



*Setting the Standard for Automation™*

# Fired Heater Instrumentation Inside API's RP-556

ISA Section meeting-Chicago  
March 2, 2010

Standards  
Certification  
Education & Training  
Publishing  
Conferences & Exhibits



# Jim Harris-Bio-Information

- 20 years with UOP
  - Technical Leader for Safety Instrumented System Applications
  - Process Control Specialist-Aromatics Technology Center-Engineering
- BS-Chemical Engineering
  - UB (University at Buffalo - *The State University of New York*)
- Sr. member of AIChE, Director-Fuels and Petrochemicals Division (2007-10)
- Current ISA Positions - executive board member of Safety Division (past director), H&A Committee and active member of SP84 & SP18
- ISA Fellow (2005), recipient of ISA's UOP Technology Award (2005)
- UOP representative to API's Committee on Refinery Equipment subcommittee on Instrumentation and Control Systems (CRE-SOICS)
- 3 US Patents



**A Honeywell Company**

# Inside API's RP556

Background

Types of Industry Documents

API RP556-Update

Summary-Q&A



# Background



- UOP supports industry standards of many different organizations.
- Industry benefits
- Participants benefit
- Shared experiences

# Additional Learning Opportunities

- **2010 Industrial Automation Safety and Security Symposium!**
- *Sponsored by the ISA Safety Division*
- *Topics*
  - *Alarm Management*
  - *Safety Instrumented Systems*
  - *Cyber Security*
- ***Wednesday, 28 April 2010 through Thursday, 29 April 2010***
- ***New Orleans, LA***
- See [www.isa.org](http://www.isa.org) for registration information

# Types Of Industry Documents

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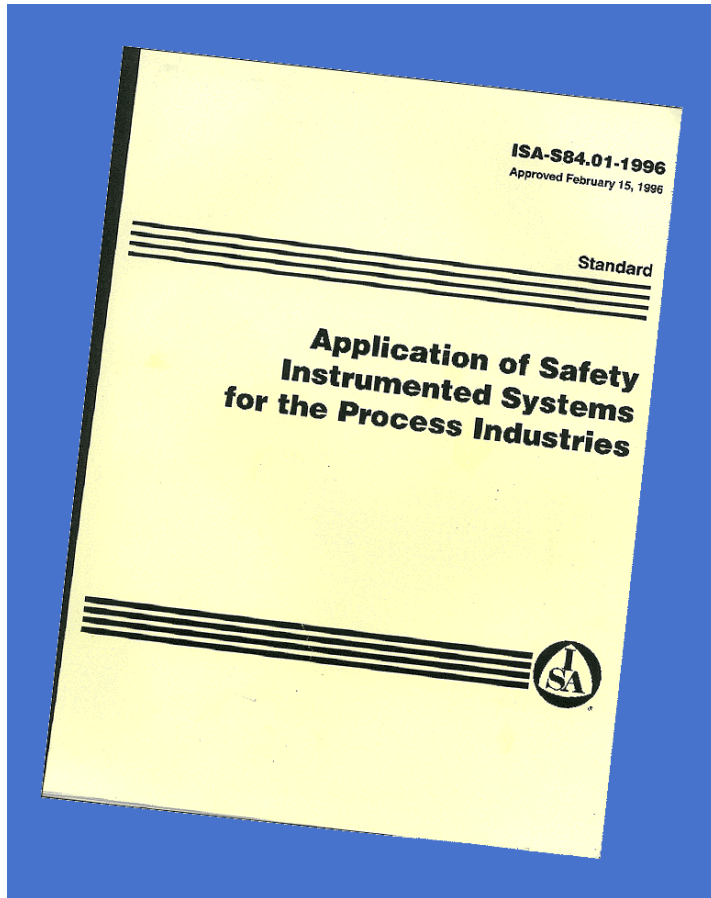
- Company Standards
- Recommended Practices
- Country Standards
- International Standards

