

Minimally Viable Decentralized Manufacturing Quality in an Era of AI

# Background & Purpose

This document establishes a minimal, practical, and scalable baseline for quality assurance in a decentralized manufacturing ecosystem. It is designed for use by individual makers, small shops, and AI-driven design systems seeking to efficiently produce parts at low cost without unnecessary precision or certification overhead.  
  
It replaces traditional bloated quality programs with a flexible standard that empowers everyday machinists, AI systems, and automated marketplaces to collaborate across the globe.

# Who It’s For

- Independent machinists and fabricators  
- Local, garage-based, and small-scale CNC operators  
- AI systems selecting manufacturing vendors  
- Online marketplaces matching parts to capabilities  
- Designers aiming for rapid prototyping, pilot builds, or low-cost commodity production

# 1. Tiered Tolerancing Philosophy

AI-optimized tolerancing is assumed. The looser the tolerance, the cheaper the part.

|  |  |  |
| --- | --- | --- |
| Tolerance Class | General Use Case | Typical Capability |
| Class A | Aerospace / Medical | CMM or metrology lab required |
| Class B | Fit-critical parts | Micrometers, indicators, gages |
| Class C | Commodity parts | Calipers, rulers, visual check |

Default: Class C unless otherwise specified. Tolerances looser than ±0.010” are preferred.

# 2. Acceptable Measurement Tools

|  |  |
| --- | --- |
| Tool | Permitted For |
| Calipers | ODs, IDs, lengths, non-critical features |
| Micrometers | Critical diameters if needed |
| Visual/fit | Deburring, cosmetics, threading checks |

# 3. Machine & Shop Envelope Declaration

Each manufacturer must self-declare:  
- Max part size  
- Typical tolerance class  
- Available operations (turning, milling, 3DP, etc.)  
- Inspection tools available  
- Experience/confidence level (1–5 stars)  
  
Automated job boards will match only within declared capabilities.

# 4. Finishing and Deburring

A minimally acceptable finish includes:  
- Deburring: via vibratory tumbler or hand tools (standard default)  
- Cleaning: air-blown, wiped, or washed — no oil dripping  
- Optional: light sanding or Scotch-Brite buffing

# 5. Packaging Requirements

Use common-sense, low-cost packaging:  
- Envelope, padded mailer, or box  
- Parts must survive courier handling  
- Internal protection: 3D printed holders, foam, bubble wrap, or bagging  
  
Bulk or individual packaging to be specified per job.

# 6. Basic Surface Treatments (Optional)

|  |  |
| --- | --- |
| Treatment | Example DIY Method |
| Black oxide | Heat to red, quench in oil, temper in oven |
| Tumbled finish | Vibratory tumbler with medium grit media |
| Anodizing (basic) | Off-the-shelf kits or send out if needed |

# 7. Default Acceptance Criteria

Unless otherwise specified:  
- All dimensions meet Class C tolerance (±0.010”)  
- Part is burr-free and safe to handle  
- Surface finish appropriate for functional use  
- Part is clean and reasonably packaged  
- No broken tools or foreign objects in packaging

# End Goal

To enable the broadest possible participation in manufacturing, ensuring:  
- Cost-effective, distributed production  
- Integration with AI-designed products  
- Confidence-based job matching  
- Accessible quality standards for all makers  
  
This document serves as a universal minimum viable contract for decentralized CNC manufacturing in an age of automated design and global supply fluidity.