



Transition to UL 60730: From UL 353 and UL 372 to IEC-Based Standards

06-07-2022

Presented by: Kent Nelson, UL Sr. Staff Engineer

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Agenda

- 01 International Harmonization of Standards
- 02 Transition Timeline for Legacy Standards to Globally Harmonized Standards
- 03 Introduction to Global Certifications for Burner/Boiler Controls
- 04 Updates in Field Codes (e.g., CSD-1, NFPA 85 & 87)
- 05 Differences between ANSI/UL Standards and UL/IEC 60730
- 06 Field Inspection of Safety Controls
- 07 Introduction to UL Product iQ
- 08 Questions and Answers

Presenter Introduction

Speaker



Kent Nelson

Senior Staff Engineer

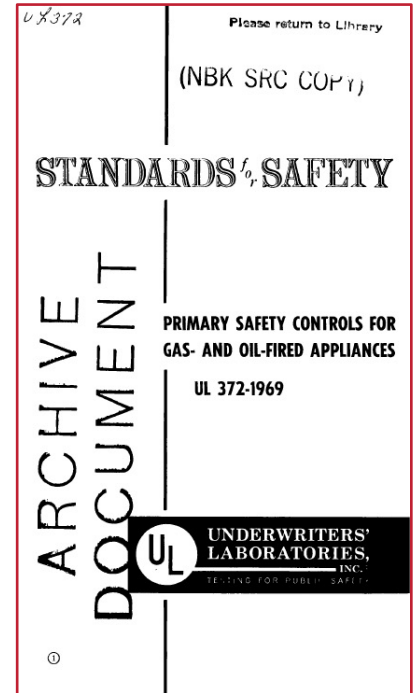
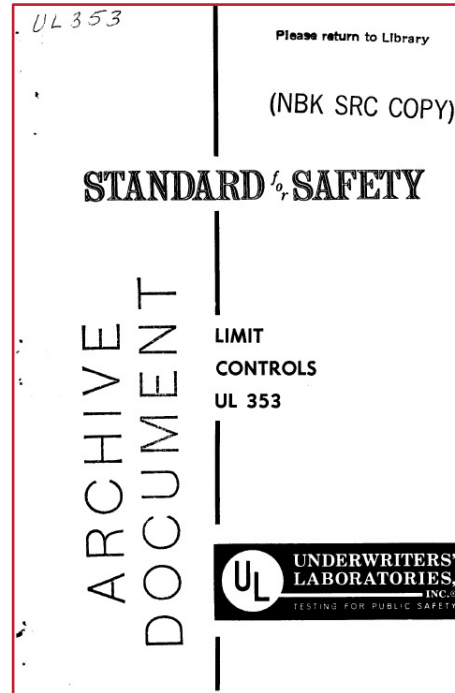
Kent Nelson is a Senior Staff Engineer at UL with 15 years of experience in HVAC-R product safety certification. His diverse competencies in control and end product requirements bridge the gap between the component evaluations and their applications in the field. As a member of IEC TC72 WG1, he has participated in the development of combustion control requirements in IEC 60730-2-5. He serves as a member on the ASME CSD-1 Standards Committee, and will be established as an alternate on NFPA 85 in the Fundamentals of Combustion Systems Hazards and Single Burner Boiler Technical Committees as part of becoming UL's Principal Engineer for Boilers this year.

International Harmonization of Standards

Relevance of Safety Standards

Specific example:

- New York Telephone Company Boiler Explosion October 3rd, 1962.
- Incidents led to creation of UL 353 and UL 372



Requirements of UL 353 and UL 372

- Standard for Limit Controls (UL 353) and Primary Safety Controls (UL 372) address this hazard
- Historically – UL **wrote** Standards
- Until recently – UL **managed Standards Technical Panels** to write Standards specific for the United States

SEPTEMBER 23, 1994

LIMIT CONTROLS - UL 353

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[...]

CONSTRUCTION

4 General

4.1 A component of a control shall comply with the requirements for that component, except that such requirements may be modified if appropriate for the particular application.

4.2 A safety control incorporating a transformer, relay, or the like, shall be supplied by a circuit consisting of a two-wire, one-side grounded system having a voltage rating of not more than a nominal 120 volts. A switch or protective device shall be in the circuit electrically connected to the ungrounded supply conductor.

SEPTEMBER 1, 2000 PRIMARY SAFETY CONTROLS FOR GAS- AND OIL-FIRED APPLIANCES - UL 372

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CONSTRUCTION

4 General

4.1 The primary input circuit of a safety control shall be a two-wire, one-side-grounded system, having a voltage rating of not more than a nominal 120 volts. A switch or protective device shall be in the circuit electrically connected to the ungrounded supply conductor.

International Standard Development

Today – Standards are developed globally, where requested by the manufacturers (e.g., the UL-based standards are not directly being harmonized at this point (UL 295, UL 296, UL 834, etc.), but ANSI/CSA standards (ANSI Z21.13, B149.3, etc.) refer to these requirements (e.g., CAN/CSA C22.2 No. 60335-2-102).

International Electrotechnical Commission (IEC) and International Organization for Standardization (ISO) are independent, non-governmental organizations.

- Leading global organizations that prepare and publish international standards for electrical, electronic and related technologies
- Worldwide organization for standardization
- Objective is to promote international co-operation
- Members are National Committees
- Do not, themselves, provide attestation of conformity



IEC Technical Committees and Standards

Relevant Committees – IEC Technical Committee 72 – Automatic Electrical Controls:

- **Working Group 1** – Burner controls and maintenance of 60730-2-5
 - 60730-2-5 (replaces UL 372, CSA C22.2 No. 199, and ANSI Z21.20)
- **Working Group 6** – Temperature and pressure sensing controls
 - Includes 60730-2-6, -2-9, and -2-15 (replaces UL 353 and CSA C22.2 No. 24)
- **Working Group 12** – Electrical sensors
 - Developing new “Part 2” Standard (60730-2-23) specifically for sensors, e.g., O2 Sensors for Fuel/Air Ratio
- **Working Group 13** – Use of intelligence in products, linking of products by information technology, wireless solutions
 - Developing requirements for the “Internet of Things” (IoT)
 - Covers topics inclusive of Standards such as UL 5500 (Remote Software Download), UL 2900 (Cybersecurity), etc.
- Burner and Boiler Control and Component Standards are harmonizing with IEC-Based Standards
- UL-based End Product Standards (e.g., UL 295, UL 296, etc.) are not harmonizing with IEC-Based Standards and continue to develop the Legacy National Standards
- ANSI/CSA-based End Product Standards (e.g., ANSI Z21.13) may not be harmonizing with these IEC-Based Standards, but the electrical requirements are beginning to reference IEC-based Standards (e.g., IEC 60335)

