Instrumentation, Control, and Protective Functions for Gas-Fired Heaters—Main Burner Ignition Criteria

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Introduction

API 556 is transitioning from a single document to a multipart series of documents, each issued as a first edition.

The subtitles for the eight parts are listed below.

— Part 1: Instrumentation

— Part 2: Control

— Part 3: Protective Functions

— Part 4: Flue Gas Analyzers

— Part 5: Main Burner Ignition Criteria

— Part 6: Tube Skin Thermocouples

— Part 7: Overlay for Oil-Fired Heaters (reserved for future publication)

— Part 8: Overlay for Steam Methane Reforming Furnaces (reserved for future publication)

This document is the fifth part of API Standard 556, *Instrumentation, Control, and Protective Functions for Gas-Fired Heaters*. API 556-5 contains requirements and background information on main burner ignition criteria for fired heaters:

a) that are designed in accordance with API 560;

b) that contain burners that are designed and tested in accordance with API 535;

c) that have instrumentation, controls, and protective functions in accordance with the respective parts of API 556.

In API standards, the SI system of units is used. In this recommended practice, where practical, U.S. Customary (USC) units are included in brackets for information.

Background for Main Burner Ignition Criteria

API 556, 2nd Edition, established main burner ignition criteria based on benchmarked OSHA and NFPA guidance for hazardous gas concentrations in open air. As a result, a not-to-exceed limit of 25 % lower explosive limit (LEL) in the firebox was specified for startup conditions. For gas-fired heaters equipped with forced-draft fans or induced-draft fans, this criterion has been acceptable because the firebox approaches well-stirred behavior during startup.

However, in the case of a natural draft heater, the firebox does not behave as a well-stirred system and can develop non-uniform local fuel concentrations during startup. For natural draft heaters, the effective ignition limit is well below 25 % LEL (typically a few percent LEL) when expressed on the basis of the total firebox volume.

Consequently, during the development of this document, the API 556 Task Group identified the need for additional technical evaluation to support the development of inherently safer ignition criteria for the main burner. The Task Group commissioned a working group to study fuel accumulation and dispersion in a firebox during the trial for ignition period and to formulate main burner ignition criteria that promote smooth and prompt ignition. A brief report describing this work and its technical basis has been added as Annex A of API 556-5.

Instrumentation, Control, and Protective Systems for Gas-Fired Heaters—Main Burner Ignition Criteria

1 Scope

API 556-5 contains recommended practices and background information on main burner ignition for new gas-fired heaters designed, operated, and safeguarded in accordance with API standards.

API 556-5 focuses on main burner ignition criteria for gas-fired heaters:

a) that are designed according to the latest editions of API 535 and API 560;

b) that have instrumentation, controls, and protective functions in accordance with the respective parts of API 556;

c) for which the fireboxes are already purged prior to introducing ignition sources in the firebox and pilot burners (if fitted) are in service.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Standard 535, *Burners for Fired Heaters in General Refinery Services*

API Standard 560, *Fired Heaters for General Refinery Service*

API Standard 556, *Instrumentation, Control, and Protective Systems for Gas-Fired Heaters*

3 Terms, Definitions, and Abbreviations

For the purposes of this document, the following terms and definitions apply.

3.1 Terms and Definitions

3.1.1
air factor
The ratio of air flow supplied to a burner to the stoichiometric air demand for the fuel that is supplied to the burner.

3.1.2
delayed ignition
A condition that occurs when there is a time delay between the moment that fuel starts to flow into the firebox and the fuel in the firebox ignites.

3.1.3
dilution criterion
A method for determining the minimum air factor to the first burner at startup, such that the burner ignites without a significant pressure rise.