# Types Of Industry Documents

- Company Standards
  - Deviations from industry standards (special requirements)
  - internal procedures, installation drawings, minimum general requirements etc.
- Recommended Practices
  - Best practices with limited mandatory requirements
- Country Standards
  - ANSI (American National Standards Institute)
  - Clearinghouse for national consensus working with other organizations (API, ISA & IEEE groups designated by ANSI)
- International Standards
  - ISO and IEC with national representatives

# Types Of Industry Documents

## ANSI/ISA S84.01



- 12 Clauses
  - Covers each major section of the Safety Lifecycle
- 5 Annexes
  - A - SIL Determination examples
  - B - SIS Design considerations
  - C - References
  - D - Example Problem
  - E - Index

# Types Of Industry Documents

## IEC 61511 - draft

### 3 Parts Focused on Process Industry

COMMISSION                      CEI  
ELECTROTECHNIQUE        IEC  
INTERNATIONALE        61511-1

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

Functional safety: Safety Instrumented Systems for the  
process industry sector  
Part 1:  
Framework, definitions, system, hardware and software  
requirements

- Part 1  
17 **required** clauses  
– cover steps in the IEC  
Safety Lifecycle
- Part 2  
**Guidance** offered for all  
17 clauses
- Part 3  
SIL Determination  
guidance and **examples**

# API-RP556 - Update API Organization

- Committee on Refinery Equipment (CRE)
  - Semi-annual face-to-face meetings (approx. 300 people)
  - All major vendors, contractors and operators attend
- Sub-Committee on Instrumentation and Control Systems (SOICS) (approx. 30 people)
- Recommended Practice (RP) list for SOICS
  - RP-551 - Process Measurement Instrumentation
  - RP-552 - Signal Transmission Systems
  - RP-553 – Refinery Control Valves
  - RP-554 – Process Control Systems
  - RP-555 – Analyzers
  - RP-556 – Instrumentation, Control and Protective Systems for Fired Heaters
  - RP-557 – Advanced Control Systems

# API RP 556 – Other Standards – ISA

## dTR84.00.05 – Burner Management Systems

ISA-dTR84.00.05  
Technical Report

**Guidance on the Identification of Safety Instrumented Functions (SIF) in Burner Management Systems (BMS)**

Draft Version 1  
September 2009

- **Informative (Non-Prescriptive)**
- **Safety Lifecycle Overview**
- **Applications**
  - **Single Burner Boiler**
  - **Multi-Burner Process Heater**
  - **Thermal Oxidizer**
  - **Oil Heater Treater**
  - **Glycol Reboiler**
- **Risk Analysis and Verification**

# API-RP556 – Other Standards - NFPA



- NFPA 85/86/87
- National Fire Protection Association
- Prescriptive-mandatory items for compliance
- NFPA 85 – Boiler Standard
- NFPA 86 – Ovens, Furnaces and Incinerators
- NFPA 87 – Fired Heaters for process applications (**new committee**)
  - API 560 heaters to be excluded

# API-RP556 - Update

- First Edition Published in May 1997
- Title, “Instrumentation and Control Systems for Fired Heaters and Steam Generators”
- Major Sections
  - Fired Heaters
  - Conventional Steam Generators
  - Carbon Monoxide or Waste-Gas Steam Generators
  - Gas Turbine Exhaust-Supplemental Fired Steam Generators
  - Unfired Waste Heat Steam Generators

# API-RP556 – Purpose

## Current Version – 2<sup>nd</sup> Edition

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Not covered in this recommended practice are the following:

- oil fired and combination fired heaters;
- water tube boilers which consist of single or multiple burners and are designed for utility operation or where the primary purpose is steam generation;
- fired steam generators used to recover heat from combustion turbines (HRSG);
- oven and furnaces used for the primary purpose of incinerating, oxidizing, reduction or destruction of the process medium (covered by NFPA 86);
- water bath or oil bath indirect fired heaters (covered by API 12K);
- CO boiler, pyrolysis furnaces, e.g. ethylene and hydrogen reformer, and other specialty heaters.