ISO Technical Committees and Standards

ISO Technical Committee 161 – Controls and protective devices for gas and/or oil:

- **ISO 23550:2018** – Safety and control devices for gas and/or oil burners and appliances – General requirements (typically covered in the US by UL 353 for electronic controls and/or ANSI Z21 Series for electronic, electromechanical, and mechanical controls)
- **ISO 23551-1:2012 and ISO 23553-1:2014** – Safety and control devices for gas burners and gas-burning appliances – Particular requirements – Part 1: Automatic and semi-automatic valves (currently covered in the US by, e.g., ANSI Z21.21)
- **ISO 23551-6:2014** – Safety and control devices for gas burners and gas-burning appliances – Particular requirements – Part 6: Thermoelectric flame supervision controls (currently covered in the US by ANSI Z21.78 and UL 60730-2-5 Annex DVKK)
- **ISO 23552-1:2007** – Safety and control devices for gas and/or oil burners and gas and/or oil appliances – Particular requirements – Part 1: Fuel/air ratio controls, electronic type (currently required for Field Erected Boilers in Canada per B149.3-15, Cl. 5.4.3 and Annex D; typically covered in the US by UL 353)

120V Example – UL 372 vs. UL 60730-2-5

- Today, the IEC prepares the requirements from a Global perspective; for the 60730 Series of Standards, it is with Technical Committee (TC) 72.
- Each National Committee publishes a document for particular countries; for the US and Canada, this document is Bi-National.
- UL publishes the US National Standard, CSA publishes the Canadian Standard, and both Harmonize together

SEPTEMBER 1, 2000 PRIMARY SAFETY CONTROLS FOR GAS- AND OIL-FIRED APPLIANCES - UL 372

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CONSTRUCTION

4 General

4.1 The primary input circuit of a safety control shall be a two-wire, one-side-grounded system, having a voltage rating of not more than a nominal **120 volts**. A switch or protective device shall be in the circuit electrically connected to the ungrounded supply conductor.

JANUARY 30, 2014

ANSI Z21.20-2014 • CAN/CSA-C22.2 NO. 60730-2-5-14 • UL 60730-2-5

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[...]

1 Scope and normative references

This clause of part 1 is applicable except as follows:

[...]

1.2 Replacement:

This part 2-5 applies to systems with a rated voltage not exceeding 660 V and with a rated current not exceeding 63 A.

1.2DV DR Modification of 1.2 by adding the following text:

The maximum control output voltage is 600 V. The maximum current is unlimited.

The primary input circuit of a system shall be a two-wire, one-side-grounded system, having a voltage rating of not more than a nominal **120 volts**. A switch or protective device shall be in the circuit electrically connected to the ungrounded supply conductor.

End Product Certification Standards

Not only control requirements are referencing IEC/Internationally-Based Standards:

- **ULC/ORD-C795** – Commercial-Industrial Gas-Fired Package Boilers
 - Published on 2021-04-22; replaces withdrawn CSA/CAN1-3.1
 - Very closely aligned with UL 795, 8th Edition, Issued 2016-12-02, Revised 2022-05-03
 - Used for developing Bi-National CAN/UL/ULC-ORD/C795
- **ANSI Z21.47/CSA 2.3** – Gas-Fired Central Furnaces
 - Upcoming edition references both Legacy (ANSI Z21.20) and IEC-based (60730-2-5) Standards
 - References UL 60335-2-40 for packaged Air Conditioning applications
 - References CAN/CSA C22.2 No. 60335-2-102 based on IEC 60335 requirements
- **Other ANSI Documents** – Soon to be updated to the same requirements, for example:
 - ANSI Z21.13/CSA 4.9, Gas-Fired Low-Pressure Steam and Hot Water Boilers
 - ANSI Z21.10.1/CSA 4.1, Gas Water Heaters, Vol. I, Storage Water Heaters $\leq 75\text{k BTU/hr.}$
 - ANSI Z21.10.3/CSA 4.3, Gas Water Heaters, Vol. III, $> 75\text{k BTU/hr.}$, Circulating and Instantaneous

New Category “Burner Management Systems”

The new category enables complex systems containing Safety Controls like Primary Safety Controls, Temperature and Pressure Limiters, Fuel/Air Ratio Controls, and also non-safety Controls like PLCs, lead-lag sequencing, etc.

XAAF.GuideInfo - BURNER MANAGEMENT SYSTEMS

DETAILS

UL Category (CCN): [XAAF.Q](#)

Document Type: Guide Info

Parent Category (CCN): [XAAA.Q](#)

RESOURCES

[View UL Certified Products](#)

[Guide Info \(XAAA\)](#)

TAGS

Add Tag

Document

[Automatic Electrical Controls for Household and Similar Use] Burner Management Systems

[See General Information for Automatic Electrical Controls for Household and Similar Use](#)

GENERAL

This category covers burner management systems (BMS) intended for heating, air conditioning, ventilating, and similar applications. The equipment may use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof. They are intended for household, commercial or industrial applications (where no other standard covers the product) in accordance with ANSI/NFPA 70, "National Electrical Code" (NEC).

This category does not cover products intended exclusively for industrial process applications. Such products are investigated to [ANSI/UL 61010-1](#), "Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements."

The BMS system typically consists of a base control unit and several peripheral devices or modules that may be connected individually or a combination thereof to form a system of components in a modular manner. The peripheral components/modules may be burner controls, flame sensors, temperature-limit controls, fuel/air ratio controls, I/Os, etc. The system is generally din-rail mounted in an electrical panel complying with the appropriate requirements for installation and field wiring of the NEC.

The peripheral devices are individual controls utilized as part of a control system with or without nonelectrical outputs or controls that are mechanically integrated with multifunctional controls having nonelectrical outputs.

The BMS system is investigated to the inherent electrical safety and to the operating values, operating times and operating sequence where such are associated with equipment safety (functional safety).

Each module of the BMS may be individually investigated to the respective component standards as noted below or investigated as part of the overall system, if a particular component standard does not exist.

Class 2 Output Circuits

A Class 2 output circuit is a device that incorporates a Class 2 transformer or a Class 2 power source with provision for field wiring of the output circuit that is marked to permit wiring as specified in Article 725 of the NEC for the Class 2 circuit.

