First Revision No. 106-NFPA 86-2012 [Chapter NFPA]

7.4.10.2*

The number of safety shutoff valve cycles shall be determined by one of the following ways:

2. Estimated time to reach 90% of lifetime total cycles based upon normal cycling rates.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 16:50:59 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: This revision is based on the TIA that was needed to correct an unintended impact of new wording.

First Revision No. 28-NFPA 86-2012 [Chapter NFPA]

13.5.7.4 Means shall be provided for metering and controlling the flow rates of all fluids comprising the special atmosphere for a furnace.

(A) Devices with visible indication of flow shall be used to meter the flows of carrier gases, carrier gas component fluids, inert purge gases, enrichment gases, or air.

(B)* Devices that meter the flow of inert purge gases shall meter and visibly indicate the flow rate by mechanical means.

(C) The installation of flow control equipment shall meet the following criteria:

1. It shall be installed either at the furnace, at the generator, or in a separate flow control unit.
2. It shall be accessible and located in an illuminated area so that its operation can be monitored.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 11:35:10 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The TIA 11-2 addresses Class C ovens and not Class D ovens as such it was relocated to the correct section in the Class C Chapter. This revision and the added annex clarifies that the visual indication of flow is to be provided by mechanical means and not solely by electrical means, see FR-119-NFPA 86-2012.

Committee Notes:

Date Submitted By
Jan 2, 2013 Duval

TIA - Accepted as revised. Note that the text is slightly different than the TIA. Also, as it was entered as Global PI, it does not show up in the body of the text.

Public Input No. 9-NFPA 86-2012 [Chapter NFPA]
1.1.7
This standard shall not apply to the following:

(1)* Coal or other solid fuel–firing systems

(2) Listed equipment with a heating system(s) that supplies a total input not exceeding 150,000 Btu/hr (44 kW)


(4)* Fluid heaters as defined in NFPA 87, *Recommended Practice on Fluid Heaters* where either of the following conditions exist:

- Fluid is flowing under pressure in tubes or pipes and is indirectly heated by combustion of liquid or gas fuel or an electrical source.
- Fluid is heated indirectly by products of combustion of liquid or gas fuel flowing through tubes (firetube).

(5) Electric arc furnaces and submerged arc furnaces
First Revision No. 74-NFPA 86-2012 [New Section after 3.3.2.4]

3.3.2.4. Process Control Air.
Air introduced to a furnace containing a special atmosphere to establish a controlled oxygen level or carbon potential.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:10:06 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Definition added for clarity in using the term in Class C furnaces.
Public Input No. 32-NFPA 86-2012 [New Section after 3.3.2.4]

First Revision No. 75-NFPA 86-2012 [New Section after 3.3.2.4]

3.3.2.1. Burnout Air.
Air introduced into a furnace chamber for the purpose of burning out flammable atmospheres, residual soot, or other carbonaceous material.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:11:27 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Definition to be added for clarity in using the term in Class C furnaces.
Response Message: FR-75-NFPA 86-2012
Public Input No. 33-NFPA 86-2012 [New Section after 3.3.2.4]
3.3.6* Burner Management System

The field devices, logic system, and final control elements dedicated to combustion safety and operator assistance in the starting and stopping of fuel preparation and burning equipment and for preventing misoperation of and damage to fuel preparation and burning equipment.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 00:23:35 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The term Burner Management System is used to describe the Logic Systems covered in Section 8.3, see FR-80-NFPA 86-2012. The proposed definition from the 2011 edition of NFPA 85, Boiler and Combustion Systems Hazards Code.
Response Message: FR-16-NFPA 86-2012

Committee Notes:

Committee Notes:

Date Submitted By
3.3.18 Flame Failure Response Time (FFRT).
The period of time that starts with the loss of flame and ends with the loss of flame signal from the combustion safeguard.

Committee Statement and Meeting Notes
Committee Statement: The Committee added definition to flame failure response time, a term that is used within the standard. See FR-143-NFPA 86-2012 for the definition of Flame Response Time (FRT).
Response Message: FR-81-NFPA 86-2012

3.3.20 Flame Response Time (FRT).
The period of time that starts with the loss of flame and ends with the de-energizing of the shutoff valve(s).

Committee Statement and Meeting Notes
Committee Statement: The Committee added a definition to flame response time, a term that is used within the standard. See FR-81-NFPA 86-2012 for an additional definition for the clarification between flame response time and flame failure response time.
Response Message: FR-143-NFPA 86-2013
3.3.27.4* Class B Furnace.  
An oven or furnace that has heat utilization equipment wherein there are no flammable volatiles or combustible materials being heated.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:12:33 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee added annex material, see FR-11-NFPA 85-2012, for clarification on Class B Ovens.
Response Message: FR-10-NFPA 86-2012

3.3.32* Hardwired.  
The method of interconnecting signals or interlocks to a logic system or between logic systems using a dedicated interconnection for each individual signal.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:31:49 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Adds a new definition for a term that is used in the standard. See FR-144-NFPA 86-2012 for the additional informational material for further clarification on the definition of hardwired.

Public Input No. 135-NFPA 86-2012 [New Section after 3.3.29]
First Revision No. 99-NFPA 86-2012 [Section No. 3.3.30.8]

3.3.33.8 Radiant Tube Heating System.
A heating system with tubular elements open at one or both ends in which each tube has an inlet burner arrangement where combustion is initiated, a suitable length where combustion occurs, and an outlet that discharges outside the work chamber for the combustion products formed.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:43:41 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee had become aware of a user that had developed a radiant tube heating system in which the products of combustion were released directly into the combustion chamber rather than outside or into an exhaust stack or header. Therefore, if a burner were to have a leak, the gas could be discharge into the combustion chamber which is not normal to radiant tube burners. Additionally, if you treat the system as a direct fired, because of a nearly 25 foot combustion sleeve, the flame is not present in the combustion chamber to provide an ignition source for unburned gases. So it really does not fall into either style of system and needs to have special considerations. The Committee changed the submitter's definition; combustion to work.

Public Input No. 139-NFPA 86-2012 [Section No. 3.3.30.8]
3.3.51 Pilot.
   A flame that is used to light the main burner.

3.3.51.1 Burn-off Pilot.
   A pilot that ignites the flame curtain or special processing atmosphere discharging from the furnace or generator.

3.3.51.2 Continuous Pilot.
   A pilot that burns throughout the entire period that the heating equipment is in service, regardless of whether the main burner is firing.

3.3.51.3 Flame Curtain Pilot.
   A pilot that ignites a flame curtain.

3.3.51.4 Intermittent Pilot.
   A pilot that burns during light-off and while the main burner is firing.

3.3.51.5 Interrupted Pilot.
   A pilot that is ignited and burns during light-off and is automatically shut off at the end of the trial-for-ignition period of the main burner(s).

3.3.51.6 Proved Pilot.
   A pilot whose flame is supervised by a combustion safeguard that senses the presence of the pilot flame.

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Fri Nov 30 10:13:38 EST 2012

Committee Statement and Meeting Notes

Committee Statement: Added new definition, as this term is used in the document, in Chapter 13 in particular, see FR-142-NFPA 86-2012.
Committee Notes:

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<tr>
<td>Nov 30, 2012 Derek Duval</td>
<td>Not shown legislatively correct. Only flame curtain pilot definition was added and removed from burn-off pilot definition.</td>
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3.3.55 Pressure Regulator.
A device placed in a gas line for reducing, controlling, and maintaining the pressure in that portion of the piping system downstream of the device.

3.3.55.1 Line Pressure Regulator.
A pressure regulator placed in a gas line between the service regulator and the appliance (equipment) regulator.

3.3.55.2 Monitoring Pressure Regulator.
A pressure regulator in a nonregulated state and set in series with another pressure regulator for the purpose of automatically taking over, in an emergency, control of the pressure downstream of the regulator in cases where pressure exceeds a set maximum.

3.3.55.3 Series Pressure Regulator.
A pressure regulator in series with one service or line pressure regulator.

3.3.55.4 Service Pressure Regulator.
A pressure regulator installed by the serving gas supplier to reduce and limit the service line gas pressure to delivery pressure.

3.3.56 Pressure Relief Valve.
A valve that automatically opens and closes a relief vent, depending on whether the pressure is above or below a predetermined value.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 18:03:30 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee added new definitions to reflect the added content in overpressure protection in FR-116-NFPA 86-2012. This new definitions do not replace current definitions, just renumber.
Committee Notes:
Date Submitted By
Nov 28, 2012 Duval
This revision does not replace any current definitions, adds new definitions and renumber current definitions.

First Revision No. 91-NFPA 86-2012 [New Section after 3.3.53]

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 14:49:16 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: A definition is required for the term “Safety Ventilation”, which is used in the standard. The Committee wanted to clarify that the LFL can be below the maximum permitted. See FR-92-NFPA 86-2012 for the associated annex material.

Public Input No. 64-NFPA 86-2012 [New Section after 3.3.53]
3.3.57 Proven Ventilation.
A supply of fresh air to, and exhaust from, a furnace that provides a vigorous, distributed flow of air through all sections of the furnace, such that flammable vapor concentrations in all parts of the furnace or furnace enclosure are maintained below the lower flammable limit all the time.

3.3.57.1 Safety Ventilation.
The ventilation necessary to dilute atmosphere within a Class A oven to not exceed the maximum permitted percent of the Lower Flammable Limit (LFL).
4.1.1.4

If a furnace is modified and/or its process load is changed from the original design, the furnace class shall be evaluated and either confirmed to remain as the original class or reassigned to a new class.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:18:48 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: If there are modifications to an existing furnace and/or process load, there is the possibility that the furnace class could change. A change in class would cause different requirements to apply. Because of this possibility, the Committee believes that the furnaces need to be evaluated to ensure that the proper requirements are applied.


Public Input No. 96-NFPA 86-2012 [New Section after 4.1.1.2]

5.2.4

Furnaces shall withstand the strains imposed by expansion and contraction, as well as static and dynamic mechanical loads.

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Mon Nov 26 11:23:50 EST 2012

Committee Statement and Meeting Notes

Committee Statement: Raise awareness of additional loads that might be required for equipment, see FR-144-NFPA 86-2012 for the added annex material.

First Revision No. 101-NFPA 86-2012 [Section No. 6.2.6.4]

6.2.6.4*
Fuel gas regulators, ratio regulators, and zero governors shall not be required to be vented to an approved location in the following situations:

1. Where backloaded from combustion air lines, air–gas mixture lines, or combustion chambers, provided that gas leakage through the backload connection does not create a hazard
2. Where a listed regulator–vent limiter combination is used
3. Where a regulator system is listed for use without vent piping
4. A regulator incorporating a leak limiting system, which prevents or restricts the escape of gas into a space large enough and with sufficient natural ventilation so that the escaping gas does not present a hazard

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:52:30 EDT 2012

Committee Statement and Meeting Notes
Committee Statement:
Recommending the use of listed regulator/vent limiter combinations essentially limits the use of the vent limiting devices to 5 PSI maximum, because the regulator standard for which such listings can be done has a limited scope of 5 PSI, 2 PSI or 1/2 PSI. The revision removes the listing combination barrier and directs the user's attention to specifically check the ratings of the limiter, and it codifies language for the use of other types of devices that limit the escape of gas into ambient if the atmospheric diaphragm ruptures. Examples of devices currently used today are safety diaphragms and ventilation valves. See also annex A.6.2.6.4 for the selection of the 2.5 ft³/h limit, see FR-102-NFPA 86-2012.

Response Message:
FR-101-NFPA 86-2012

Public Input No. 167-NFPA 86-2012 [Section No. 6.2.6.4]
First Revision No. 2-NFPA 86-2012 [New Section after 6.2.6.8]

6.2.6.8
Vent lines from multiple regulators and switches of a single furnace, where manifolded together, shall be piped in such a
manner that diaphragm rupture of one vent line does not backload the others.

6.2.6.8.1
Vents from systems operating at different pressure levels shall not be manifolded together.

6.2.6.8.2
Vents from systems served from different pressure-reducing stations shall not be manifolded together.

6.2.6.8.3
Vents from systems using different fuel sources shall not be manifolded together.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 15:48:39 EDT 2012

Committee Statement and Meeting Notes

Committee: NFPA 86 currently does not prohibit manifolding vent lines from different pressure sources, but it is good engineering
Statement: practice to avoid doing this and NFPA 85, Boiler and Combustion Systems Hazards Code, prohibits it. The new language
matches current text in NFPA 85 (2011), Section 4.9.3.
Response: FR-2-NFPA 86-2012
Message: Public Input No. 44-NFPA 86-2012 [New Section after 6.2.6.8]
First Revision No. 3-NFPA 86-2012 [Section No. 6.2.6.9]

6.2.6.9
The size of the vent manifold specified in section 6.2.6.8 shall be not less than the cross-sectional area of the manifold line shall not be less than the greater of the following:

1. The cross-sectional area of the largest vent plus 50 percent of the sum of the cross-sectional areas of the additional vent lines.

2. The sum of the cross-sectional areas of the two largest vent lines.

Supplemental Information

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Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 15:55:17 EDT 2012

Committee Statement and Meeting Notes

Committee: NFPA 86 currently does not prohibit manifolding vent lines from different pressure sources, but it is good engineering practice to avoid doing this and NFPA 85, Boiler and Combustion Systems Hazards Code, prohibits it. The new language matches the text from NFPA 85 (2011), Section 4.9.3.

Response: FR-3-NFPA 86-2012
Message: Public Input No. 45-NFPA 86-2012 [Section No. 6.2.6.9]
First Revision No. 116-NFPA 86-2012 [New Section after 6.2.6.10]

6.2.7 Overpressure Protection

6.2.7.1 Overpressure protection shall be provided in either of the following cases:

(1) When the supply pressure exceeds the pressure rating of any downstream component

(2) When the failure of single upstream line regulator or service pressure regulator results in a supply pressure exceeding the pressure rating of any downstream component

6.2.7.2 Overpressure protection shall be provided by any one of the following:

(1) A series regulator in combination with a line regulator or service pressure regulator

(2) A monitoring regulator installed in combination with a line regulator or service pressure regulator

(3) A full-capacity pressure relief valve

(4) An overpressure cutoff device, such as a slam-shut valve or a high-pressure switch in combination with an adequately rated shutoff valve

6.2.7.3* When a relief valve is used to comply with 8.2.10, the relief valve shall be a full-capacity relief type.

6.2.7.4 Token relief valves and internal token relief valves shall not be permitted to be used as an OPD.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submit Date: Wed Oct 24 17:57:06 EDT 2012

Committee Statement and Meeting Notes

Committee: Relocating the concept from chapter 8 to chapter 6 to place in the appropriate section. The Committee also expanded the content to provide further guidance on the topic. See FR-138-NFPA 86-2012 for the annex material to further clarify the requirements.


Message:
First Revision No. 103-NFPA 86-2012 [Section No. 6.3.8.3]

6.3.8.3
Pilot burners shall be considered burners, and all provisions of Section 6.2 shall apply.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:57:40 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:
Reference should be to the oil fired section 6.3, not to the gas fired section 6.2. This was a copy-paste editing error, see 6.2.10.3 for the corresponding fuel gas requirement.

Response Message:
FR-103-NFPA 86-2012

Committee Notes:
Date Submitted By
Nov 28, 2012 Duval Not shown legislatively correct.

Public Input No. 89-NFPA 86-2012 [Section No. 6.3.8.3]

First Revision No. 14-NFPA 86-2012 [Section No. 6.5.2]

6.5.2
The following shall apply to collecting and venting systems for radiant tube–type heating systems:

(1) The system shall be of a capacity to prevent an explosion or fire hazard due to the flow of unburned fuel through the radiant tubes.

(2) The system shall be capable of dilution of the rated maximum input capacity of the system to a noncombustible state.

(3) A radiant tube–type heating system provided with two safety shutoff valves interlocked with combustion safeguards shall be exempt from the requirements of 6.5.2.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:22:33 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Added annex material, see FR-15-NFPA 86-2012.
Response Message: FR-14-NFPA 86-2012
Public Input No. 97-NFPA 86-2012 [Section No. 6.5.2]
First Revision No. 93-NFPA 86-2012 [New Section after 7.1.6]

7.1.7*  
A confirmed source of combustible gas shall be provided to the inlet of the equipment isolation valve(s) (see 6.2.4.1 and 13.5.11.10.2.1) each time a combustible gas supply is placed into service or restored to service.

Submitter Information Verification

Submitter Full Name:  [ Not Specified ]
Organization:  [ Not Specified ]
Submittal Date:  Wed Oct 24 15:24:59 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:  This revision originates from Tentative Interim Amendment 86-11-3 (TIA 1010) issued by the Standards Council on March 1, 2011. The U.S. Chemical Safety and Hazard Investigation Board (CSB) requested an appropriate action by NFPA 86 in response to the following fuel gas related explosion at ConAgra Foods, Garner, NC in 2009. The NFPA 86 task group elected to wait until NFPA 54 took action on this matter. NFPA 54 issued TIA 09-3 with an effective date of 08/25/10. Excerpt from NFPA 54-2009 3.3.105.1 Appliance Shutoff Valve. A valve located in the piping system used to shut off individual equipment. Excerpt from NFPA 86-2011 3.3.76.3 Equipment Isolation Valve. A manual shutoff valve for shutoff of the fuel to each piece of equipment. Note: This TIA does not address liquid fuel evacuation/purge, charging, and confirmation of liquid fuel supply. The emergency condition identified by the CSB for fuel gas discharges did not extend to liquid fuels, however, the management of liquid fuels should be considered in the next revision cycle. Emergency Nature: The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing or dangerous condition or situation. The submitter has proposed this Tentative Interim Amendment to add sections 7.1.7*, A.7.1.7, 7.4.19* and A.7.4.19 on evacuation/purging, charging, and confirmation of the fuel or combustible gas supply in the supply piping because of the Technical Committee’s awareness of incidents including the investigation findings of the U.S. Chemical Safety and Hazard Investigation Board (CSB). The current requirements of the NFPA 86 Standard provide a performance approach to establishing safe conditions but does not provide any requirements for the evacuation/purging, charging, and confirmation of the fuel or combustible gas supply contained within the fuel or combustible gas supply piping nor any requirements defining the quality of the fuel or combustible gas being delivered by piping systems governed by NFPA 54 National Fuel Gas Code and other Codes and Standards. The submitter and members of the NFPA 86 Technical Committee wish to draw attention to this potential hazard by the addition of the proposed requirements and Annex referencing NFPA 54’s related requirements.


