NFPA 70-2023: National Electrical Code® (NEC)
Analysis of Impact Considerations on the Design and Installation of Audio/Video, Information and Communication Technology (AV/ICT) Equipment

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This analysis is intended to identify and analyze changes in the 2023 Edition of NFPA 70, National Electrical Code® (NEC), which have potential impact on safety and installation of AV & ICT equipment, including the National Differences (ND) / requirements in CSA UL 62368-1, Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements. Key changes are highlighted.

Other observations are included that may be of interest to the AV/ICT Industry.

The 2023 NEC is available from the NFPA: https://catalog.nfpa.org/NFPA-70-National-Electrical-Code-NEC-C4022.aspx

Explanation of Impact Statements:

Statement	Impact
None	Anticipate no impact on design and/or installation of AV/ICT equipment due to the change.
Minor	Anticipate limited impact on the design and/or installation of some AV/ICT equipment due to the change.
Significant	Anticipate potentially sizable impact on the design and/or installation of some AV/ICT equipment due to the change.

Article/ Section	Title	Summary	Impact	ND Proposed in CSA UL 62368-1 Ed 4?
100	**Definitions - Scope**	For the 2023 NEC, all terms and definitions that were not already located in Article 100 (i.e., were in other Articles of the Code), have been moved into Article 100, *Definitions*. Now, all terms / definitions are in Article 100. This change was made primarily to align the NEC with other NFPA Codes / Standards and to make the Code more user-friendly.	**None.** Because terms/ definitions are informative, there should be no significant impact, although it may take time for Users of the NEC to adjust to all the terms and definitions being in Article 100.	**No.**
100	**Appliance**	Although most AV/ICT equipment is considered *Utilization Equipment* versus an *Appliance*, it is noteworthy that the definition of *Appliance* now includes clarification that the definition of *appliance* covers equipment that is "fastened in place, stationary, or portable."	**None.** Informative clarification - most AV/ICT would not be formally considered an *Appliance* but, rather, *Utilization Equipment*.	**No.**
100	**Class 4 Circuit**	Supporting the addition into the 2023 NEC of a new Article (726) covering *Class 4 Fault-Managed Power Systems,* a series of new terms and definitions have been added to Article 100. A *Class 4 circuit* joins the series of circuit classifications currently associated with the more familiar Class 1, 2 and 3 power limited circuits. Additional new terms associated with Class 4 circuits include, *Class 4 Device*, *Class 4 Power System*, *Class 4 Receiver*, *Class 4 Transmitter*, and *Class 4 Utilization equipment*, plus a new term/definition for *Fault-managed Power (FMP).* Such fault-managed power system technology often is referred to as, Packet Energy Transfer (PET), Digital Electricity (DE), Pulsed Power, etc. This technology is different than other power transfer technologies associated with ICT equipment, such as PoE or USB, in that the voltage levels are up to 400 V L-L and the power levels	**None.** Definition	**Yes.** A comprehensive proposal has been submitted to direct equipment that transmits and receives Class 4 power to UL 1400-1, *Fault-Managed Power Distribution Technologies -Part 1 General Requirements.*

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		are up to several thousand Watts. There is a relatively sophisticated verification process that takes place between transmitter and receiver before power levels greater than NEC Class 2 are permitted to transferred. The technology is named fault-managed power because a fault in the system will terminate the transfer of output power. The technology currently is implemented in stadiums, hotels, casinos and similar locations where significant amounts of power need to be transmitted over long distances. It also is becoming an important technology in the powering of radios and small cell sites associated with 5G networks, although the range of applications is not ICT-centric. For example, currently the technology is also being utilized in some indoor farming / agriculture environments (for smart lighting). For some good background on Class 4 Circuits and Fault-managed Power in the context of ICT equipment, see the article, *The Power of 5G*, by CAN US 62368 THC Member, Mr. Ernie Gallo: https://www.isemag.com/featured/article/14266741/the-power-of-5g .		
100	**Class 4 Device**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**
100	**Class 4 Power System**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**
100	**Class 4 Receiver**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**
100	**Class 4 Transmitter**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**
100	**Class 4 Utilization Equipment**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**
100	**Fault-Managed Power (FMP)**	See Class 4 Circuit.	**None.** Definition	**See Class 4 Circuit.**