Ratings

These automatic electrical controls have a voltage rating not exceeding 600 V. The input, output, and other environmental ratings of each module and the system are based on the manufacturer's declarations and verified through testing. An input/output circuit that fulfills the requirements for both SELV and limited-energy not exceeding 15 W is considered to address the risk of fire and electric shock. An input/output circuit is marked "Class 2" when the electrical characteristics of the circuits meet the requirements in Article 725 of the NEC, specifically Table 11(A) or 11(B) in Chapter 9, under normal and single-component fault operating condition.

Classification per ANSI/UL 60730 Series of Standards

Controls are classified based on their unique features, intended applications and environment, level of reliability, etc. These classifications are noted in [ANSI/UL 60730-1](#), "Automatic Electrical Controls for Household and Similar Use - Part 1: General Requirements," and the respective Part 2 standards. Two of the more common classifications are:

Type 1 action — Automatic action for which the manufacturing deviation and the drift (calibration) of its operating value, operating time, or operating sequence have not been declared and tested under this standard.

Standards Chart

Table of Standards and Editions (current as of January 2022):

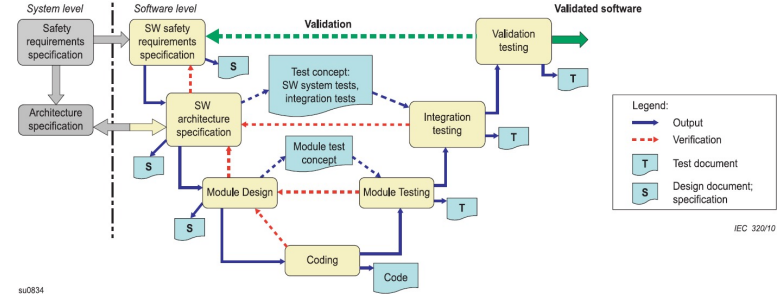
60730		Legacy		Control Types	Notes
UL	CSA	UL	CSA		
60730-1, 5th Ed.	E60730-1:15+A1:2017+A2:2021	N/A	N/A	General Requirements	Latest Edition
60730-1, 4th Ed.	E60730-1:2013			General Requirements	Previous Edition; used with -2-5
UL 60730-2-5, 3rd Ed. ANSI Z21.20:2014 - C22.2 No. 60730-2-5-14, 1st Ed.		UL 372 – or – ANSI Z21.20	CSA C22.2 No. 199	Oil/Gas Burner	Used with 4th Edition of Part 1; new edition out for publication
60730-2-6, 3rd Ed.	E60730-2-6:17	UL 353 CSA	C22.2 No. 24	Pressure	Based on IEC 5.0 Edition of Part 1
60730-2-9, 4th Ed.	E60730-2-9:2018			Temperature	Based on IEC 5.0 Edition of Part 1
60730-2-15, 2nd Ed.	E60730-2-15:2014			Water Level	Based on IEC 3.2 Edition of Part 1
60730-2-15, 3rd Ed.	Not yet published				Based on IEC 5.0 Edition of Part 1

Requirement Alignment

Subject	ANSI Z21.20-2005	UL 353 / 372	UL/CSA 60730-X	CSA C22.2 No. 24	CSA C22.2 No. 199
Spacings	UL 840 [1.8.9]	UL 840 [19.1]	20 (based on IEC 60664)	CSA C22.2 No. 0.8	TIL-H18A
Safety Software	UL 1998 [2.11.2]	UL 1998 [4A]	H.11.12		– or –
Thermal Cycling	2.10	31C / 30C	H.17.1.4		-
Electromagnetic Compatibility	2.15	UL 991 [31B / 30B]	H.26 (based on IEC 61000 Series)		CSA C22.2 No. 0.8
Component Faults	2.11	31A / 30A	H.27		
Fire Hazard	NEC Class 2 (Article 725) [Definition of “Circuit, Low-Voltage”]	NEC Class 2 (Article 725) [3.6(b) / 3.9(b)]	> 15W (H.27)	CEC Class 2 (Section 16)	
Shock Hazard			> 30V (H.27)		

A Note on Safety Software

- Very similar concepts between UL 1998 and 60730 Series
- UL 60730 adds “informative” references to IEC 61508 e.g. V-Model



UL 1998	Document Requirement	IEC 60730-1	Document Requirement
3, 8.3, 12.3	Risk Analysis Approach and Results	H.7, Table 1, 66	Software sequence document
4, 12.2	Software Development Plan	H.7, Table 1, 68-72	Software Fault Analysis (Risk Analysis)
12.5	System Architecture	Figure H.1	Software Development Life Cycle
12.6	Programmable Component and Software Requirements Specification	H.11.12.3.2.1	Software Safety Requirements Specification
6, 7, 12.7	Software Design	H.11.12.3.2.2	Software Architecture Specification
11.1	Software Design and Code Analysis	H.11.12.3.2.3	Software Module Design Specification
5	Tool Documentation	H.11.12.3.2.4	Design and Coding Standards
13	Off-the-Shelf Software Documentation	H.11.12.3.3.1	Software Module Testing
12.8	Test Documentation	H.11.12.3.3.2	Software Integration Testing
11.2	Software Development and Post-Release Tests	H.11.12.3.3.3	Software Validation Testing
11.3	Operational Tests	H.11.12.3.4.1	Tools and Programming Languages
12.1	User Documentation	H.11.12.3.4.2	Software Version Management (i.e. Configuration Management) Plan
12.4	Configuration Management Plan	H.11.12.3.4.3	Software Modification Plan
14	Software Change and Document Control		
15	Software Identification		

The background image shows two large, light-blue industrial steam turbines in a factory. The turbine on the left is in the foreground, showing its large circular front with various pipes, valves, and a pressure gauge. The turbine on the right is slightly behind and to the right, also showing its front and associated piping. The setting is an industrial facility with concrete pillars and overhead pipes.

