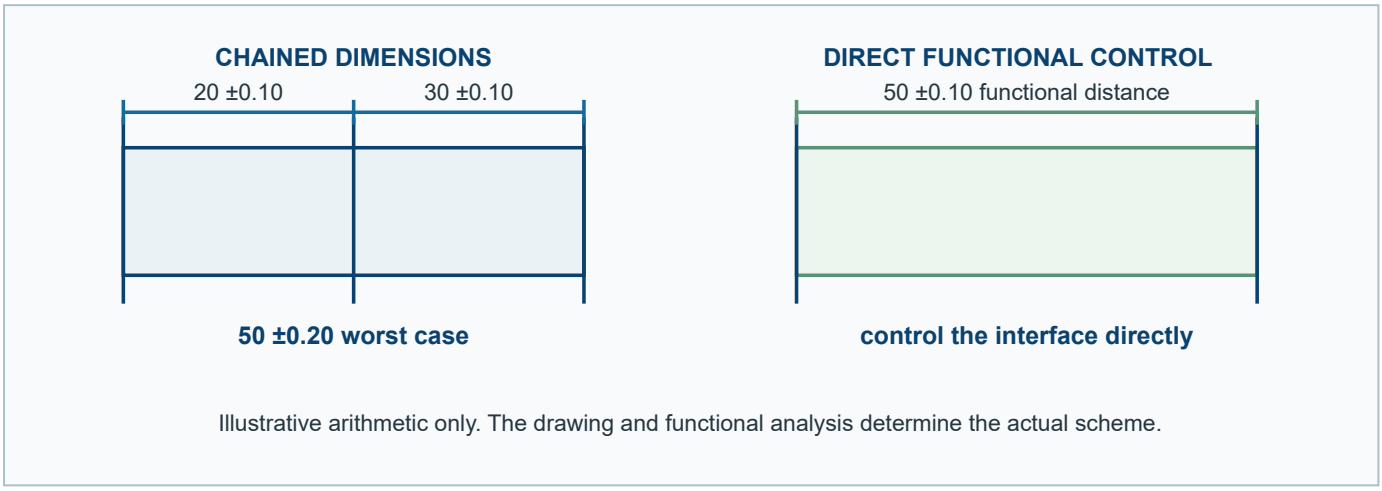
BUYER QUESTION Which profile needs a start hole, retained tab, controlled slug removal, special corner strategy or surface-integrity evidence, and how is that work represented in the quotation?

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TOLERANCE STRATEGY AND STACK EXAMPLE

A tolerance is a functional requirement with manufacturing and inspection consequences; apply the tightest control where it protects function.

ILLUSTRATIVE WORST-CASE STACK



Two chained dimensions of 20 ±0.10 mm and 30 ±0.10 mm can produce a 50 ±0.20 mm worst-case total, while direct control can specify the functional distance without tightening both contributors.

Four control levels

Level	Purpose	Planning response
A - general geometry	Non-critical size and proportion.	Proportionate general tolerance and inspection.
B - functional size	Fit, sealing, bearing, spacing or assembly interface.	Stable finishing route and capable measurement.
C - geometric relationship	Orientation or location relative to functionally chosen datums.	Datum strategy, fixture and GD&T evaluation.
D - validated critical feature	Requirement close to process or measurement limits.	Drawing-specific process study and inspection confirmation.

How to use the arithmetic

The example shows worst-case addition, not a complete statistical tolerance analysis. Actual stack work must include the functional loop, direction, geometric controls, modifiers, assembly condition and the chosen acceptance rule.

Do not tighten every contributor merely to force a total. Control the relationship that the assembly uses.

Conditional Jaquent capability statement

When a metal drawing does not specify a general tolerance, ±0.10 mm is a common quotation and delivery basis. Selected milling or turning features may be reviewed to ±0.01 mm, and selected five-axis, Wire EDM or Swiss-machined features to ±0.005 mm, only where the quoted material, geometry, process controls and inspection method support the requirement. No value applies universally; the quoted drawing and inspection plan control acceptance.

