

Smart operations in heat treatment

Eurotherm[®]

Expertise in systems and solutions, services and support

AMS2750F[™] pyrometry solutions

Eurotherm by Schneider Electric[™] provides a range of products, engineered solutions, and services throughout the world. Our specialist heat treatment know-how and embedded expertise can help you to save energy, improve material properties and reduce regulatory costs.

We provide scalable solutions that enable smart operations and help to reduce downtime.

Safer world

We help our customers to meet material property specifications and reduce regulatory costs.

Sustainable world

We help our customers reduce energy and manufacturing costs by providing scalable, high-reliability, power, and control solutions.

We have application expertise in:

- Control algorithms for temperature, atmosphere, vacuum, and energy management
- Electrical power control
- Furnace/oven process control and sequencing
- Recipe and setpoint management
- Batch entry and management
- Data historian and reporting
- Alarm management
- Plant and machine SCADA with customized operator interfaces
- EcoStruxure[™] platform to support Industry 4.0/IoT digital transformation
 - Augmented reality
 - Predictive maintenance
 - Remote monitoring
- OEM support
- Compliance: AMS2750F, CQI9, calibration, TUS, SAT
- System lifecycle and cybersecurity support services

AMS2750F pyrometry solutions

Heat treatment is a NadcapSM 'special process'. Any process that can change or alter a part's material or physical integrity by introducing stresses via mechanical, thermal, or chemical operations may be considered a special process and must be given particular care to avoid potential defects. AMS2750 was created to provide standardized pyrometry requirements (temperature measurement) in the heat treatment of products for the aerospace industry. Organizations need qualified employees and a well-documented set of procedures and approved equipment to provide evidence that proves both the procedure and results of each batch processed.

Nadcap acts as the approval body for 'special processes' for the aerospace industry and is administered by the Performance Review Institute (PRI). Regular audits are undertaken to ensure facilities meet the requirements. AMS2750 is also referenced in other special process standards and has been adopted in different forms for the automotive (CQI9), oil & gas, and other industries.

AMS2750F overview

The AMS2750 specification covers pyrometry requirements for equipment used in the thermal processing of metallic materials. The following provides an overview of the main sections addressed by Eurotherm products. Please refer to the AMS2750F standards for the full detail (www.sae.org).

Temperature sensors (section 3.1)

This section in the standard outlines the sensor job, use, type, calibration and accuracy requirements. The fig. 1 gives an example of common thermocouple types and accuracy requirements.

Thermocouple construction includes both expendable (any portion of the thermal element exposed to the process environment) and non-expendable thermocouples (thermal element protected from the process environment e.g., metal sheath).

Base-metal non-expendable load thermocouple usage is dependent on temperature.

Control thermocouple replacement period should be based on data from SAT, TUS, re-calibration, trend analysis and results.

Instrumentation (section 3.2)

This section outlines the instrument job, type, calibration and accuracy requirements. The fig.(s) 3 and 4 outline the key instrument type requirements supplied by Eurotherm. Recording instruments should be checked annually to the accuracy of ± 1 min/h by an external timing device (timing device calibrated every 2 years to ± 1 s/min). A possible alternative is to document digital synchronization to NIST (or equivalent) via satellite, internet, or phone (at least monthly) to support these accuracy requirements.

Thermal processing equipment (section 3.3)

This section defines the furnace class (1-6) uniformity tolerance and the instrumentation type (A-E).

SAT (section 3.4) describes a probe check to assess the variation from the control systems with an independent master thermocouple and field instrument. TUS (section 3.5) is used to assess the temperature variation within a qualified work zone with respect to setpoint temperature.