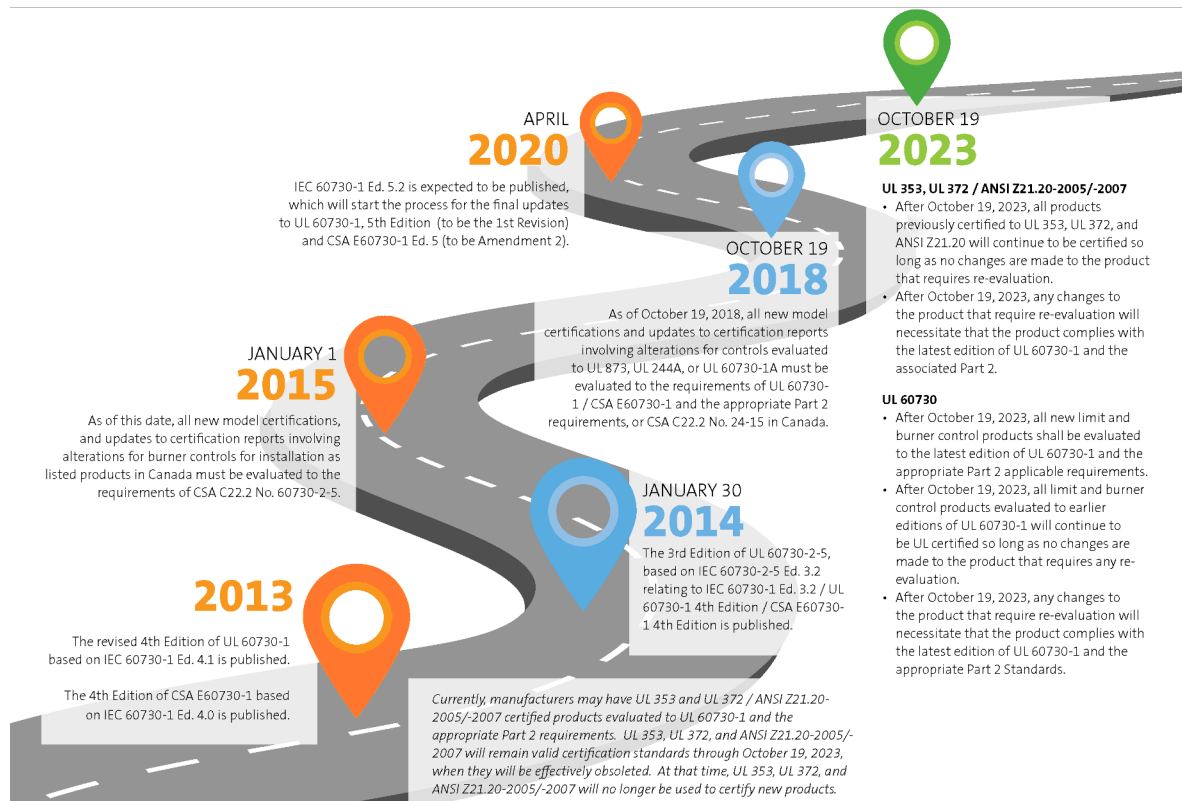
Transition Timeline for Legacy Standards to IEC Harmonized Standards

Transition Timeline for Legacy Standards to IEC Harmonized Standards

- For Product certified to US Standards (e.g., UL 353) or Bi-National US/Canadian Standards (e.g. UL 372/ANSI Z21.20/CSA C22.2 No. 199), certifications can continue to Legacy Standard until 2023-10-19.
- Products updated before the 2023-10-19 date can remain certified to Legacy Standard after this date (noted on Product iQ).
- The Standard Technical Panel (STP) voted that the change in requirements does not warrant existing products certified to the previous requirements to be recertified to the recently adopted requirements. Manufacturers have the option of continuing their certifications to the standard in effect at the time of the original certification **if no changes requiring a certification decision are made to the product after the Effective Date.**
- Unlisted Components may be certified to Legacy standards after this date, if permitted by the End Product Standard.
- For Product certified to Canadian Standards (e.g., CSA C22.2 No. 24), as of today they must be evaluated to the latest published Standard (either CSA C22.2 No. 24-15 or CSA E60730-1:15 and the relevant Part 2 (as of April 2018)).
- Documented on <http://ifr.ul.com/>
- **GOING FORWARD:** Pop-Ups/Notification via myUL Portal
 - <https://my.ul.com/>

INDUSTRY FILE REVIEW NEWS	
Bulletin/Letter Date	TITLE
03/28/2019	UL 1995 (UL60335-2-40) Change of Effective Date to January 1, 2024
03/26/2019	UL 62275 Effective Date Extension to 2019-11-30
02/18/2019	1995 Proposed Effective Date Change
02/04/2019	UL 218 Effective Date change to 2019-09-01
01/22/2019	UL 508 Certification Requirement Changes Announcement
12/21/2018	UL 218 Extention Proposal
07/16/2018	Subject 2251 Proposal to change Effective Date to November 20, 2022
04/25/2018	Industry File Review FAQs
04/23/2018	Transition of UL 353

Limit and Burner Controls Transition to UL 60730



Introduction to Global Certifications for Burner/Boiler Controls

Global Certifications

- Most countries accept UL or CE Certifications
- EN 298:2012 update soon to be published to more closely align with IEC 60730-2-5 Ed. 4.2
 - UL 60730-2-5 4th Edition / CSA C22.2 No. 60730-2-5 2nd Edition is out for publication based on this same IEC Edition
- European and some international jurisdictions also require Functional Safety evaluation (e.g., IEC 61508/61511)
- Brexit will impact CE acceptance effective 2022-01-01
 - Products already Certified to CE requirements are acceptable until 2023-01-01



Differences in EN 298

Must consider IEC/EN (e.g., non UL/CSA Deviation) for 60730-2-5

- Independence of Micros – stringent application of functionally independent means to de-energize fuel (2 micros)
- Relay requirements – 250,000 cycles; overload vs. overvoltage; rating types ($\cos \phi$ vs. HP/VA/GP)
- **Component requirements, for example:**
 - IEC 61558-2-6 instead of UL 5085-3
 - IEC 61558-2-16 instead of UL 60730-1 Cl. 24.2.1DV.3
 - Utilize 60730-1 Cl. 20.3 vs. R/C Optocoupler
 - Resistance to Fire – Proof Tracking, Glow Wire, Ball Pressure instead of UL 746C/UL 796

Additionally, other requirements are different:

- EMC requirements – still based on IEC 61000-4 Series, with different modifications; special attention to DC powered controls
- Internal Fault Reaction Time – 3 s mandatory (e.g., Cl. 6.6.4.2)
- Flame Failure Response Time (FFRT) shall not exceed 1 s (Cl. 7.101.3.7)
- **No “soft” lock-out allowed, even on residential equipment:**
 - Volatile lock-out is only permitted to be accomplished by manual reset or power interruption – not via timers