Tolerance discipline

- Avoid duplicate dimensions that create conflicting acceptance criteria.
- Separate general dimensions from critical interfaces.
- Review temperature, compliance and restraint near the required limit.

Cost discipline

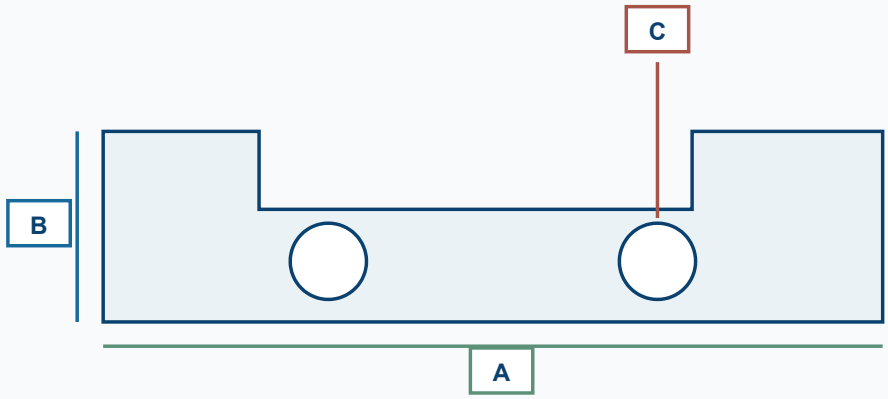
- Tight tolerances can add finishing, handling and inspection steps.
- There is no universal cost multiplier for a tolerance value.
- Compare quotes only after evidence and process assumptions align.

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GD&T AND DATUM STRATEGY

Use geometric controls to communicate functional relationships that plus/minus dimensions cannot express cleanly.

SYNTHETIC BEARING-MOUNT BRACKET USED IN THIS GUIDE



Synthetic bearing-mount bracket: A seats on the frame, B controls orientation, and the selected bore feature establishes tertiary locatior

This non-customer teaching part has a base datum A that seats on a frame, a side datum B that controls orientation, and a selected bore feature C that completes location for the illustrative assembly.

Control family	Typical controls	Engineering question
Form	Straightness, flatness, circularity, cylindricity.	Is the feature sufficiently well formed by itself?
Orientation	Parallelism, perpendicularity, angularity.	Is the feature oriented correctly to the datum frame?
Location	Position and profile where applicable.	Is the feature located from the functional datums?
Profile	Profile of a line or surface.	Does a boundary lie within the intended zone?
Runout	Circular or total runout.	Does a rotating surface meet the required relation to the datum axis?

Feature meaning in the teaching part

- Base A seats the bracket on the machine frame and establishes primary orientation.
- Side B locates the bracket laterally and removes rotational ambiguity.
- The selected bore feature C represents the assembly locator for the illustrated datum frame.
- The second bore is inspected relative to the established functional frame.

Datum selection rules

Start with function

Choose surfaces and features that locate or orient the real assembly, not merely convenient drawing edges.

Make it reproducible

Manufacturing and inspection must be able to contact or simulate the datum features consistently.

Control restraint

Flexible datum features may require datum targets, defined support or an assembly simulation.

ASME Y14.5-2018 was reaffirmed in 2024. When ASME Y14.5 or another dimensioning standard governs the drawing, state the exact designation and edition. This guide does not reproduce protected standards tables or replace the standard's rules and definitions.

RELEASE CHECK Verify that the datum reference frame represents assembly, that feature controls use it consistently, and that the proposed inspection alignment does not silently substitute different surfaces.

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SURFACE TEXTURE, FINISHING AND FINAL SIZE

Separate as-machined texture, functional surface requirements, cosmetic appearance and post-process dimensions.

Seal face

Texture, waviness, flatness and lay interact. Define measurement direction and clean condition.

Bearing / sliding

Texture works with size, form, hardness and lubrication. Do not isolate Ra from fit.

Cosmetic face

Define visual zones, allowable tool marks, color consistency and viewing condition separately.

