



UL 62091

STANDARD FOR SAFETY

Low-Voltage Switchgear and
Controlgear – Controllers for Drivers of
Stationary Fire Pumps

UL Standard for Safety for Low-Voltage Switchgear and Controlgear – Controllers for Drivers of Stationary Fire Pumps, UL 62091

First Edition, Dated September 30, 2020

Summary of Topics

This First Edition of ANSI/UL 62091, the common ANCE, CSA Group and UL (trilateral) standard that is an adoption of IEC 62091, Standard for Low-Voltage Switchgear and Controlgear – Controllers for Drivers of Stationary Fire Pumps (IEC 62091, Edition 1:2007.)

The new requirements are substantially in accordance with Proposal(s) on this subject dated April 3, 2020.

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NMX-J-XXXX
First Edition



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CSA C22.2 No. 62091:20
First Edition
(IEC 62091:2007, MOD)



Underwriters Laboratories Inc.
UL 62091
First Edition

Low-Voltage Switchgear and Controlgear – Controllers for Drivers of Stationary Fire Pumps

September 30, 2020

This national standard is based on publication IEC 62091, First Edition (2007).



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This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 62091 as an American National Standard (ANSI) occurred on September 30, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards. Any other portions of this ANSI/UL standard that were not processed in accordance with ANSI/UL requirements are noted at the beginning of the impacted sections.

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PREFACE

This is the harmonized ANCE, CSA Group, and UL Standard for Low-Voltage Switchgear and Controlgear – Controllers for Drivers of Stationary Fire Pumps. It is the First edition of NMX-J-XXXX, CSA C22.2 No. 62091, and UL 62091.

This harmonized standard is based on IEC Publication 62091: First Edition, Low-voltage switchgear and controlgear – Controllers for drivers of stationary fire pumps, issued January 2007, and the requirements pertaining to fire pump controllers from the 2019 and past editions of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection. This document is intended to replace NMX-J-626-ANCE-2015/UL 218/CSA C22.2 No. 263-15, published in September 2015, to provide globally accepted requirements for fire pump controllers. IEC 62091 is copyrighted by the IEC.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Subcommittee, Fire Pump Controllers, CANENA THSC 121A-62091 on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA), are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

The present Mexican Standard was reviewed and approved by the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE.

This standard was reviewed by the CSA Subcommittee on Fire Pump Controllers, under the jurisdiction of the CSA Technical Committee on Industrial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for ANCE, CSA Group and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the ANCE, CSA Group, and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for Differences From IEC

Differences from the IEC are being added in order to address safety and regulatory situations present in Mexico, the US and Canada.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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For ANCE, the text, figures, and tables of International Electrotechnical Commission Publication 62091, *Low-voltage switchgear and controlgear – Controllers for drivers of stationary fire pumps*, issued 01-2007, are used in this Standard according to the guidelines provided in the ISO/IEC/POCOSA.

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 62091, *Low-voltage switchgear and controlgear – Controllers for drivers of stationary fire pumps*, copyright 2007, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

These materials are subject to copyright claims of IEC and UL. No part of this publication may be reproduced in any form, including an electronic retrieval system, without the prior written permission of UL. All requests pertaining to the Standard for Low-Voltage Switchgear and Controlgear – Controllers for Drivers of Stationary Fire Pumps, UL 62091, should be submitted to UL.

NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 62091, Low-voltage switchgear and controlgear – Controllers for drivers of stationary fire pumps, copyright 2007, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

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Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR – CONTROLLERS FOR DRIVERS OF STATIONARY FIRE PUMPS

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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International Standard IEC 62091 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This first edition cancels and replaces the technical specification published in 2003. It constitutes a technical revision and now has the status of an International Standard.

The text of this standard is based on the following documents:

FDIS	Report on voting
17B/1527/FDIS	17B/1536/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

IEC 62091 pertains to life-safety equipment and is based in part on NFPA 20 (1996) *Standard for the Installation of Centrifugal Fire Pumps*. When called upon to work by automatic signal, manual-electric signal or manual-emergency actuation, the controller is expected to start the pump driver (motor or diesel engine) because “the building is on fire”. Failure to carry out its task will increase fire damage to the building, its contents and people therein.

