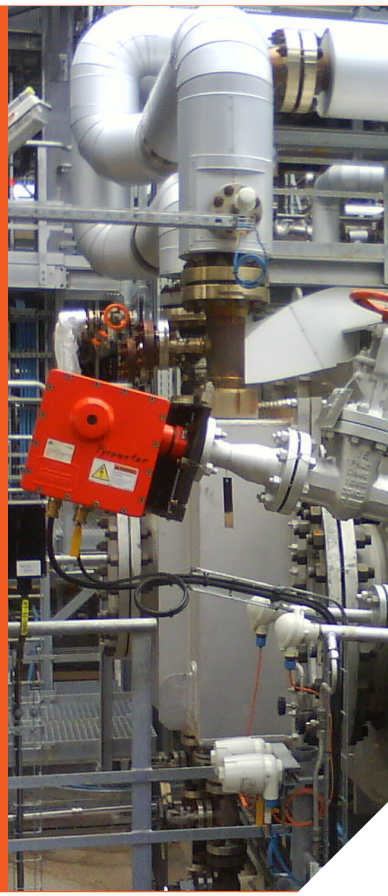
ON-SITE PULSAR PREVENTATIVE SOLUTIONS

FIELD SERVICE



Achieving Sustainable Results with Advanced Energy Services

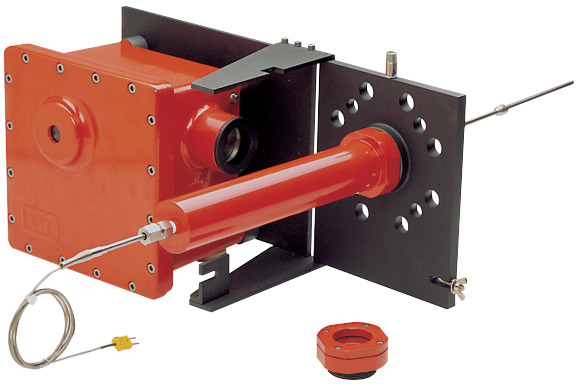
The mission of our services organization is to deliver consistent value-added service so you can focus on your business. Our highly trained and dedicated Field Service Engineers (FSEs) are ready to partner with you to deliver the right sensing solutions with the best performance and longest-life.

You expect the highest quality from your investments in Advanced Energy's technology; therefore, our promise is to:

- Deliver high-value customer care.
- Keep your assets reliable and working.
- Provide you the knowledge and expertise required to solve complex problems quickly.
- Service to prevent unplanned downtime and keep you running safely.

Proper temperature control is critical to production efficiency, product quality, and environmental compliance.

Our E²T Pulsar support services are designed to keep your E²T Pulsar system performing with minimal downtime for the long-term.



E²T Pulsar On-site Maintenance

Advanced Energy Technologies, Inc. can schedule to have an experienced and dedicated Field Service Engineer come out to your site to perform field commissioning and inspection. This includes troubleshooting and field verification of calibration of E²T Pulsar II, Pulsar III, and Pulsar 4 units.

Introduction

The purpose of this document is to provide an overview of Advanced Energy's field calibration and verification services for E²T Pulsar products.

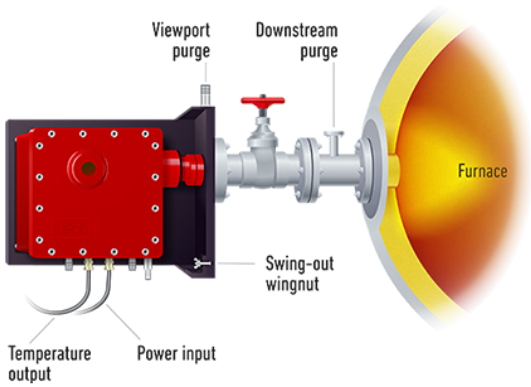
The E²T Pulsar service will ensure your Pulsar divice is calibrated precisely and within range per original factory specifications. The benefits of these services are to prevent potential problems, ensure optimum performance, and avoid costly shutdowns.

Services include:

- Checking for proper SOF mounting hardware. Replacing parts as needed.
- Aligning, field calibration verification, and focusing each Pulsar unit.
- Cleaning the flame-path and viewport, if necessary.
- Checking and adjusting the combustion and viewport purge rates.
- Setting the correct spectral band on each channel, per customer requirements.
- Taking a T/C reading and making appropriate adjustments if the default emissivity settings are not satisfactory.

During the service event, a NIST certified transfer standard will be used to verify the Pulsar temperature readings.

E²T mounting to furnace



Service Description

Pulsar infrared pyrometers are perhaps the most precise way to monitor process temperatures inside sulphur reactors and tail gas incinerators. The control of the reaction furnace temperature is important for preventing damage to the refractory lining at high temperatures. Proper temperature control also prevents ammonium salts from plugging converters at low temperatures. In applications where waste gases are being incinerated, such as ammonia and hydrocarbons, temperature measurement is critical to ensure temperatures are adequate to ensure their destruction.

A typical SRU may have two or three Pulsar Systems installed to monitor temperatures in different areas of the reactor. Both Gas and Refractory measurements are critical to furnace operations. The Gas (Flame) measurement is used by the operator to detect thermal events before IR energy is absorbed by the refractory, creating a refractory thermal event. This method of early warning, by use of the Gas (Flame) temperatures, allows added time for operators to make process changes and reduce potential refractory thermal events before they can become critical. This notification occurs by triggering a high level alarm system based on the refractory temperature measurement's set point.

Periodic maintenance of Pulsar systems is essential to ensure accurate temperature measurement and avoid costly shutdowns.

MONTHLY MAINTENANCE
Optical and Purge Check

A clear optical path is critical. If the flame-path is even partially blocked, radiation from the target cannot reach the Pulsar detector. If the viewport assembly (VP-10) or lens becomes smudged or dirty, attenuation of the signal will occur, resulting in abnormally low readings.

Viewport windows and o-rings will be inspected and cleaned or replaced as necessary. Any blockages noted in the nozzle will be removed using a clean out probe. Instrument alignment and focus will be adjusted.

It is important that purge rates are correct for both the viewport and port. The viewport and combustion purge will help prevent any future build-up of Sulphur or debris, which could block the flame-path. The purge rates will be checked and adjusted to proper values.

QUARTERLY MAINTENANCE
Electronics and Output Temperature Verification

The Pulsar chassis or electronics module will be removed from the EXP housing and taken to a clean work area to be thoroughly checked and tested. Pulsar II units in the NEMA housing (7000-1D2), will need to be removed from the SOF mounting bracket to be serviced.

On Pulsar II, all dc voltages will be checked, and the chopper motor will be inspected. Chopper motor failure is the leading cause of failure in Pulsar II. Pulsar III and PULSAR 4 do not have chopper motors.

If the output cannot be brought into spec, it will be recommended the unit be sent to the factory for repair.

For Pulsar III and PULSAR 4, the correct sub-range will be verified. The instrument will then be re-installed at the SRU.

Summary

A service report will be generated for each instrument showing the data collected, adjustments made, and any recommended action to be taken.

The benefits of these services include preventing potential problems, ensuring optimum performance, and avoiding costly shutdowns.

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

PRECISION | POWER | PERFORMANCE

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