| Fig. 1 | | Thermocouple accuracies |
|--------------|--|---|
| Type R, S | | $\pm 1.0^{\circ}\text{F}$ or $\pm 0.6^{\circ}\text{C}$ or $\pm 0.1\%$ |
| Type J, K, N | | $\pm 2.0^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$ or $\pm 0.4\%$ |

| Fig. 2 | | | Set temperature |
|-----------------------------|--------------------|--|--------------------|
| Usage period | $^{\circ}\text{F}$ | | $^{\circ}\text{C}$ |
| One use | 2300.0 and above | | 1260.0 and above |
| Quarterly or 10 uses | 2200.0 to 2299.9 | | 1204.5 to 1259.9 |
| Quarterly or 90 uses | 1800.0 to 2199.9 | | 982.8 to 1204.4 |
| Quarterly or 180 uses | 1200.0 to 1799.9 | | 648.9 to 982.7 |
| Quarterly or 270 uses | 500.1 to 1199.9 | | 260.1 to 648.8 |
| Quarterly or unlimited uses | At or below 500.0 | | Below 260.0 |

| Fig. 3 | | Instrument accuracies |
|--------------------------------|--|--|
| Field test | | $\pm 1.0^{\circ}\text{F}$ or $\pm 0.6^{\circ}\text{C}$ or $\pm 0.1\%$. Shall be digital and have a readability of 0.1°F or 0.1°C . |
| Control, recording instruments | | $\pm 2.0^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$ or $\pm 0.2\%$. Recording instruments shall be digital by 2022-06 and have a readability of 0.1°F or 0.1°C by 2022-06. |

| Fig. 4 | | Calibration intervals |
|--------------------------------|--|--|
| Field test | | Quarterly |
| Control, recording instruments | | Class 1 monthly Class 2,3,4 quarterly Class 5,6 semiannually Refrigeration and quench equipment calibration semiannually. |

| Furnace class | Sensors per control zone | | Instrumentation type | | | | | |
|---------------|--------------------------|--------------------|----------------------|---|---|----|---|---|
| | $^{\circ}\text{F}$ | $^{\circ}\text{C}$ | A | B | C | D+ | D | E |
| 1 | ± 5.0 | ± 3.0 | x | x | x | x | x | x |
| 2 | ± 10.0 | ± 6.0 | x | x | x | x | x | |
| 3 | ± 15.0 | ± 8.0 | x | | x | | | |
| 4 | ± 20.0 | ± 10.0 | x | x | | | | |
| 5 | ± 25.0 | ± 14.0 | | | | x | | |
| 6 | ± 50.0 | ± 28.0 | x | x | x | x | x | |

Instrumentation to help meet AMS2750F

When subject to the necessary field calibration, the following instruments manufactured by Eurotherm are suitable for use in aerospace (Nadcap/AMS2750F) and automotive (IATF16949/CQI9 version 4)

Control or recording (AMS2750F table 7)

Calibration to meet $\pm 2.0^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$ or $\pm 0.2\%$ of temperature, whichever is greater.

| Type | Eurotherm instrument | Model numbers |
|-----------------------|--|--|
| Control | EPC2000 programmable controller | All models |
| | 2000 series controller | 2704 and 2604 |
| | EPC3000 programmable controller | EPC3016, EPC3008, and EPC3004 |
| | 3000 series controller | 3200 series and 3500 series |
| | Mini8 [®] loop controller | With enhanced thermocouple board (ET8) |
| Control and recording | nanodac [™] recorder/controller ¹ | All models |
| | E+PLC range | E+PLC100 ¹ and E+PLC400 ¹ |
| | PAC system hardware | T2550 ¹ and T2750 ¹ |
| Recording | 6180 AeroDAQ ¹ and 6000 series graphical recorder | 6100XIO ¹ , 6100 ¹ , 6180XIO ¹ , and 6180A ¹ |
| | versadac [™] scalable data recorder ¹ | All models |
| | Eycon [™] 10/20 visual supervisors ¹ | All models |

Field test instruments

6000 series graphical recorder, model numbers: 6100A TUS and 6180A TUS with external CJC and fast-acting accuracy to meet $\pm 1.0^{\circ}\text{F}$ or $\pm 0.6^{\circ}\text{C}$ or $\pm 0.1\%$ of temperature, whichever is greater.

