TSSA FIELD APPROVAL CODE, TSSA-FA-2012 December 2012

REVISION I

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TSSA FIELD APPROVAL CODE
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TECHNICAL STANDARDS AND SAFETY AUTHORITY

FOREWORD

The Gaseous Fuels, Propane and Fuel Oil Regulations made under the Technical Standards and Safety *Act* adopt this Code for the Province of Ontario.

Definitions in this Code have the same meaning as those contained in the relevant regulations made under the *Technical Standards and Safety Act*.

This document was developed in consultation with the TSSA Gaseous Fuels Advisory Council and the TSSA Field Approvals Risk Reduction Group.

This document adopts either in whole or in part:

- the CSA B149.3-10 Code for the Field Approval of Fuel-Related Components on Appliances and Equipment published in 2010 with amendments;
- the National Fire Protection Association NFPA 85-2011 Boiler and Combustion Systems Hazards Code with amendments; and
- the National Fire Protection Association NFPA 86-2011 Standard for Ovens and Furnaces with amendments.

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Foreword

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1. General

1.1 Scope and Application

1.1.1

This document establishes the requirements for approval of ***appliances*** that are custom made, built on site or produced in limited numbers.

1.1.2

Approval under this code is limited to the fuel features of ***appliances/equipment*** where fuel features mean ***components*** that use fuel, handle fuel, control combustion or vent combustion products and features of construction and installation that relate to the safe use and handling of fuel.

1.1.3

Approval under this code is for code compliance and safety. It does not include performance of the ***appliance*** or ***equipment***.

1.1.4

The TSSA Field Approval includes installation and except for portable ***appliances***, is valid only for the specific physical location where the appliance is installed. If the ***appliance/equipment*** is moved, the approval is void and the ***appliance*** shall be re-approved in its new location.

1.1.5

If the appliance ***approved*** under this Code is modified, the approval is void and the modified ***appliance shall*** be re-***approved***.

Note: For further details, refer to the TSSA Advisory Maintenance vs. Modification and Upgrading, Ref. No. FS-133-08.

1.1.6

In the event of a conflict between this code and other codes and standards, this code shall prevail.

1.1.7

In the event of a conflict between this code and the regulations it is made under, the regulations shall prevail.

1.1.8

Where ***appliances*** have electrical features, TSSA approval shall require evidence of electrical approval for Ontario.

1.1.9

Where a deviation from this Code is required, a separate application for a variance shall be made and approval of a variance shall be obtained prior to ***appliance*** approval.

1.2 Required Documentation

1.2.1

An application of field approval shall be made to the TSSA Statutory Director and shall include:

Two sets of:

(a) Completed Application for Field Approval;
(b) Process description;
(c) Electrical schematic;
(d) ***Valve train*** diagram, combustion schematic or piping and instrumentation diagram (P&ID);
(e) Bill of materials for all fuel features; and
(f) Deposit in the form of a purchase order, cheque, cash or credit card payment in the amount specified on the Application for Field Approval.

1.2.2

For **Class A appliances**, the following additional information shall be submitted:

(a) Safety ventilation calculation as per NFPA 86; and

(b) Calculation for the explosion relief area.

1.2.3

For ***appliances*** that use programmable controllers for flame safety, the following additional information shall be submitted:

(a) A letter from a Professional Engineer as defined by the Ontario Professional Engineers Act confirming the system has been reviewed by him/her and that it complies with section 9.7 of CSA B149.3-10, as amended in TSSA-FA-2012 – Field Approval Code, as amended in TSSA-FA-2012 Field Approval Code;

(b) Functional logic diagrams complete with timer and counter presets;

(c) Power distribution drawings;

(d) A list of all error and alarm messages, their meaning, and suggested operator reactions;

(e) A description of the microprocessor-based system and BMS operation;

(f) Training arrangements;

(g) Security procedures, privileges level, and assignments; and

(h) At the time of commissioning and site verification, an electronic copy of the as-built system program code.

1.2.4

Notwithstanding 1.2.1, 1.2.2 and 1.2.3, an applicant may be required to provide such other information or documentation as may be required by the Director or an inspector.

1.3 Approval Process – Technical Review

1.3.1

The purpose of the technical review is:

(a) To verify that the design of the ***appliances, equipment*** and ***components*** complies with this Code and the Regulations;

(b) To resolve any conflicts or deviations from this Code or the Regulations; and

(c) To ensure the documentation is complete.

1.4 Approval Process - Site Verification and Testing

1.4.1

The purpose of the site verification and testing is to confirm that:

(i) An ***appliance/equipment*** is constructed according to the reviewed documentation and that the fuels ***components*** are ***approved/certified*** for their intended use;

(ii) An ***appliance/equipment*** is installed in accordance with the applicable code; and

(iii) The fuel features of an ***appliance/equipment*** perform the required safety functions and are set in accordance with the applicable code/standard.