Public Input No. 174-NFPA 86-2012 [New Section after 7.1.6]
First Revision No. 104-NFPA 86-2012 [ New Section after 7.3.1 ]

7.3.2
Personnel instructed and trained per 7.2.1 shall be present within the facility when Class C or D furnaces are operating with material movement, unless the design or a hazard analysis permits unattended operation.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Wed Oct 24 16:04:21 EDT 2012

Committee Statement and Meeting Notes
Committee Statement:
To clarify that the trained operators must be present when equipment is operated. The Committee understands that some furnaces are designed for unattended operation and as such changed the text.
Response Message:
FR-104-NFPA 86-2012

First Revision No. 30-NFPA 86-2012 [ Section No. 7.4.10.1 ]

7.4.10.1
Safety shutoff valves used to comply with 8.5.1.8(4) that are not proved closed shall be replaced before they exceed their maximum allowable number of lifetime open–closed cycles.

Supplemental Information
File Name Description
FR-30.docx Correct legislative text.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 12:28:00 EDT 2012

Committee Statement and Meeting Notes
Committee Statement:
There is no definition of pulse fired. The Committee clarified both submitters intent by adding a reference to section 8.5.1.8(4) which relates to pulse fired operations and similar rapid cycling of SSOV operations.
Response Message:
FR-30-NFPA 86-2012
Committee Notes:
Date Submitted By
Nov 9, 2012 Duval FR does not show legislative text correctly, to see correct text and changes click "hide markup" or see attached.

Public Input No. 137-NFPA 86-2012 [Section No. 7.4.10]
Public Input No. 161-NFPA 86-2012 [Section No. 7.4.10.1]
7.4.19* Whenever combustible gas piping is placed into service or removed from service, any release of combustible gas shall be vented to an approved location.

Submission Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]

Committee Statement and Meeting Notes

Committee Statement: This revision originates from Tentative Interim Amendment 86-11-3 (TIA 1010) issued by the Standards Council on March 1, 2011. The U.S. Chemical Safety and Hazard Investigation Board (CSB) requested an appropriate action by NFPA 86 in response to the following fuel gas related explosion at ConAgra Foods, Garner, NC in 2009. The NFPA 86 task group elected to wait until NFPA 54 took action on this matter. NFPA 54 issued TIA 09-3 with an effective date of 08/25/10. Excerpt from NFPA 54-2009 3.3.105.1 Appliance Shutoff Valve. A valve located in the piping system used to shut off individual equipment. Excerpt from NFPA 86-2011 3.3.76.3 Equipment Isolation Valve. A manual shutoff valve for shutoff of the fuel to each piece of equipment. Note: This TIA does not address liquid fuel evacuation/purging, charging, and confirmation of liquid fuel supply. The emergency condition identified by the CSB for fuel gas discharges did not extend to liquid fuels, however, the management of liquid fuels should be considered in the next revision cycle. Emergency Nature: The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing or dangerous condition or situation. The submitter has proposed this Tentative Interim Amendment to add sections 7.1.7*, A.7.1.7, 7.4.19* and A.7.4.19 on evacuation/purging, charging, and confirmation of the fuel or combustible gas supply in the supply piping because of the Technical Committee’s awareness of incidents including the investigation findings of the U.S. Chemical Safety and Hazard Investigation Board (CSB). The current requirements of the NFPA 86 Standard provide a performance approach to establishing safe conditions but does not provide any requirements for the evacuation/purging, charging, and confirmation of the fuel or combustible gas supply contained within the fuel or combustible gas supply piping nor any requirements defining the quality of the fuel or combustible gas being delivered by piping systems governed by NFPA 54 National Fuel Gas Code and other Codes and Standards. The submitter and members of the NFPA 86 Technical Committee wish to draw attention to this potential hazard by the addition of the proposed requirements and Annex referencing NFPA 54’s related requirements.


Public Input No. 175-NFPA 86-2012 [New Section after 7.4.18]
First Revision No. 8-NFPA 86-2012 [Section No. 8.2.1, 8.2.2]

8.2.1
All safety devices shall meet one of the following criteria:

- Be listed for the service intended
- Be approved if listed devices are not available
- Be programmable controllers applied in accordance with Section 8.4

3.3.69 A.13.5.11.11.12(D)
Combustion safeguards, excess temperature limit interlocks, and safety shutoff valves shall be listed for combustion safety service or approved if a listed device is not commercially available.

8.2.2
Safety devices not identified in 8.2.1 shall be listed for the service intended or approved if a listed device is not commercially available.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:05:51 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: New text clarifies types of acceptable devices. Certain types (combustion safeguards, excess temperature limit interlocks and safety shutoff valves) require separate listing for combustion safety service. The Committee added annex material to help clarify when approving devices when listed devices are not available, see FR-118-NFPA 86-2012. The new 8.2.2 does not replace the existing 8.2.2. The subsequent sections are to be renumbered.
Response Message:
Committee Notes:

Committee Notes:

Submitted By

Nov 6, 2012 Duvall

Renumber the subsequent sections. DO NOT DELETE EXISTING 8.2.2.

Public Input No. 50-NFPA 86-2012 [Section No. 8.2.1]
First Revision No. 107-NFPA 86-2012 [Section No. 8.2.7.2]

8.2.8.2
The requirement in 8.2.8 shall not prohibit a time delay applied to the action of pressure-proving, flow-proving, or proof-of-closure safety switch as used in accordance with 8.8.1.3(3)(c), where the following conditions exist:

1. There is an operational need demonstrated for the time delay.
2. The use of a time delay is approved.
3. The time delay feature is not adjustable beyond 5 seconds.
4. A single time delay does not serve more than one pressure-proving or flow-proving safety device.
5. The time from an abnormal pressure or flow condition until the holding medium is removed from the safety shutoff valves does not exceed 5 seconds.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 16:52:40 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: 8.8.1.3(3)(c) deals with the application of proof, the entire 8.8.1.3(3).
Committee Notes:

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<tr>
<td>Nov 28, 2012</td>
<td>Duval</td>
<td>Not shown legislatively correct. The only thing that should be stricken is (c)</td>
</tr>
</tbody>
</table>

First Revision No. 22-NFPA 86-2012 [Section No. 8.2.8]

8.2.9
At least one manual emergency switch shall be provided to initiate a safety shutdown.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 00:49:55 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee revised the current text that implies there is to be a single manual emergency switch. Depending upon the type of furnace there maybe multiple manual emergency switches to address the multiple "safety" hazards of the furnace. All of the furnace’s safety hazards should be evaluated and a manual emergency "system" should be designed/incorporated into the furnace design.

Public Input No. 168-NFPA 86-2012 [Section No. 8.2.7.2]

Public Input No. 117-NFPA 86-2012 [Section No. 8.2.8]
8.2.10*
A safety shutdown of the heating system by any safety feature or safety device shall require manual intervention of an operator for re-establishment of normal operation of the system.

Committee Statement and Meeting Notes
Committee Statement: The Committee believes that the revised section and the added annex material meets the submitter’s intent on when manual intervention is required, see the added annex in FR-120-NFPA 86-2012.

8.2.11*
Where transmitters are used in place of switches for safety functions, the following shall apply:
(1) The transmitter shall be safety integrity level (SIL) 2 capable.
(2) The transmitter shall be dedicated to safety service unless listed for simultaneous process and safety service.

Committee Statement and Meeting Notes
Committee Statement: Relocates text from 8.4.4 and modifies requirement from PLC subsection and makes it generally applicable to all safety control systems (including hardwired), see FR-83-NFPA 86-2012 for the deletion of this text in 8.4.4. Use of MTBF (Mean Time Between Failures) is ambiguous as to the type of failure mode. MTBF does not distinguish if the safety function is compromised. A Probability of Failure on Demand (PFD) measures the failure rate that compromises the safety function. A transmitter that is SIL-2 capable has met or exceeded a PFD defined by IEC61508 as well as other fault criteria. Requiring the transmitter be SIL-2 capable simplifies the selection. SIL-2 capable transmitters are readily available, so this requirement would not cause an undue burden.
8.2.11

If the inlet pressure to a fuel pressure regulator exceeds the pressure rating of any downstream component, overpressure protection shall be provided.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 17:52:27 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee removed this section and relocated with new proposed language to a new section 6.2.7 (before original 6.2.7, but renumbering. See FR-116-NFPA 86-2012).
Response: FR-115-NFPA 86-2012
Message: REMOVE ANNEX TO THIS SECTION

Committee Notes:

Date Submitted By
Oct 24, 2012 Duval
8.3* Burner Management System, Logic Systems.

8.3.1 General.

8.3.1.1 Purge, and ignition trials, and other burner safety sequencing shall be performed using either devices listed for such service or programmable controllers used in accordance with Section 8.4. 

8.3.1.2 The activation of any safety interlock required in Chapter 8 shall result in a safety shutdown.

8.3.1.3 Safety interlocks shall meet one or more of the following criteria:

1. Be hardwired without relays in series ahead of the controlled device
2. Be connected to an input of a programmable controller logic system complying with Section 8.4
3. Be connected to a relay that represents a single safety interlock configured to initiate safety shutdown in the event of power loss
4. Be connected to a listed safety relay that represents one or more safety interlocks and initiates safety shutdown upon power loss

8.3.1.4* Electrical power for safety control circuits shall be dc or single-phase ac, 250 volt maximum, one-side grounded, with all breaking contacts in the ungrounded, fuse-protected, or circuit breaker-protected line.

8.3.2 Hardwired Logic Systems.

8.3.2.1 Safety interlocks shall meet one or more of the following criteria:

1. Be hardwired without relays in series ahead of the controlled device
2. Be connected to an input of a programmable controller logic system complying with Section 8.4
3. Be connected to a relay that represents a single safety interlock configured to initiate safety shutdown in the event of power loss
4. Be connected to a listed safety relay that represents one or more safety interlocks and initiates safety shutdown upon power loss

8.3.2.1* Electrical power for safety control circuits shall be dc or single-phase ac, 250 volt maximum, one-side grounded, with all breaking contacts in the ungrounded, fuse-protected, or circuit breaker-protected line.
8.4* Programmable Logic Controller Systems.

8.4.1 Programmable logic controller (PLC)-based systems listed for combustion safety service shall be used in accordance with the listing requirements and the manufacturer's instructions.

8.4.2 PLCs, except those not listed for combustion safety service, shall be used in accordance with and associated I/O used to perform safety functions shall be certified to IEC 61508 for use in safety applications with a safety integrity level of 2 or greater, 8.4.2.1 through 8.4.2.3.

8.4.2.1 The safety functions shall be implemented according to the device's safety manual requirements to achieve a safety integrity level of 2 or greater.

8.4.2.2 General.

(A) Before the PLC is placed in operation, documentation shall be provided that confirms that all related safety devices and safety logic are functional.

(B) All changes to hardware or software shall be documented and maintained in a file that is separate from the furnace programmable controller.

(C) System operation shall be tested and verified for compliance with the design criteria when the PLC is replaced, repaired, or updated.

(D) The control system shall have at least one manual emergency switch that initiates a safety shutdown.

(E) The PLC shall detect the following conditions:

1. Failure to execute any program or task containing safety logic
2. Failure to communicate with any safety input or output
3. Changes in software set points of safety functions
4. Failure of outputs related to safety functions
5. Failure of timing related to safety functions

(F) A safety shutdown shall occur within 3 seconds of detecting any condition listed in 8.4.2.1(E).

(G) A dedicated PLC output shall initiate a safety shutdown for faults detected by the PLC.

(H) Unless allowed by 8.4.5(e), the following devices and logic shall be hardwired external to the PLC:

1. Manual emergency switch
2. Combustion safeguards
3. Safe start checks
4. Ignition transformers
5. Trial-for-ignition periods
6. Excess temperature limit interlocks
7. The 1400°F (760°C) bypass interlocks required by Section 8.17
8. Continuous vapor concentration high limit controller
9. Valve-proving systems

(I) Unless allowed by 8.4.5(f), a combustion safeguard shall directly control at least one safety shutoff valve between the fuel gas supply and the monitored burner.

(J) Unless allowed by 8.4.5(g), where two oxygen safety shutoff valves are required, combustion safeguards shall control at least one oxygen safety shutoff valve.
Where airflow proving logic is performed in the PLC, the logic shall include the following:

1. Verification of a change of state in each airflow proving device during the startup of the related ventilation equipment
2. Initiation of a safety shutdown if a change of state in an airflow proving device is not detected

8.4.2.3 Software.
(A) Access to the PLC and its logic shall be restricted to authorized personnel.
(B) Software shall be documented as follows:
   (1) Labeled to identify elements or a group of elements containing safety software
   (2) Labeled to describe the function of each element containing safety software

(C) A listing of the program with documentation shall be available.

8.4.2.3 Hardware.
(A) Memory that retains information on loss of system power shall be provided for software.
(B) The PLC shall have a minimum mean-time-between-failures (MTBF) rating of 250,000 hours.
(C) Only one safety device shall be connected to a PLC input or output.
(D) Output checking shall be provided for PLC outputs controlling fuel safety shutoff valves and oxygen safety shutoff valves.

8.4.2.4 Software.
(A) Access to the PLC and its logic shall be restricted to authorized personnel.
(B) The following power supplies shall be monitored:
   (1) Power supplies used to power PLC inputs and outputs that control furnace safety functions
   (2) Power supplies used to power pressure and flow transmitters required by 8.4.4

(C) When any power supply required by 8.4.2.3(B) (1) fails, the dedicated PLC output required in 8.4.2.1(G) shall be deactivated.
(D) When the voltage of any power supply required by 8.4.2.3(B) (2) is detected outside the manufacturer's recommended range, the dedicated PLC output required in 8.4.2.1(G) shall be deactivated.
(E) Software shall be documented as follows:
   (1) Labeled to identify elements or group of elements containing safety software
   (2) Labeled to describe the function of each element containing safety software

(F) A listing of the program with documentation shall be available.

8.4.3 General purpose PLCs shall be permitted to perform the purge timing function.

8.4.4 Safety PLCs.
(A) Where used for combustion safety service, safety programmable logic controllers shall have the following characteristics:
   (1) The processor and the input and output (I/O) shall be listed for control reliable service with an SIL rating of at least 2.
   (2) Access to PLCs dedicated to safety functions shall be restricted.
   (3) Nonsafety functions, where implemented, shall be independently accessible from safety functions.
   (4) All safety function sensors and final elements shall be independent of operating sensors and final elements.
Safety PLCs shall not implement the following:

1. Manual emergency switches
2. Continuous vapor concentration high-limit controllers

8.4.5
PLCs shall not implement the following:

1. Manual emergency switches
2. Continuous vapor concentration high-limit controllers

8.4.3
PLCs that do not comply with 8.4.1 or 8.4.2 shall comply with the following:

1. The PLC shall not perform required safety functions.
2. The PLC shall not interfere with or prevent the operation of the safety interlocks.
3. Only isolated PLC contacts shall be used in the required safety circuits.

8.4.4
Where PLC-based systems use flow transmitters in place of flow switches and pressure transmitters in place of pressure switches for safety functions, the following shall apply:

1. The transmitter shall be listed, possess a MTBF rating of 250,000 hours, or possess a safety integrity level (SIL) rating of 2.
2. Upon transmitter failure, the PLC shall detect the failure and initiate a safety shutdown.
3. The transmitter shall be dedicated to safety service unless listed for simultaneous process and safety service.

8.4.6 Safety PLCs -

(A)
Where used for combustion safety service, safety programmable logic controllers shall have the following characteristics:

1. The processor and the input and output (I/O) shall be listed for control reliable service with an SIL rating of at least 2.
2. Access to PLCs dedicated to safety functions shall be restricted.
3. Non-safety functions, where implemented, shall be independently accessible from safety functions.
4. All safety function sensors and final elements shall be independent of operating sensors and final elements.

(B)
Safety PLCs shall not implement the following:

1. Manual emergency switches
2. Continuous vapor concentration high-limit controllers
3. Combustion safeguards
4. Excess temperature limit interlocks

Committee Statement and Meeting Notes

Committee: General revisions to sections 8.3 and 8.4 to clarify Committee intent regarding logic systems and the application of PLC’s.

Statement: Regarding paragraph 8.4.4, the use of MTBF (Mean Time Between Failures) is ambiguous as to the type of failure mode. MTBF does not distinguish if the safety function is compromised. A Probability of Failure on Demand (PFD) measures the failure rate that compromises the safety function. A transmitter that is SIL 2 capable has met or exceeded a PFD defined by IEC61508 as well as other fault criteria. Requiring the transmitter be SIL 2 capable simplifies the selection. SIL 2 capable transmitters are readily available, so this requirement would not cause an undue burden. Combustion safeguard was removed from the safety PLC because it is a physical component that cannot be part of the logic system. The Committee believes that Safety PLCs should be able to perform flame sensing and it should not be excluded here. Similarly, Safety PLCs are
permitted to do ignition timing, purge timing, safe start check, low temperature permissive, limits monitoring, the combustion sequence, and all associated logic so there is no logical reason to exclude the excess temperature safety function from Safety PLC functionality. Deletes and relocates 8.4.4 and to 8.2.11 to makes it generally applicable to all safety control systems (including hardwired). See FR-9-NFPA 86-2012.