Coated / anodized

Define buildup, masking, conductivity, threads and whether dimensions apply before or after finish.

Requirement	Incomplete callout	Controlled definition
Texture	A single Ra value with no surface or direction.	Named surface, parameter, cutoff/filter, direction, process state and measurement method.
Cosmetic finish	Finish all over.	Zone map, reference sample or agreed visual criteria, excluded functional faces and handling protection.
Coating thickness	Anodize per standard.	Type/class/color, masking, thickness evidence where required and final-size ownership.
Close fit after finish	Dimension shown with no process state.	Explicit pre-finish allowance or final-after-finish acceptance tied to the mating function.
Edge condition	Deburr only.	Functional edge break, protected sharp edge, allowed blend and inspection method.

External surface-finish example

Protolabs publishes CNC machining service guidance with typical general machining values spanning approximately Ra 6.3 µm to Ra 0.8 µm and describes a typical service finish below Ra 1.6 µm on its referenced page. These are Protolabs service statements, not Jaquent limits.

Confirm the material, cutting process, measurement cutoff, direction and final condition for the actual project. A roughness value alone does not control waviness, form, lay, defects or coating appearance.

Final-size equation

Where a coating adds nominal thickness c to each side of an external feature, the conceptual size change is approximately **2c**. Real processes may have nonuniform buildup, masking transitions and specification ranges, so the drawing must define which stage controls acceptance.

Finish handoff checklist

- Identify the owner of finishing, masking and final inspection.
- Protect datum and gauge surfaces required after finishing.
- Confirm which finish certificates and measurements are quoted deliverables.

BUYER QUESTION Which surfaces are functional, cosmetic, masked, conductive, dimension-critical after coating or subject to a separate finish specification?

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TOOL ACCESS, WORKHOLDING AND SETUP COUNT

A feature that is easy to model may still be difficult to reach, clamp, re-establish or inspect after reorientation.

SETUP 1
Establish primary datum, stable grip and accessible stock.

→

RE-CLAMP
Transfer, probing, jaw error, damage and distortion risk.

→

SETUP 2
Re-establish features from controlled datums and verify the transfer.

Design condition	Manufacturing consequence	DFM response
Deep feature under obstruction	Long tool projection or holder collision.	Open access, increase radius, change direction or evaluate another process.
Critical features on many faces	Re-clamping, probing and repeated datum transfer.	Review multi-axis machining or a common-datum route.
Thin part with limited grip	Distortion, jaw marks or unstable support.	Add temporary stock, grip land, tabs or a sacrificial feature.
Finished surface used for clamping	Cosmetic damage or dimensional change.	Protect the surface and sequence final finishing after critical machining.
Datum removed too early	Later features cannot be re-established or inspected consistently.	Preserve datum pads or define surrogate targets through the route.

Fixture and NRE questions

- Is fixture design, manufacture and validation included in the quote?
- Who owns the fixture, program, soft jaws and dedicated gauges?
- Can the tooling be reused for repeat orders or revised parts?
- What storage, maintenance and replacement assumptions apply?
- What event triggers revalidation or a new first article?

Datum continuity questions

- Which surfaces establish the primary frame in each operation?
- How is a critical relationship transferred after re-clamping?
- Can probing confirm location without using a variable or unfinished surface?
- Do finishing and inspection still have access to the approved datum features?
- Will clamp release change the condition that is inspected?

Grip
Provide a robust land or controlled temporary stock where possible.

Locate
Use datums that survive the process and represent function.

Verify
Plan the first-article or transfer check before committing to production.

PRINCIPLE Every re-clamp creates a datum-transfer opportunity. A sound plan controls that transfer; it does not pretend the opportunity disappears.

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INSPECTION AND QUALITY PLANNING

Every critical requirement needs a practical method, reproducible alignment, defined record and appropriate inspection rate.