1.4.2

The applicant/owner of the ***appliance/equipment*** shall perform or cause to be performed tests deemed necessary, by the inspector, to verify proper operation of the ***appliance*** being ***approved*** and have the necessary test equipment available.

Tests shall include analysis of flue gases including oxygen and carbon monoxide.

Note: An ***appliance*** should not produce flue gases which contain carbon monoxide in excess of 0.04 percent (400 PPM) on an air free basis.

1.4.3
The inspector may require the person who possesses the required knowledge and is familiar with the fuel features of the ***appliance*** and installation to be present during the site verification.

1.5 Field Approval Label
1.5.1
Upon successful completion of site verification and testing, the inspector shall place the TSSA Field Approval label on or in the immediate vicinity of the ***appliance*** rating plate.

1.6 Closure and Fees
1.6.1
Upon successful completion of site verification and testing, TSSA shall issue a written confirmation of the ***appliance*** approval under this program to the applicant.

1.6.2
The fees under this program shall be applied in accordance with the TSSA fee schedule in effect at the time the specific activity, technical review or site verification and testing, takes place.

2. Appliance Construction and Control
2.1
The CSA-B149.3-10 entitled "Code for the Field Approval of Fuel Related Components on Appliances and Equipment" prepared by the Canadian Standards Association, is adopted with the following amendments:
2.1.1
Sub clause 1.2(g) is revoked and the following is substituted for it:
(g) fuels not included under the TSS Act.
2.1.2

Clause 1.2 is amended by adding to it the following sub clause:

(h) propane used as refrigerant.

2.1.3

Section 3 is amended by revoking the definitions of "***Appliance***", "***Approved***", and "***Authority having jurisdiction***" and by adding the following definitions:

Appliance – as defined in the applicable regulation under the Technical Standards and Safety Act

Class A Appliance - an ***appliance*** that has heat utilization ***equipment*** operating at approximately atmospheric pressure, where there is a potential hazard of explosion or fire due to the presence of flammable volatiles or combustible materials processed or heated in the furnace.

Exception:

(1) Oven or furnaces having concentration of flammable volatiles less than or equal to 0.5% of the **Lower Flammable Limit (LFL).**
(2) Special atmosphere furnaces***, oxidizers***, cremators and fume incinerators.

Approved – as defined in the applicable regulation under the Technical Standards and Safety Act

Authority having jurisdiction - the Director designated for the purposes of the applicable regulation made under the Technical Standards & Safety Act.

Biogas - a gas produced in a digester at a location other than a water pollution control plant, generally composed of approximately one-half to two-thirds methane and approximately one-third carbon dioxide that is produced from organic residues with a heating value averaging approximately 590 to 700 Btu/ft^3 (22 to 26 MJ/m^3). By the nature of the biological process under anaerobic conditions, its production and constituents are considered flammable, corrosive, and potentially hazardous. It may contain traces of water, hydrogen, sulphide gas and dissolved ammonium and bicarbonate ions.

Confined space – a space whose volume is less than 50 ft^3/1000 Btuh (4.8 m^3/kW) of the aggregate input rating of all ***appliances*** installed in that space.

Digester Gas - a gas produced from organic sludge through an anaerobic process with a heating value averaging approximately 590 to 700 Btu/ft^3 (22 to 26 MJ/m^3), generally composed of about two thirds methane and one third carbon dioxide. It may contain up to 0.5 per cent hydrogen sulphide (by volume).

Landfill Gas - a gas consists primarily of methane, carbon dioxide, water and traces of hydrogen sulphide gas and dissolved ammonium and bicarbonate ions from the decomposition of organic waste material at a landfill site.

Lower Flammable Limit (LFL) **-** the lowest concentration of a flammable gas or vapour in air within which a flame can be propagated.

Operating Engineer - a holder of a subsisting certificate of qualification as an operating engineer under O.Reg. 219/01.

Oxidizer (or fume incinerator) - an independently controlled, enclosed combustion system whose purpose is to destroy Volatile Organic Compounds (VOC's) and/or Hydrocarbon (HC) gases or vapours using elevated temperature, residence time, mixing, excess oxygen, and in some cases, catalysts. These may be equipped with heat recovery systems.

Pressure Controller - a combination of control ***valve*** and associated measuring, transmitting and controlling elements that maintains a constant outlet pressure at varying rates of flow.

