Flame Arresters in Piping Systems

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FOREWORD

This recommended practice was prepared under the direction of the API Safety and Fire Protection Subcommittee. This third edition of API 2028 *Flame Arresters in Piping Systems* has been extensively rewritten and updated from the previous edition. Appendices to the document are intended to provide additional supplementary information.

This guide was prepared to help provide a basic understanding of flame arresters used in piping systems. The information presented is based primarily upon experience in the petroleum industry. It is not intended to exclude or limit the use of other approaches of comparable merit. Because of the special nature of flame arresters, especially those used for detonation protection, this recommended practice strongly encourages dialogue with the equipment supplier and the use of sound engineering judgement in flame arrester selection and application.

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Flame Arresters in Piping Systems

SECTION 1—INTRODUCTION

1.1 PURPOSE

This recommended practice is intended to inform industry about limitations of flame arresters installed in piping systems. Concerns about potential environmental effects of hydrocarbon and chemical vapor emissions have led to regulations requiring the installation of vapor control systems. In the United States, for marine transfer of oil or hazardous materials, United States Coast Guard regulations require installation of flame arresters (suitable to interrupt a detonation) in vapor control piping. These USCG regulations specifically direct (in detail) where to install these flame detonation arresters in the vapor control systems. An independent laboratory must test detonation arresters installed to meet these regulations.

The diversity of commercial flame arresters can lead to the installation of these arresters in piping systems where the conditions within the piping may be significantly different from the conditions for which they were designed, or tested and listed by testing laboratories. Under certain conditions, flames propagating through piping systems can reach velocities and pressures at which detonation can occur. Unless a flame arrester has been designed and tested for a detonation, it may not stop the progression of a combustion wave in the piping. Guidance is provided concerning the important factors involved in the selection, installation and maintenance of appropriate flame arresters. The intent is to assist the user of this recommended practice in developing the awareness of review needs, and to encourage discussions with flame arrester manufacturers regarding specific applications and test results.

1.2 SCOPE

The scope of this recommended practice is the use and limitations of flame arresters installed in piping systems in the petroleum and petrochemical industries. It provides a general overview of flame arresters currently in use and some potential concerns or limitations. Applicable combustion and flame propagation parameters are discussed including the distinction between arresting flames versus arresting detonations.

This recommended practice is neither a design manual nor a regulatory compliance document. It does provide reference to more detailed technical discussions of flame arresters and combustion. Various standards, codes, and regulations are noted in the Section 2 references and in the Appendix A Bibliography.

1.3 CONCEPT OF HAZARD VS. RISK

Hazards are properties of materials with the inherent ability to cause harm. Flammability, toxicity, corrosivity, stored chemical or mechanical energy all are hazards associated with various industrial materials. Risk requires exposure. The flammability of a material transported in piping is an inherent hazard, but becomes a risk only when having access to an oxidizer and being exposed to an ignition mechanism. There is no risk of ignition when there is no potential for those exposures. Determining the level of risk involves estimating the probability and severity of exposure conditions that could lead to harm.

1.4 RETROACTIVITY

Any provisions in this recommended practice related to design are intended for reference when designing new facilities or when considering major revisions or expansions. It is not intended that any recommendations in this recommended practice be applied retroactively to existing facilities unless deemed appropriate based on facility review. Each facility must make their own determination regarding how to comply with any applicable regulations.

SECTION 2—REFERENCED PUBLICATIONS

The most recent edition or revision of each of the following standards, codes, and regulations are cited in this recommended practice. Additional references not specifically cited in this document are listed in the Bibliography, Appendix A.

API[1]

Std 2000 *Venting Atmospheric and Low-Pressure Storage Tanks*

RP 2210 *Flame Arresters for Vents of Tanks Storing Petroleum Products*

ASTM[2]

F 1273 *Standard Specification for Tank Vent Flame Arresters*

[1]www.api.org

[2]American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania, USA 19428. www.astm.org