Method	Well suited to	Main limitation or review question
Caliper	General dimensions and quick checks.	Force, access and resolution may not suit critical features.
Micrometer	Controlled external size or thickness.	Measures size locally; does not establish a complete geometric relationship.
Height gauge / surface plate	Heights, steps and datum checks.	Requires stable datum contact, access and controlled setup.
Pin, plug or thread gauge	Functional pass/fail for size or assembly interface.	Does not provide complete geometric data or numeric trend.
Bore or air gauge	Controlled bore size and selected form behavior.	Mastering, cleanliness, temperature and access are essential.
CMM	3D geometry, GD&T and complex relationships.	Probe access, fixture, alignment and evaluation strategy matter.
Vision / optical	Small, delicate or dense features.	Line of sight, focus, contrast, calibration and algorithm validation matter.
Profilometer	Specified surface-texture parameters.	Direction, cutoff, filtering, cleanliness and access affect the result.

Filled teaching example: synthetic bearing-mount bracket

Characteristic	Method and alignment	Record	Rate
Base datum A flatness	Surface plate/height system or validated CMM strategy; part supported at defined points.	Numeric flatness result and setup ID.	First article + sampling.
Locator bore C size	Mastered bore or air gauge at controlled temperature; verify entry condition.	Numeric size result.	Specified critical rate.
Second bore location to A|B|C	CMM with approved datum alignment and accessible probe path.	Reported positional result and alignment reference.	First article + change trigger.
Mounting face texture	Profilometer perpendicular to dominant lay with specified cutoff/filter.	Parameter result and trace ID.	First article + sampling.
Threaded holes	Calibrated functional thread gauge in final coating condition.	Pass/fail by characteristic ID.	Specified rate.

Measurement system questions

- Can the instrument resolve the requirement?
- Does the fixture reproduce the datum frame?
- Does contact or clamp force change the part?

Release record questions

- Is the result numeric or functional pass/fail?
- Does the report identify revision and characteristic?
- What failure reaction and retention period apply?

TEACHING EXAMPLE The bracket values and inspection route are illustrative and are not customer data. The controlled drawing, validated method and quoted evidence package govern a real order.

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COST OPTIMIZATION

CNC cost follows setup time, cutting time, tooling, secondary processing, inspection, logistics and yield risk - not one universal feature multiplier.

Cost driver	Why it adds cost	Design or RFQ action
Extra setups	Fixture design, probing, re-clamping and datum transfer.	Simplify access directions or choose a better-suited route.
Long tool reach	Lower stable cutting rate, special tooling and more finishing effort.	Open access, reduce depth or increase non-functional radii.
Small internal radii	Smaller cutters, lower feed and local cleanup operations.	Use larger radii except where the interface requires otherwise.
Blanket tight tolerance	More process control, finishing, handling and inspection across the part.	Apply close control only to functional relationships.
Special finish	Outside supplier, transport, masking, certificates and dimensional risk.	Define final size, masking and evidence before quotation.
Complex inspection	Programming, fixtures, records, review and cycle time.	Create measurable datums and remove redundant acceptance criteria.
Low-volume custom tooling	Fixture and gauge cost is spread across few parts.	Clarify prototype versus production quantity and reuse ownership.

Variables buyers can control

- Prototype quantity, expected lot size and release frequency.
- Required delivery date and approved split shipments.
- Material grade, condition, stock source and approved alternatives.
- Special processes and the responsible supplier.
- Fixture or NRE ownership, reuse and storage.
- Inspection-report scope, rate and retention.
- Packaging, cleanliness and traceability.

Cost review sequence

1. Lock requirements that protect function and cannot change.
2. Challenge geometry that creates deep reach, small tools or unnecessary setups.
3. Relax non-critical tolerances, texture and cosmetic requirements.
4. Coordinate machining, finishing and inspection so work is not repeated.
5. Compare quotations using the same technical and evidence basis.

Route
Does geometry fit the process?

Setup
How many datum transfers?

Proof
What evidence is required?

Risk
What can create scrap or delay?

NO FIXED MULTIPLIER Do not use a universal tolerance, finish or feature multiplier. A credible comparison aligns quantity, material, geometry, process route, special processes, evidence and delivery assumptions.