Ventilation (with respect to the space in which an ***appliance*** is installed) - the removal of inside air, leaked or spilled products of combustion, or flue gases from the space in which an ***appliance*** is installed to outside the space, and the replacement of same by air from outside the space.

Waste Gas - digester, landfill or biogas.

2.1.4

Clause 4.3.6 is revoked and the following is substituted for it:

4.3.6 A ***pilot pressure regulator*** shall be equipped

(a) for lighter-than-air gas, with a ***bleed vent*** leading outdoors in accordance with CSA B149.1, or into the ***combustion chamber*** adjacent to a continuous ***pilot***, unless the ***pilot pressure regulator***, having an inlet pressure not in excess of 2 psig (14 kPa) is

constructed or equipped with a device that restricts the escape of gas to not more than 2.5 scfh (0.0706 m^3/h) of a gas having a specific gravity of 0.6. A regulator with vent limiting means shall only be installed in a ***ventilated space***; or

(b) for heavier-than-air gas, with a ***bleed vent*** leading outdoors in accordance with Clause 5.8.1 of CSA B149.2, unless the ***pilot pressure regulator*** having an inlet pressure not in excess of 2 psig (14 kPa) is constructed or equipped with a device that restricts the escape of gas to not more than 1 scfh (0.0283 m^3/h) of a gas having a specific gravity of 1.53. A regulator with a vent limiting means shall not be installed in a ***confined space***.

Note: *For the purposes of installation of **pilot pressure regulators** with a vent-limiting means, a **ventilated space** should not be considered a **confined space**.*

2.1.5

Section 5.2 is renamed as ***Pressure Regulators*** and ***Pressure Controllers***.

2.1.6

Clause 5.2.1 is revoked and the following is substituted for it:

5.2.1 The fuel supply to the ***burner*** or group of ***burners*** shall be regulated by a ***pressure regulator*** or a ***pressure controller***.

2.1.7

The following new clauses shall be added to section 5.2:

5.2.6 The ***pressure controller*** settings shall be protected from unauthorized access and adjustment.

5.2.7 The materials of construction of the ***pressure controller*** shall be compatible with the anticipated operating conditions and fluids, and shall provide adequate protection from moisture, corrosion and components of the fuel gas.

5.2.8 The installation, operating and maintenance manuals for a ***pressure controller*** shall be provided to the end user and shall be available on site for as long as the ***pressure controller*** is in operation.

5.2.9 The flow direction shall be marked on the ***pressure controller***.

5.2.10 The ***pressure controller*** shall control the outlet pressure to within +/- 10% of its set point.

5.2.11 When the inlet supply pressure to the ***pressure controller*** is in excess of 0.5 psig (3.5 kPa), the pre***ssure controller*** shall be of the positive shut off type.

5.2.12 When a ***pressure controller*** is used, a documented assessment shall be provided to demonstrate that there is appropriate evidence, based on proven-in-use, that the ***pressure controller*** is suitable for the application.

2.1.8

Clause 5.4.3 is revoked and the following is substituted for it:

5.4.3 When a fuel air ratio control (FARC) system is used, it shall be in compliance with ISO 23552-1 or Annex D as ***approved*** by the ***authority having jurisdiction.***

2.1.9

Clause 5.6.7 is revoked and the following is substituted for it:

5.6.7 When a ***burner combustion air*** or exhaust is provided by mechanical means, fuel shall be prevented from entering the ***burner*** until the mechanically produced flow is proven by means of a flow proving device. In the event of failure of airflow to the ***burner*** or exhaust from the ***appliance***, fuel shall be shut off. Static air ***pressure switches*** are acceptable provided they are installed downstream of all tight closing flow control devices.

2.1.10

Clause 7.3.1 is revoked and the following is substituted for it:
7.3.1 Pressure test points shall be provided to allow testing of the ***valve train components*** and the set-up of the ***burner***.

2.1.11

Clause 7.6.2 is revoked and the following is substituted for it:

7.6.2 An ***appliance pressure regulator*** shall be equipped:

(a) for lighter-than-air gas, with a ***bleed vent*** leading outdoors in accordance with 5.5.9 of CSA B149.1, as amended in TSSA Gaseous Fuel Code Adoption Document or into the ***combustion chamber*** adjacent to a continuous ***pilot***, unless the ***appliance pressure regulator*** having an inlet pressure not in excess of 2 psig (14 kPa) is constructed or equipped with a device that restricts the escape of gas to not more than 2.5 scfh (0.0706 standard m^3/h)per hour of a gas having a specific gravity of 0.6. A regulator with vent limiting means shall only be installed in a ***ventilated space*** ; or

(b) for heavier-than-air gas, with a ***bleed vent*** leading outdoors in accordance with Clause 5.8.1 of CSA-B149.2, unless the ***appliance regulator*** having an inlet pressure not in excess of 2 psig (14 kPa) is constructed or equipped with a device that restricts the escape of gas to than 1 scfh (0.0283 standard m^3/h) per hour of a gas having a specific gravity of 1.53. A regulator with a vent limiting means shall not be installed in a ***confined space***.