Response FR-83-NFPA 86-2012
Message:
Committee Notes:
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<th>Date</th>
<th>Submitted By</th>
<th>Notes</th>
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<td>Nov 28, 2012</td>
<td>Duval</td>
<td>The legislative text is shown incorrectly</td>
</tr>
<tr>
<td>Nov 28, 2012</td>
<td>Duval</td>
<td>Combustion safety service is not defined, we removed combustion safety circuitry, should we replace this term as well?</td>
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Public Input No. 52-NFPA 86-2012 [Section No. 8.4.4]
Public Input No. 114-NFPA 86-2012 [Section No. 8.4.5(B)]
Public Input No. 119-NFPA 86-2012 [Section No. 8.4.2]
Public Input No. 121-NFPA 86-2012 [Section No. 8.4.3]
Public Input No. 122-NFPA 86-2012 [New Section after 8.4.5(B)]

First Revision No. 37-NFPA 86-2012 [Section No. 8.5.1.2(C)]

(C)
To begin the timed pre-ignition purge interval, all of the following conditions shall be satisfied:

(1) The minimum required pre-ignition airflow is proved.
(2) At least one safety shutoff valve(s) is proved closed between all pilot burners and the fuel supply for ovens with total pilot capacity over 400,000 Btu/hr.
(3) At least one safety shutoff valve is proved closed between all main burners and the fuel supply for ovens with total capacity over 400,000 Btu/hr.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 16:24:26 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The intent of the submitter has been met by the reference to 8.8.2.2, for proven closed requirement has been incorporated into 8.5.1.2(C). See FR-35-NFPA 86-2012 for the added annex material for 8.5.1.2(c).
Response FR-37-NFPA 86-2012
Message:
Public Input No. 43-NFPA 86-2012 [Section No. 8.5.1.2(C)]
Public Input No. 160-NFPA 86-2012 [Section No. 8.5.1.2(C)]
8.5.1.8*
Repeating the pre-ignition purge shall not be required where any one of the following conditions is satisfied:

(1) The heating chamber temperature is proved above 1400°F (760°C).
(2) For a multiburner fuel-fired system not proved above 1400°F (760°C), all of the following conditions are satisfied:
   (a) * At least one burner remains operating in the common combustion chamber of the burner to be re-ignited.
   (b) The burner(s) remaining in operation shall provide ignition of any unintended release of fuel through other burners that are not in operation without explosion.
(3) * For fuel gas–fired burner systems and assuming that all safety shutoff valves fail in the full open position, it can be demonstrated that the combustible concentration in the heating chamber and all other passages that handle the recirculation and exhaust of products of combustion cannot exceed 25 percent of the LFL.
(4) All of the following conditions are satisfied (does not apply to fuel oil systems):
   (a) At least two The number of safety shutoff valves are proved closed between a burner required to close in 8.8.1.3 and 8.8.2.1 will close between the burner system and the fuel gas supply when that burner system is off.
   (b) Safety shutoff valve seat leak testing is performed on at least a semiannual basis.
   (c) The burner system uses natural gas, butane, or propane fuel gas.
   (d) * It can be demonstrated based on the safety shutoff valve leakage rates, that the combustible concentration in the heating chamber and all other passages that handle the recirculation and exhaust of products of combustion cannot exceed 25 percent of the LFL.
   (e) The minimum airflow used in the LFL calculation in 8.5.1.8(4)(d) is proved and maintained during the period the burner(s) are off.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 12:07:20 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: This revision incorporates but changes TIA 11-4. It resolves a conflict and eliminates multiple-level referencing (a section that refers to another section). The conflict is that 8.5.1.8 (4) 'does not apply to fuel oil systems' but the original TIA 11-4 cites 8.8.1.2 which refers to 8.8.3.1 on Oil Safety Shutoff Valves. By deleting TIA 11-4’s referral to 8.8.1.2 and replacing it with 8.8.2.1, the proposed language more directly points the user to the number of valves required for fuel gas. The Committee did not incorporate the changes of PI-159 because existing requirements preclude the need for time limits. The submitter did not provide data substantiation for the time limits submitted.

Response Message:

Public Input No. 147-NFPA 86-2012 [Section No. 8.5.1.8]
Public Input No. 159-NFPA 86-2012 [Section No. 8.5.1.8]
Public Input No. 178-NFPA 86-2012 [Section No. 8.5.1.8]
8.5.2.1
The trial-for-ignition period of any pilot or main gas burner shall not exceed 15 seconds, unless both of the following conditions are satisfied:

1. A written request for an extension of the trial-for-ignition period is approved by the authority having jurisdiction.
2. It is determined that 25 percent of the LFL cannot be exceeded in the extended time.

8.5.2.2
The trial-for-ignition period of any pilot or main gas oil burner shall not exceed 15 seconds, unless both of the following conditions are satisfied:

1. A written request for an extension of the trial-for-ignition period is approved by the authority having jurisdiction.
2. It is determined that 25 percent of the LFL cannot be exceeded in the extended time.

8.5.2.3
Electrical ignition energy for direct spark ignition systems shall be terminated after the main burner trial-for-ignition period.

Exception: Continuous operation of direct spark igniters shall be permitted for explosion-resistant radiant-tube-type heating systems, which do not require combustion safeguards.
First Revision No. 27-NFPA 86-2012 [Section No. 8.6.1 [Excluding any Sub-Sections]]

Where a fan is essential to the operation of an oven or allied equipment, fan operation shall be proved and interlocked into the safety circuitry.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 10:39:17 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee clarified the breadth of the requirement and helps ensure consistency with other parts of this Standard. Additionally, the Committee added annex material to help clarify this requirement, see FR-51-NFPA 86-2012.

Public Input No. 54-NFPA 86-2012 [Section No. 8.6.1 [Excluding any Sub-Sections]]
Public Input No. 55-NFPA 86-2012 [Section No. 8.6.1]

First Revision No. 20-NFPA 86-2012 [New Section after 8.6.2]

8.6.3
In any combustion system where the combustion air supply can be diverted to an alternate flow path than a burner (e.g., to a regenerative burner system’s exhaust path), that burner’s associated combustion air flow path valve(s) shall be proved open, and its alternate air flow path valve(s) shall be proved closed, before that burner’s fuel safety shutoff valve(s) are energized.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 00:44:48 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: In a regenerative combustion system, independent combustion air and exhaust cycle valves may be used to correctly establish the simultaneous flow paths of combustion air and exhaust during each regenerative cycle. With an exhaust cycle valve incorrectly positioned during a firing cycle, fuel will be introduced into the burner without combustion air available. Even though the combustion chamber may be proven above 1400F, the exhaust system would be expected to be well below 1400F. Fuel passing to the exhaust system creates a potential hazard. This revision adds requirements to ensure combustion air and exhaust cycle valves are in the correct position prior to energizing the fuel SSOV’s.

Public Input No. 115-NFPA 86-2012 [New Section after 8.6.2]
8.7 Combustion Air Safety Devices.

8.7.1 Where air from the exhaust or recirculating fans is required for combustion of the fuel, the minimum required airflow shall be proved prior to an ignition attempt interlocked according to 8.7.

8.7.2 Reduction of airflow to a level below the minimum required level shall result in closure of the safety shutoff valves.

8.7.2 Where a combustion air blower is used, the minimum combustion airflow or source pressure needed for burner operation shall be proved prior to each attempt at ignition.

8.7.3 Motor starters on equipment required for combustion of the fuel shall be interlocked into the combustion safety circuitry, burner management system.

8.7.4* Combustion air minimum pressure or flow shall be interlocked into the combustion safety circuitry, burner management system, by any of the following methods:

1. A low pressure switch that senses and monitors the combustion air source pressure
2. A differential pressure switch that senses the differential pressure across a fixed orifice in the combustion air system
3. An airflow switch

8.7.5* Where it is possible for combustion air pressure to exceed the maximum safe operating pressure, a high pressure switch interlocked into the combustion safety circuitry, burner management system, shall be used.

8.7.6 In any combustion system where the combustion air supply can be diverted to an alternate flow path than a burner (e.g., to a regenerative burner system’s exhaust path), that burner’s associated combustion air flow path valve(s) shall be proven open, and its alternate air flow path valve(s) shall be proven closed, before that burner’s fuel safety shutoff valve(s) are energized.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:21:51 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The requirements in the newly renumbered 8.7.5 permits either airflow or air pressure interlocks. The requirements in 8.7.1 only identify airflow requirements. The revised language eliminates any possible conflict between the current requirements in 8.7.1 and those in 8.7.5. The requirement in 8.7.2 is redundant to the requirement in 8.7.5 which is to interlock airflow or pressure into the combustion safety circuitry which will result in the closure of the safety shutoff valves if the interlock is not proven. Additionally, the Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.

Response Message:

Committee Notes:

Date Submitted By
Oct 23, 2012 Duval
Change Annex references due to renumbering of this section.

Public Input No. 131-NFPA 86-2012 [Section No. 8.7.1]
Public Input No. 132-NFPA 86-2012 [Section No. 8.7.2]
First Revision No. 21-NFPA 86-2012 [New Section after 8.7.6]

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 00:46:08 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: In a regenerative combustion system, independent combustion air and exhaust cycle valves may be used to correctly establish the simultaneous flow paths of combustion air and exhaust during each regenerative cycle. With an exhaust cycle valve incorrectly positioned during a firing cycle, fuel will be introduced into the burner without combustion air available. Even though the combustion chamber may be proven above 1400°F, the exhaust system would be expected to be well below 1400°F. Fuel passing to the exhaust system creates a potential hazard. This revision adds requirements to ensure combustion air and exhaust cycle valves are in the correct position prior to energizing the fuel SSOV's.

First Revision No. 95-NFPA 86-2012 [Section No. 8.8.1.3]

8.8.1.3*
In fuel gas systems or oil systems where multiple burners or pilots operate as a burner system firing into a common heating chamber, the loss of flame signal shutting off of fuel at one or more burners either shall comply with 8.8.1.2 or shall shut off those burner(s) by closing a single safety shutoff valve as long as a second safety shutoff valve between the fuel supply, and the burners shall close when any of the following conditions occurs:
(1) Upon activation of any safety interlock common to the burner system
(2)* Where the individual burner safety shutoff valves do not have proof of closure and it is demonstrated, based on available airflow, that the number of failed burners will result in the furnace being above 25 percent of the LFL, assuming the single burner safety shutoff valve(s) fails in the open position
(3) Where individual burner safety shutoff valves have proof of closure and any of the following conditions occur:
   (a) Where flame supervision is used, the individual burner safety shutoff valve not proved closed after loss of flame signal
   (b) Where flame supervision is not used, the individual burner safety shutoff valve not proved closed when the furnace is not proved to be above 1400°F (760°C)
   (c) Upon loss of flame signal at all burners in the burner system

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:33:44 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The phrase "loss of flame signal" restricts the subsequent allowance for closing of one valve to only a combustion safeguard function. Shut off of fuel by a single valve from a temperature control function should also be allowed (where all requirements of this section are met). The annex Figure A.8.8.1.3 supports the idea of allowing "burner shutdown", i.e. controlled shut-off.
Committee Notes:
Date Submitted By
Nov 28, 2012 Duval Terra not showing legislative text correctly
Public Input No. 92-NFPA 86-2012 [Section No. 8.8.1.3]
First Revision No. 34-NFPA 86-2012 [Section No. 8.8.2.2]

8.8.2.2*
Where the capacity of the main or pilot fuel gas burner system exceeds 400,000 Btu/hr (117 kW), at least one of the safety shutoff valves between each burner and the fuel supply shall be proved closed and interlocked with the pre-ignition purge interval. A safety shutoff valve is required to be proved closed, the following shall apply:

(A) A proved closed condition shall be accomplished by either of the following means:

(1) A proof-of-closure switch incorporated in a listed safety shutoff valve assembly in accordance with the terms of the listing

(2) A valve proving system

(B) Auxiliary and closed position indicator switches shall not satisfy the proved closed requirement of 8.8.2.2(A).

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 15:45:00 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee wanted this section to explain how proving closing valves is to be accomplished. Other sections explain when proving closed is required.
Response: FR-34-NFPA 86-2012
Message: Public Input No. 157-NFPA 86-2012 [Section No. 8.8.2.2]

First Revision No. 127-NFPA 86-2012 [Section No. 8.9.1]

8.9.1
A low fuel pressure switch shall be provided and shall be interlocked into the combustion safety circuitry burner management system.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:23:32 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
Message:
First Revision No. 128-NFPA 86-2012 [Section No. 8.9.2]

8.9.2 A high fuel pressure switch shall be provided and shall meet the following criteria:

1) It shall be interlocked into the burner management system combustion safety circuitry.

2) It shall be located downstream of the final pressure-reducing regulator.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:24:35 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.

First Revision No. 125-NFPA 86-2012 [Section No. 8.10]

8.10 Combustion Safeguards and Flame Supervision

8.10.1 Combustion Safeguards

8.10.1.1 Each burner flame shall have a combustion safeguard that is interlocked into the burner management system unless otherwise permitted in 8.10.1.2.

8.10.1.2 The following burner flames shall not require a combustion safeguard:

1) Burner flames for radiant tube-type heating systems where a means of ignition is provided and the systems are arranged and designed such that either of the following conditions is satisfied:
   a) The tubes are of metal construction and open at one or both ends. If heat recovery systems are used, they shall be of explosion-resistant construction,
   b) The entire radiant tube heating system, including any associated heat recovery system, is of explosion-resistant construction.

2) Burner flames at burners interlocked with a 1400°F (760°C) bypass interlock that prevents burner operation when the temperature in the zone where the burner is located is less than 1400°F (760°C).

8.10.1.3* A combustion safeguard and the logic system shall have a flame response time of 4 seconds or less.

8.10.1.4 The logic system shall perform a safe-start check.
8.10.2 Each burner flame shall have a combustion safeguard that has a maximum flame failure response time of 4 seconds or less, that performs a safe-start check, and that is interlocked into the combustion safety circuitry in accordance with the following:

1. The flame supervision shall not be required in the combustion safety circuitry of a furnace zone where that zone temperature is greater than 1400°F (760°C) and the following criteria are met:
   a. When the zone temperature drops to less than 1400°F (760°C), the burner is interlocked to allow its operation only if flame supervision has been re-established.
   b. A 1400°F (760°C) bypass interlock is used to meet the requirement of 8.10.1 (4)(e).

2. Combustion safeguards on radiant tube-type heating systems are not required where a means of ignition is provided and the systems are arranged and designed such that either of the following conditions is satisfied:
   a. The tubes are of metal construction and open at one or both ends. If heat recovery systems are used, they shall be of explosion-resistant construction.
   b. The entire radiant tube heating system, including any associated heat recovery system, is of explosion-resistant construction.

3. Burners without flame supervision are interlocked to prevent their operation when the zone temperature is less than 1400°F (760°C) by use of a 1400°F (760°C) bypass interlock.

8.10.2* Flame Supervision.
8.10.2.1 Each Where a combustion safe guard is required for a burner flame, each pilot and main burner flame shall be equipped with flame supervision in one of the following ways:

1. Main and pilot flames supervised with independent flame sensors
2. Main and interrupted pilot flames supervised with a single flame sensor
3. Self-piloted burner supervised with a single flame sensor

8.10.2.2* Line burners, pipe burners, and radiant burners, where installed adjacent to one another or connected with flame-propagating devices, shall be considered to be a single burner and shall have at least one flame safeguard installed to sense burner flame at the end of the assembly farthest from the source of ignition.

8.10.2.3 Where a combustion safeguard is required for a burner flame, flame supervision shall not be required in the burner management system of a furnace zone when that zone temperature is greater than 1400°F (760°C) and the following criteria are met:

1. When the zone temperature drops to less than 1400°F (760°C), the burner is interlocked to allow its operation only if flame supervision has been re-established.
2. A 1400°F (760°C) bypass interlock is used to meet the requirement of 8.10.1.2(2).

Supplemental Information

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Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Tue Nov 27 21:30:07 EST 2012

Committee Statement and Meeting Notes

Committee: The Committee clarified when combustion safeguards are required and not required. Additionally, the Committee clarified the flame response time requirement, safe-start check requirement, and allowable arrangements of combustion safeguards. The Committee replaced the term “combustion safety circuitry” with “burner management system” per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
Message:
Committee Notes:
First Revision No. 129-NFPA 86-2012 [Section No. 8.11.1]

8.11.1
The pressure of the atomizing medium shall be proved and interlocked into the combustion safety circuitry burner management system.

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:29:54 EST 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.

First Revision No. 7-NFPA 86-2012 [New Section after 8.11.2]

8.11.2.1
The low pressure switch used to supervise the atomizing medium shall be permitted to be located upstream of atomizing media balancing orifices and balancing valves provided the balancing devices are equipped with a locking device to prevent an unintentional change in the setting.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:04:19 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Previously, A.8.11.2 included a requirement which should have been in the mandatory text. This proposal moves the prior Annex text here and augments it. See FR-6-NFPA 86-2012.
Response Message: FR-7-NFPA 86-2012

Public Input No. 49-NFPA 86-2012 [New Section after 8.11.2]
8.12 Fuel Oil Temperature Limit Devices.
Where equipment is used to regulate fuel oil temperature, fuel oil temperature limit devices shall be provided and interlocked into the combustion safety circuitry, burner management system, if it is possible for the fuel oil temperature to rise above or fall below the temperature range required by the burners.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:30:44 EST 2012

Committee Statement and Meeting Notes
Committee Statement:
The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
Response Message:
FR-130-NFPA 86-2012

First Revision No. 131-NFPA 86-2012 [ Section No. 8.15.3 ]

8.15.3 A high oxygen flow or a high pressure limit shall be interlocked into the combustion safety circuitry, burner management system, with the switch located downstream of the final pressure regulator or automatic flow control valve.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:31:47 EST 2012

Committee Statement and Meeting Notes
Committee Statement:
The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
Response Message:
FR-131-NFPA 86-2012
First Revision No. 132-NFPA 86-2012 [Section No. 8.15.4]

8.15.4
A low oxygen flow or a low pressure limit shall be interlocked into the combustion safety circuitry burner management system.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:32:35 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.