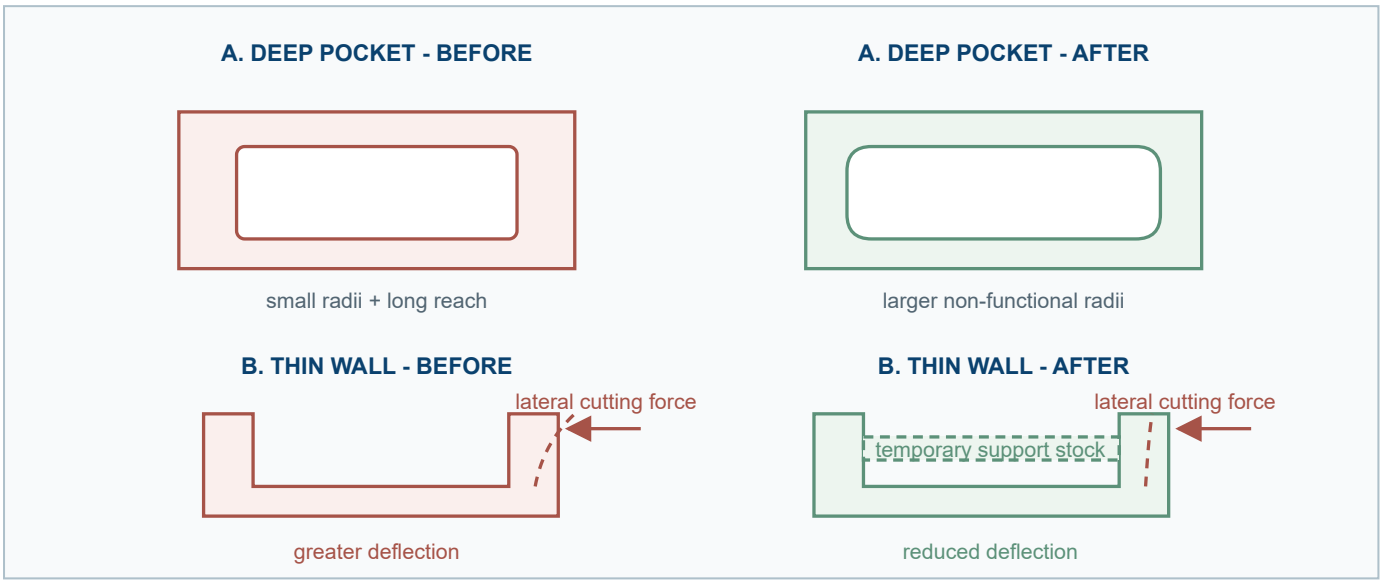
CHANGE CONTROL A cost proposal changes the product definition only after the buyer accepts its functional effect, revision and approval evidence.

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ILLUSTRATED DFM SCENARIOS ONE

These synthetic examples show engineering decision logic. They are not customer cases and do not promise a fixed saving or capability result.

DEEP POCKET AND THIN WALL - BEFORE AND AFTER



Localized deep-pocket radii improve access. Equal force reduces thin-wall deflection after temporary support stock is added.

Scenario A - deep pocket

Functional requirement: The cavity clears an internal assembly while one local corner protects connector access.

Original risk: A small radius around the full perimeter forces a small cutter at long reach, increasing deflection, cycle time and corner variation.

DFM change: Keep the small radius only at the connector interface; enlarge other radii and confirm the holder envelope.

Manufacturing and inspection effect: A larger, stiffer cutter serves most of the cavity. Inspection focuses on the local interface, floor depth and wall relationship.

Approval evidence: Revised model/drawing, marked functional corner, tool-access image and buyer approval tied to revision.

Scenario B - thin wall

Functional requirement: The wall separates two volumes and must fit the assembly after clamp release.

Original risk: Tall unsupported geometry moves under cutting, fixture and probe force; a single measured result can depend on restraint.

DFM change: Reduce unsupported height, add non-interfering ribs and leave temporary support stock until late in the sequence.