Other EN Standards

Fuel/Air Ratio Controllers	Temperature, Pressure, and Low Water Controls	Combustion Sensors
<ul style="list-style-type: none">• US – UL 353 (Legacy), UL 60730-1• CAN – CSA C22.2 No. 24-15, ISO 23552-1• EU – EN 12067-2	<ul style="list-style-type: none">• US – UL 353 (Legacy for all), UL 60730-2-9 (Temp.), UL 60730-2-6 (Pressure), UL 60730-2-15 (Low Water)• CAN – CSA C22.2 No. 24-15, CSA E60730-2-9 (Temp.), CSA E60730-2-6 (Pressure), CSA E60730-2-15 (Low Water)• EU – EN 60730-2-15	<ul style="list-style-type: none">• US – UL 353 (Legacy), UL 60730-1• CAN – CSA C22.2 No. 24-15, CSA E60730-1• EU – EN 16340 – Safety and control devices for burners and appliances burning gaseous or liquid fuels: combustion product sensing devices

The background image shows two large, light blue industrial gas cylinders standing in a factory or warehouse. The cylinders are positioned on yellow safety mats. They have various pipes, valves, and gauges attached to them. A concrete pillar is visible between the two cylinders. The scene is brightly lit with overhead industrial lights.

Updates in Field Codes (e.g., CSD-1, NFPA 85 & 87)

Updates made in CSD-1–2021 for Transition

CW-110 General Requirements for Water Level Controls for All Boilers

(a) Each low-water fuel cutoff or combined feeder/cutoff device shall be labeled and listed to UL 353 as a safety control and/or UL 60730-2-15 as a protective control.

CW-210 Requirements for Flow or Temperature Sensing Devices for Forced Circulation Boilers

In lieu of the requirements for low-water fuel cutoffs in [CW-100](#), a boiler requiring forced circulation to prevent overheating and failure of the heat exchanger (tubes, coils, etc.) shall have one or more of the following means to protect the boiler unit against overheating at all allowable firing rates:

(a) a flow sensing device labeled and listed to UL 353 as a safety control and/or UL 60730-2-15 as a protective control. This safety control shall be independent of any other operating controls and may be automatically reset when sufficient water flow is restored.

CW-310 Requirements for Pressure Controls for Steam Boilers

(a) Each boiler pressure control shall be labeled and listed to UL 353 as a safety control and/or [UL 60730-2-6](#) as a protective control.

CW-410 Requirements for Temperature Controls for Hot Water Boilers

(a) Each automatically fired hot water boiler or each system of commonly connected hot water boilers shall have at least two temperature-control devices labeled and listed to UL 353 as a safety control and/or UL 60730-2-9 as a protective control. This requirement does not preclude the use of additional temperature control devices that are not labeled and listed to UL 353 and/or UL 60730-2-9 as a protective control.

CW-710 Requirements for Vacuum Boilers

Vacuum boilers complying with ASME Boiler and Pressure Vessel Code, Section IV, Mandatory Appendix 5 shall be permitted to have the safety limit controls meeting the requirements identified in [\(a\)](#), [\(b\)](#), [\(c\)](#), and [\(d\)](#) in lieu of all other requirements in [Part CW](#).

(a) Each boiler pressure control shall be labeled and listed to UL 353 as a safety control and/or [UL 60730-2-6](#) as a protective control and each boiler temperature control shall be a safety control labeled and listed to UL 353 and/or UL 60730-2-9 as a protective control.

Recent Updates to NFPA 85

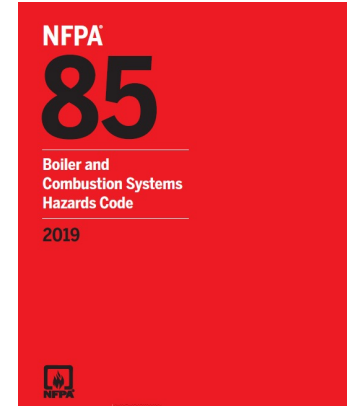
From, 'Origin and Development of NFPA 85:'

- The 2015 edition recognized the use of safety-rated programmable logic controllers for use with single burner boilers where they are certified as at least **SIL 3 capable according to IEC 61508**, Functional Safety of Electrical/Electronic Programmable Electronic Safety-Related Systems.

Controls developed to IEC 61508 are **not acceptable for Listed Burners and Boilers** unless also certified to UL 372 or UL 60730-2-5.

Approach between the Standards is essentially different:

- UL 372 / 60730-2-5: **Deterministic** Functional Safety
- IEC 61508: **Probabilistic** Functional Safety



Requirements in NFPA 87

Similar statement to NPFA 85, except allowing the lower SIL 2 capability:

(NOTE: below shows original updates from 2018; this text is unchanged in 2021 edition)

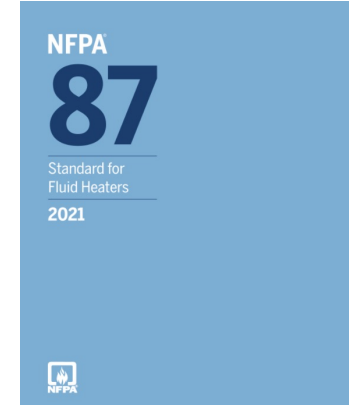
8.3* – Burner Management System Logic.


8.3.1 – General.

83.1.1 – Purge, 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**.

△ 8.4.2% – **Where** PLCs are not listed for combustion **safety service or as a combustion safeguard**, the PLC and its associated **input and output (I/O)** used to perform safety functions **shall be as follows**:

- 1) Third-party certified to IC 61508, Functional Safety of Electrical / Electronic / Programmable Electronic Safety Related Systems, safety integrity level (SIL) 2 or greater
- 2) Applied to achieve at least a SIL 2 capability per the manufacturer's safety manual



The image shows two large, light blue industrial gas cylinders standing in a factory. They are positioned on the left and right sides of the frame, separated by a concrete pillar. The cylinders have various pipes, valves, and gauges attached to them. The background shows industrial infrastructure like pipes and overhead lights.