# API-RP556 – Purpose

## Current Version – 2<sup>nd</sup> Edition

This document provides guidelines that specifically apply to instrument, control, and protective system installations for **gas fired heaters** in petroleum refinery, petrochemical, and chemical plants.

A gas fired general service heater defined in this practice liberates heat by the combustion of fuel gas and this heat is transferred to fluids and/or gases in tubular coils all contained within an internally insulated enclosure.

This practice includes primary measuring and actuating instruments, controls, alarms, and protective systems as they apply to fired heaters. For additional subject matter review, refer to the referenced or industry standards.

# API-RP556

## Current Version – 2<sup>nd</sup> Edition

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- Ballot approved in 2009
- Comment Resolution stage 2
  - 600 comments at the ballot stage
  - Group working to resolve each comment
  - Agreed, Disagree or committee to discuss
- Earlier draft received 500 comments (reviewed in 2007-2008)

# API-RP556

## Current Version – 2<sup>nd</sup> Edition

### Structure

- Measurement
  - Temperature
  - Draft and Pressure
  - Flow
  - Analyzers
  - Flame Monitoring
- Process Control Systems
- Protective Instrumentation and Protective Functions (15 parts)

## Technical Issues-Measurement

- Use of pressure and draft
  - Instrument language vs. fired heater mechanical language
- Adopting new analyzer technologies
  - Laser technology
  - Next Generation O<sub>2</sub> Monitors
  - Emission Requirements
  - Combustibles/CO

## Technical Issues-Measurement

- Flame Monitoring
  - Ionization Rods
  - Flame Scanners
  - Pilots and/or main flames
  - Indicator, Permissive or Trip Initiator

## Technical Issues-Process Control Systems

- Reduced Firing Mode or Heater Trip
- Continuous Pilots or No Pilots
  - Different major oil companies have different practices

# API-RP556 – Technical Issues

## Protective Instrumentation and Protective Functions

### Technical Issues- Protective Functions

- Safety or Asset Protection
- Alternate paths to: Flame Instability, Loss of Flame or Small Tube Leak leading to accumulation in the firebox
  - Total loss of flame (process safety time < 10 seconds)
  - Rapid accumulation (process safety time < 15 seconds)
  - Gradual accumulation (process safety time > 15 seconds)

# API-RP556 – Technical Issues

## Protective Instrumentation and Protective Functions

### Technical Issues- Protective Functions

- 15 process hazards analyzed
- Common Format for each item
  - **Process Hazard Defined**
  - **Considerations related to each hazard**
  - **Control overrides**
  - **Alarms**
  - **Protective Functions**