Note: *For the purposes of installation of* ***appliance pressure regulators*** *with a vent-limiting means, a* ***ventilated space*** *should not be considered a* ***confined space****.*

2.1.12

Clause 7.6.10 is revoked and the following is substituted for it:

7.6.10 A safety limit or a safety relief device shall not be isolated, bypassed, or in any way made ineffective by a ***valve*** or other device except as permitted in Clause 9.7.2.3.1.

2.1.13

Clause 9.1.3 is revoked and the following is substituted for it:

9.1.3 Except as specified in Clause 9.1.4, where intermediate relays are used in the limit circuit or used to control ***safety shut off valves*** or used to control direct spark transformer ***igniters***, a safety relay that provides redundancy and a self-monitoring function to ensure the contacts are operating properly, or an equivalent circuit, shall be used.

2.1.14

Clause 9.2.1 is revoked and the following is substituted for it:

9.2.1 When either an ***intermittent*** or an ***interrupted pilot*** or a direct transformer spark ***igniter*** is used to light the main ***burner*** and the ***combustion air*** supply is by mechanical means, the ***appliance control system*** shall provide a proven ***purge*** period prior to the ***ignition*** cycle. This ***purge*** period shall provide at least four air changes of the combustion zone and ***flue*** passages at an airflow rate of not less than 60% of that required at maximum input. See also Clause 13.5. After a ***burner*** shutdown or flame failure a proven pre-purge period is not required if:

> **(a)** the ***appliance*** heating chamber is at or above 1400ºF (760 ºC) and a bypass controller is used for this purpose; or,
> **(b)** when multiple ***burners*** are firing inside a common combustion chamber, at least one of the ***burners*** remains ignited and any accumulation of combustible gases or vapours resulting from leaking or failed ***valves*** does not exceed 25% of the ***lower flammable limit*** (LFL). Re-***ignition*** of remaining ***burners*** shall be accomplished through a proven ***low-fire start*** for each ***burner***; or,
> **(c)** when multiple ***burners*** are firing inside a common ***combustion chamber***, at least one of the ***burners*** remains ignited and at least one ***safety shut off valve*** on each ***burner*** is proven closed with an overtravel ***proof of closure switch***. Re-***ignition*** of remaining ***burners*** shall be accomplished through a proven ***low-fire start*** for each ***burner***.

2.1.15

Clause 9.2 is amended by adding the following:

9.2.4 For a single boiler venting into a dedicated venting system without any economizers or emission control devices, the purge shall be based on the volume of the internal flue passages up to the flue collar.

2.1.16

Clause 9.4.1 is amended by adding to it the following sub-clause:

> (f) high water in a steam boiler other than a boiler under continuous attendance by an ***operating engineer***.

2.1.17

A new clause 9.4.5 is added to section 9.4:

9.4.5 The sensing element for the low water cut-off shall be located above the lowest safe permissible water level established by the boiler manufacturer.

2.1.18

Clause 9.6.1 is revoked and the following is substituted for it:

9.6.1 When air-supply fans, compressors, or blowers for supply air or ***instrument and control air*** are required for use with an ***appliance*** combustion system, airflow proving devices shall be provided and shall be interlocked to prevent the flow of fuel to the ***burners*** when the air supply fails.

2.1.19

Clause 9.7.1 is revoked and the following is substituted for it:

9.7.1 General
When microprocessors are used as a primary safeguard device they shall be ***certified*** to IEC61508-2(hardware) and IEC61508-3(programming software) and installed as per the manufacturer's safety manual.

The requirements of Clause 9.7.2 shall apply.
*Note**:** Programmable logic controllers (PLCs) and distributed control systems (DCSs) form pairs of a family of microprocessor-based burner management systems (BMSs) and diverse sequence control applications. These devices execute their application programs in a rigidly organized sequential manner. They are extensively used because of their high reliability and their fault-diagnostic capabilities. In recent years, the functionality and use of the two processors, PLCs and DCSs, have become very similar, and for the purpose of these requirements, they are designated microprocessor-based systems.*

2.1.20

Clause 9.7.2.2.(b) is revoked and the following is substituted for it:

9.7.2.2.(b) A watchdog timer internal to the BMS processor shall monitor the program scan time. In the event of an occurrence of a non-deterministic condition, all outputs shall de-energize, resulting in an immediate master fuel trip. The time allowed for a single processor scan shall not exceed three times the predefined scan time.