Differences between UL 353/372 and UL 60730

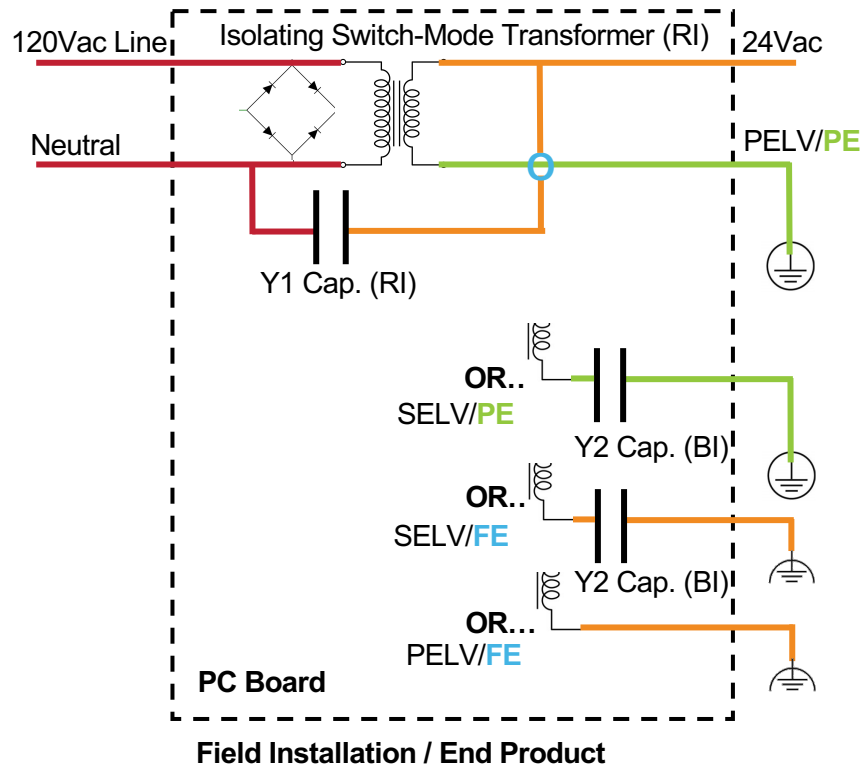
Significant Differences in IEC Harmonized Standards

Spacings:

- Functional/Operational (FI)
- Basic(/Supplementary) (BI)
- Reinforced(/Double) (RI)

Different Extra Low Voltage Concepts:

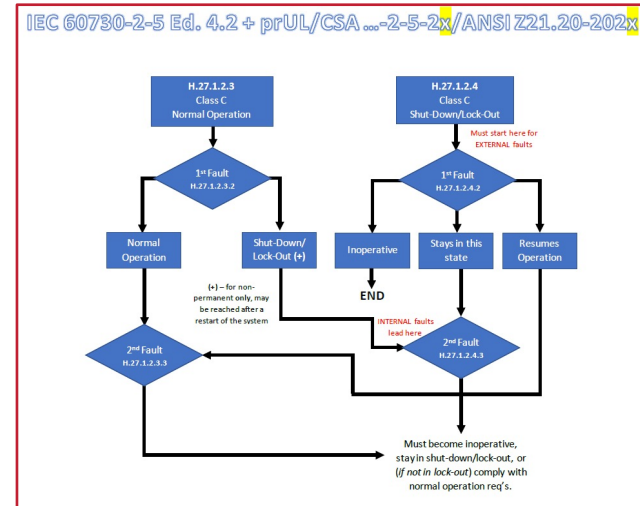
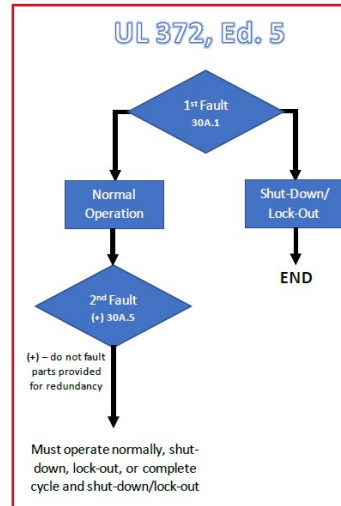
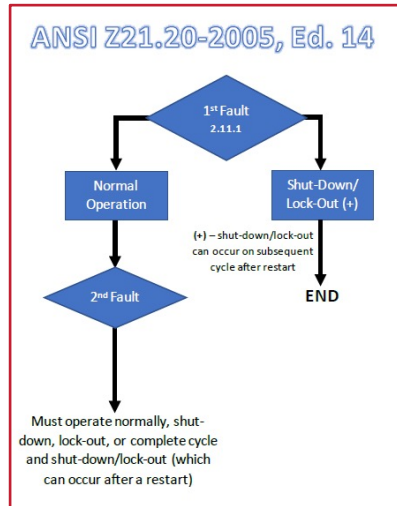
- SELV – Safety/Separated Extra Low Voltage
- PELV – Protected Extra Low Voltage
- **Functional Earth** (ISO 60417-5018) (FE)
- **Protective Earth** (ISO 60417-5019) (PE)



Significant Differences in IEC Harmonized Standards

Different Failure Mode Effects Analysis:

- Components provided for redundancy are no longer exempt from being included as in UL 372 and 353
- Faults shall be conducted in both Normal Operation **and** Lockout/Safety Shutdown



Differences between UL 353/372 and UL 60730

Relay Requirements:

Require 'Disconnection Type:'

- Full Disconnection (e.g., “Marked Off” position):
 - Basic Insulation
 - Spacing
 - Electric Strength
- Micro Disconnection:
 - Electric Strength
- Micro Interruption:
 - No Added Quantitative Criteria

Extra Low Voltage Power Supply Changes (15W vs. Class 2)”

Legacy:

- “NEC Class 2”
 - NFPA 70, Article 725

Modern:

- Low-Power Point:
 - 15W Power Limit
- SELV:
 - 30Vac/60Vdc Voltage Limit

Transition to the Future State of Controls

Transition from separate Functional Safety Standards to embedded requirements in the IEC-based Standards:

- **UL 1998** – Standard for Safety for Software in Programmable Components
 - Replaced by UL 60730 Clause H.11.12
- **UL 991** – Standard For Safety For Tests for Safety-Related Controls Employing Solid-State Devices
 - Replaced by UL 60730 such as Clauses H.17.1.4.2 (Thermal Cycling), H.26 (EMC Tests), H.27 (FMEA), etc.

