Coffee Roasting Temperature & Heat Management Guide

Target Temperature Milestones

Key Temperature Targets (Bean Temperature - BT)

- **Charge:** 135-140°C
- **Turning Point:** 105-110°C (at 90-120 seconds)
- **Dry End:** 150-155°C (at 3:30-4:00)
- **First Crack Start:** 165-170°C (at 6:30-7:00)
- **Drop:** 175-185°C (at 8:30-9:30)

Environmental Temperature (ET) Guidelines

- **Charge:** 95-105°C
- **Turning Point:** 90-100°C
- **Dry End:** 115-125°C
- **First Crack:** 125-135°C
- **Drop:** 135-145°C

Rate of Rise (RoR) Targets by Phase

Phase 1: Drying Phase (0-4:00)

Target RoR: 8-12°C/min declining to 6-8°C/min

- **0-1:30:** 10-12°C/min (initial momentum)
- **1:30-3:00:** 8-10°C/min (controlled decline)
- **3:00-4:00:** 6-8°C/min (preparing for Maillard)

Phase 2: Maillard Phase (4:00-7:00)

Target RoR: 4-6°C/min

- **4:00-5:30:** 5-6°C/min (flavor development)
- **5:30-7:00:** 4-5°C/min (approaching first crack)

Phase 3: Development Phase (7:00-9:00)

Target RoR: 2-4°C/min

- **7:00-8:00**: 3-4°C/min (early development)
- **8:00-9:00**: 2-3°C/min (final development)

Heat Management Strategy

Pre-Charge Setup

1. **Preheat roaster to 200-220°C** environmental temperature
2. **Set initial burner to 60-70%** of maximum
3. **Airflow at 50-60%** for small batch roasting
4. **Plan heat reduction schedule** before charging

Heat Application Timeline

Phase 1: Drying (0-4:00)

Heat Management Goal: Controlled, declining energy input

0-0:30 (Charge to Turnaround)

- **Burner**: Start at 60-70%, immediately reduce to 50-60%
- **Goal**: Achieve turning point at 90-120 seconds
- **Watch for**: Rapid temperature drop, then gradual climb

0:30-2:00 (Post-Turnaround)

- **Burner**: Reduce to 40-50%
- **Goal**: Maintain 8-10°C/min RoR
- **Adjustment**: Small 5-10% changes every 30 seconds

2:00-4:00 (Late Drying)

- **Burner**: Gradual reduction to 30-40%
- **Goal**: Achieve 6-8°C/min RoR approaching dry end
- **Critical**: Don't let RoR crash below 5°C/min

Phase 2: Maillard (4:00-7:00)

Heat Management Goal: Steady, controlled energy for flavor development

4:00-5:00 (Early Maillard)

- **Burner**: Maintain 30-40%
- **Goal**: Stabilize RoR at 5-6°C/min
- **Watch for**: Color changes, first aroma development

5:00-6:00 (Mid Maillard)

- **Burner**: Small reductions to 25-35%
- **Goal**: Maintain 4-5°C/min RoR
- **Listen for**: Beans expanding, subtle cracking sounds

6:00-7:00 (Pre-First Crack)

- **Burner**: Fine adjustments, possibly small increase
- **Goal**: 4-5°C/min RoR leading to first crack
- **Strategy**: Some roasters add 5-10% heat just before FC

Phase 3: Development (7:00-9:00)

Heat Management Goal: Controlled finish without stalling

7:00-7:30 (First Crack Peak)

- **Burner**: Reduce by 10-20% from previous setting
- **Goal**: Control the crack intensity
- **Watch for**: Even crack propagation through batch

7:30-8:30 (Mid Development)

- **Burner**: Maintain 20-30%
- **Goal**: 3-4°C/min RoR
- **Strategy**: Steady heat for even development

8:30-9:00 (Final Development)

- **Burner**: Final adjustments, possibly reduce to 15-25%
- **Goal**: 2-3°C/min RoR to drop
- **Decision point**: Monitor for desired roast level

Heat Adjustment Principles

When to Increase Heat

- **RoR dropping below targets** (especially <5°C/min in drying)
- **Temperature stalling** for more than 30 seconds
- **First crack too quiet** or uneven
- **Bean development lagging** behind time targets

When to Decrease Heat

- **RoR exceeding targets** (especially >12°C/min early)
- **Temperature climbing too aggressively**
- **Environmental temperature spiking**
- **Approaching phase transitions**

Size of Adjustments

- **Large changes (15-25%)**: Only during major corrections
- **Medium changes (10-15%)**: Phase transitions or significant course corrections
- **Small changes (5-10%)**: Most common adjustments
- **Micro adjustments (2-5%)**: Fine-tuning in development phase

Environmental Factors

Ambient Temperature Effects

- **Cold days**: May need 10-15% more heat throughout
- **Hot days**: Reduce initial heat by 10-15%
- **Humidity**: High humidity may require longer drying phase

Batch Size Adjustments

- **Smaller batches**: Reduce all heat settings by 15-20%
- **Larger batches**: Increase heat settings by 15-20%
- **Different bean densities**: Adjust initial heat ±10%

Troubleshooting Common Issues

RoR Too High Early

- **Cause**: Charge temperature too high or too much initial heat
- **Fix**: Reduce heat immediately, may need 20-30% reduction
- **Prevention**: Lower charge temperature for next roast

RoR Crashes Mid-Roast

- **Cause**: Too aggressive heat reduction
- **Fix**: Increase heat by 15-20%, then gradual reductions
- **Prevention**: Make smaller, more frequent adjustments

Stalled Development

- **Cause**: Insufficient heat in development phase
- **Fix**: Increase heat by 10-15%
- **Prevention**: Plan heat increases before first crack

Uneven First Crack

- **Cause**: Usually insufficient heat or poor heat distribution
- **Fix**: Small heat increase and ensure good airflow
- **Prevention**: Maintain 4-5°C/min RoR approaching FC

Advanced Techniques

Heat Soak Method

- **Principle**: Higher initial heat, then rapid reduction
- **Timing**: 70-80% initial, drop to 40% by 1:00
- **Benefit**: Better heat penetration, more even roasting

Gradual Decline Method

- **Principle**: Steady, predictable heat reductions
- **Timing**: Reduce by 5-10% every minute after turnaround
- **Benefit**: Very controlled, repeatable profiles

First Crack Power Method

- **Principle**: Small heat boost just before first crack
- **Timing**: Add 5-15% heat at 6:30, then reduce after crack starts
- **Benefit**: More explosive crack, better development

Remember: These are guidelines, not rigid rules. Your specific roaster, batch size, bean origin, and desired profile may require adjustments to these targets.