



CQI-9: salient features

AIAG Special Process: Heat Treat System Assessment, and what it means for heat treatment furnaces.

1. Purpose and scope

- Published by AIAG (Automotive Industry Action Group) as a self-assessment tool for heat treatment operations.
- Widely required by OEMs and Tier-1 automotive customers of their heat treat suppliers.
- Works alongside IATF 16949 and ISO 9001; it does not replace them.
- Current edition: 4th edition. Please confirm the latest revision on the AIAG website.

2. Structure of the assessment

- **Management responsibility and quality planning:** quality manual, APQP and control plans, FMEA, training and competency.
- **System-level requirements:** materials handling, equipment, maintenance and pyrometry, applicable to every furnace.
- **Process-specific tables:** additional requirements by process, for example carburizing and carbonitriding, neutral hardening and tempering, nitriding and ferritic nitrocarburizing, aluminum heat treating, induction hardening and brazing.
- Table letters and numbering differ between editions, so check against your copy of the standard.

3. Pyrometry: the signature element

Element	What it requires
Furnace classes (1-6) and instrument types (A-D)	Together they set the allowed temperature uniformity range and the SAT and TUS frequencies. A tighter class means tighter uniformity and more frequent checks.
System Accuracy Test (SAT)	Compares the furnace control and recording instruments against a calibrated test instrument and sensor, at a defined frequency.
Temperature Uniformity Survey (TUS)	Verifies that the working zone stays within the tolerance band, at a frequency based on furnace class.
Calibration and traceability	Test instruments traceable to NIST (or equivalent) with defined calibration intervals.
Thermocouples	Defined types and classes, usage tracking, and replacement and recalibration limits for base-metal thermocouples.
Instruments	Requirements on control, monitoring, over-temperature and recording instruments: resolution, accuracy and calibration.

SAT: System Accuracy Test. TUS: Temperature Uniformity Survey.

4. Process control

- **Atmosphere control:** dew point, carbon potential, endothermic gas and probe checks, with defined verification frequencies.
- **Quench control:** quenchant temperature, agitation and, for polymer quenchants, concentration.
- **Work instructions:** recipes, load configuration, soak time and temperature, and tolerances must be documented and followed.
- Control plans and FMEA feed into the process definitions.

5. Equipment maintenance

- Documented, scheduled preventive maintenance for furnaces, burners, fans, atmosphere equipment and quench tanks.
- Leak checks and burn-off or purge procedures where relevant to the furnace type.

6. Product testing and verification

- Hardness, case depth, microstructure and similar tests per customer specification.
- Calibrated test equipment, defined test frequency and sampling practice.
- Handling of nonconforming product and containment.

7. Documentation and records

- Records for SAT, TUS, calibration, maintenance, load charts and product testing, retained for a defined period.
- Traceability from furnace charts back to the customer lot.

8. Assessment mechanics

- Each requirement is scored Yes, No or N/A; gaps need corrective action.
- Self-assessment is typically annual, and customers may ask to see results and action plans.
- Customer-specific requirements may add to or tighten the standard.

9. Why it matters for a furnace manufacturer

A CQI-9-ready furnace is a strong selling point to automotive heat treaters.

Relevant features: suitable furnace class, calibrated control and recording, multi-zone control, independent over-temperature protection, ports for SAT and TUS thermocouples, atmosphere control and data logging.

Each of these can be framed directly against the pyrometry requirements.

This summary is for orientation and is not a substitute for the standard. Requirements, table numbering and frequencies should be verified against the current AIAG CQI-9 edition.