New Requirements must consider the ‘Internet of Things,’ Smart Controls; Data Security; etc:

- **IEC 61508** – Functional Safety
 - Probabilistic Analysis as compared to Deterministic Functional Safety Analysis of 60730, 1998, 991, etc.
- **UL 2900** – Standards for Software Cybersecurity
- **UL 5500** – Standard for Safety for Remote Software Updates
 - Also represented by UL 60730 Clause H.11.12.4

Field Inspection of Safety Controls

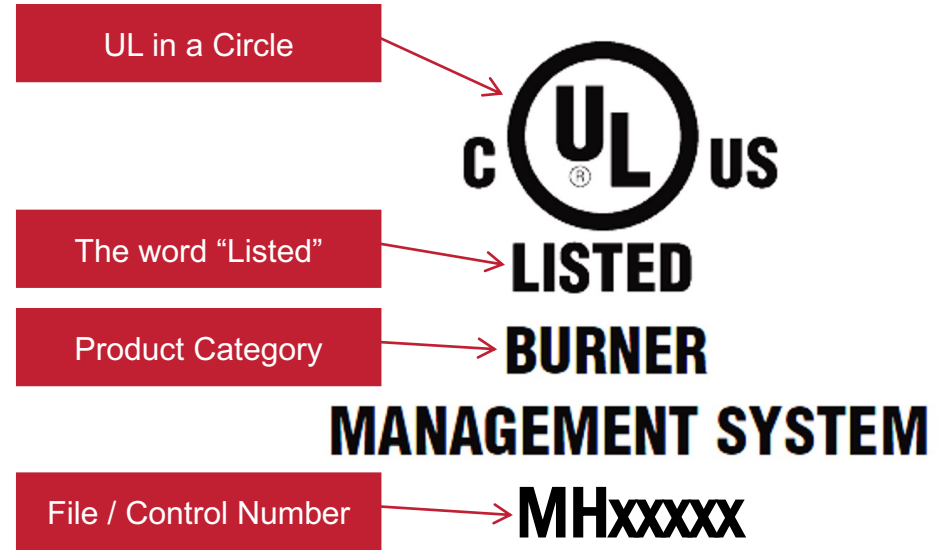
Inspecting Controls in the Field

New Category for **Burner Management Systems** (Category Code XAAF)

“Four Elements” to the “Traditional”
UL Listing Mark




Note: First characters of File Number
Indicate Certification Type, e.g.:

MH = Miscellaneous Hazard
MP = Miscellaneous Petroleum
E = Electrical
SA = Safety Appliance



Inspecting Controls in the Field

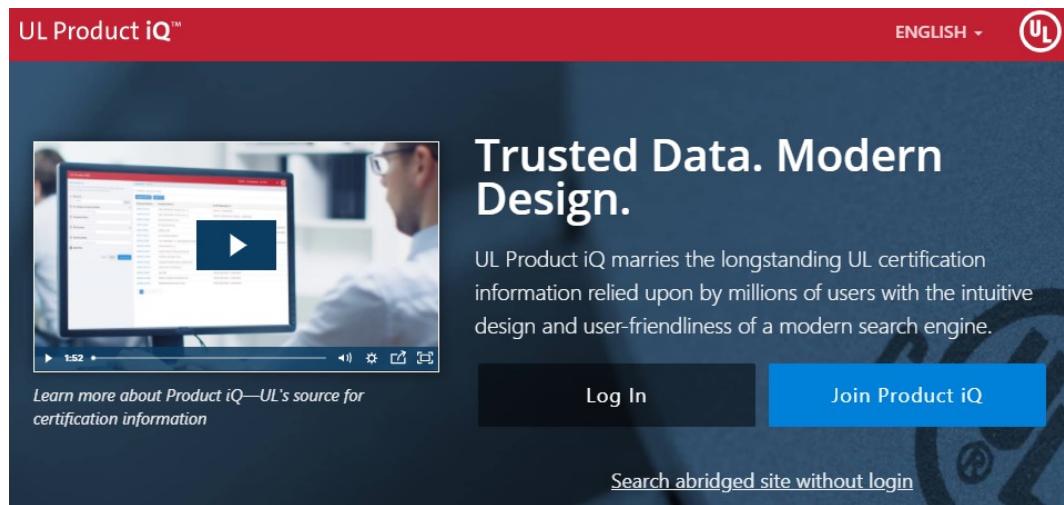
- 'Enhanced' UL Certification Mark has a new format
- Allows integration of QR Code to directly link to Product iQ Web Page
- Customers can build marks at: <https://markshub.ul.com/>

		
<h3>ADD A MARK</h3> <p>The Enhanced UL Certification Mark has been created to deliver greater transparency and efficiency in the market today.</p> <p>Promotes multiple-market acceptance and faster deployment</p> <p>Allows for bundling of current and future Certifications</p> <p><input type="checkbox"/> ADD A MARK</p>	<h3>ADD A BADGE</h3> <p>The UL Certification Badge communicates product compliance for buyer confidence at point-of-sale or in marketing materials.</p> <p>Optimized for online, advertising and packaging materials</p> <p>Provides flexibility in packaging placement and design options</p> <p><input type="checkbox"/> ADD A BADGE</p>	<h3>MAKE SMART</h3> <p>Advance your UL Certification Marks and Badges with the addition of a unique product Web page for audiences activated through a QR code.</p> <p>Automatically generates a Web page as part of the build process</p> <p>Provides mobile, in-market access to compliance information</p> <p><input checked="" type="checkbox"/> MAKE SMART</p>

Introduction to UL Product iQ

New: Product iQ

- Replaces “Online Certification Directory”
- Requires Login
- Significantly more powerful and easier to use
- As always, available directly from the UL homepage,
<https://www.ul.com>



UL Product iQ™

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Trusted Data. Modern Design.

UL Product iQ marries the longstanding UL certification information relied upon by millions of users with the intuitive design and user-friendliness of a modern search engine.