An external watchdog timer shall not be required for systems that conform to IEC61508-2 and IEC61508-3.

2.1.21

Clause 9.7.2.3.1 is revoked and the following is substituted for it:

9.7.2.3.1 Critical input signals are process parameters that activate a BMS master fuel trip and shall be configured in the fail-safe mode. Input channels for all critical signals shall incorporate a continuous self-test feature that satisfies the requirements of Clause 9.7.2.3.2 or 9.7.2.3.3, or they shall be hard-wired to the master fuel trip relay. Bypass switches for critical field inputs shall not be permitted.
For petrochemical, refinery industries and integrated steel mills, the use of bypasses may be permitted by the ***authority having jurisdiction*** for the purposes of on-line testing or maintenance if the following is met:

1) Documented and ***approved*** mitigations are implemented during the override period; and
2) A strict time limit is enforced upon the bypass.

2.1.22

Clause 9.7.2.3.2 is revoked and the following is substituted for it:

9.7.2.3.2 All safety critical inputs shall be monitored for faults
Example: The interrogation voltage to all critical field devices can be periodically removed.
Upon detection of the fault, one of the following shall occur:
(a) For systems using a one out of one or a one out of two voting scheme, any safety input channel recognized as faulty shall be alarmed and a BMS trip shall be activated;
(b) For systems using a one out of two or a two out of two voting scheme with diagnostics, a single faulty input shall be alarmed and the system may default to one out of one voting scheme;
(c) For systems using a two out of two or a two out of three voting scheme, a channel recognized as faulty shall indicate a trip for that channel;
(d) For systems using a two out of three voting scheme with diagnostics, a single faulty input shall be alarmed and the system may default to a two out of two voting scheme;
(e) For systems using voting schemes other than listed above, the approval shall be obtained from the ***authority having jurisdiction***.

2.1.23

Clause 9.7.2.3.3 is revoked and the following is substituted for it:

9.7.2.3.3 The design of the BMS communications to other non-safety microprocessor based systems, including operator stations, shall ensure that any failure of the communications shall not adversely affect the ability of the BMS to bring the process to a safe state. Signals from other non-safety microprocessor based systems that initiate a master fuel trip shall be hard-wired. BMS trips may be allowed over safety ***certified*** communications.
When analogue input signals associated directly with the BMS are used, the following shall apply:

(a) the analogue transmitter shall be dedicated to the BMS; and
(b) out-of-range signals shall default to the safe condition.

2.1.24

Clause 9.7.2.4 is revoked and the following is substituted for it:

9.7.2.4 All safety critical outputs shall be monitored for faults.
Interposing relays shall only be used where the power demand exceeds the power rating of the output module or where the operating voltage for the field device is outside of the range offered by the output modules. Where interposing relays are used, the relay shall be sized to the voltage and current requirements of the ***equipment*** being controlled and shall be equipped with arc suppression devices designed for the application.
Electronic output switches or dry relay contacts may be used in systems operating on AC voltages. They shall have a rating sufficient to control the application in both ON/OFF and continuous operations.

2.1.25

Clause 9.7.2.6 is revoked and the following is substituted for it:

9.7.2.6 Functional testing shall be performed on the complete system.
Functional testing shall include all aspects of the BMS, including the hard-wired tripping circuit, processor scan time, and I/O scan time. Where videographical display systems are involved in control selection and display, video response times shall be tested and recorded for all time-critical BMS safety functions.

2.1.26

Section 11 is revoked and the following is substituted for it:
11. Rating Plate
11.1 An ***appliance*** shall have a clearly legible permanent rating plate that shall include the following information:

(a) manufacturer's or vendor's name;
(b) ***appliance*** type and identification number;
(c) electrical specifications;
(d) type of fuel(s);
(e) maximum input rating in Btuh (kW);
(f) minimum purge time
(g) approval_standard.

11.2 For gas fired ***appliances,*** in addition to information required in 11.1, the following shall be provided on the rating plate:

(a) inlet pressure at the point of connection;
(b) maximum ***burner manifold*** fuel pressure;
(c) minimum ***burner manifold*** fuel pressure, if applicable.