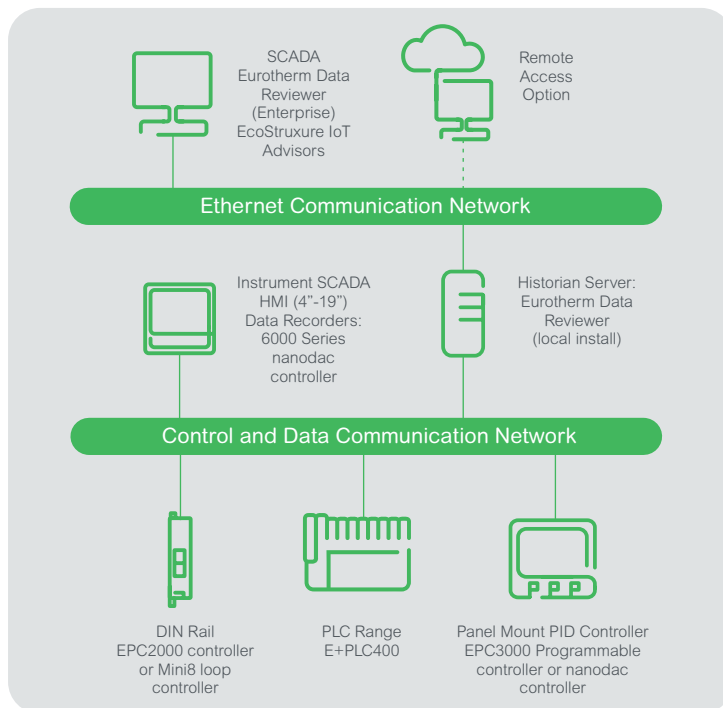
¹Devices for use in data acquisition (AMS2750F 3.2.4). Please refer to table below for electronic record solutions. Simple Network Time Protocol (SNTP) is available in the 6000 series graphical recorder, nanodac recorder/controller, PAC system hardware (model numbers T2550, T2750), and Eycon 10/20 visual supervisors to provide digital synchronization to help meet recording timing accuracy.

| Electronic records | AMS2750F clause | Eurotherm solutions |
|---------------------------------|-----------------|---|
| Tamper evident | 3.2.4.2a | Records unalterable without detection. Eurotherm 6000 series recorders, nanodac recorder/controller, versadac scalable recorder, E+PLC controller, and T2750 PAC controller create write-once, read-only data records in a tamper-evident binary file format with the file extension .UHH. |
| Record playback | 3.2.4.2b | Source data unalterable in reviewing tool. Eurotherm Data Reviewer software utility enables playback of the data in an easy to examine trend format. The source data is recorded in a tamper-evident file format. |
| Records in readable form | 3.2.4.2c | Accurate, complete records for inspection, review, and copying. Eurotherm Data Reviewer and AVEVA [™] Reports for Operations software can generate accurate copies of records in human-readable and electronic form, suitable for inspection, review, and duplication. |
| Record review | 3.2.4.2d | Evidence of record reviews in electronic or printed format. Eurotherm Data Reviewer has an embedded annotation function to provide evidence that the record was reviewed - this review then becomes a part of the permanent record. The record can be printed as a PDF file (for electronic review) or a hard-copy for physical marking to verify review. |
| Protection of records | 3.2.4.2e | Retrieval of accurate records throughout the retention period. Eurotherm Data Reviewer is a 2nd generation software utility that also accepts Eurotherm .UHH file formats created 15+ yrs ago. Redundant archiving of the source data provides additional retention assurance. 6000 series recorders support secure FTP when transferring files to Eurotherm Data Reviewer. Eurotherm 'store and forward' feature automatically backfills data to servers if communications are temporarily lost. |
| Hardware and software operation | 3.2.4.2f | Operate throughout retention period (min. 5 years). The Eurotherm established obsolescence program ensures both hardware and software are supported throughout stated retention periods. |
| System access | 3.2.4.2g | Authorization methods of record access. Data acquisition products have an optional user management feature that can be used to manage password access. |
| Software revisions | 3.2.4.3 | Eurotherm Data Reviewer software revisions do not impact process parameters. Setpoint cycle revisions in PLC's or programmers can be controlled by authorized access and quality procedures. Eurotherm control products have passcode protection on configuration. Eurotherm Data Reviewer operates independently to cycle setpoint programmers and will not impact process parameters on revision updates. |

Industry 4.0 ready technology

EcoStruxure is Schneider's open IoT-enabled system architecture aiding the digital transformation to Industry 4.0 technology. Eurotherm connected instruments and software fit into this cybersecurity-in-mind designed architecture.

EcoStruxure™
Innovation At Every Level



Life Is On

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