First Revision No. 133-NFPA 86-2012 [Section No. 8.15.10 [Excluding any Sub-Sections]]

Burner systems employing water or other liquid coolants shall be equipped with a low coolant flow limit switch located downstream of the burner and interlocked into the combustion safety circuitry burner management system.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:33:14 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
8.16.1 An excess temperature limit interlock shall be provided and interlocked into the combustion safety circuitry burner management system, unless permitted by 8.16.2.

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.

8.17.1 Where flame supervision is switched out of the combustion safety circuitry burner management system or unsupervised burners are brought on-line, as permitted by 8.10.1(1) or 8.10.1(3), a 1400°F (760°C) bypass interlock shall be used.

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "combustion safety circuitry" with "burner management system" per the removal of combustion safety circuitry from FR-85-NFPA 86-2012.
First Revision No. 136-NFPA 86-2012 [Section No. 8.18.2.1]

8.18.2.1
Excess temperature limit interlocks shall be installed in accordance with one of the following:

1. An excess temperature limit interlock shall be installed and interlocked into the safety circuitry burner management system.

2. Class B, Class C, or Class D furnaces shall not be required to have an excess temperature where it can be demonstrated that the maximum temperature limit specified by the furnace manufacturer cannot be exceeded.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:35:30 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "safety circuitry" with "burner management system" as it is not defined and burner management system is more widely recognized in the industry, see FR-85-NFPA 86-2012.

First Revision No. 137-NFPA 86-2012 [Section No. 8.19.1]

8.19.1
Excess temperature limit interlocks shall be installed in accordance with one of the following:

1. An excess temperature limit interlock shall be installed and interlocked into the safety circuitry burner management system.

2. Class B, Class C, or Class D furnaces shall not be required to have an excess temperature where it can be demonstrated that the maximum temperature limit specified by the furnace manufacturer cannot be exceeded.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 21:38:17 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee replaced the term "safety circuitry" with "burner management system" as it is not defined and burner management system is more widely recognized in the industry, see FR-85-NFPA 86-2012.
### First Revision No. 109-NFPA 86-2012 [New Section after 9.1.2]

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<th>9.1.3*</th>
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<td>Written procedures shall be established outlining actions to be taken in response to an unintended fire involving an oven system.</td>
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### Submitter Information Verification

**Submitter Full Name:** [Not Specified]

**Organization:** [Not Specified]

**Submit Date:** Wed Oct 24 17:09:27 EDT 2012

### Committee Statement and Meeting Notes

**Committee Statement:**
Existing requirements in Chapter 9 do not address what action should be taken in the event of a fire in an oven or furnace. While such actions are not "one-size-fits-all", where fire protection is needed it is important it be a coordinated system and, where manual actions are required, written procedures exist and operator training (addressed in Section 7.2) is done. The Committee changed text from "each action" to "actions" and removed interlocks. It is virtually impossible to define precise actions to be taken while fighting a fire. Personnel trained to fight fires need the latitude to adjust their actions to a particular event.

**Response Message:**

- **Public Input No. 165-NFPA 86-2012 [New Section after 9.1.2]**
First Revision No. 87-NFPA 86-2012 [Section No. 10.6.3.3]

10.6.3.3*

Where direct heat recovery systems are employed and portions of the incinerator exhaust gases are utilized as the heat source for one or more of the zones of the fume-generating oven, special one of the following precautions shall be taken to prevent recycling unburned solvent vapors and unburned fuel:

1. Mechanical means such as fixed dampers shall be used to ensure that the ratio of fresh air to recycled exhaust cannot reduce the destruction efficiency of the incinerator below specification or 90%, whichever is higher.

2. Oxygen sensors in the air stream to the incinerator are interlocked to divert recycled exhaust gases to atmosphere if levels drop below specifications for the incinerator.

3. A continuous vapor concentration high-limit controller is provided in accordance with 11.6.10.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 14:04:27 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:
The term "special precautions" is imprecise and unenforceable language. The goal of this paragraph is to prevent the exhaust from the incinerator increasing the concentration of flammable vapors within the heated ovens to above 25% LFL (or 50% if a continuous vapor concentration controller is used). When exhaust is recycled, it can reduce the oxygen content supplied to the incinerator (reducing efficiency) and allow concentrations of flammable vapors to build over time. System design should have inherent physical characteristics or control and interlocks to prevent this from occurring. Annex material is proposed separately to provide more guidance to the reader of the standard, see FR-88-NFPA 86-2012.

Response Message:
FR-87-NFPA 86-2012

Committee Notes:

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<td>Duval</td>
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Public Input No. 84-NFPA 86-2012 [Section No. 10.6.3.3]
Public Input No. 124-NFPA 86-2012 [Section No. 10.6.3.3]
First Revision No. 90-NFPA 86-2012 [Section No. 11.5]

11.5 Fire Protection.

11.5.1 Upon activation of an oven's fire protection system, the following actions shall be initiated:

1. Safety shutdown of the oven.
2. Discontinue the introduction of flammable or combustible material.
3. Position damper(s) to maintain the minimum airflow through all oven passages to provide the required safety ventilation or demonstrate by calculation that the combustible concentration in the work chamber cannot exceed 25 percent of the lower flammable limit (LFL) under any conditions.
4. Keep fan(s) in operation to maintain the required safety ventilation or demonstrate by calculation that the combustible concentration in the work chamber cannot exceed 25 percent of the lower flammable limit (LFL) under any conditions.
5. Shut down the recirculation air and exhaust air systems and close the damper(s) where the type of automatic fire protection system requires that ventilation be discontinued.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 14:20:54 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Two different types of hazards may develop when an emergency shutdown of the oven is required. (1) In cases where a fire involving combustible solids or liquids in the oven has been initiated, but hasn’t grown very large, allowing more air into the oven will “fan the flames”. (2) In cases where excess temperature might cause the buildup of flammable gases and an approach to LFL, shutting off the source of air to the oven could create an explosive atmosphere. The goal of the shutdown logic should be: Distinguish between over temperature situation and internal fire. - Initiate action that is consistent with the type of problem discerned and the nature of fire detection and suppression systems present in the oven.

Committee Notes:

<table>
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<tr>
<th>Date</th>
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<tr>
<td>Nov 28, 2012</td>
<td>Duval</td>
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</table>

Text not shown correct legislatively

Public Input No. 75-NFPA 86-2012 [Section No. 11.5]
Safety ventilation shall be arranged to meet the following design characteristics:

(1) The reduction of air flow below the minimum required by 11.6.1 shall activate the ventilation safety devices provided in accordance with Section 8.6.

(2) The physical arrangement of dampers, fans, ducts, chambers, and passages shall ensure that a short-circuited airflow cannot occur without activating the ventilation safety devices provided in accordance with Section 8.6.
First Revision No. 26-NFPA 86-2012 [Section No. 11.6.1.10]

11.6.1.10*

Required safety ventilation shall be proved by one of the following:

1. A dedicated exhaust fan proved in accordance with Section 8.6
2. The presence of at least the required fresh air flow into the system proven in accordance with Section 11.6.1.11
3. The presence of at least the required exhaust flow out of the system proven in accordance with Section 8.6
4. A continuous vapor concentration high-limit controller in accordance with 11.6.10

Supplemental Information

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Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 10:12:47 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Complex systems with multiple airflow paths, multiple heating zones, and other variations are not adequately encompassed by the current 11.6.1.10, which simply provides a generic reference to requirements in Section 8.6. The new 11.6.1.11, see FR-25-NFPA 86-2012, language is necessary to ensure that the designer, AHJ, and end user are able to apply the requirements for safety ventilation to these complex systems.

Response Message:
Committee Notes:
Date Submitted By
Nov 7, 2012
Duval
FR does not show legislative text correctly, to see correct text and changes click "hide markup" or see attached.

Public Input No. 78-NFPA 86-2012 [Section No. 11.6.1.10]

First Revision No. 52-NFPA 86-2012 [Section No. 11.6.2.1]

11.6.2.1*

Interlocks for exhaust and recirculation fans shall be installed in accordance with Sections 8.6 and 8.7.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 22:00:24 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Adds reference to Annex A.8.6.1 where new content was added to clarify the need for interlocking the operation of non-ducted fans into the safety circuitry, see FR-53-NFPA 86-2012.

Response Message:
Public Input No. 57-NFPA 86-2012 [Section No. 11.6.2.1]
11.6.8.7
The products of combustion in direct-fired process ovens shall be accounted for by implementing one of the following approaches:

(1) The safety ventilation shall be increased to include the products of combustion ventilation rate determined in 11.6.6.

(2) A continuous vapor concentration high-limit controller shall be provided in accordance with 11.6.10.

The safety ventilation shall be increased for direct-fired process ovens to include the products of combustion ventilation rate determined in 11.6.6.

Committee Statement and Meeting Notes

Committee: In cases where a continuous vapor concentration high limit controller has been provided, the products of combustion will be addressed by the system without the need for an additional calculated safety ventilation rate. Moreover, it has been demonstrated that the inert components of the products of combustion are effective in diluting flammable vapors as required by the standard. Combustible components such as CO and those resulting from incomplete combustion will be monitored by the continuous vapor concentration high limit controller.

Response: FR-89-NFPA 86-2012

Message:

Committee Notes:

Text is not shown correct legislatively.

Public Input No. 126-NFPA 86-2012 [Section No. 11.6.8.7]
(A)—
The switch shall be connected to a circuit breaker by cables that are separated completely from any other wiring.

(B)—
The switch shall provide a positive lockout and isolation of the circuit breaker, thereby preventing accidental closure of the breaker by grounds in the closing circuit.

(C)—
The key shall be trapped when the switch is in the on position and shall be free when the switch is in the off position.

(D)—
The key shall be kept under the supervision of the authorized operator.

12.5.2.4 Interlocks—
Interlocks shall be provided to ensure that all of the following conditions are satisfied before the main disconnect can be closed:

1. Furnace transformer heat exchangers are operating.
2. Oil is flowing to furnace heat exchangers (if fitted).
3. Water is flowing to furnace transformer heat exchangers (flow or pressure-proving switch).
4. The transformer tap changer is on the tap position (if the transformer is fitted with an off-load tap changer).
5. The furnace transformer oil temperature is within operating limits.
6. The furnace transformer winding temperature is within operating limits.
7. The gas detector is registering no gas in transformer tank.
8. The furnace electrode drive control gear is on.
9. All supply voltages are on and within operating limits.
10. The furnace roof and the electrode swing are within operating limits.
11. The furnace is within specified limits of forward and backward tilt.
12. The master lockout switch is on.
13. Safety shutoff valves on oxygen and fuel lines supplying burners are proved closed.

12.5.2.5 Interlocks for Main Furnace Structure—

(A)—
The main furnace structure shall be interlocked where the arc furnace operation includes tilting of the furnace to remove molten metal at the end of the furnace heat, and the following criteria also shall be met:

1. The furnace shall not be tilted during the melt operation, and interlocks shall be provided to prevent furnace tilting until furnace controls have been proved in the correct position.
2. Interlocks shall be fitted to prevent tilting of the furnace unless both of the following conditions are satisfied:
   a. The roof is down.
   b. The limit switches are at forward and backward limits of travel.

(B)—
Interlocks shall be fitted to prevent swinging of the roof and electrodes unless the following three conditions are satisfied:

1. The electrode arms are up and clear of shell.
2. The furnace tilt platform is normal and locked (if fitted).
3. The roof is raised.

12.5.2.6—
A line supplying compressed air for unclamping electrodes shall be fitted with a solenoid valve interlocked with the furnace circuit breaker to ensure that the electrodes cannot be released unless the furnace power is off.

12.5.2.7*—
For burner ignition with the arc, oxy-fuel and oxygen-enriched air burner controls shall be interlocked with the furnace controls, and the following criteria also shall apply:

1. An isolated contact on the arc furnace controls shall be provided for interconnecting the burner management system to establish that enough current is flowing through the secondary leg of the power transformer to maintain a strong arc in the furnace.
2. Operation of a burner shall not be required to be halted in the event of a momentary interruption of the arc, or after arc heating has been intentionally discontinued, provided that the contents of the furnace are incandescent or determined to be at a temperature in excess of 1400°F (760°C).
12.5.2.8

Oxy-fuel burners installed on arc metal heating furnaces shall not be required to have both of the following:

1. Burner flame pilots or igniters
2. Combustion safeguards (flame supervision)

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 18:35:57 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The information on arc melt furnaces in NFPA 86 has not been updated since when it was originally entered into the standard in 1973. There has and currently is no expertise within the committee to address this type of equipment. Currently, most of the industry does not use this standard because of the degree of specialized design and engineering for each unique arc furnace, this standard does not have the capability to cover such a design.

Response Message:
Committee Notes:
Date Submitted By
Oct 23, 2012 Duval
Delete associated annex material.
Public Input No. 106-NFPA 86-2012 [Section No. 12.5.2.5(A)]
Public Input No. 107-NFPA 86-2012 [Section No. 12.5.2.5(B)]
Public Input No. 108-NFPA 86-2012 [New Section after 12.5.2.5(B)]

First Revision No. 54-NFPA 86-2012 [Section No. 13.5.1.5]

13.5.1.5
Nonflammable and nontoxic fluids or gasses shall be vented to an approved location outside the building at a rate that does not pose a hazard of asphyxiation.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 22:03:08 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee believes that at this point we are specifically addressing gases. "Fluids" applies to both liquids and gases (liquids can not be "vented")
Response Message:
Public Input No. 26-NFPA 86-2012 [Section No. 13.5.1.5]
First Revision No. 55-NFPA 86-2012 [Section No. 13.5.2.1(B)]

(B) — Copper and copper alloy components or materials shall not be used in exothermic atmosphere gas generators, cooling systems, heat exchangers, and distribution systems where they will be exposed to makeup, reacting, or final product exothermic atmosphere gas.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 22:04:44 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Removed because it is a duplicate statement from 13.5.2.1 (A).
Public Input No. 41-NFPA 86-2012 [Section No. 13.5.2.1(B)]
13.5.3.5
Protective equipment for the reaction section of endothermic generators shall include the following:

(1) Safety shutoff valve(s) in the reaction gas supply piping requiring manual operation for opening shall close under any of the following conditions:
   - (a) Low reaction gas pressure
   - (b) High reaction gas pressure
   - (c) Loss of reaction air supply
   - (d) Low generator temperature
   - (e) Power failure

(2) A low pressure switch in the reaction gas supply piping shall close the safety shutoff valve and shut off the reaction air supply in case of abnormally low reaction gas pressure at the mixer.

(3) Where the system is subject to abnormally high reaction gas pressure, a high pressure switch shall be installed in the reaction gas supply piping that operates as follows when the gas reaction pressure exceeds a predetermined upper value:
   - (a) The device closes the safety shutoff valve.
   - (b) The device shuts off the reaction air supply.

(4) When an air blower or compressed air line is used to supply the reaction, a low pressure switch in the reaction air supply piping connected to an air blower or compressed air line shall close the safety shutoff valve and shut off the reaction air supply in case of abnormally low reaction air pressure.

(5) A device that shuts off reaction air in case of power failure or abnormally low or abnormally high reaction gas pressure at the mixer shall be included.

(6) A means for making tightness checks of all reaction gas safety shutoff valves shall be included.

(7) A valve shall be designated the main shutoff valve and shall be located upstream of the safety shutoff valve and shall be accessible for normal and emergency shutdown.

(8) A generator temperature control to prevent the flow of reaction air and reaction gas unless the generator is at the minimum generator temperature specified by the generator manufacturer shall be included.

(9) Automatic fire check protection shall be included.

(10) A visual and audible alarm when the reaction gas safety shutoff valve is closed shall be included.
13.5.7.5
When flow rates and piping arrangements create a risk of flame strike back and burning within the furnace piping, it shall not be permissible to manifold flammable special atmospheres and process control air or admit both via a common inlet.

Committee Statement and Meeting Notes
Committee Statement: Flammable gas and air admitted to a furnace via a common inlet pipe may create a risk of flame strike back and burning within the furnace piping.
Public Input No. 74-NFPA 86-2012 [New Section after 13.5.7.4(C)]

13.5.8.3
* A safety When a flammable liquid is used as a carrier gas and introduced in the liquid state, a second low temperature interlock shall be provided if flow of the liquid state is continued at less than 1400°F (760°C). The second interlock shall interrupt the flow of methanol (methyl alcohol) or other flammable liquid atmospheres into a furnace when the temperature inside drops below a minimum dissociation temperature required to maintain a positive furnace pressure. Furnace temperature is less than the temperature needed to reliably dissociate the liquid special atmosphere used.

Committee Statement: The Committee modified the wording to unify the requirement in a single location.
Public Input No. 68-NFPA 86-2012 [Section No. 13.5.8.3]
13.5.8.12
Automatic excess flow shutoff protection shall be provided for each liquid special atmosphere.

(1) The excess flow sensor shall be located immediately downstream of the filter required in 13.5.11.10.5.