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100	**Energized, Likely to Become**	Although not directly a consideration for installation of AV/ICT equipment, it is noteworthy that a new term and definition for *Likely to Become Energized* has been added to the NEC for the first time. The term is used numerous times (at least 25) in the NEC and now will be a defined term for the first time.	**None.** Definition	**No.**
100	**Grounded System, Impedance. (Impedance Grounded System)**	Article 250 of the NEC covers *Grounding and Bonding.* Although Article 250 has covered Impedance Grounded Systems for some time, there never was a definition of such a system in the NEC. Although there is no direct implication on AV/ICT equipment, it is noted that in the context of how power systems are defined per IEC 60364-1:2005, Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions, this definition mirrors, or is similar to the definition of an IT system, which is isolated from earth, except that one point may be connected to earth through an impedance or a voltage limiter. The parts of the equipment required to be earthed are connected to earthing electrodes at the user's premises. Traditionally, within the AV/ICT industry, IT Systems have been thought to be used almost exclusively in Europe, including France and some Nordic countries, but it is noteworthy that the NEC also anticipates a similar system.	**None.** Definition	**No.**
100	**Grounding Conductor, Impedance. (Impedance Grounding Conductor)**	See Grounded System, Impedance. (Impedance Grounded System).	**None.** Definition	**No.**
100	**Safety Circuit**	Although not directly a consideration for installation of AV/ICT equipment, it is noteworthy that a new term and definition for *Safety Circuit* has been added to the NEC for the first time. In the NEC, it specifically used in the context of industrial control	**None. Definition**	**No.**

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		equipment, intrinsically safe systems, and industrial machinery, and is the part of a control system containing one or more devices that perform a safety-related function.		
100	**Servicing**	Due to the relatively recent introduction of requirements for *Reconditioned Equipment* into the NEC, there has been the need to provide clarity on what is meant by reconditioning of electrical equipment, compared to normal servicing, maintenance, and repair. As a result, a new term and definition for *Servicing* has been added to the 2023 NEC.	**None.** Definition	**No.**
110.3 (A)(8)	**General Requirements for Electrical Installations - Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment - Examination**	Article 110 contains general requirements for the examination and approval, installation and use, access to and spaces about electrical conductors and equipment, etc. Section 110.3 covers Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment. In its subdivision (A) *Examination,* stated considerations for judging equipment include: (1) Suitability for installation and use in conformity with this Code, including the importance of Listing to help identify suitability for use; (2) Mechanical strength and durability; (3) Wire-bending and connection space; (4) Electrical insulation; (5) Heating effects under normal conditions of use and also under abnormal conditions likely to arise in service; (6) Arcing effects; (7) Classification by type, size, voltage, current capacity, and specific use; and (9) Other factors that contribute to the practical safeguarding of persons using or likely to come in contact with the equipment. However, for the 2023 NEC, another condition has been added, (8) *Cybersecurity.* Noteworthy is that the scope is limited to "*network-connected life safety equipment,"* so not all electrical equipment is impacted. Also, further clarification is provided that the main concern is " to address its ability to withstand unauthorized updates and	**Minor.** Most AV/ICT equipment is not considered "network-connected life safety equipment," although the hardware/ technology often is used in Life Safety Technology and Health Sciences systems that are so associated. So, manufacturers of AV/ICT hardware should be aware of such potential implications.	**Yes.** Since AV/ICT equipment often serves as the hardware (technology) for larger network-connected life safety systems, a proposal has been submitted to make note of this new requirement.

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		malicious attacks while continuing to perform its intended safety functionality." In Informational Note No. 3, several standards are named that provide frameworks to mitigate current and future security cybersecurity vulnerabilities and address software integrity in systems of electrical equipment, including the ANSI/ISA 62443 series of standards for industrial automation and control systems, the UL 2900 series of standards for software cybersecurity for network-connectable products, and UL 5500, Standard for Remote Software Updates.		
110.3 (B)	**General Requirements for Electrical Installations - Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment - Installation and Use**	Most equipment has "intended use" considerations that are established by the manufacturer, regardless of whether specifically associated with the product's Listing, if Listed. Typically, such considerations are communicated in the form of markings or instructions, which for instructions, traditionally have been in paper (hardcopy) form. For the first time the 2023 NEC is acknowledging (clarifying) via a new Informational Note that installation and use instructions may be provided in the form of printed material, *quick response (QR) code, or the address on the internet where users can download the required instructions.*	**Minor.** Generally, the requirement reflects present practice, although for 'global' AV/ICT products intended for sale both in and outside the U.S., which most are, the requirements in other countries /regions that require hardcopy often override what is permitted in the U.S.	**Yes.** Since for the first time the NEC is acknowledging that installation and use instructions may be provided in the form of quick response (QR) code, or via an address on the internet, a proposal has been submitted to note this.
110.17	**General Requirements for Electrical Installations - Servicing and Maintenance of Equipment**	Similar to the driver for adding a new term for "Servicing" in the 2023 NEC, the recent introduction of requirements for *Reconditioned Equipment* has driven the need to provide some clarity on what is meant by servicing and maintenance of equipment and the obligations in accordance with the Code when doing so. New Section 11.17 does this.	**Minor.** Although these considerations typically will come into play post-Listing, the fact that this Section now is in the Code and establishes some criteria for servicing	**Yes.** Although these requirements typically won't impact a 'type' (Listing) investigation, a proposal has been submitted to reference them since

