

REFERENCE

Metrology and Inspection: How Parts Are Verified

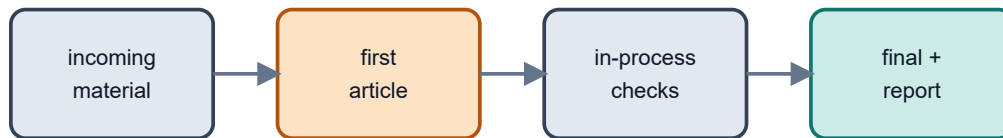
The inspection workflow, the measurement equipment (CMM, optical, roughness, hardness, XRF), how to choose an inspection level, and the documentation you can receive.

A part is only as good as the measurement that proves it. Inspection is what turns a drawing tolerance into a verified dimension, and what catches a drift before it becomes a batch of scrap. This guide explains how parts are inspected, the equipment involved, and the documentation you can receive, so you know what to ask for and how to specify it.

The reference standards are public: ISO 2768 and ISO 286 for the tolerances being verified, and ASME B46.1 for surface texture. The manufacturing facilities hold ISO 9001 quality-management certification, with IATF 16949 for automotive work and ISO 13485 for medical components where required.

The inspection workflow

Inspection workflow



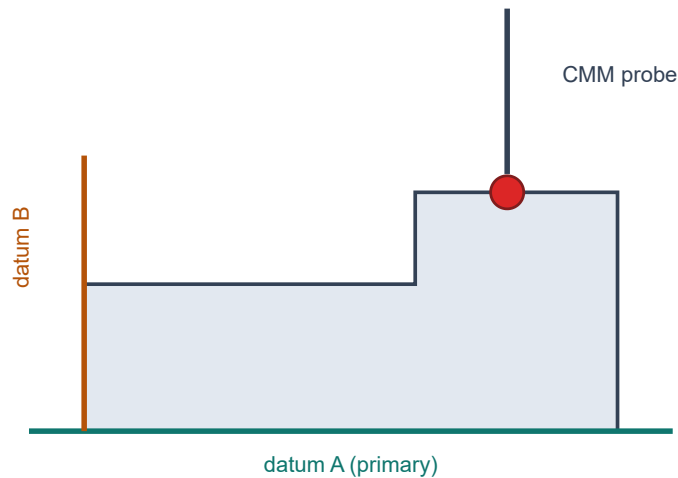
Quality is checked at every stage: material, first article, in-process, then a final report.

Quality is built in across the job, not bolted on at the end:

1. Design review. The DFM check happens before anything is cut, so a feature that cannot be made or measured is caught first.
2. Incoming material. Material is verified against its certificate, by grade and often by composition, before it enters production.
3. First article. The first part off a new setup is fully measured against the drawing and approved before the run continues, so a setup error is caught on part one, not part one thousand.
4. In-process checks. Key dimensions are sampled during the run to catch tool wear or drift.
5. Final inspection. Finished parts are inspected to the agreed level, from a visual and dimensional sample to full dimensional measurement per part.
6. Documentation. The measured results are recorded and, where requested, delivered as a report.

Inspection equipment

Datums and CMM probing



A CMM locates the part on its datums, then probes points for size, position, and form.

Instrument	Measures	Typical resolution
Coordinate measuring machine (CMM)	Size, position, form, GD&T, on datums	Micron-level
Optical, vision comparator	2D profiles and edges, without contact	Micron-level
Surface roughness tester	Ra, Rz on a surface	Sub-micron
Micrometers, calipers, height gauges	Individual dimensions	0.01 mm (0.0004 in) and finer
Hardness tester (Rockwell, Vickers)	Material hardness after heat treat	Per scale
Material analyzer (XRF)	Alloy composition, RoHS screening	Elemental
3D scanner	Whole-surface deviation against the model	Depends on setup

A CMM is the core tool for dimensional and geometric verification. It locates the part on its datums, then probes points to measure size, position, and form against the drawing, which is how a GD&T callout is actually checked.

Choosing an inspection level

You specify how much inspection a part receives, and the level should match the part's risk and volume:

Level	What it means	Fits
Basic visual	Workmanship and obvious defects	Low-risk, non-critical parts
Dimensional sample	Key dimensions on a sample of the batch	Most production runs
Full dimensional per part	Every dimension on every part	Critical or low-volume parts
CMM with report	Full geometric verification, documented	Tight-tolerance and regulated parts

A higher level costs more time, so specify full or CMM inspection on the features and parts that need it rather than across the board.

The documentation you can receive

Depending on the level you choose, a job can come with a dimensional report against the drawing, a first-article report, material certificates, and a certificate of conformance. Tell us the level and the documents you need at quote time so inspection is planned into the job, not added after.

The checklist

1. Critical dimensions and GD&T clearly called out so they can be measured.
2. Datums defined for any geometric tolerance.
3. An inspection level chosen to match the part's risk and volume.
4. Required documents (first-article, dimensional report, material certificate) requested at quote time.

How FabWorks supports this

Every part runs through a DFM check before production, so features are designed to be measurable as well as makeable, and the inspection level and documentation you choose are carried through to the floor. The measured results tie back to the

same drawing tolerances the DFM engine screened, so what was designed, what was made, and what was verified all speak the same language.