11.3 For fuel oil fired ***appliances***, in addition to information required in 11.1, the following shall be provided on the rating plate:

(a) where applicable, minimum and maximum fuel oil nozzle pressure
(b) where applicable, minimum and maximum atomizing media type and pressure
(c) where applicable, nozzle sizes, angles and patterns

11.4 For ***Class A appliances***, in addition to the information required in 11.1, the following additional information shall be provided on the rating plate:

a) Solvent used
b) Solvent and volatiles entering the ***appliance*** _____(US Gals/Litres per batch or per hour)
c) Maximum ***appliance*** operating temperature _____ (^{o}F or ^{o}C)
d) Exhaust blower capacity _____ SCFM (m3/hr)
e) **CAUTION: This appliance is designed and approved for the above conditions. Prior to any change in the solvent type, solvent loading or oven operating temperature, recheck and document that the above exhaust capacity is sufficient to maintain appliance atmosphere at or below 25% LFL.**

2.1.27

Clause 13.1.5.1 is revoked and the following is substituted for it:

13.1.5.1 When a fan is essential to the operation of a furnace, oven, or related **equipment**, an airflow proving device shall be provided and shall be interlocked to prevent the flow of fuel to the **burners** on failure of the air supply.

2.1.28

Clause 13.4.1 is revoked and the following is substituted for it:

13.4.1 An ***approved*** manual reset high temperature limit controller or equivalent shall be used on any ***appliance*** where it is possible for the controlled temperature to exceed a safe limit.

2.1.29

A new section 13.9 is added:

13.9 ***Class A Appliances***.

13.9.1 ***Class A appliances*** shall comply with the following additional requirements:

(a) The safety ventilation rate shall maintain the oven exhaust below 25% LFL as calculated using sections 11.6.6, 11.6.8.4(A), 11.6.8.4 (B) and 11.6.9.3(A) of NFPA 86-2011.

(b) The safety ventilation required for powder curing ovens shall be established by assuming that 9 percent of the mass of the powder is xylene and the remaining mass is inert. The safety ventilation shall then be determined for xylene in accordance with sections 11.6.6, 11.6.7, 11.6.8.4 and 11.6.9.3 of NFPA 86 - 2011.

(c) Explosion relief shall comply with clause 13.1.4 of CSA B149.3-10.

(d) Excess temperature or failure of the exhaust system or failure of the recirculation system shall shut down the conveyors or sources of flammable or combustible materials.

(e) On completion of an oven installation, airflow tests shall be conducted on the ventilation systems under the oven operating conditions, with flow control devices at their

minimum setting, to confirm that adequate ventilation, as determined under 13.9.1, is available.

2.1.30

A new section 13.10 is added:

13.10 Oxidizers and Fume Incinerators

13.10.1 ***Oxidizers*** and incinerators shall comply with Section 10 of NFPA 86-2011 excluding Clause 10.6.2.1.

2.1.31

A new section 13.11 is added:

13.11 Boilers for use with Waste Gas
13.11.1 Boilers for use with ***waste gas*** shall comply with the following additional requirements:

(a) A flash-back (flame) arrester and a check ***valve*** shall be installed downstream of the ***safety shut-off valve or valves*** on the ***waste gas valve train***.
Note: The check valve is not required at the connection of a burner if the burner is so designed that it prevents the introduction of air, oxygen or other gas into the digester gas piping.
(b) For duel fired boilers a check ***valve*** or equivalent shall be installed on the standby gas (secondary fuel) **valve train** immediately upstream of the standby gas (secondary fuel) connection to provide isolation for the standby (secondary fuel) **valve train**.
(c) When an automatic **safety shut-off valve** comes in contact with the ***waste gas,*** it shall be suitable for use with the ***waste gas***. Suitability can be demonstrated via declaration from the ***valve*** manufacturer. The **valve** or **valves** shall be designed so that its invert does not allow accumulation of moisture.
(d) Boilers shall be equipped with a natural or propane gas ***pilot burner***.
(e) Piping, tubing and fittings in contact with the **waste gas** shall be made of stainless steel.
(f) ***Components*** in contact with the **waste gas** shall be suitable for use with **waste gas**. Suitability can be demonstrated via declaration from the ***component*** manufacturer.
(g) The pressure taps for the ***low*** and ***high gas pressure switches*** shall be located on the top of the pipe.

2.1.32

Annex D is revoked and the following is substituted for it:

Annex D
Requirements for fuel air ratio control (FARC) systems
This provides a listing of features that shall be incorporated with typical fuel air ratio control (FARC) systems.
*Note: If the burner management system monitors the fuel air ratio independent of the combustion control system and cause the affected **burner(**s) to safely trip if the fuel air ratio is not within the safe operating limits, Annex D shall not apply.*

Regardless of whether the provisions specified in this Annex are satisfied, each application needs to be assessed to determine the suitability of the controller for the application.
When a ***certified*** FARC system is used, it shall be in compliance with ISO 23552-1.
If a non-***certified*** engineered FARC system is used, it shall comply with the following:
(a) The entire FARC system shall be evaluated as a complete closed-loop system.
(b) Where the FARC system is of a positioning type,
(i) it shall have provisions for continuous feedback of all ***valve***/damper/actuator positions to ensure that the command position has been achieved;