(2) Upon detection of liquid special atmosphere excess flow, the liquid special atmosphere safety shutoff valve shall close.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 22:20:27 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Relocated from 13.5.11.11.11, see FR-60-NFPA 86-2012.
Public Input No. 70-NFPA 86-2012 [New Section after 13.5.8.11]
## 13.5.10.3 Furnace Type

The type of furnace shall be determined in accordance with Table 13.5.10.3. Table 13.5.10.3 Types of Class C Furnaces

<table>
<thead>
<tr>
<th>Furnace Type</th>
<th>Feature</th>
<th>Operating Temperature</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>The chamber(s) &lt;1400°F are separated by doors from those operating at &gt;1400°F</td>
<td>One or more zones always &gt;1400°F</td>
<td>Pusher tray (cold chambers at each end, inner and outer doors with and without integral quench)</td>
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<tr>
<td>Type II</td>
<td>Both inlet and outlet ends of furnace are open and no external doors or covers</td>
<td>Can be &lt;1400°F after introduction of a cold load</td>
<td>Batch integral quench (1 or more cold chambers, integral quench)</td>
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<tr>
<td>Type III</td>
<td>Only one end of the furnace is open and there are no external doors or covers</td>
<td>At least one zone &gt;1400°F and have no inner doors separating zones &gt; and &lt;1400°F</td>
<td>Belt (both ends open)</td>
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<tr>
<td>Type IV</td>
<td>Outer doors or covers are provided</td>
<td></td>
<td>Belt (with integral quench, entry end open)</td>
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<tr>
<td>Type V</td>
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<td></td>
<td>Box (exterior door)</td>
</tr>
<tr>
<td>Type VI</td>
<td>&gt;1400°F before introduction and removal of special atmosphere gas</td>
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<td></td>
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<tr>
<td>Type VII</td>
<td>A heating cover furnace with an inner cover</td>
<td>Never &gt;1400°F</td>
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<tr>
<td>Type VIII</td>
<td>A heating cover furnace without an inner cover or with a nonsealed inner cover</td>
<td>A heating cover and inner cover are separated from a base that supports the work being processed</td>
<td>Bell (with or without retort)</td>
</tr>
<tr>
<td>Type IX</td>
<td></td>
<td></td>
<td>Car tip-up</td>
</tr>
</tbody>
</table>

For SI units, 1400°F = 760°C.

### Submitter Information Verification

- **Submitter Full Name:** [Not Specified]
- **Organization:** [Not Specified]
- **Submittal Date:** Tue Oct 23 22:23:39 EDT 2012

### Committee Statement and Meeting Notes

- **Committee Statement:** The Committee clarified that Table 13.5.10.3 is only applicable to Class C furnaces to avoid any confusion or misuse of the table.
- **Response Message:** FR-61-NFPA 86-2012
- **Public Input No. 16-NFPA 86-2012 [Section No. 13.5.10.3]**
First Revision No. 62-NFPA 86-2012 [New Section No. after 13.5.11.1(E)]

(F)* _
Process control air or burnout air shall be supplied from an air blower.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 22:25:35 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:
Often plant airlines can become slugged with water. Regulator failures could result in high-pressure air admission to furnace.

Response Message:
FR-62-NFPA 86-2012

First Revision No. 142-NFPA 86-2012 [Section No. 13.5.11.3]

13.5.11.3* Flame Curtains.
Where a flame curtain is used, the following features shall be provided and in service:

(1) One or more _burn-off flame curtain_ pilots shall be positioned to reliably ignite the flame curtain.

(2) At least one _burn-off flame curtain_ pilot at a flame curtain shall have flame supervision interlocked to prevent the opening of a closed door served and interlocked to prevent operation of the flame curtain at the door served.

(3) At least one safety shutoff valve upstream of all flame curtains on a furnace shall be interlocked to close upon the following conditions:
   (a) Low fuel gas pressure on the flame curtain fuel gas supply
   (b) High fuel gas pressure on the flame curtain fuel gas supply where a high gas pressure issue would create a safety concern

(4) An automatic control valve shall be provided ahead of each flame curtain arranged to open when the door served is not closed.

(5) When the safety shutoff valve in item 13.5.11.3(3) is closed, any doors served by that safety shutoff valve shall be interlocked so they cannot open.

(6)* A manual means of overriding the door interlock in 13.5.11.3(5) shall be provided.

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Fri Nov 30 10:18:34 EST 2012

Committee Statement and Meeting Notes

Committee Statement:
The added definition of a flame curtain pilot divorces the flame curtain pilot from the provisions of 13.5.11.2(G) such that flame curtain pilot gas may be shut-off in the event of flame curtain pilot flame failure. The Committee believes that the submitter’s intent is captured. See FR-141-NFPA 86-2012.

Response Message:
FR-142-NFPA 86-2012
13.5.11.9.5
Burnout air shall be admitted by any of the following arrangements:

1. Through furnace doors
2. Through independent piping and furnace gas inlets
3. Through sections of piping and furnace inlets that are common to both flammable special atmosphere and burnout air when the systems are designed to prevent the flow of air and flammable special atmosphere at the same time

Committee Statement and Meeting Notes
Committee Statement: Flammable gas and air admitted to a furnace via a common inlet pipe creates a risk of flame strike back and burning

A bypass manual shutoff valve shall be provided to bypass each normally open emergency inert gas purge valve and be arranged as follows:

1. Be accessible to the operator for use in accordance with written operating instructions
2. Have a port area equal to or larger than the bypassed normally open emergency inert gas purge valve

Committee Statement and Meeting Notes
Committee Statement: This unifies the requirement into a single item.
### First Revision No. 65-NFPA 86-2012 [Section No. 13.5.11.10.2.6]

<table>
<thead>
<tr>
<th>Section</th>
<th>13.5.11.10.2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The operating instructions required by 7.3.3 shall reference the valve tag identifications required by 13.5.11.10.2.4.</td>
</tr>
</tbody>
</table>

#### Submitter Information Verification

- **Submitter Full Name**: [Not Specified]
- **Organization**: [Not Specified]
- **Submittal Date**: Tue Oct 23 22:45:35 EDT 2012

#### Committee Statement and Meeting Notes

- **Committee Statement**: Corrects the references due to First Revisions. This change is taking into account the removal of the current 13.5.11.10.2.4 and anticipating the section renumbering. It is intended to reference the current 13.5.11.10.2.5 which will be 13.5.11.10.2.4 through FR-110-NFPA 86-2012.

### First Revision No. 64-NFPA 86-2012 [Section No. 13.5.11.10.2.8]

<table>
<thead>
<tr>
<th>Section</th>
<th>13.5.11.10.2.7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manual valves that are not used for shutoff shall not be required to comply with 13.5.11.10.2 other than 13.5.11.10.2.4.</td>
</tr>
</tbody>
</table>

#### Submitter Information Verification

- **Submitter Full Name**: [Not Specified]
- **Organization**: [Not Specified]
- **Submittal Date**: Tue Oct 23 22:28:58 EDT 2012

#### Committee Statement and Meeting Notes

- **Committee Statement**: Corrects the references. This change is taking into account the removal of the current 13.5.11.10.2.4 (FR-110-NFPA 86-2012), and anticipating the section renumbering. It is intended to reference the current 13.5.11.10.2.5 which will be 13.5.11.10.2.4 through FR-110-NFPA 86-2012.
- **Response Message**: FR-64-NFPA 86-2012
First Revision No. 66-NFPA 86-2012 [ New Section after 13.5.11.10.7 ]

13.5.11.10.8* Atmosphere Inlets
Atmosphere inlets shall not be located in such a way that atmosphere flow will directly impinge on temperature control or over temperature control thermocouples.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization:  [ Not Specified ]
Submittal Date: Tue Oct 23 22:46:19 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Atmosphere impingement on the temperature control thermocouple can result in overheating of the furnace: impingement on the over temperature thermocouple can cause erroneous control readings.
Public Input No. 30-NFPA 86-2012 [New Section after 13.5.11.10.7]

First Revision No. 60-NFPA 86-2012 [ Section No. 13.5.11.11.11 ]

13.5.11.11.11 Liquid Excess Flow Control:
(A) Automatic, excess flow, and shutoff protection shall be provided for each liquid special atmosphere.
(B) The excess flow sensor shall be located immediately downstream of the filter required in 13.5.11.10.5.
(C) Upon detection of liquid special atmosphere excess flow, the liquid special atmosphere safety shutoff valve shall close.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization:  [ Not Specified ]
Submittal Date: Tue Oct 23 22:22:15 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Relocated to section 13.5.8.12, see FR-59-NFPA 86-2012.
Public Input No. 71-NFPA 86-2012 [Section No. 13.5.11.11.11]
First Revision No. 67-NFPA 86-2012 [ Section No. 13.5.11.11.13(A) ]

(A) For furnaces using burn-in procedures for introducing flammable special atmosphere carrier gases, it shall be permissible to admit flammable special atmosphere carrier gas safety shutoff valves shall open only when one of the following conditions exists:

1. The furnace temperature exceeds 1400°F (760°C) at the point where the flammable special atmosphere carrier gas is introduced.
2. If the furnace is designed to operate with an automatic inert gas purge, the presence of the required inert gas pressure shall be verified manually or automatically.
3. Operator action opens the valve.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 22:48:28 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: During the last cycle when reorganizing the document the intent of the language was inadvertently changed. The language has been changed to establish the original intent.
Public Input No. 59-NFPA 86-2012 [Section No. 13.5.11.13(A)]

First Revision No. 68-NFPA 86-2012 [ Section No. 13.5.11.11.13(B) ]

(B) For furnaces using purge-in procedures for introducing flammable special atmosphere carrier gases, it shall be permissible to admit flammable special atmosphere carrier gas safety shutoff valves shall open only when one of the following conditions exist:

1. The inert gas purge is complete.
2. If the furnace is designed to operate with an automatic inert gas purge, the presence of the required inert gas pressure shall be verified manually or automatically.
3. Operator action opens the valve.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 22:52:02 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: During the last cycle when reorganizing the document the intent of the language was inadvertently changed. The language has been changed to establish the original intent.
Public Input No. 60-NFPA 86-2012 [Section No. 13.5.11.13(B)]
(D)
Safety shutoff valves shall be de-energized automatically close upon occurrence of the following conditions:

1. Normal furnace atmosphere burn-out initiated
2. Normal furnace atmosphere purge-out initiated
3. Low flow of carrier gas(es) that will not maintain a positive pressure in chambers below 1400°F (760°C) and positive pressure not restored by the automatic transfer to another source of gas
4. A furnace temperature below which any liquid carrier gas used will not reliably dissociate
5. Automatic emergency inert gas purge initiated
6. Manual operator emergency inert gas purge initiated
7. Power failure
8. Liquid carrier gas excess flow

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 22:57:18 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Ultimately it is the closure of the safety shutoff valve what we desire, so let's just say it. Adding item 8 completes the list of conditions that require closing of the safety shutoff valve.
Message: Public Input No. 28-NFPA 86-2012 [Section No. 13.5.11.13(D)]
First Revision No. 70-NFPA 86-2012 [Sections 13.5.11.15(A), 13.5.11.15(B), 13.5.11.15(...]

(A) A flow interlock shall be provided on the equipment piping for each special atmosphere that is considered a carrier gas. Minimum carrier gas flow(s) required by this standard shall be proved by either:

1. A flow switch for each special atmosphere that is considered a carrier gas

2. Furnace pressure switch(s)

(B) Carrier gas flow shall be interlocked to initiate the actions listed in 13.5.11.11.10(B) if the total carrier gas flow from gas or liquid sources falls below the minimum required to keep a furnace chamber under positive pressure. If minimum carrier gas flow is not proven, the following shall be applied:

1. Actions listed in 13.5.11.11.10(b) shall be initiated.

2. Visual and audible alarms shall alert the operator of loss of minimum carrier gas flow.

(C) Furnace pressure interlock(s) shall be permitted as an alternative to the flow interlock(s) in 13.5.11.11.15(A). Inert purge gas equipment piping shall be equipped with:

1. A pressure switch that will audibly and visually alert the operator of a low purge pressure condition.

2. A flow switch that will audibly and visually alert the operator of a low purge flow condition.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:01:15 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:

This defines the actions of the carrier gas flow interlocks. The inert purge flow switch requirement was required in previous sections but was inadvertently omitted from the 2011 edition.

Response Message:

FR-70-NFPA 86-2012

Committee Notes:

<table>
<thead>
<tr>
<th>Date</th>
<th>Submitted By</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 27, 2012</td>
<td>Duval</td>
<td>The FR is not shown legislatively correct. This is another instance where pulling in the PI as a starting point cause all the existing text to appear as underline or new text. Terra issue. To view the text as the committee intended, click on &quot;hide markup&quot;.</td>
</tr>
</tbody>
</table>

Committee Notes Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:01:15 EDT 2012
First Revision No. 71-NFPA 86-2012 [Section No. 13.5.11.11.17]

13.5.11.11.16*
The flow of noncarrier special atmosphere gases that are nonflammable shall not be permitted until minimum carrier gas flow has been established.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:01:54 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The revised text clarifies that a carrier gas flow interlock is required.
Public Input No. 66-NFPA 86-2012 [Section No. 13.5.11.17]

First Revision No. 72-NFPA 86-2012 [Section No. 13.5.11.11.19]

13.5.11.11.19 Liquids Atmosphere Low Furnace Dissociation Temperature Interlock.
   (A)— Where a flammable liquid is used as a carrier gas and introduced in the liquid state, a second low temperature safety interlock shall be provided if flow of the liquid is continued at less than 1400°F (760°C).
   (B)— The liquids atmosphere low furnace dissociation temperature interlock set point temperature shall not be less than the temperature needed to reliably dissociate the liquid special atmosphere used.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 23:03:22 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Content has been moved to 13.5.8.3, see FR-58-NFPA 86-2012.
Public Input No. 67-NFPA 86-2012 [Section No. 13.5.11.19]
A.1.1.2
The following types of industrial systems are generally considered to be among those covered by NFPA 86 where the fuel is covered by the standard: afterburners, ammonia dissociators, annealing furnaces, arc melting furnaces, atmosphere generators (endothermic, exothermic), autoclaves, bakery ovens, bath furnaces, bell furnaces, bell furnaces, blast furnaces, brazing furnaces, brick kilns, car-bottom kilns, casting furnaces, catalytic thermal oxidizers, cement kilns, chemical vapor deposition furnaces, crematories, crucible furnaces, cupola furnaces, drying ovens, electric arc furnaces, electron beam melters, flameless thermal oxidizers, fume incinerators, glass melting furnaces, heat treating furnaces, heating cover furnaces, indirect-fired furnaces, induction furnaces, inert-atmosphere furnaces, integral quench furnaces, kilns, lime kilns, melting kettles/pots, muffle furnaces, open hearth furnaces, ovens, oxygen-enriched furnaces, paint drying ovens, paper drying ovens, plasma melting furnaces, pusher furnaces, reduction furnaces, refining kettles, regenerative thermal oxidizers, reheating furnaces, retort furnaces, reverberatory furnaces, roasting ovens, rotary calciners, rotary dryers, rotary kilns, shaft furnaces, shaft kilns, shuttle kilns, sintering furnaces, slag furnaces, smelting furnaces, solvent atmosphere ovens, special atmosphere furnaces, sweat furnaces, textile dryers, thermal oxidizers, tube furnaces, tunnel kilns, vacuum furnaces, vaporizers, and wood-drying kilns.

Submitter Information Verification:
- **Submitter Full Name:** [Not Specified]
- **Organization:** [Not Specified]
- **Submittal Date:** Tue Oct 23 18:42:03 EDT 2012

Committee Statement and Meeting Notes:
- **Committee Statement:** The information on arc melt furnaces in NFPA 86 has not been updated since when it was originally entered into the standard in 1973. There has and currently is no expertise within the committee to address this type of equipment. Currently, most of the industry does not use this standard because of the degree of specialized design and engineering for each unique arc furnace, this standard does not have the capability to cover such a design.

A.1.1.7(4)
For information on fluid heaters, refer to NFPA 87, Recommended Practice for Fluid Heaters.

Submitter Information Verification:
- **Submitter Full Name:** [Not Specified]
- **Organization:** [Not Specified]
- **Submittal Date:** Tue Oct 23 21:34:46 EDT 2012

Committee Statement and Meeting Notes:
- **Committee Statement:** See FR-40-NFPA 86-2012. The Committee moved this reference to the body of the standard to ensure that it is not misapplied.
- **Response Message:** FR-45-NFPA 86-2012

Public Input No. 142-NFPA 86-2012 [Section No. A.1.1.7(4)]
A.3.3.6
The burner management system logic can include the following functions: safety interlocks, pre-purge, trial for ignition, and safe-start check.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 00:26:50 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Added annex material to FR-16-NFPA 86-2012 for clarification on burner management systems. The annex material is similar to the annex material for burner management systems found in 2011 edition of NFPA 85, Boiler and Combustion Systems Hazards Code, but it is modified to reflect the system logic that is specific to ovens and furnaces.
Response Message:
Public Input No. 104-NFPA 86-2012 [New Section after A.3.2.4]

A.3.3.27.4
It is important to note that the loads processed in Class B furnaces typically do not contain any flammable volatiles or combustible materials. However, when small amounts of flammable volatiles or combustible materials are present, it can be appropriate not to add safety ventilation, as would be required for a Class A furnace, when doing so would be detrimental to the process and would not increase the level of safety. (See A.3.3.25.3.)

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Oct 22 16:14:25 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee added annex material to clarify the definition of Class B ovens.
Public Input No. 94-NFPA 86-2012 [New Section after A.3.3.25.3]
First Revision No. 50-NFPA 86-2012 [Section No. A.3.3.25.3]

A.3.3.27.3 Class A Furnace. 
Flammable volatiles or combustible materials can include, but are not limited to, any of the following:

1. Paints, powders, inks, and adhesives from finishing processes, such as dipped, coated, sprayed, and impregnated materials
2. Substrate material
3. Wood, paper, and plastic pallets, spacers, or packaging materials
4. Polymerization or other molecular rearrangements

In addition, potentially flammable materials, such as quench oil, waterborne finishes, cooling oil, or cooking oils, that present a hazard should be ventilated according to Class A standards.