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			and maintenance of electrical equipment installed per the Code this may drive manufacturers to pay more attention to such after-market activities and the support that will be expected by those involved in servicing and maintenance.	knowing the post-sale obligations of manufacturers is beneficial, especially to those manufacturers outside the U.S.
110.20	**General Requirements for Electrical Installations - Reconditioned Equipment**	Rather than attempt to cover the requirements for Reconditioned Equipment via a definition for *Reconditioned Equipment* in Article 100, supported by additional detail in Section 110.21, *Marking*, as was done in the 2020 NEC, CMP 1 felt there was the need for a general stand-alone section for Reconditioned Equipment, which is now found in Section 110.20 of the 2023 NEC.	**Minor.** Most of the additional material provides further application details on what was in the 2020 NEC.	**Yes.** Although Annex DVA of CSA UL 62368-1 already references the NEC requirements for reconditioned equipment, a proposal has been submitted to update the references to include these additional details.
110.21 (A)	**General Requirements for Electrical Installations – Marking – Equipment Markings**	Section 110.21(A) has been restructured, with added clarity and additional detail on the specific equipment marking requirements for Reconditioned Equipment, as indicated in 110.21(A)(2).	**Minor.** Most of the additional material provides further application details on what was in the 2020 NEC.	**Yes.** Although Annex DVA of CSA UL 62368-1 already references the NEC requirements for reconditioned equipment, a proposal has been

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				submitted to update the references to include these additional details.
300.22	**General Requirements for Wiring Methods and Materials - Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums)**	For the 2023 NEC, Section 300.22, covering, *Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums),* which is part of Article 300*, General Requirements for Wiring Methods and Materials*, has not undergone any significant change. Most of the changes are realignment of its references to other Article and Sections that have changed location from the 2020 NEC.	**None.**	**No.**
314.16 (B)(6)	**Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures - Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies - Box Fill Calculations - Terminal Block Fill.**	The 2023 Code now acknowledges that terminal blocks are more frequently being used in boxes for field wiring, which has an impact on the terminal block fill. The 2023 NEC now includes a methodology for calculating the volume allowance of terminal blocks in such applications.	**Minor.**	**Yes.** A proposal has been submitted to update Annex DVH, *Permanently connected equipment – mains connections.*
409.70	**Industrial Control Panels - Surge Protection**	Aligned with the new definition for a *safety circuit,* industrial control panels with safety circuits for personnel protection that may be subjected to damage from surge events are required to have surge protection installed within or immediately adjacent to the control panel.	**Minor.**	**Yes.** Since CSA UL 62368-1 can cover power distribution units (PDUs) and similar power distribution equipment containing

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				panelboards (when associated with ICT applications), a proposal has been submitted to propose a reference to these new requirements.
640	**Audio Signal Processing, Amplification, and Reproduction Equipment**	For the 2023 NEC, Article 640, *Audio Signal Processing, Amplification, and Reproduction Equipment,* which covers such audio equipment installed in a variety of locations, including studios, auditoriums, stadiums, retail establishments, etc., has not undergone any addition of major requirement, or major restructuring. As Chapter 6 applies to special equipment and may supplement or modify the requirements in Chapters 1 through 7, most of the changes are realignment of its references to other Article and Sections that have changed location from the 2020 NEC.	**None.**	**No.**
645	**Information Technology Equipment**	In a departure from the last few Code cycles, the 2023 NEC's Article 645, *Information Technology Equipment*, which covers electrical installation requirements for ITE in Data Centers and similar environments, has not undergone addition of major requirements, or major restructuring. As Chapter 6 applies to special equipment and may supplement or modify the requirements in Chapters 1 through 7, most of the changes are realignment of its references to other Article and Sections that have changed location from the 2020 NEC.	**None.**	**Yes.** A proposal has been submitted to update the Article 645 references, as needed**.**
646	**Modular Data Centers**	Like Article 645, for the 2023 NEC, Article 646, *Modular Data Centers*, has not undergone addition of major requirements, or major restructuring. As Chapter 6 applies to special equipment and may supplement or modify the requirements in Chapters 1 through 7, most of the changes are realignment of its references to other Article and Sections that have changed location from the 2020 NEC.	**Minor.**	**No.** However, the changes likely will drive an eventual proposal to revise UL Subject 2755, *Outline of Investigation for*