Manufacturing and inspection effect: Roughing remains balanced; the final wall is released in controlled steps and measured using defined support.

Approval evidence: Section comparison, assembly-clearance check, process sequence and free-state/restraint agreement.

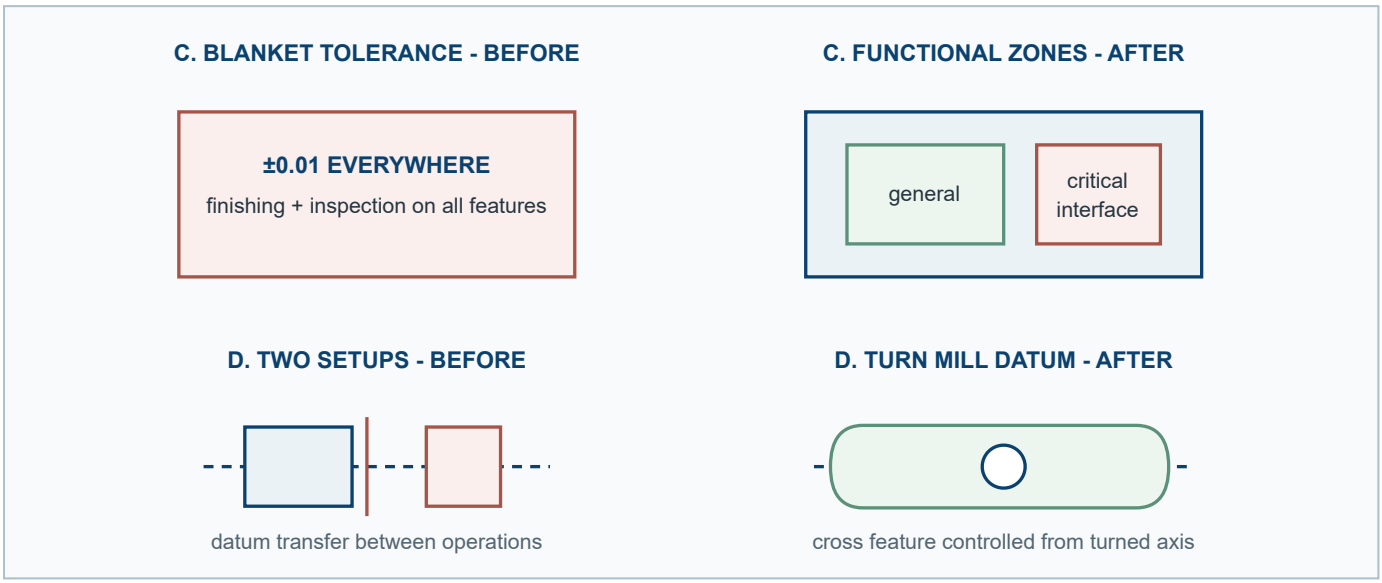
ACCEPTANCE RECORD For each DFM change, record the function preserved, drawing revision, commercial effect, inspection effect, approval owner and evidence used to release the revision.

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ILLUSTRATED DFM SCENARIOS TWO

The best change focuses control on function and removes avoidable datum transfers or inspection work without hiding risk.

BLANKET TOLERANCE AND TURN-MILL DATUM - BEFORE AND AFTER



The tolerance example separates a critical interface from general geometry; the shaft example controls a cross feature from the turned axis instead of transferring the relationship through an unrelated setup.

Scenario C - blanket tolerance

Functional requirement: One bore and mounting face locate the assembly; the external envelope provides clearance only.

Original risk: Applying ±0.01 mm everywhere drives finishing and inspection across non-functional surfaces, increasing cost without protecting the interface.

DFM change: Apply close control to the locating bore and mounting relationship; use proportionate general control elsewhere.

Manufacturing and inspection effect: Process capability and detailed records focus on the functional zone, while general geometry uses efficient inspection.

Approval evidence: Functional stack review, revised drawing, inspection characteristic list and assembly-owner approval.

Scenario D - turn-mill datum

Functional requirement: A cross hole must align with the axis established by two turned diameters.