Submitter Information Verification
Submitter Full Name: Not Specified
Organization: Not Specified
Submittal Date: Tue Oct 23 21:53:58 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: "Potentially flammable" materials such as quench oil, waterborne finishes, cutting oil, and cooking oils may present a hazard if they are heated to a temperature approaching their flash points. When these materials are cool enough or present in negligibly small amounts so they don't present a hazard in a heated enclosure, Class B requirements are sufficient. This revision adds a "should" recommendation so users are cognizant of a potential hazard that might necessitate Class A treatment (e.g., ensuring adequate safety ventilation).

First Revision No. 144-NFPA 86-2013 [New Section after A.3.3.28]

A.3.3.32 Hardwired.
When the term hardwired is applied to the logic system itself, it refers to the method of using individual devices and interconnecting wiring to program and perform the logic functions without the use of software-based logic solvers.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Jan 02 10:43:08 EST 2013

Committee Statement and Meeting Notes
Committee Statement: New definition added in FR-44-NFPA 86-2012, this is the annex material to that definition.
Response Message: FR-144-NFPA 86-2013
A.3.3.57.1 Safety Ventilation.

The maximum allowed percent of the lower flammable limit (LFL) is 25% when the safety ventilation rate is based upon the calculation methods provided in this standard for Class A ovens. As permitted by this standard, the maximum allowed percent of the lower flammable limit (LFL) may range up to 50% when a continuous vapor concentration high-limit controller(s) is used.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 14:55:54 EDT 2012

Committee Statement and Meeting Notes


Public Input No. 65-NFPA 86-2012 [New Section after A.3.3.45.1]

A.5.2.4 Consider additional design loads, such as seismic, precipitation, and wind loads where appropriate.

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Jan 02 13:28:03 EST 2013

Committee Statement and Meeting Notes

Committee Statement: Raise awareness of additional loads that might be required for equipment.
A.5.3

Explosion hazards can be mitigated by the following methods:

(1) Containment
(2) Explosion relief
(3) Location
(4) Explosion suppression
(5) Damage-limiting construction

For additional information regarding explosion protection of equipment and buildings, see NFPA 68, Standard on Explosion Protection by Deflagration Venting, and NFPA 69, Standard on Explosion Prevention Systems.

Committee Statement and Meeting Notes

Committee Statement: The Committee recognized that there are other methods for explosion mitigation.


A.6.2.5.3

When the fuel main is opened for service, the risk of dirt entry exists. It is not required that existing piping be opened for the sole purpose of the addition of a filter or strainer. It is good practice to have the sediment trap located upstream of the filter. The intent of the sediment trap is to remove larger particulates, while the intent of the filter is to remove smaller particulates. The reverse arrangement will result in additional maintenance and could result in removal of the filter element from service. The mesh size should be sized to protect downstream controls as prescribed by the components' manufacturer(s).

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Jan 02 13:44:30 EST 2013

Committee Statement and Meeting Notes

Committee Statement: Section 8.2.2 already covers safety devices to be installed per manufacturer's instructions. The Committee did see merit in adding in the statement to the annex to help users understand the need to protect downstream devices.

Response Message: FR-146-NFPA 86-2013

Public Input No. 173-NFPA 86-2012 [Section No. 6.2.5.3]
A.6.2.6.4

See NFPA 54, National Fuel Gas Code, for exception to vent requirements.

Vent limiters are used to limit the escape of gas into the ambient atmosphere if a vented device (e.g., regulator, zero governor, pressure switch) requiring access to the atmosphere for operation has an internal component failure. When a vent limiter is used, there might not be a need to vent the device to an approved location. Following are some general guidelines and principles on the use of vented devices incorporating vent limiters:

1. The listing requirements for vent limiters are covered in ANSI Z21.18/CSA 6.3, Standard for Gas Appliance Pressure Regulators, for regulators and in ANSI/UL 353, Standard for Limit Controls, for pressure switches and limit controls. ANSI Z21.18/CSA 6.3 requires a maximum allowable leakage rate of 2.5 ft³/hr (0.071 m³/hr) for natural gas and 1.0 ft³/hr (0.028 m³/hr) for LP-Gas at the device’s maximum rated pressure. ANSI/UL 353 allows 1.0 ft³/hr (0.028 m³/hr) for natural gas and 1.5 ft³/hr (0.043 m³/hr) for LP-Gas at the device’s maximum rated pressure. Since a vent limiter may be rated less than the device itself and may be a field installable device, or it may de-rate the device to a lower pressure rating, a combination listed device-vent limiter should be used.

2. Where a vent limiter is used, there should be adequate airflow through the room or enclosure in which the equipment is installed. In reality, conditions can be less ideal, and care should be exercised for the following reasons:

   a. The relative density of the gas influences its ability to disperse in air. The higher the relative density, the more difficult it is for the gas to disperse (e.g., propane disperses more slowly than natural gas).

   b. Airflow patterns through a room or enclosure, especially in the vicinity of the gas leak, affect the ability of the air to dilute that gas. The greater the local air movement, the greater the ease with which the gas is able to disperse.

   c. The vent limiter may not prevent the formation of a localized flammable air-gas concentration for the preceding reasons.

3. Table A.6.2.6.4(3) shows various gases and their equivalent allowable leakage rates through a vent limiting device as per ANSI Z21.18/CSA 6.3, Standard for Gas Appliance Pressure Regulator. The leakage rates are based on the maximum pressure rating for the device.

<table>
<thead>
<tr>
<th>Gas Type</th>
<th>s.g. (based on air = 1.0)</th>
<th>Leakage Rate (ft³/hr)</th>
</tr>
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<tbody>
<tr>
<td>Natural gas</td>
<td>0.65</td>
<td>2.5</td>
</tr>
<tr>
<td>Propane</td>
<td>1.50</td>
<td>1.0</td>
</tr>
<tr>
<td>Butane</td>
<td>1.95</td>
<td>0.8</td>
</tr>
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</table>

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:56:10 EDT 2012

Committee Statement and Meeting Notes

Committee: New annex material added to provide information for the use of vent limiters with other gases, it adds some information on a leak limiting systems, and draws special attention to field installable vent limiters, see FR-101-NFPA 86-2012.
Message: Not shown legislatively correct.

Committee Notes: Nov 28, 2012 Duval

Public Input No. 169-NFPA 86-2012 [Section No. A.6.2.6.4]
A.6.2.7.3
Token relief valves only provide minimum pressure relief in cases where ambient temperatures increase the pressure inside the gas piping, which can occur during shutdown periods, or relieves small increases of pressure due to high lockup pressures that occur during a shutdown.

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc

Committee Statement and Meeting Notes

A.6.5.2(3)
The designer and user are cautioned that hazard conditions can result in common exhaust systems even when the radiant tube burners connected to the common exhaust system are equipped with flame supervision.

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Oct 22 16:24:21 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Off ratio conditions in radiant tube systems sharing a common exhaust system can create hazardous conditions even when the burners are equipped with flame supervision.

A.6.5.2(2)
The following sample calculation is provided to demonstrate a method of determining the required exhaust flow moving through the collecting and venting system for unsupervised radiant tube burners such that the atmosphere in the collecting and venting system is less than 100 percent LFL equals noncombustible state requirement. The sample calculation is based on the following assumptions:

(1) The fuel is methane gas.
(2) All burners are not firing.
(3) All burner fuel valves are open.
(4) The main safety shutoff valve is open.
Overall, the sample calculation is based on the following conservative conditions:

1. Use of the maximum fuel input rate for each burner
2. Assumption that all burner fuel valves are open
3. The design limit of <100% of LFL = noncombustible state
4. Inclusion of the effects of elevated furnace temperature on the LFL
5. The use of ambient air to dilute the products of combustions exiting the radiant tubes and being conveyed in the collecting and venting system

The effects of temperature on fuel gas LFL were obtained from Bureau of Mines Bulletin 680, “Investigation of Fire and Explosion Accidents in the Chemical, Mining, and Fuel-Related Industries – A Manual.” Figure 34 in that bulletin, “Temperature effect on lower limits of flammability of 10 normal paraffins in air at atmospheric pressure,” shows temperature (°C) versus combustibles (volume percent) and includes curves for methane, butane, and propane. It also includes a formula for computing LFL at elevated temperature. The formula, from Bureau of Mines Bulletin 627, “Flammability Characteristics of Combustible Gases and Vapors,” is as follows:

\[ L_T = L_{25} \left[ 1 - 0.000721(T - 25°C) \right] \]

where:

- \( L_T \) = LFL at the desired elevated temperature \( T \) (°C)
- \( L_{25} \) = LFL at 25°C
- \( T \) = Desired elevated temperature (°C)

**Sample Problem — U.S. Customary Units**

**Objective.** Calculate the exhaust flow moving through the collecting and venting system for unsupervised radiant tube burners so as to maintain the collecting and venting system atmosphere below 100% LFL (i.e., noncombustible state).

Given the following information:

1. Furnace type: Continuous
2. Fuel: Methane
3. Number of burners: 10
4. Maximum fuel input per burner: 600 scfh
5. Furnace temperature: 1200°F
6. Radiant tube exhaust temperature: 2000°F
7. Collecting and venting system temperature: 500°F, or 260°C

**Step 1.** Determine LFL at 500°F (which will be the same as the LFL at 260°C) using the formula from above.

\[ L_{500°F} = L_{260°C} = L_{25°C} \left[ 1 - 0.000721(260°C - 25°C) \right] \]

\[ = 5.3 \times 10^{-3} \text{ by volume} \]

**Step 2.** Determine exhaust flow at 70°F to control fuel input to <100% LFL. This formula follows an approach similar to that given in 11.6.3.3(A).

**Step 3.** Determine the temperature correction factor for volume. This formula is similar to the temperature correction factor formula used in 11.6.5.1.
Step 4. Determine exhaust flow at collection and venting system operating temperature to limit fuel input rate to 100% LFL at $T_{FCE\ TEMP}$. This formula follows an approach similar to that given in Chapter 9:

Conclusion. The calculated exhaust rate of > 4115 cfm at 500°F is required to keep the collecting and venting system <100% LFL at its operating temperature with all burners off and fuel gas flowing at the maximum input rate.

Sample Problem — SI Units

Objective. Calculate the exhaust flow moving through the collecting and venting system for unsupervised radiant tube burners so as to maintain the collecting and venting system atmosphere below 100% LFL (i.e., noncombustible state).

Given the following information:

(1) Oven type: Continuous
(2) Fuel: Methane
(3) Number of burners: 10
(4) Maximum fuel input per burner: 16.99 $m^3/hr @ 21^\circ C$
(5) Furnace temperature: 649°C
(6) Radiant tube exhaust temperature: 1093°C
(7) Collecting and venting system temperature: 500°F (260°C)

Step 1. Determine LFL at 260°C using the formula from above:

$$I_{260^\circ F} = I_{25^\circ C} = I_{25^\circ C} \left[ 1 - 0.000721 \left( T - 25^\circ C \right) \right]$$

$$= 5.3 \left[ 1 - 0.000721 \left( 260^\circ C - 25^\circ C \right) \right]$$

$$= 4.4\% \text{ by volume}$$

Step 2. Determine exhaust airflow at 21°C to control fuel input to <100% LFL. This formula follows an approach similar to that given in Chapter 11:

$$Q_{EXH\ 21^\circ C \& %\ LFL} > \frac{Q_{FUEL\ INPUT}}{\left[ (LFL_{FCE\ TEMP}) \cdot (1.0)\% \text{ fuel vol. at } 25\% \ LFL \right]}$$

$$> \frac{\left[ (16.99 \ m^3/hr @ 21^\circ C/burner)(10 \ burners)(1 \ hr/60 \ min) \right]}{(1.0)/(0.044)(1.0)}$$

$$> 64.33 \ m^3/min @ 21^\circ C$$

Step 3. Determine the temperature correction factor for volume. This formula is similar to the temperature correction factor formula used in Chapter 11:

$$T_{CF\ VOL} = \frac{T_{EXH\ TEMP} + 273\ C}{(21^\circ C + 273\ C)}$$

$$= \frac{260^\circ C + 273\ C}{(21^\circ C + 273\ C)}$$

$$= 1.81$$

Step 4. Determine exhaust flow at oven operating temperature to limit fuel input rate to 100% LFL at $T_{FCE\ TEMP}$. This formula follows an approach similar to that given in Chapter 11:
\[ Q_{\text{EXH}} \geq 116.63 \text{ cfm} \times \text{m}^3 @ 260^\circ C \]

Conclusion. The calculated exhaust rate of >116.63 cfm m^3 @ 260°C is required to keep the collecting and venting system <100% LFL at its operating temperature with all burners off and fuel gas flowing at the maximum input rate.

Supplemental Information

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Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:43:34 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The referenced section shows formulas for temperature correction of the LFL and does not relate to the formula of Step 2. In the Sample Problem — U.S. Customary Units, Step 2 and 4 the following is revised: The decimal in the resulting value 2.272 is not correct and the actual calculation equals 2272. The referenced section is Fire Protection and has no formulas or methods relating to the formula of Step 4. The correct value of TCF VOL in Step 3 was 1.81 instead of 2.38. The correct final result is 4112 instead of 4.115. In the conclusion for the Sample Problem - SI units, the cfm units are incorrect and should be m3 / min as shown in the preceding text line.

Response: FR-47-NFPA 86-2012

Committee Notes:

Nov 27, 2012 Duval The updated equations are part of the edited text and attached

Public Input No. 156-NFPA 86-2012 [Section No. A.6.5.2(2)]
First Revision No. 94-NFPA 86-2012 [New Section after A.7.1.6]

A.7.1.7

The evacuation, purging, charging, and confirmation of the fuel or combustible gas supply in the piping upstream of the equipment isolation valve is governed by other codes, standards, and recommended practices. One example is Section 8.3 of NFPA 54, *National Fuel Gas Code*, which requires charging to be stopped upon detection of combustible gas at the point of discharge. Careful consideration should be given to the potential hazards that may be created in the surrounding area for any fuel or combustible gas discharge.

In NFPA 54, the term *Appliance Shutoff Valve* is analogous to the term *Equipment Isolation Valve* in NFPA 86.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:25:29 EDT 2012

Committee Statement and Meeting Notes

Committee Statement:

This revision originates from Tentative Interim Amendment 86-11-3 (TIA 1010) issued by the Standards Council on March 1, 2011. The U.S. Chemical Safety and Hazard Investigation Board (CSB) requested an appropriate action by NFPA 86 in response to the following fuel gas related explosion at ConAgra Foods, Garner, NC in 2009. The NFPA 86 task group elected to wait until NFPA 54 took action on this matter. NFPA 54 issued TIA 09-3 with an effective date of 08/25/10. Excerpt from NFPA 54-2009 3.3.105.1 *Appliance Shutoff Valve.* A valve located in the piping system used to shut off individual equipment. Excerpt from NFPA 86-2011 3.3.76.3 *Equipment Isolation Valve.* A manual shutoff valve for shutoff of the fuel to each piece of equipment. Note: This TIA does not address liquid fuel evacuation/purging, charging, and confirmation of liquid fuel supply. The emergency condition identified by the CSB for fuel gas discharges did not extend to liquid fuels, however, the management of liquid fuels should be considered in the next revision cycle. Emergency Nature: The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing or dangerous condition or situation. The submitter has proposed this Tentative Interim Amendment to add sections 7.1.7*, A.7.1.7, 7.4.19* and A.7.4.19 on evacuation/purging, charging, and confirmation of the fuel or combustible gas supply in the supply piping because of the Technical Committee’s awareness of incidents including the investigation findings of the U.S. Chemical Safety and Hazard Investigation Board (CSB). The current requirements of the NFPA 86 Standard provide a performance approach to establishing safe conditions but does not provide any requirements for the evacuation/purging, charging, and confirmation of the fuel or combustible gas supply contained within the fuel or combustible gas supply piping nor any requirements defining the quality of the fuel or combustible gas being delivered by piping systems governed by NFPA 54 National Fuel Gas Code and other Codes and Standards. The submitter and members of the NFPA 86 Technical Committee wish to draw attention to this potential hazard by the addition of the proposed requirements and Annex referencing NFPA 54’s related requirements.

Response:

FR-94-NFPA 86-2012

Message:

Public Input No. 176-NFPA 86-2012 [New Section after A.7.1.6]
First Revision No. 105-NFPA 86-2012 [New Section after A.7.4.9]

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Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 16:49:17 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The revision describes an alternative means to leak test a safety shutoff valve. This is not a new section after A.7.4.9, but it is to be added to the end of the existing A.7.4.9.
Response: FR-105-NFPA 86-2012
Message: Public Input No. 152-NFPA 86-2012 [New Section after A.7.4.9]
First Revision No. 98-NFPA 86-2012 [ New Section after A.7.4.15 ]

Submitter Information Verification
Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]

Committee Statement and Meeting Notes
Committee Statement: Revision originates from Tentative Interim Amendment 86-11-3 (TIA 1010) issued by the Standards Council on March 1, 2011. The U.S. Chemical Safety and Hazard Investigation Board (CSB) requested an appropriate action by NFPA 86 in response to the following fuel gas related explosion at ConAgra Foods, Garner, NC in 2009. Excerpt from NFPA 54-2009 3.3.105.1 Appliance Shutoff Valve.&lt;/amp;#160;&lt;/amp;#160; A valve located in the piping system used to shut off individual equipment. Excerpt from NFPA 86-2011 3.3.76.3 Equipment Isolation Valve.&lt;/amp;#160;&lt;/amp;#160; A manual shutoff valve for shutoff of the fuel to each piece of equipment. Note: This TIA does not address liquid fuel evacuation/purge, charging, and confirmation of liquid fuel supply. The emergency condition identified by the CSB for fuel gas discharges did not extend to liquid fuels, however, the management of liquid fuels should be considered in the next revision cycle. Emergency Nature: The proposed TIA intends to offer to the public a benefit that would lessen a recognized (known) hazard or ameliorate a continuing or dangerous condition or situation. The submitter has proposed this Tentative Interim Amendment to add sections 7.1.7*, A.7.1.7, 7.4.19* and A.7.4.19 on evacuation/purging, charging, and confirmation of the fuel or combustible gas supply in the supply piping because of the Technical Committee’s awareness of incidents including the investigation findings of the U.S. Chemical Safety and Hazard Investigation Board (CSB). The current requirements of the NFPA 86 Standard provide a performance approach to establishing safe conditions but does not provide any requirements for the evacuation/purging, charging, and confirmation of the fuel or combustible gas supply contained within the fuel or combustible gas supply piping nor any requirements defining the quality of the fuel or combustible gas being delivered by piping systems governed by NFPA 54 National Fuel Gas Code and other Codes and Standards. The submitter and members of the NFPA 86 Technical Committee wish to draw attention to this potential hazard by the addition of the proposed requirements and Annex referencing NFPA 54’s related requirements.