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		However, in Section 646.5(1), *Nameplate Data*, clarification has been provided, " *For listed equipment, the full-load current shown on the nameplate shall be permitted to be the maximum, measured, 15-minute, average full-load current*." Also, in Section in Section 646.5(2), "*As an alternative to the feeder and service load calculations required by Parts III and IV of Article **220**, feeder and service load calculations for new, future, or existing loads shall be permitted to be used if performed by qualified persons under engineering supervision*."		*Modular Data Centers*, which contains Listing requirements for MDC.
647	**Sensitive Electronic Equipment**	Similar to several other articles previously referenced, Article 647, *Sensitive Electronic Equipment*, for the 2023 NEC has not undergone addition of major requirements, or major restructuring.	**None.**	**No.**
722	**Cables for Power-Limited Circuits and Fault-Managed Power Circuits**	See Definitions – *Class 4 Circuit.* As part of the effort to establish a new Article 726 for *Class 4 Fault-Managed Power Systems,* a decision was made by CMP 3 to segment all the Cable requirements for Power-limited Circuits (Class 2 & 3) and Fault-Managed Power Circuits (Class 4) into an independent article since many of the requirements are similar.	**Minor.**	**Yes.** Since Annex DVA references a variety of Chapter 3 and Chapter 7 wiring methods, a proposal has been submitted to update the relevant material, as appropriate.
725.60	**Power Sources for Class 2 and Class 3 Circuits**	Section 725.121 of the 2020 NEC has been restructured as Section 725.60 of the 2023 NEC. This section is noteworthy, and commonly referenced, since it allows for special circuits from several standards to be considered equivalent to Class 2 power sources for purposes of application of Article 725 and its Class 2 wiring methods. For example, limited-power circuits (derived from UL 62368-1 limited power sources (LPS)) are an example of such a circuit that can considered equivalent to Class 2 for purposes of application of Article 725's Class 2 requirements.	**None.**	**Yes.** A proposal has been submitted to update the references to Article 725.

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726	**Class 4 Fault-Managed Power Systems**	See Definitions – *Class 4 Circuit.* Article 726 is the main set of new requirements that address *Class 4 Fault-Managed Power Systems* and their installation. Special attention is noted to Section 726.170, *Listing of Equipment for Class 4 Systems*, which requires that active components of a Class 4 system be listed as a Class 4 device, and that the listing information shall include compatible devices if a listed Class 4 device depends on specific system devices for interoperability, monitoring, or control. UL 1400-1, *Outline for Fault-Managed Power Systems — Part I: General Requirements,* is referenced in Informational Note 1, and Informational Note No. 2 provides an example of a dependent active device in a Class 4 system, i.e., a transmitter that relies on a particular receiver or receivers as part of the monitoring and control system.	**Minor.** Equipment designed to provide Class 4 power will be required to consider UL 1400-1, rather than UL 62368-1 or another standard, although UL 1400-1 references UL 62368-1 for those parts of the system that are not associated with fault-managed technology.	**Yes.** See Class 4 circuit.
Chapter 8	**Communication Systems**	Communications Systems typically consist of electronic equipment, cabling and other devices that perform telecommunications operations for the transmission of audio, video, and data. They can include power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment. Chapter 8 is unique in that Section 90.3 specifies that Chapter 8 covers communications systems and is not subject to the requirements of Chapters 1 through 7, other than where Chapter 8 specifies a requirement. Chapter 8 was reorganized and rewritten for the 2020 edition of the NEC with the intent of minimizing redundant requirements across Chapter 8. There were fewer significant changes in the	**Minor.**	**Yes.** A proposal has been submitted to update associated references, as needed.

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		2023 NEC, but clarification was added in 805.170, *Protectors*, that Protectors shall be Listed.		
Annex A	**Informative Annexes – Informative Annex A – Product Safety Standards**	Note is made of new Table A.1(b), *Product Safety Standards for Conductors and Equipment That Do Not Have an Associated Listing Requirement*, which now supplements the existing Table A.1(a), *Product Safety Standards for Conductors and Equipment That Have an Associated Listing Requirement.* Table A.1(b) was added as an aide to Users of the Standard who may want to identify an associated product safety standard even though there is not a formal Listing requirement in the 2023 NEC.	**None.** Informative	**No.**