# Inside API's RP556

- Background
- Types of Industry Documents
- API RP556-Update

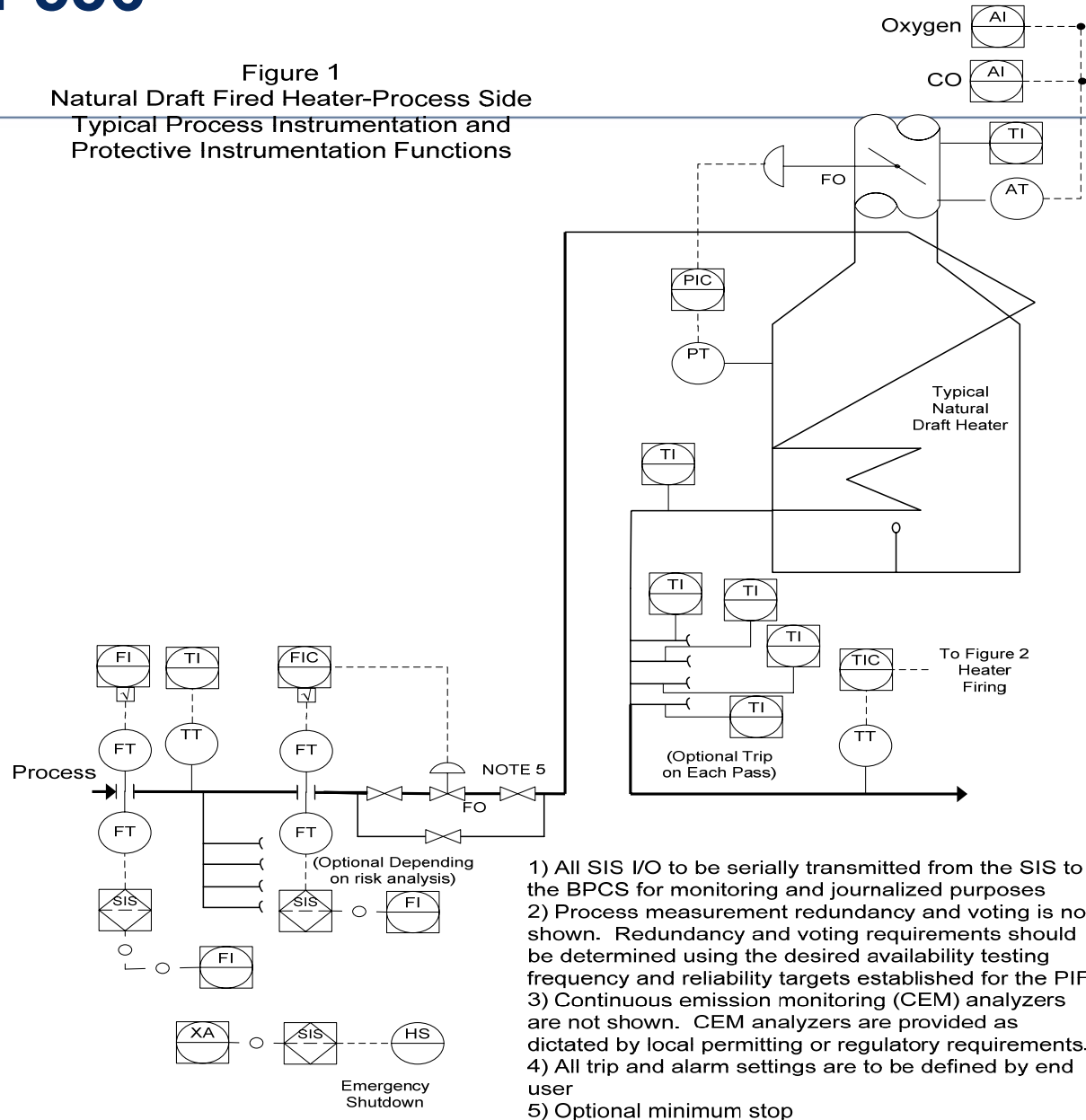
Q&A

# Inside API's RP556

## Back-Up Material



Figure 1  
Natural Draft Fired Heater-Process Side  
Typical Process Instrumentation and  
Protective Instrumentation Functions



- 1) All SIS I/O to be serially transmitted from the SIS to the BPCS for monitoring and journalized purposes
- 2) Process measurement redundancy and voting is not shown. Redundancy and voting requirements should be determined using the desired availability testing frequency and reliability targets established for the PIF.
- 3) Continuous emission monitoring (CEM) analyzers are not shown. CEM analyzers are provided as dictated by local permitting or regulatory requirements.
- 4) All trip and alarm settings are to be defined by end user
- 5) Optional minimum stop

Figure 2  
 Forced Draft Fired Heater-Fuel Side  
 Typical Process Instrumentation and Protective Instrumentation Functions