Original risk: A separate milling setup locates from an external face, transferring error into the axis-to-hole relationship.

DFM change: Review turn-mill production or a fixture that explicitly re-establishes the functional turned axis.

Manufacturing and inspection effect: The process and CMM alignment share the same axis logic; transfer validation becomes visible.

Approval evidence: Datum scheme, setup/fixture plan, first-article result and drawing-specific process confirmation.

DO NOT OVERSELL These scenarios explain mechanisms and records. They do not claim a universal cycle-time reduction, cost saving or tolerance result.

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ENGINEERING AND PROCUREMENT RELEASE CHECKLISTS

Use both lists before quotation or production release; one protects technical intent and the other aligns supplier and commercial evidence.

Engineering release

- ☐ Critical interfaces and performance requirements are identified.
- ☐ Machining route fits dominant geometry and access directions.
- ☐ Exact material grade, condition, stock form and substitution rule are defined.
- ☐ Thin, slender and flexible features have cutting, clamp and inspection review.
- ☐ Corner radii, holder clearance, chip evacuation and usable depths are practical.
- ☐ Thread engagement, runout, inserts, burrs and bottom conditions are clear.
- ☐ Functional axis, Wire EDM start/taper and retained-core strategy are reviewed.
- ☐ Tight tolerances are limited to functional relationships.
- ☐ Datum scheme represents assembly and supports inspection.
- ☐ Texture, cosmetics, masking and post-finish dimensions are separated.
- ☐ Part can be held without distorting critical geometry.
- ☐ A realistic method and access exist for every critical characteristic.
- ☐ Model, drawing, revision and approved DFM changes agree.

Procurement and supplier confirmation

- ☐ Contracting entity and authorized production route are confirmed.
- ☐ Matching 3D model and marked 2D drawing revision are supplied.
- ☐ Prototype quantity, expected lot size and delivery target are stated.
- ☐ Finish, masking, assembly, packaging and cleanliness are defined.
- ☐ Critical characteristics and acceptance criteria are identified.
- ☐ Required FAI, CMM, MTR/CoC, sampling, specified 100% characteristic checks and shipment records are quoted.
- ☐ NDA, drawing-recipient and data-handling constraints are agreed.
- ☐ Special-process suppliers and evidence responsibilities are visible.
- ☐ Fixture/NRE ownership, reuse, storage and validation are defined.
- ☐ Change-control and deviation approval process is agreed.
- ☐ Lead time, shipment basis, quote validity and exclusions are stated.
- ☐ Inspection record delivery and retention period are confirmed.
- ☐ Governing standard and edition have been checked at release.

Release rule

A requirement is not ready for routine production until the approved drawing, model, process route, datum strategy, special-process ownership and inspection method agree. Any accepted DFM change must be reflected in the controlled product definition, not left only in a quotation note or email thread.

Revision

Does every released file show the same revision and date?

Approval

Who accepted each deviation or DFM change?

Evidence

What proves conformity and accompanies shipment?

WEBSITE SUBMISSION Use no more than five files totaling 25 MiB at Request a Quote.

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REFERENCES ONE

Sources support claims; external evidence does not prove Jaquent capability.

