

# Temperature measurement Oil refineries

Refining the art of temperature  
measurement for the Oil & Gas industry



## Introduction

There are around 720 oil refineries worldwide with at least 132 in the USA alone. Each of these refineries has a requirement for temperature measurement equipment for control, monitoring and safety. The vast majority of temperature measurements in oil refineries are for either process monitoring or for safety applications. Almost all of the individual processes within a refinery have a number of temperature measuring points and two or even three times that number of safety-redundant measurements.

## Typical refinery diagram

While every refinery is slightly different, all share common components in their design. The vast majority of processes use heat in one form or another to process their product.

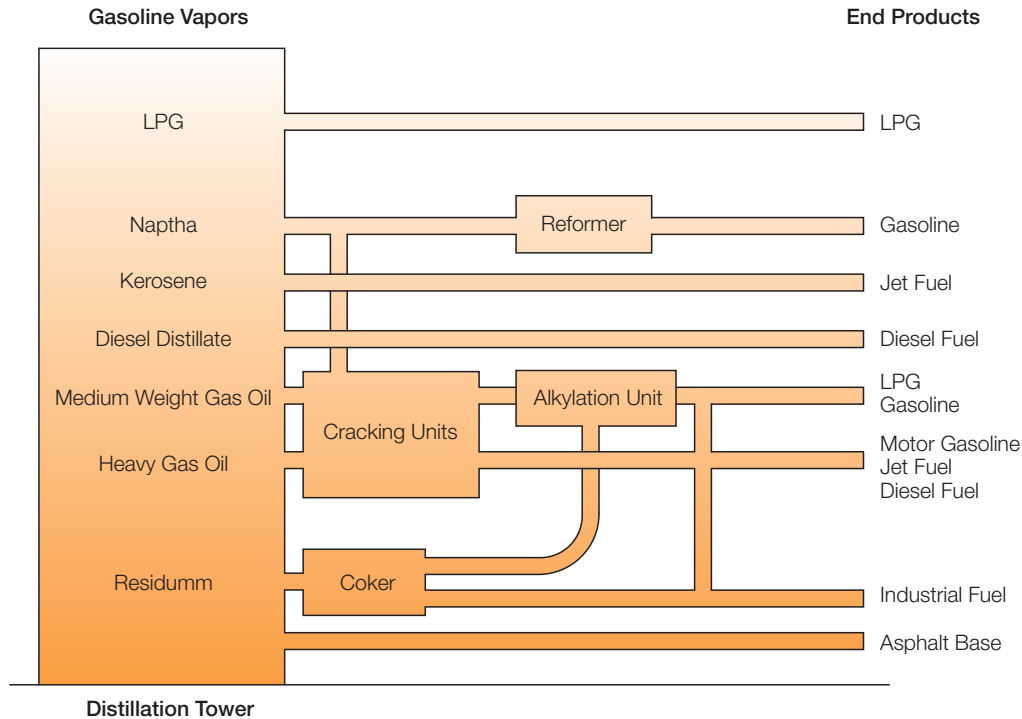


Fig. 1 Typical refinery diagram

## Typical temperature measurement requirements

The areas where temperature is to be measured fall into two main categories – vessels and pipelines. Temperature measurement in vessels vary greatly in type, ranging from traditional thermometers mounted in thermowells through multipoint measurement systems to cable-type thermometers mounted on pipe bundles within the vessel with connection heads mounted on the outside of the vessel. Pipeline temperature measurement is largely performed by traditional thermometers mounted within thermowells.

For all refinery measurements, hazardous area (explosion risk) protection is a major issue. The two most common methods of protection employed are explosion protection (for example, IECEx d) and intrinsic safety such as IECEx ia. Explosion protection (explosion or flame proof) is a mechanical protection method that ensures that any explosion from a spark is contained within the instrument's enclosure. Intrinsic safety is an electronic system that ensures there is never sufficient energy in the circuit to produce a spark.

Pipeline and vessel pressure integrity is taken very seriously by refinery operators and designers; the regulatory environment in most countries is extremely demanding. Equipment supplied must comply with numerous safety standards and be accompanied by extensive documentation detailing the methods and materials of manufacture. Equipment to be supplied is frequently subjected to factory acceptance testing that, in the case of measuring equipment, focusses on the verification of the supplied documentation and equipment.

The temperature measurement requirements of most refinery processes are not particularly demanding when compared to the needs of other industries where small variations in temperature can have significant effects on yield. Refineries therefore concentrate on those aspects of supply that effect safety; items such as thermowells (that in many industries are considered as accessories) become critical components under these circumstances.

## Traceability and verification

Wetted components such as thermowells come under significant scrutiny. Most refineries have standard thermowell designs based on either national, company or even plant standards. Frequently, thermowells are connected to the process piping via flanges. The traceability of the materials used and the welding qualifications employed to build the thermowells must be fully documented and in many cases, verified by testing. In the case of materials, not only is the original material certification required, evidence must also be supplied of the quality processes that mark and re-mark the material at every manufacturing stage to certify that the correct material was used. The finished product is often subjected to a final X-Ray PMI check to ensure that the chemical components of the product match the original metal manufacturer's certificate.



Fig. 2 An ABB operator performing X-Ray PMI on a set of thermowells

Welding procedures must be produced by a qualified welding engineer and verified by a third party (most insurance companies, particularly ones involved in industrial or ship building insurance, have a verification arm). Welders must be qualified to perform the welding procedure required. All of this information must be available and verifiable via a documentation trail. This documentation must then be supplied to the refinery where it is securely retained. Similar verification steps may be required for other wetted parts. Temperature measurement elements and associated transmitters may require a calibration certificate traceable to national standards, although this is not always the case.

### Specification

It is normal practice for refinery operators to have detailed drawings of their exact requirements regarding temperature instrumentation designs. Under normal circumstances, a drawing and a specification is provided to all suppliers. Under exceptional circumstances, a plant operator may be facing a problem with a measurement; for example, a component may be eroding too quickly, a measurement point may be inaccessible or a particular design of equipment may be too difficult to maintain or replace. Under these circumstances, a supplier may be asked to suggest a suitable solution to the problem. This is an opportunity to demonstrate competence and build a relationship with the refinery operator and expert help should be sought.

Under normal circumstances a specification is issued and bids invited to supply equipment. Understanding the need of the refinery operator for extensive documentation to verify the manufacturing integrity of the components is an essential supply consideration.

### ABB temperature for the Oil & Gas market

ABB can satisfy all of the demands of the Oil & Gas market, both off-shore and on-shore. Please contact your temperature PLS to discuss the supply of equipment to your local refineries. ABB design and manufacture:

- transmitters (both head and field mounting)
- temperature sensors (including specialist cables)
- explosion-proof housings
- thermowells for the oil and gas industry

ABB can supply multipoint measurement solutions and cable-type sensors to a customer's specification and design, using the highest quality components to third-party-verified manufacturing processes. ABB's temperature for the Oil & Gas industry is a satisfier of customer's requirements, driven by each customer's unique manufacturing and regulatory environment.

Fig. 3 shows an ABB multipoint measurement system designed precisely to a customer's requirements. The system includes 3 measurement points, each with 2 sensors, all in a single thermowell.



Fig. 3 Custom-designed multipoint measurement system

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