(ii) the inability of any of the ***valve***/dampers or actuators to achieve the command position shall be detected and it shall prevent the associated ***valve***/damper/actuator from traveling to a position that creates an unsafe fuel air ratio.
(iii) the error tolerance in ***valve***/damper/actuator position shall be within the ***appliance***'s safe operating range at all firing rates. Determining error tolerance shall consider relevant factors that may affect fuel or air mass flows such as temperature, density, gas pressure, voltage fluctuations, or flue blockage. The fuel air ratio error tolerance shall be declared and documented at the time of commissioning.
(iv) fuel(s)/combustion air flow cross-limiting shall be incorporated in the control logic to ensure that the error tolerance in Subitem (iii) is not exceeded and that the ***burner*** does not operate in unsafe condition;
(v) upon detection of a ***valve***/damper/actuator position fault or of another unsafe condition, the system shall revert to a risk-addressed state as determined by a risk analysis or cause the affected ***burner(***s) to safely trip.
(vi) assured sensing of ***valve***/damper shaft position is required. Preferably this should be achieved through a shaft position sensor attached directly and securely to the shaft. If the sensor is attached to a linkage or an actuator, or is part of the actuator, all in-between connections shall be securely fastened to prevent slippage. Use of fastening methods that could become loose is not allowed;
(vii) the ***valve***/damper/actuator assembly shall incorporate an external indication of open/close position. In many applications that use quarter-turn dampers, a permanent method of marking the damper position on the visible end of shaft may be acceptable. In other applications, marking of open/close position and, in some cases, marking of intermediate positions may be required in another accessible location;
(viii) ***valve***/damper/actuator purge and ***ignition*** (low-fire or light-off) position interlocks shall be incorporated and interlocked with the ***burner*** management system; and
(ix) where a variable speed drive is incorporated into the combustion control system and used as the air flow control method, secondary feedback from current, fan speed, or flow sensor shall be used.

(c) Where the FARC system is of a metering type,
(i) it shall have provisions for continuous feedback of fuel(s) and combustion air flow(s) to ensure that the command air-to-fuel ratio is achieved;
(ii) where combustion air or fuel(s) pressure or temperature can change, appropriate temperature and pressure compensation shall be used;
(iii) where the calorific fuel value (Wobbe Index) can change, appropriate compensation shall be considered in the design;
(iv) the inability of any of the flows to achieve the command setpoint shall be detected, and it shall prevent the associated flow from changing to the position that creates an unsafe fuel air ratio;
(v) the error tolerance in fuel(s) and combustion air flow readings shall be within the ***appliance***'s safe operating limits at all firing rates. The fuel air ratio error tolerance shall be declared and documented at the time of commissioning.
(vi) fuel(s)/combustion air flow cross-limiting shall be incorporated in the control logic to ensure that the error tolerance in Subitem (v) is not exceeded and that the ***burner*** does not operate in an unsafe condition;
(vii) for flow metering devices, the manufacturer shall declare the frequency of calibration, and this shall be documented within the service instructions;
(viii) all connections between actuator and ***valve***/damper shall be securely fastened to prevent slippage. Use of fastening methods that could become loose is not allowed;
(ix) the ***valve***/damper/actuator assembly shall incorporate an external indication of open/close position. In many applications that use quarter-turn dampers, a permanent method of marking

the damper position on the visible end of shaft may be acceptable. In other applications, marking of open/close position and, in some cases, marking of intermediate positions may be required in another accessible location; and

(x) if the air and fuel measurement system is not self-checking, ***valve***/damper/actuator purge and ***ignition*** (low-fire or light-off) position interlocks shall be independent of the flow measurements and shall be incorporated and interlocked with the flame safeguard system.

(d) The FARC system designer shall provide documentation indicating how a system or ***component*** failure will be detected, alarmed and a corresponding action taken. The FARC system may be also equipped with a means of providing a redundant confirmation of ***valve***/damper/actuator positions, fuel(s) or combustion air flow(s), pressures or temperatures, correct air-to-fuel ratio, or other system parameters that are important to safe FARC system operation. In some instances, special maintenance procedures may have to be included in order to test on a regular basis that both the primary sensing element and calibration are correct.

(e) If a stack O2/CO/CO2 analyzer is used as a trim, the O2/CO/CO2 measurement shall not be used as the primary method of controlling combustion air flow. The O2/CO/CO2 trim control system shall be limited to the ***appliance***'s safe operating limits at all firing rates.