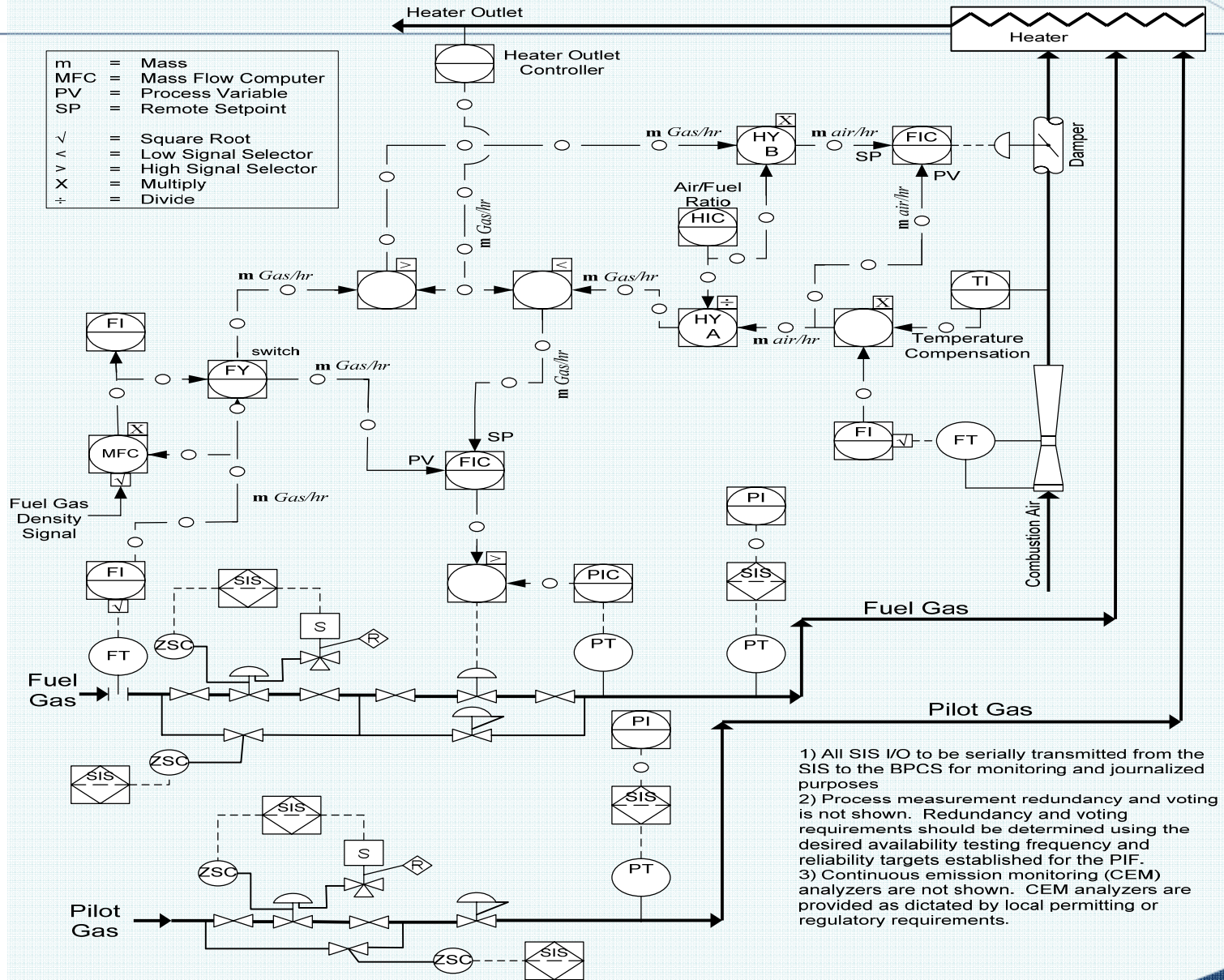


Figure 3  
Natural Draft Fired Heater-Fuel Side  
Typical Process Instrumentation and Protective Instrumentation Functions