1. **ASME.** *Y14.5 - Dimensioning and Tolerancing, 2018 (R2024).* Status and scope checked 3 October 2026. https://www.asme.org/codes-standards/find-codes-standards/dimensioning-and-tolerancing
2. **ISO.** *ISO 2768, Edition 2 - Geometrical product specifications (GPS) - Dimensional tolerancing.* Stage 60.00; will replace ISO 2768-1:1989. Checked 3 October 2026. https://www.iso.org/standard/85741.html
3. **Protolabs.** *Designing for Machinability.* External geometry screening, including an approximately 0.5 mm wall example. Checked 3 October 2026. https://www.protolabs.com/en-gb/resources/guides-and-trend-reports/cnc-machining-designing-for-speed/
4. **Protolabs.** *Mastering Complex Features on Machined Parts.* Hole-depth, adjacent-wall and small-feature examples. Checked 3 October 2026. https://www.protolabs.com/en-gb/resources/design-tips/mastering-complex-features-on-machined-parts/
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6. **Kennametal.** *KSEM Modular Drill Bodies.* Lists 3D, 5D, 7D and 10D body categories. Checked 3 October 2026. https://www.kennametal.com/ca/en/products/metalworking-tools/holemaking/modular-drills/ksem-modular-drill-system/ksem-bodies.html
7. **Sandvik Coromant.** *Silent Tools™ Application Guide*, document C-1040-380, p. 36. Tool-selection guidance for solid steel, solid carbide and damped boring bars. Verified 3 October 2026. Official Silent Tools entry: https://www.sandvik.coromant.com/en-us/tools/silent-tools/what-is-silent-tools/silent-tools-turning
8. **Makino.** *Wire EDM Machine Centers Tutorial.* Rough/skim, taper, wire deflection and part-movement context. Checked 3 October 2026. https://www.makino.com/resources/content-library/article/archive/edm-wire-tutorial/198

SOURCE USE Source statements remain tied to the named publisher, version, page or page context. Do not convert a tool catalog class, service limit or material data point into a universal design rule.

ISO STATUS On 3 October 2026, ISO listed ISO 2768 Edition 2 at stage 60.00, under publication, and stated that it would replace ISO 2768-1:1989. Recheck the official catalog before release. This guide intentionally does not reproduce the tolerance tables.

Evidence application matrix

Claim area	Primary evidence	Engineering use	Boundary
Drawing rules	ASME and ISO	Confirm edition and release basis	No protected tables
Geometry screening	Protolabs	Prepare DFM questions	Not a Jaquent limit
Tool reach	Sandvik and Kennametal	Frame rigidity and access checks	Not proof of capability
Wire EDM	Makino	Plan rough, skim and core control	No fixed skim count
Engineering plastics	Ensinger	Check named-grade behavior	Do not transfer between grades

PUBLICATION POLICY Recheck source status before release, keep links and access dates, and validate every screening value against the actual grade, geometry, process and inspection method.

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REFERENCES, DOCUMENT CONTROL AND CONTACT

Rev E is the controlled release approved for technical, quality, company/brand and publication use on 4 October 2026.

9. **Ensinger.** *TECAPEEK natural - unfilled PEEK.* Named-grade property and application context. Checked 3 October 2026. https://www.ensingerplastics.com/en-sg/shapes/tecapeek-natural
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13. **Jaquent controlled company facts.** Company relationship, RFQ upload rules, response expectations and conditional capability statements. Internal controlled source confirmed for this release.

Revision history

Issue	Date	Status	Change
Rev D	October 2026 (day not recorded)	Withdrawn	Legacy-brand technical source; not for publication.
Rev E issue 1	1 October 2026	Superseded review draft	Brand, evidence and procurement-first restructuring.
Rev E issue 2	3 October 2026	Superseded review draft	A4 redesign, expanded engineering examples, improved density and reproducible build.
Rev E	4 October 2026	Released	Audit corrections completed; technical, quality, company/brand and publication approvals recorded.

Release approvals

Technical
Technical Engineer
Approved: 4 October 2026

Quality
Technical Engineer
Approved: 4 October 2026

Company / brand
General Manager
Approved: 4 October 2026

Publication
General Manager
Approved: 4 October 2026

Company statement

Jaquent is the international trade interface of Shenzhen Jiancang International Trading Co., Ltd. Precision CNC work placed under authorization JAQ-AUTH-20260919-001 is produced by the Dongguan manufacturing facility named in that authorization. Approved specialist suppliers may support project-specific processes. Capability and inspection scope are confirmed per drawing.

Request a project-specific DFM review

Send the 3D model, marked drawing, material and condition, quantity, finish, critical characteristics, delivery target and required inspection records.

CONTACT Request a Quote
support@jaquent.com
Mutual NDA

CONTROLLED RELEASE Rev E is approved for release. Future changes require documented review, approval and revision history before publication.

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