(f) The FARC system shall be interfaced and interlocked with the ***burner*** management system to ensure that the required functionality is achieved. In the event that the FARC system detects a fault, the system shall revert to a risk-addressed state as determined by a risk analysis or cause the affected ***burner(***s) to safely trip

(g) The combustion control microprocessor may be independent from the ***burner*** management or incorporated into a PLC-based ***burner*** management system.

(h) If the air-to-fuel flow ratio control limits are changeable, they shall be password protected.

(i) The FARC system shall be protected from RF interference sources such as VHF radios, cell phones, and variable-frequency drives.

(j) The FARC system shall be calibrated/commissioned by a qualified technician, recalibrated/ re-commissioned after any ***component*** is replaced, and checked/maintained on a regular basis as required to ensure its safe operation and as recommended by the ***equipment*** manufacturer.

(k) For ***appliances*** that use programmable controllers for fuel air ratio control, the following additional information shall be submitted:

(i) A letter from a Professional Engineer as defined by the Ontario Professional Engineers Act confirming the system has been reviewed by him/her and that it complies with Annex D of CSA B149.3-10 as amended in TSSA-FA-2012 Field Approval Code;

(ii) Functional logic diagrams complete with timer and counter presets;

(iii) Power distribution drawings;

(iv) A list of all error and alarm messages, their meaning, and suggested operator reactions;

(v) A description of the microprocessor-based system and fuel air ratio control operation;

(vi) Training arrangements;

(vii) Security procedures, privileges level, and assignments; and

(viii) At the time of commissioning and site verification, an electronic copy of the as-built system program code.

3. Additional Requirements for Fuel Oil Appliances

3.1
The NFPA 85 "Boiler and Combustion Systems Hazards Code, 2011 Edition" prepared by NFPA International, as applicable to fuel oil systems is adopted with the following amendments:
3.1.1
Section 1.1 is revoked and the following is substituted for it:
1.1 This code shall apply to fuel oil single burner appliances and multiple burner appliances.

3.1.2

Section 4.11.1 is revoked and the following is substituted for it:

4.6.3.2.1 **General**. As a minimum, the requirements of 4.11.1 through 4.11.10 and CSA-B149.3-10 Section 9.7, shall be included in the design to ensure that a logic system for burner management meets the intent of those requirements.

3.1.3

References to NFPA 31 are replaced with the TSSA Fuel Oil Code Adoption Document.

3.1.4

References to "Boilers" shall also include references to "Appliances".

3.1.5

Section 5.3.1.9 is revoked and the following is substituted for it:

5.3.1.9 Where the input to an appliance is

(a) up to and including 12 500 000 Btuh, two safety shut-off valves in series shall be provided in the oil line to the main burner;

(b) over 12 500 000 Btuh, two safety shut-off valves, each with proof of closure switch, shall be provided in the oil line to the main burner.

Exception: For mechanical atomizing burners, where certified safety shut-off valves with proof of closure are not available for the size and pressure rating, proof of closure switches are not required provided the oil pump does not start until after the pre-purge period is completed.
3.1.6

Section 5.5.2.6.4.3(A) is amended by adding the following:

(11) High oil pressure if the pressure from the pump can exceed safe burner operation.

3.1.7

Section 5.5.4.2.4.4(A) is amended by adding the following:

(11) High oil pressure if the pressure from the pump can exceed safe burner operation.

3.1.8

Section 5.5.7.4 is amended by adding the following:

(9) High oil pressure if the pressure from the pump can exceed safe burner operation.

3.1.9

Section 5.6.5.3.1 is amended by adding the following:

(5) High oil pressure if the pressure from the pump can exceed safe burner operation.

3.1.10

Figure A.5.3.1 is amended as follows:

Clearing line and Alternate Atomizing Medium lines are optional

J - Atomizing differential control valve (optional). **L -** Atomizing medium shut-off valve (optional provided atomizing medium will not detrimentally affect natural gas firing) **P -** Atomizing medium flow interlock differential switch, or pressure interlock switch. For appliances with an input up to and including 12 500 000 BTUH, a single pressure interlock device is acceptable.

R - Low Pressure switch. For appliances with an input up to and including 12 500 000 BTUH, a low pressure switch is optional provided the pump is connected to the burner motor.

S - Pressure Gauge and High Oil Pressure Switch. The high oil pressure switch is optional if the pressure from the pump cannot exceed the safe burner operating pressure or if the pressure is protected at the pump.

3.1.11

Figure A.6.7.5.1.5.4 (d) is amended as follows:

$\mathbf{Z_1}$ **-** Differential pressure and alarm trip switch. This is optional when multiple atomizing medium pressure switches are installed, one switch in the header and one at each burner.