

METHANE FROM FLARING TOOLKIT



Measure Efficiency: Pyrometer

Can I measure flare efficiency? > Measure Efficiency: Pyrometer

Summary

A pyrometer provides a real-time measurement of the temperature of a distant source. This remote-sensing technology is based on changes in the intensity of light received by the observer. It is an optical system that works for various flare sizes and types. Typical application is the continuous flare or pilot monitoring, to confirm its operation. It is often used in combination with thermocouples for ensuring a redundant system. Temperature may be used as a proxy for combustion efficiency, where changes to the temperature may be indicative of lower efficiency – it is not a direct measure of methane emissions.

How it Works

- Distant optical measurement of temperature of a source
- An optical system focuses the thermal radiation onto a detector to create a temperature value as an output signal
- Temperature is connected to the thermal radiation by the Stefan-Boltzmann law

- Provides a real-time direct measurement of temperature to confirm operation

Advantages

- ✓ No direct access/physical contact to source required
- ✓ Distances up to ¼ mile (400 meters) possible
- ✓ Applicable for various flare types: ground flares, elevated flares, offshore
- ✓ Can either be permanently installed or as mobile device
- ✓ Operates in range of conditions, day & night
- ✓ Easy to install and upgrade existing facilities, scalable

Limitations

- ✗ Does not directly measure methane
- ✗ Needs a clear line of sight
- ✗ Limited to temperature measurement only (typically used to confirm operation a pilot or a but no further details)
- ✗ Monitoring of staged flares might require additional imaging technology/software
- ✗ Some limitations in severe weather conditions (e.g. heavy fog/heavy rain)

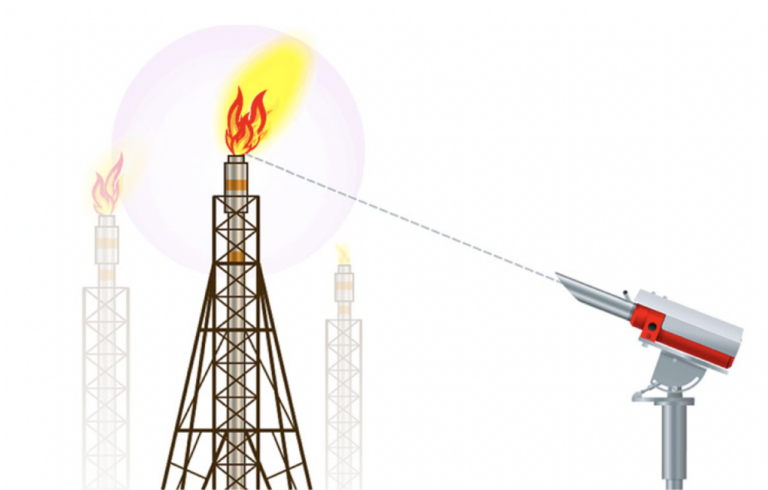
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Case study

For efficient operation of a flare stack, additional monitoring with a pyrometer as redundancy for a thermocouple system is installed. This ensures safe operation, environmental assurance and governmental compliance at all time. In this example, pyrometry is used in a single flare tip application to detect if the pilot flame is on or off. In case the installed thermocouple fails, the pyrometer still provides a reliable mA signal if the pilot is working or not. This signal is then translated into a green or red light to show the operational status. While the thermocouple needs to be installed in a very challenging environment at the flare tip (high temperatures, corrosion, vibration), the pyrometer is located in a safe distance to the flare tip only requiring a clear line of sight, as illustrated in the picture below.



Example of pyrometer installation to monitor flare operation [maintworld.com]

Can I measure flare efficiency?



Measure Efficiency: Predictive Feedback and Control



Measure Efficiency: Flare Simulations



Measure Efficiency: Drone equipped with single methane sensor



Measure Efficiency: Aerial measurement of flare efficiency



Measure Efficiency: Extractive method for determining flare efficiency