Response Message:
Public Input No. 177-NFPA 86-2012 [New Section after A.7.4.15]

First Revision No. 120-NFPA 86-2012 [ New Section after A.8.1 ]

Submitter Information Verification
Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Mon Nov 19 10:36:32 EST 2012

Committee Statement and Meeting Notes
Committee Statement: The Committee believes that the revised section and the added annex material meets the submitter's intent on when manual intervention is required, see FR-32-NFPA 86-2012.
A.8.2.3
Consideration should be given to the effects of radiant heat on the safety devices. Radiant heat can cause safety devices to be exposed to temperatures greater than their ratings. Adequate insulation, heat shields, ventilation, or other measures should be used in cases where radiant heat causes safety devices to reach temperatures above their ratings.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Nov 06 11:34:40 EST 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee added annex material on the new 8.2.2, see FR-8-NFPA 86-2012, to help clarify when approving devices when listed devices are not available. Also, the existing subsequent annex sections to be renumbered because of the new 8.2.2 added in FR-8-NFPA 86-2012.
Committee Notes:

Date Submitted By
Nov 6, 2012 Duval
Renumber existing sections to reflect new addition of 8.2.2 in FR-8.

First Revision No. 23-NFPA 86-2012 [ Section No. A.8.2.8, A.8.2.10, A.8.2.11 ]

A.8.2.9
The actions resulting from a manual emergency switch action take into account the individual system design and the hazards (e.g., mechanical, combustion system, special atmosphere, etc.) associated with changing the existing state to another state and initiates actions to cause the system to revert to a safe condition.
For some applications, additional manual action may be required to bring the process to a safe condition.

A.8.2.10
The manual intervention applies only to shutdowns of a safety function. Safety devices such as burner safeguard controllers can contain non-safety-related control sequences that can shut down the heating system due to a process control function, such as temperature control. Even though the action is within a safety device, the shutdown is not by a safety function.

A.8.2.11
A single pressure transmitter with associated logic can be used to provide both of the required low and high pressure interlock functions. A single flow transmitter with associated logic can be used to provide both of the required low and high flow interlock functions.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 01:03:38 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Annex material added for further clarification, see FR-22-NFPA 86-2012.
Public Input No. 118-NFPA 86-2012 [Section No. A.8.2.8]
A.8.2.11
A single pressure transmitter with associated logic can be used to provide both of the required low and high pressure interlock functions. A single flow transmitter with associated logic can be used to provide both of the required low and high flow interlock functions.

Submitter Information Verification
Submitter Full Name:[ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Wed Oct 24 09:48:19 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: Add clarification that 8.2.11 (FR-9-NFPA 86-2012) does not specifically require a one for one replacement of one transmitter for the low gas pressure switch and a separate transmitter for the high gas pressure switch. With advances in diagnostics of transmitters for the detection of internal failures as well as diagnostic capabilities afforded by monitoring an analog variable, the replacement of two discrete switches by a single transmitter does not reduce the level of safety. The function being monitored by a transmitter is viewed as a single function, “in safe range”.
Public Input No. 134-NFPA 86-2012 [New Section after A.8.4]

A.8.3
Furnace controls that meet the performance-based requirements of standards such as ANSI/ISA 84.00.01, Application of Safety Instrumented Systems for the Process Industries, and IEC 61511, Functional Safety: Safety Instrumented Systems for the Process Industry Sector, can be considered equivalent. The determination of equivalency will involve complete conformance to the safety life cycle including risk analysis, safety integrity level selection, and safety integrity level verification, which should be submitted to the authority having jurisdiction.

Submitter Information Verification
Submitter Full Name:[ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Wed Oct 24 17:38:51 EDT 2012

Committee Notes:
Committee Statement: The requirements are identical in the two cited standards.
Committee Notes:
Date Submitted By
Nov 28, 2012 Duval Not shown legislatively correct. The only new text is the second reference
Public Input No. 123-NFPA 86-2012 [Section No. A.8.3]
First Revision No. 84-NFPA 86-2012 [ New Section after A.8.4.5(A)(1) ]

A.8.4.5(A)(4)

This standard requires that the signal from the safety device be directly transmitted to the safety PLC input. Once the safety PLC processes the signal the resulting data can be used for any purpose.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Wed Oct 24 12:54:58 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee added annex material to help clarify the requirements in the Safety PLC Section.
Response Message: FR-84-NFPA 86-2012
A.8.5.1.2(C)(2)

See, Figure A.8.5.1.2(C)(2)

**Figure A.8.5.1.2(C)(2) Example for Multiple Burner System with Independently Operated Burners Using a Common SSOV with Single Proved Closed Interlock for Pre-purge.**

Note: * Indicates a proof of closure switch. A valve proving system may also be an option.

** Indicates position indication. Where the individual burner inputs are under 150,000 Btu/h, position indication is not required.

**Supplemental Information**

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**Submitter Information Verification**

Submitter Full Name: [Not Specified]

Organization: [Not Specified]

Submittal Date: Tue Oct 23 16:12:48 EDT 2012

**Committee Statement and Meeting Notes**

Committee: Modifies the drawing to be consistent with NFPA 86 (2011) symbols. Clarifies that 8.8.2.2 does not require more than one proved closed interlock for pre-purge in a multi-burner system. The Committee moved the proposed figure to annex to 8.5.1.2 (C)(2). Figure is in the attachment.

Response: FR-35-NFPA 86-2012 Message:

Committee Notes:

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Figure is in the attachment. Would not paste in.

**Public Input No. 130-NFPA 86-2012 [Section No. A.8.8.2.2]**

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**First Revision No. 31-NFPA 86-2012 [ Section No. A.8.5.1.8(4)(d) ]**

A.8.5.1.8(4)(d)

In accordance with A.8.5.1.8(4)(c), fuels other than natural gas, butane, or propane may require additional consideration. These additional considerations would be addressed using Section 1.5. The concern with other fuel gases is the variability of fuel gas content being delivered over time. Specific examples include landfill gas and bio gas.

The following sample calculation illustrating the use of 8.5.1.8(4)(d) is provided to demonstrate a method of determining the 25% LFL requirement.
The sample calculation is based upon the following assumptions:

1. The fuel is methane gas.
2. All burners are turned off for control purposes. All safety shutoff valves are de-energized.
3. Two safety shutoff valves are closed. At each burner, two safety shutoff valves are closed, or a single shutoff valve is proven closed.
4. All safety shutoff valves are proven closed. All safety shutoff valves are tested for seat leakage at least semiannually.
5. Safety shutoff valve seat leakage is assumed to be 1 scfh (0.0283 m³/hr @ 21°C).

The following thoughts are offered regarding the selection of the 1 scfh (0.0283 m³/hr @ 21°C) safety shutoff valve seat leakage rate.

Limited data reviewed by the committee indicates that valve seat leakage rates over 1 scfh (0.0283 m³/hr @ 21°C) are not anticipated unless the safety shutoff valve seats are exposed to extremely unusual conditions such as corrosives in the fuel gas or furnace heat allowed to back up the fuel line and burn the safety shutoff valve seat. The former condition is the basis for limiting the use of 8.5.1.8(4) to furnaces using natural gas, butane, or propane fuel gases. The latter condition occurred in a case where a fuel line was inappropriately opened by maintenance staff while the furnace was in operation. The furnace was promptly shut down, and the safety shutoff valves were replaced.

Under operating conditions expected by this standard, it is anticipated that debris from internal fuel gas line oxidation (rust), pipe thread shavings not removed before fuel line assembly, or similar exposures can subject one safety shutoff valve to seat damage that can lead to seat leakage of one safety shutoff valve; however, it is not expected that both safety shutoff valves would experience similar seat leakage. The selected safety shutoff valve seat leakage rate of 1 scfh (0.0283 m³/hr @ 21°C) is considered conservative.

Overall, this sample calculation is based upon the following conservative conditions:

1. The use of a 1 scfh (0.0283 m³/hr @ 21°C) safety shutoff valve seat leakage rate.
2. Providing two safety shutoff valves for each fuel path.
3. Using valve proving to prove each safety shutoff valve closed.
4. Assuming safety shutoff valve leakage at each burner fuel path.
5. Assuming safety shutoff valve leakage at each burner fuel path.
6. Including the effects of elevated furnace temperature on the LFL.
7. Assuming no fuel exits the furnace.

The effects of temperature on fuel gas LFL were obtained from a United States Department of the Interior, Bureau of Mines Bulletin 680, “Investigation of Fire and Explosion Accidents in the Chemical, Mining, and Fuel-Related Industries — A Manual.” Figure 34 in that bulletin, “Temperature effect on lower limits of flammability of 10 normal paraffins in air at atmospheric pressure,” shows temperature (°C) versus combustibles (volume percent) and includes curves for methane, butane, and propane. It also includes a formula for computing LFL at elevated temperature. That formula, based on Bureau of Mines Bulletin 627, “Flammability Characteristics of Combustible Gases and Vapors,” is as follows:

\[
L_T = L_{25} \left[1 - 0.000721\left( T - 25^\circ C \right) \right]
\]

where:

- \( L_T \) = LFL at the desired elevated temperature, \( T \) (°C)
- \( L_{25} \) = LFL at 25°C
- \( T \) = Desired elevated temperature (°C)

**Sample Problem — U. S. Customary Units**

**Objective.** Calculate the amount of time that all burners can be turned off before the furnace atmosphere will reach 25% of LFL.

**Assumptions.** Furnace contains no combustibles when the burners are turned off. Furnace is under positive pressure with no air infiltration.

Given the following information:

- Furnace type: Batch
- Furnace size: 8 ft wide × 6 ft deep × 8 ft tall
- Number of burners: 5
- Burner design rate: 0.8 MM Btu/hr
- Burner design excess air: 10.0%
- Burner design air capacity: 8800 scfh
- Burner air minimum design flow: 100 scfh
- Maximum leak rate each flow path*: 1 scfh
- Number of burner flow paths**: 5
Furnace temperature: 900°F or 482°C
Oxygen in furnace atmosphere: 18%
Fuel: Methane

*The flow path is across one set of safety shutoff valves proven closed.
**The number of flow paths is the number of sets of safety shutoff valves which are closed that can leak into the furnace enclosure.

Step 1. Determine LFL at 900°F using the formula from above:

\[
I_{900°F} = I_{25°F} = I_{25} \left[ 1 - 0.000721(T - 25°C) \right] \\
= 5.3 \left[ 1 - 0.000721(482°C - 25°C) \right] \\
= 3.6 \% \text{ by volume}
\]

Step 2. Determine the furnace volume:

\[ V_{FCE} = L \times W \times H = 8 \text{ ft} \times 6 \text{ ft} \times 8 \text{ ft} = 384 \text{ ft}^3 \]

Step 3. Determine the methane leak rate into the furnace with all burners off:

\[ Q_{\text{LEAK}} = \# \text{ flow paths} \times \text{ leak rate per path} \\
= 5 \text{ paths} \times 1 \text{ scfh/path} \\
= 5 \text{ scfh} \]

Step 4. Determine the airflow into the furnace with all burners off:

\[ Q_{\text{AIR}} = \# \text{ burners} \times \text{ airflow rate per idle burner} \\
= 5 \text{ burners} \times 100 \text{ scfh/burner} \\
= 500 \text{ scfh} \]

Step 5. Determine the percent volume methane to air through all burners:

\[
\% \text{ volume methane to air} = \left( \frac{Q_{\text{LEAK}}}{Q_{\text{AIR}}} \right) (100\%) \\
= (5 \text{ scfh}/500 \text{ scfh})(100\%) \\
= 1\% 
\]

Step 6. Determine the percent LFL resulting from the methane flow through all burner fuel paths at 900°F:

\[
\% LFL_{900°F} = \left( \frac{\% \text{ volume methane to air}}{LFL_{900°F}} \right) (100\%) \\
= (1\% / 3.5\%) (100\%) \\
= 28.57\% 
\]

Step 7. Determine the time in minutes to reach 25% LFL with all burners off:

\[
t_{\text{FCE 25% LFL}} = \left[ \left( I_{900°F} \right)(0.25) \right] / \left[ \left( Q_{\text{LEAK}} / V_{\text{FCE}} \right) \right] (60 \text{ min/hr}) \\
= \left[ \left( 0.036 \right)(0.25) / (5 \text{ ft}^3/\text{hr}/384 \text{ ft}^3) \right] (60 \text{ min/hr}) \\
= 41.5 \text{ minutes} 
\]

Conclusions. Where the value of % LFL_{900°F} exceeds 25 percent, the burner safety shutoff valves can remain closed and burners be reignited without a repurge within a period of time not exceeding t_{\text{FCE 25% LFL}}. After t_{\text{FCE 25% LFL}} is exceeded, a repurge of the furnace is required.

Where the value of % LFL_{900°F} equals or is less than 25 percent, burners can be reignited at any time as long as the airflow rate Q_{\text{AIR}} is proven and interlocked in the burner management system such that loss of this proven airflow rate will require a repurge of the furnace before burner reignition is permitted.

Sample Problem — SI Units

Objective. Calculate the amount of time that all burners can be turned off before the furnace atmosphere will reach 25% of LFL.

Assumptions. Furnace contains no combustibles when the burners are turned off. Furnace is under positive pressure with no air infiltration.

Given the following information:

Furnace type: Batch
Furnace size: 2.438 m wide × 1.828 m deep × 2.428 m tall
Number of burners: 5
Burner design rate: 234.2 kW
Burner design excess air: 10.0%
Burner design air capacity: 249.2 m$^3$/hr @ 21°C
Burner air minimum design flow: 2.83 m$^3$/hr @ 21°C
Maximum leak rate each flow path*: 0.0283 m$^3$/hr @ 21°C
Number of burner flow paths**: 5
Furnace temperature: 900°F or 482°C
Oxygen in furnace atmosphere: 18%
Fuel: Methane

*The flow path is across one set of safety shutoff valves proven closed.

**The number of flow paths is the number of sets of safety shutoff valves which are closed that may leak into the furnace enclosure.

Step 1. Determine LFL at 482°C using the formula from above:

$$L_{\text{482°C}} = L_{\text{LFL}} \left[ 1 - 0.000721 \left( T - 25°C \right) \right]$$

$$= 5.3 \left[ 1 - 0.000721 \left( 482°C - 25°C \right) \right]$$

$$= 3.6 \% \text{ by volume}$$

Step 2. Determine the furnace volume:

$$V_{\text{FCE}} = L \times W \times H = 2.438 \text{ m} \times 1.828 \text{ m} \times 2.428 \text{ m} = 10.87 \text{ m}^3$$

Step 3. Determine the methane leak rate into the furnace with all burners off:

$$Q_{\text{LEAK}} = \# \text{flow paths} \times \text{leak rate per path}$$

$$= 5 \text{ paths} \times 0.0283 \text{ m}^3/\text{hr @ 21°C} / \text{path}$$

$$= 0.142 \text{ m}^3/\text{hr @ 21°C}$$

Step 4. Determine the airflow into the furnace with all burners off:

$$Q_{\text{AIR}} = \# \text{burners} \times \text{airflow rate per idle burner}$$

$$= 5 \text{ burners} \times 2.83 \text{ m}^3/\text{hr @ 21°C} / \text{burner}$$

$$= 14.2 \text{ m}^3/\text{hr @ 21°C}$$

Step 5. Determine the percent volume methane to air through all burners:

$$\% \text{ vol. methane to air}$$

$$= \left( \frac{Q_{\text{LEAK}}}{Q_{\text{AIR}}} \right) \left( 100\% \right)$$

$$= \left( \frac{0.142 \text{ m}^3/\text{hr @ 21°C}}{14.2 \text{ m}^3/\text{hr @ 21°C}} \right) 100\%$$

$$= 1\%$$

Step 6. Determine the percent LFL resulting from the methane flow through all burner fuel paths at 482°C:

$$\% LFL_{\text{482°C}} = \left( \frac{\% \text{ volume methane to air}}{LFL_{\text{482°C}}} \right) \left( 100\% \right)$$

$$= \left( \frac{1\%}{3.5\%} \right) \left( 100\% \right)$$

$$= 28.57\%$$

Step 7. Determine the time in minutes to reach 25 percent LFL with all burners off:

$$t_{\text{FCE 25% LFL}} = \left[ \left( \frac{L_{\text{482°C}}}{0.25} \right) / \left( \frac{Q_{\text{LEAK}}}{V_{\text{FCE}}} \right) \right] \left( 60 \text{ min/hr} \right)$$

$$= \left[ \left( 0.036 \right) / \left( 0.142 \text{ m}^3/\text{hr @ 21°C} / 10.87 \text{ m}^3 \right) \right] \left( 60 \text{ min/hr} \right)$$

$$= 41.3 \text{ minutes}$$

Conclusions. Where the value of % LFL 482°C exceeds 25 percent, the burner safety shutoff valves can remain closed and burners be reignited without a repurge within a period of time not exceeding $t_{\text{FCE 25% LFL}}$. After $t_{\text{FCE 25% LFL}}$, a repurge of the furnace is required.