[Log In](#) [Join Product iQ](#)

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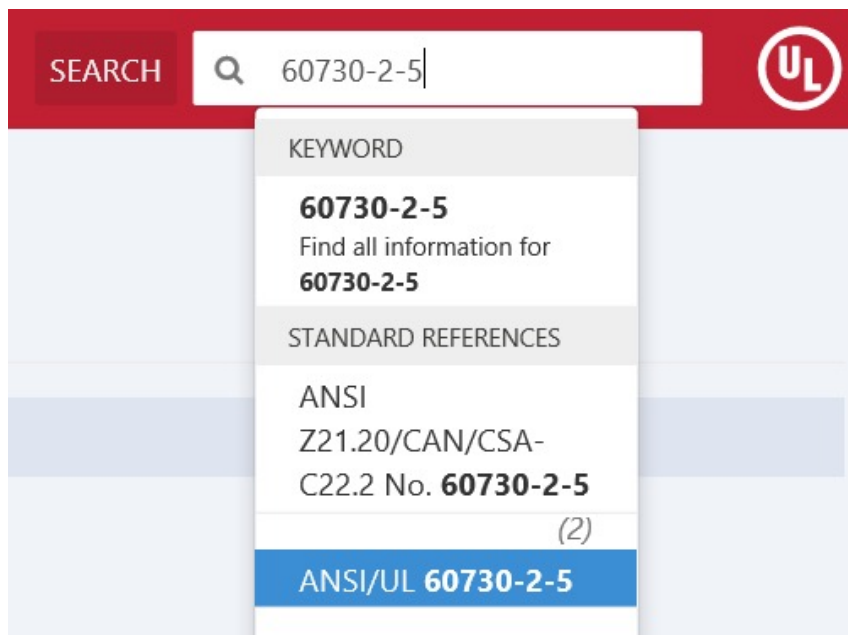
Learn more about Product iQ—UL's source for certification information

What do you want to do today?



Product iQ Searching

Can search directly by product Standard, e.g. “60730-2-5:”



Product iQ Searching

This exposes all Category Code Numbers (CCNs) which contain this in the Guide Information:

REFINE RESULTS

Build or filter your results by keyword and/or adding criteria like document type, file number and country name.

Keyword

Filter by Keyword Search

Standard References

× ANSI/UL 60730-2-5

+ Add Filter

Cancel Reset Save Search

Dashboard / Search

► 6 Results :: *Standard References: ANSI/UL 60730-2-5*

Display: General ▾ Rows: 15 ▾

Document Name ↕	Company Name ↕	UL CCN Description ↕
JHYR.GuidelInfo		GAS APPLIANCE ACCESSORIES
JHYR2.GuidelInfo		GAS APPLIANCE ACCESSORIES - COMPONENT
LZZG2.GuidelInfo		CONTROLS, PRIMARY SAFETY FOR USE IN HAZARDOUS LOCATIONS - COMPONENT
MCCZ.GuidelInfo		CONTROLS, PRIMARY SAFETY
MCCZ2.GuidelInfo		CONTROLS, PRIMARY SAFETY - COMPONENT
XAAF.GuidelInfo		BURNER MANAGEMENT SYSTEMS

<< 1 >>

Protective vs. Operating; Type 1 vs. Type 2

Legacy: Limiting controls are ‘**safety**’
Regulating or Ancillary/Auxiliary Controls are ‘**non-safety**’

Modern: **Type 2, Protective** Controls are ‘**safety**’
Type 2, Operating Controls are ‘**safety**’
Type 1, Protective Controls do not exist
(all are safety by definition)
Type 1, Operating Controls are ‘non-safety’

60730

2.2.19 – OPERATING CONTROL: CONTROL Which starts or regulates the equipment during normal operation

2.2.20 – PROTECTIVE CONTROL: CONTROL, the OPERATION of which is intended to prevent a hazardous situation during abnormal OPERATION of the equipment

2.6.1 – TYPE 1 ACTION: AUTOMATIC ACTION for which the MANUFACTURING DEVIATION and the DRIFT of its OPERATING VALUE, OPERATING TIME or OPERATING SEQUENCE have not been declared and tested under this standard.

A type 1 action is subclassified as specified in 6.4.

2.6.2 – TYPE 2 ACTION: AUTOMATIC CONTROL for which the MANUFACTURING DEVIATION and the DRIFT of its OPERATING VALUE, OPERATING TIME or OPERATING SEQUENCE have been declared and tested under this standard.

A type 2 action is subclassified as specified in 6.4.

CSD-1

CG-700 Definitions

Control: a device designated to regulate the fuel, air, water, steam, or electrical supply to the controlled equipment. It may be automatic, semiautomatic, or manual.

Control operating: an automatic control, other than a safety control, to start or regulate input according to demand and to stop or regulate input on satisfaction of demand.

Control, primary safety: a control directly responsive to flame properties, sensing the presence of flame and, in event of ignition failure or loss of flame, causing safety shutdown

Control, safety (also known as limit): a control responsive to changes in liquid level, pressure, or temperature and set beyond the operating range to prevent the operation beyond designed limits.

Control protective: safety control investigated to 60730 Standards as a Protective (Type 2 Action) Control with Class Safety Function.

Applying Types to Inspection: Example

Burner Control Company
123 Main Street, Anytown, USA

MH0000

Model	Control Function Class	Operating Ambient, °C	Optional or Required	Notes
XYZ. Master Control Component with or without:	C	-30 to +70	Required	(1)
XYZ1. Flame Scanner or	C	-20 to +60	Optional	(2)
XYZ2. Flame Detector	C	-20 to +60	Optional	(2)
XYZ3. Actuator Module	C	-30 to +70	Optional	(1)
XYZ4. Input / Output Module	C	-30 to +70	Optional	(1)
XYZ5. User Interface	A	-30 to +70	Optional	(1)
XYZ6. Flue Gas Analyzer	A	-20 to +60	Optional	(3)
XYZ7. Actuator	C	-30 to +60	Optional	(4)

Summary:

- Class A is non-safety (ancillary control)
- Class B includes some safety
- Class C is safety (2nd order fault tolerant)

UL 372/UL 353 may be prescribed by an End Product Standard; suitability varies by usage.

Various jurisdictions may adopt different codes e.g., in Canada C22.1-2015 **requires** 60730-2-5.

Notes: Standards used for certification:

- (1) – UL 60730-1 Ed. 4 dated 2014-05-21. CAN/CSA 160730-1 Ed 4 dated 2013-03-01, **UL 60730-2-5 Ed. 3** dated 2014 01-30, CAN/CSA-C222 No. 60730-2-5 Ed. 1 dated 2014-01-30, ANSI Z21.20 Ed. 1 dated 2014-01-30
- (2) – UL 372. 5th Ed. Dated 2000-09-01
- (3) – UL 353, 5th Ed., Dated 2001-04-30.

Canadian Electrical Code, Part II

Appendix A - Safety standards for electrical equipment:

Notes: This appendix is a normative (mandatory) part of this standard.

ANSI Z21.20-2014/CAN/CSA-C22-2. No. 60730-2-5-14

Automatic electrical controls for household and similar use – Part 2-5
Particular requirements for automatic electrical burner control systems.

Questions or comments

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