Where the value of % LFL 482°C equals or is less than 25 percent, burners can be reignited at any time as long as the airflow rate $Q_{\text{AIR}}$ is proven and interlocked in the burner management system such that loss of this proven airflow rate will require a repurge of the furnace before burner reignition is permitted.
Committee Statement and Meeting Notes

Committee Statement: This revision fixes a discrepancy from adopting TIA86-11-4. The TIA changed the original A.8.5.1.8(4)(a) condition and replaced the “At least two safety shutoff valves are proved closed…” requirement with “The number of safety shutoff valves required to close in 8.8.1.2 and 8.8.1.3 will close…”. The Annex assumption condition of A.8.5.1.8(4)(d)(4) which refers to the original condition for “proved close” does not apply when TIA11-4 is incorporated. All use of “proven” for this annex example do not apply and should be deleted. The Committee also corrected a typo in the Sample Problem - U.S. Customary Units of A.8.5.1.8(4)(d) Step 1 which should read: L900F=L482C. Additionally, the Committee corrected the application of the formula presented in the Sample Problem - U.S. Customary Units of A.8.5.1.8(4)(d) Step 5. Which should read: (5 scfh/500 scfh) (100%).

Response Message:

Committee Notes:

Date Submitted By
Nov 19, 2012 Duval FR does not show legislative text correctly, to see correct text and changes click "hide markup" or see attached.

Public Input No. 40-NFPA 86-2012 [Section No. A.8.5.1.8(4)(d)]
Public Input No. 148-NFPA 86-2012 [Section No. A.8.5.1.8(4)(d)]
Public Input No. 170-NFPA 86-2012 [Section No. A.8.5.1.8(4)(d)]
Public Input No. 179-NFPA 86-2012 [Section No. A.8.5.1.8(4)(d)]

First Revision No. 51-NFPA 86-2012 [New Section after A.8.5.2]

Use of a rotational switch is an acceptable means of proving operation of a fan where the impeller is not located in a dedicated housing (nonducted). A Hall effect sensor is one example of a device that can be used to prove fan shaft rotation.

Regular inspection of the impeller may be required to ensure original performance is maintained (i.e., blades still attached, angles on blades correct, etc.).

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 21:58:39 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Annex material is added to help clarify acceptable methods for monitoring operation of non-ducted fans or fans not enclosed in a dedicated housing.

Response Message:

Public Input No. 56-NFPA 86-2012 [New Section after A.8.5.2]
A.8.7.4

In industrial combustion applications with modulating flow control valves downstream of the combustion air blower, it is most common to interlock the constant combustion air source pressure on single and multiburner systems to meet the requirements of 8.7.2 and 8.7.4.

Because the combustion airflow is proved during each purge cycle along with the combustion air source pressure, the most common convention is to prove the combustion air source pressure during burner operation following purge. In a multiburner system, the proof of combustion airflow during purge proves that any manual valves in the combustion air system are in an adequately open position. These manual air valves are provided for maintenance and combustion airflow balancing among burners in a temperature control zone. In combustion air supply systems that use either an inlet damper or a speed control, the combustion air pressure can fall below reliably repeatable levels with listed pressure switch interlocks at low fire. For these systems, the proof of minimum airflow can be a more reliable interlock.

A pressure switch on the inlet (suction) side of an induced draft (ID) fan can be used to prove that the minimum required suction pressure is available.

For combustion systems that use high pressure gas/air to induce (inspirate) air locally at each burner, it is impractical to monitor and prove the availability of combustion air.

For combustion systems that use natural (stack) draft to induce air into the burners or combustion chamber, it is impractical to monitor and prove the availability of combustion air.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Mon Oct 22 15:57:06 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Adds clarifying content to the Annex to help users differentiate between sources of combustion air for which minimum flow or pressure can be proven and sources for which it cannot, practically speaking.
Response: FR-4-NFPA 86-2012
Message:
Committee Notes:

Date    Submitted By
Nov 20, 2012        Duval
FR-42 - Changes the section numbers acceptance of this FR would affect the numbering and reference numbering.

Public Input No. 46-NFPA 86-2012 [Section No. A.8.7.5]
Paragraph A.8.8.1.3 addresses conditions under which only one safety shutoff valve is to close to isolate a burner from its fuel gas supply. Figure A.8.8.1.3 provides a summary of A.8.8.1.3 in the form of a decision tree. See 8.5.1.7 and 8.5.1.8 for guidance regarding conditions that are needed to allow that burner to be placed back in service. The requirements of 8.5.1.8 might not allow a burner shut off by closing a single safety shutoff valve to be placed back in service without repeating a pre-ignition purge.

The requirements of A.8.8.1.3 do not preclude opening of the safety shutoff valve located upstream of the individual burners using single safety shutoff valves during the trial for ignition for the first burner being lighted.

Figure A.8.8.1.3 Safety Shutoff Decision Tree.

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Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:39:54 EDT 2012

Committee Statement and Meeting Notes

Committee: 8.5.1.7 is also a condition (repeating pre-purge) needed to allow a burner placed back into service. Both 8.5.1.7 and 8.5.1.8 work together and as such are referenced together.
Message:

Committee Notes:

Date Submitted By
Nov 20, 2012 Duval

The only addition in this section is the reference to 8.5.1.7
A.8.8.1.3(2)
See A.8.8.1.3(3) and A.8.5.1.8(3) for a sample calculation to demonstrate a method of determining the 25 percent LFL requirement.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 15:41:29 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: The reference to A.8.8.1.3(3) does not exist. Section A.8.5.1.8(3) covers the case where the valve is wide open which is the subject of 8.8.1.3(2).
Response: FR-96-NFPA 86-2012
Message:
Committee Notes:

Date Submitted By
Nov 28, 2012 Duval not showing legislative text correctly.

Public Input No. 90-NFPA 86-2012 [Section No. A.8.8.1.3(2)]
Public Input No. 171-NFPA 86-2012 [Section No. A.8.8.1.3(2)]
First Revision No. 36-NFPA 86-2012 [Section No. A.8.8.2]

A.8.8.2
See Figure A.8.8.2.
Figure A.8.8.2 Typical Piping Arrangement Showing Fuel Gas Safety Shutoff Valves.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 16:20:35 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: This Figure is no longer consistent with the new text in FR-(PI-157) and as such the Committee removed the figure.
Committee Notes:
Date Submitted By
Oct 23, 2012 Duval REMOVE FIGURE A.8.8.2

First Revision No. 49-NFPA 86-2012 [Section No. A.8.8.3.2]

A.8.8.3.2
An additional safety shutoff valve located to be common to the furnace system and proved closed and interlocked with the pre-ignition purge circuit can be used to meet the requirements of A.8.8.2.

Submitter Information Verification
Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:50:54 EDT 2012

Committee Statement and Meeting Notes
Committee Statement: 8.8.2.2 deals with gas valves, this annex is in reference to oil valves.
Public Input No. 172-NFPA 86-2012 [Section No. A.8.8.3.2]
A.8.9 A system designer can choose to use pressure switches in a pilot. However, gas pressure switches on a pilot can be desirable, and the following conditions should be considered in deciding whether or not switches should be used:

1. If it’s a continuous pilot, if a reliable pilot after light off is still a desirable part of the safety during operation of the burner, the switches help prove the reliability of the pilot so that the gas pressure to the pilot is proven to be within designed parameters.

2. If the pilot burner capacity is above 400,000 Btu/hr, direct sparking a burner in excess of 400,000 Btu/hr could introduce added risks if a delayed ignition occurs due to too much or too little gas pressure.

3. If the pilot burner uses its own pressure regulator, failure of that regulator could cause instability of the burner or expose downstream components to pressures exceeding their ratings.

4. If the inlet pressure to the pilot regulator exceeds ½ psi, the higher the pressure to the pilot burner, the greater the risk of a problem due to incorrect gas pressure. The failure or overloading of a pilot regulator can be at a significantly higher risk where inlet pressures to the pilot regulator exceed ½ PSI.

Where providing overpressure protection for a pilot line in order to comply with 8.2.10, a high gas pressure switch on the pilot line in combination with a shutoff valve may be used.

A.8.10.1.3 Subsections 8.2.1, 8.2.2, and 8.2.5 require the combustion safeguard be listed, applied, and installed according to the manufacturer’s instructions. Manufacturer’s instructions can limit the operating time of a combustion safeguard without shutdown and safe-start check or a self-checking logic. Figure A.8.10.1.3 shows the difference between flame response time (FRT) and flame failure response time (FFRT).

Figure A.8.10.1.3 Example of the Difference Between FRT and FFRT.
First Revision No. 126-NFPA 86-2012 [Section No. A.8.10.1]

Supplemental Information

File Name: FR_126_A81013_Figure.pdf

Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Tue Nov 27 22:21:33 EST 2012

Committee Statement and Meeting Notes

Committee Statement: The Committee clarified when combustion safeguards annex material from the revised FR-125-NFPA 86-2012.

First Revision No. 6-NFPA 86-2012 [Section No. A.8.11.2]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 16:03:09 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: A.8.11.2 included a requirement which should be in the mandatory text. See related FR-7-NFPA 86-2012.
Response Message: FR-6-NFPA 86-2012
Public Input No. 48-NFPA 86-2012 [Section No. A.8.11.2]

First Revision No. 5-NFPA 86-2012 [New Section after A.8.17.4]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Mon Oct 22 15:58:23 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Clarifies that the standard permits the 1400F (760C) Bypass Interlock function and the Excess Temperature Limit Interlock function can be incorporated into the same physical device.
Response Message: FR-5-NFPA 86-2012
Public Input No. 47-NFPA 86-2012 [New Section after A.8.17.4]
Where fire protection is determined to be necessary, a documented study should be conducted to determine the correct response to a fire to achieve a safe shutdown of the oven and an effective response of the fire protection system. Automatic interlocks should be provided where actions do not require operator evaluation. Specific actions will depend on the oven design, type of fire protection system, the characteristics of the combustible material(s), the source(s) of combustibles, the ability to isolate combustible sources, and the effects of fresh air. Items to be considered should include, but not be limited to, the following:

1. The means for detecting a fire
2. Type(s) of fire protection system(s) effective at controlling the fire
3. Manual vs. automatic operation of the fire protection system
4. Shutting down the fuel supply (heating system) where such action does not increase the fire hazard
5. Stopping the conveyor system vs. diverting or stopping entering product and running the conveyor at high speed to empty oven
6. Shutting down fans and closing dampers to block fresh air entry and contain the fire suppression medium vs. maintaining fans in operations and dampers open to ensure an explosive atmosphere does not develop

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 21:48:47 EDT 2012

Committee Statement and Meeting Notes

Committee: Existing requirements in Chapter 11 do not address what action should be taken in the event of a fire in an oven or furnace.

Statement: While such actions are not "one-size-fits-all", where fire protection is needed it is important it be a coordinated system and, where manual actions are required, written procedures exist and operator training (addressed in Section 7.2) is done.

Message: Public Input No. 166-NFPA 86-2012 [New Section after A.9.1]
When exhaust is recycled, it can reduce the oxygen content supplied to the incinerator (reducing destruction efficiency). This in turn will result in increased levels of flammable vapors being exhausted into the oven for heat recovery purposes. The system design should have inherent physical characteristics to ensure that the ratio of heat recovery gases is limited to prevent unsafe conditions or use a combination of telemetry controls and interlocks to prevent this from occurring.

Committee Statement and Meeting Notes

Committee Statement: The new text for 10.6.3.3 requires explanatory text to assist the reader in understanding the purpose in providing "special precautions". Annex material to FR-87-NFPA 86-2012.


Public Input No. 128-NFPA 86-2012 [New Section after A.10.6.2.2]
Ovens using a single fan for both recirculation and exhaust are currently in use and manufactured. These dual-purpose fan installations have a long history of fire and explosion incidents. Figure A.11.6.1.10 shows examples of unacceptable safety ventilation systems. In the past, NFPA 86 prohibited ovens using a single fan for both recirculation and exhaust. These dual-purpose fan installations have a long history of fire and explosion incidents. The primary cause of these incidents was short-circuiting of safety ventilation resulting in pockets or zones in which flammable vapors can concentrate.

The current text for 11.6.1.10 now permits alternative means to dedicated exhaust fans for proving safety ventilation. Accordingly, the user, oven designer, and the AHJ are cautioned to carefully examine air flow of both incoming and exhaust with respect to operating pressures, circulating methodology, and proof of the air flow design.

Figure A.11.6.1.10 illustrates an example that is unacceptable because short-circuiting is possible as well as an example that is potentially acceptable. The key in most cases is locating the fresh air intake(s) in relation to the exhaust appropriately to ensure that fresh air passes throughout the volume.

These drawings best pertain to batch ovens, as the openings in a continuous oven alter pressure differentials creating additional flow paths which must be taken into consideration.

Figure A.11.6.1.10 Unacceptable Safety Ventilation Systems Using a Single Fan (Recirculation Combined with Spill Exhaust).
Supplemental Information

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Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]

Committee Statement and Meeting Notes

Committee Statement: Clarifies title of figure to identify the figure's content as "examples" and to inform readers that "short-circuited airflow" is the problem being addressed in the examples.
Public Input No. 83-NFPA 86-2012 [Section No. A.11.6.1.10]

First Revision No. 53-NFPA 86-2012 [New Section after A.11.6.1.15]

| A.11.6.2.1               | See A.8.6.1          |

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Submittal Date: Tue Oct 23 22:01:10 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Provides cross-reference to new annex material added at A.8.6.1 which will help the users of Class A ovens to clarify acceptable methods for monitoring operation of non-ducted fans or fans not enclosed in a dedicated housing.
Public Input No. 58-NFPA 86-2012 [New Section after A.11.6.1.15]
Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Tue Nov 20 08:42:40 EST 2012

Committee Statement and Meeting Notes

Committee Statement: The information on arc melt furnaces in NFPA 86 has not been updated since when it was originally entered into the standard in 1973. There has and currently is no expertise within the committee to address this type of equipment. Currently, most of the industry does not use this standard because of the degree of specialized design and engineering for each unique arc furnace, this standard does not have the capability to cover such a design.

Response Message: FR-121-NFPA 86-2012
A.13.5.7.4(B)
The indication of flow is intended to be provided by a device that will indicate flow any time a flow is occurring, including during a power outage. A mechanical device that indicates the flow rate without using any source of power except the physical flow of the inert purge gas meets this requirement. Where an inert purge gas flow is metered and displayed using electrical means, the uncertainty of a reliable backup power supply, such as backup batteries or an uninterruptible power supply during a primary power interruption precludes the use of "electronic" monitoring of flow, is needed to meet this requirement.

Where back-up power sources are used, such as batteries and uninterruptible power supplies, the power source should be designed to supply power for the duration needed to purge-out the complete furnace system. In addition, appropriate maintenance procedures should be provided to inspect, test, and maintain the back-up power supply on a regular basis to reduce the possibility of its unavailability during a primary power interruption.

Subsection A.13.5.7.4(B) was added by a tentative interim amendment (TIA). See page 1.

A.13.5.8.12(1)
Paragraph 13.5.8.12(1) addresses excess flow in the equipment piping for an individual furnace. This involves a device at the special atmosphere control panel, such as an electronic sensor, along with logic to close an automatic shutoff valve upon detection of excess flow. Paragraph 13.5.8.12(1) does not preclude operational high flow set points at thresholds below the shutoff excess flow set point. The operational high flow set points can be provided to initiate alarms that prompt operator intervention to restore appropriate flow levels before the shutoff excess flow level is reached.

Committee Statement: Relocated annex material with text.
A.13.5.11.1(F)

The use of plant air with reducing regulators is prohibited. Plant air lines can become slugged with water passing into the heated furnace resulting in abnormally high furnace pressures. Plant air lines can experience regulator failures resulting in high-pressure air admission into a furnace that contains a flammable atmosphere.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Wed Oct 24 17:33:24 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Plant air line failures result in unsafe operating conditions.

Public Input No. 36-NFPA 86-2012 [New Section after A.13.5.11.1(E)]
Public Input No. 76-NFPA 86-2012 [New Section after A.13.5.11.1(E)]
A.13.5.11.10  
See Figure A.13.5.11.10.

Figure A.13.5.11.10 Examples of Special Atmosphere Equipment Piping.
Committee Statement and Meeting Notes

Committee Statement: Revising annex material to match the text that it supports. Flow meters changed to flow switches.
Public Input No. 38-NFPA 86-2012 [Section No. A.13.5.11.10]

First Revision No. 73-NFPA 86-2012 [New Section after A.13.5.11.10.4(C)]

Committee Statement: Atmosphere impingement on the temperature control thermocouple can result in overheating of the furnace or erroneous control readings on the over temperature thermocouple.
Public Input No. 35-NFPA 86-2012 [New Section after A.13.5.11.10.4(C)]

First Revision No. 113-NFPA 86-2012 [Section No. A.13.5.11.11.11(A)]

Committee Statement: Relocated to A13.5.8.12, see FR-60-NFPA 86-2012.
Public Input No. 72-NFPA 86-2012 [Section No. A.13.5.11.11(A)]
First Revision No. 139-NFPA 86-2012 [New Section after M.1.2.7]

M.1.2.8 IEC Publications.

International Electrical Commission, 3 rue de Varembé, P.O. Box 131, CH - 1211, Geneva 20, Switzerland.


Submitter Information Verification

Submitter Full Name: Derek Duval
Organization: National Fire Protection Assoc
Submittal Date: Wed Nov 28 22:52:54 EST 2012

Committee Statement and Meeting Notes

Response Message: FR-139-NFPA 86-2012

First Revision No. 41-NFPA 86-2012 [Section No. M.1.2.12]

M.1.2.13 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Submittal Date: Tue Oct 23 20:50:27 EDT 2012

Committee Statement and Meeting Notes

Committee Statement: Update referenced standard to most recent edition as indicated.

Public Input No. 25-NFPA 86-2012 [Section No. M.1.2.12]