These controllers default to a RUN state. They are intended to be located in compliance with local requirements which generally will place them in pump rooms or pump houses that have some specified degree of fire protection. These locations often have sweating overhead pipes, are possibly sprinklered and are in the vicinity of vaults housing other building distribution equipment.

Fire pumps are intended to boost water pressure. Many sprinkler systems are assumed to have small leaks for which “Jockey Pumps” (also known as make-up pumps) are installed to maintain desired pressure in the sprinkler pipes, thus preventing the main fire pump from excessive starts and stops. Experience has shown that leakage water flowing through the fire pump (at rest) over long periods of pump inactivity can carry sand, aggregates, rocks, rust and such which collect in the fire pump. These contaminants may prevent normal starting until the pump impeller accelerates to clear the pump housing. This standard recognizes the condition of under-exercised fire pumps by permitting up to 20 s at locked rotor current, whether the starts are “cold starts” (initial starts) or “hot starts” (restarts). Starting a distressed pump may cause temporary or permanent damage to electrical conductors, equipment and the motor, because shutdown for equipment protection could possibly permit its destruction by fire along with the building and its contents.

Several examples of the construction and installation applications between a fire pump controller and other controllers include the following:

(1) all fire pump controllers

- a) The main circuit conductors and components are considered to be sacrificial (i.e. temporary and permanent damage levels are permitted) during any attempt to start a distressed motor/pump and to keep it operating.
- b) They are expected to provide a high degree of reliability to start the pump driver automatically and suppress a fire upon sensing a pressure drop in the sprinkler pipe or by other automatic fire detection equipment.
- c) Failures in external control circuits should not prevent operations of pumps from all other internal or other external means.
- d) External control circuits are expected to be arranged so that failure of any external circuit (open or short-circuit) will not prevent operation of pump(s) from all other internal or external means. Breakage, disconnecting, shorting of the wires or loss of power to these circuits can cause continuous running of the fire pump but should not prevent the controller(s) from starting the fire pump(s) due to causes other than these external circuits.
- e) External automatic starting means should be accomplished by opening a normally closed contact on the external means to de-energize a normally energized control circuit in the controller.
- f) While external start buttons or other starting means are permitted, the controller should not be equipped with any means to accommodate remote stopping (a remote STOP button should not be used).
- g) Nuisance starts are permitted in the case where a failure of internal control components might cause the motor to start running.

(2) electric motor fire pump controllers

- a) They are expected to include means for external, manual mechanical operation of the controller in the event of loss of ability to close the contactor electrically/magnetically.
- b) Thermally reactive over-current protective devices should not be permitted. The controller should provide short-circuit and locked rotor protection only.
- c) Releases of the FPC-overcurrent protective devices (short-circuit protective and locked rotor protective devices) are expected to permit it to carry 300 % of rated operational motor current for an extended period of time.

(3) diesel engine fire pump controllers

- a) Should provide means to automatically exercise the engine on a weekly basis.
- b) When an automatic or manual signal to start/run exists, (except under TEST) the controller should not shut down the engine for any reason except OVERSPEED. When in TEST mode, the controller may shut down under low oil pressure and high engine temperature conditions. The two conditions mentioned illustrate the sacrificial nature while fighting a fire.

Therefore, the most significant purpose of this standard is to characterize the unique features of fire pump controllers.

An installation with two fire pumps will increase the reliability and safety of the installation, especially if the two fire pumps are supplied from two different power supplies. This is especially true during maintenance or repairing of a single controller, as fire protection is still being maintained by the other fire pump.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR – CONTROLLERS FOR DRIVERS OF STATIONARY FIRE PUMPS

1 Scope and object

This International Standard applies to controllers intended for starting, controlling and stopping stationary fire pumps, including automatic and non-automatic types for alternating current electric motor or diesel engine-driven fire pumps. It is anticipated that a controller only controls a single driver.

Controllers for electric motor-driven fire pumps always include suitable short-circuit protection as an integral part of the controller. These controllers may include an integral power transfer switch. These controllers are rated 1 000 V a.c. maximum.

Controllers for diesel engine-driven fire pumps include electrical circuits that operate various control and supervisory functions, such as remote control (starting), alarms, signals, indicators, and the proper operation of battery chargers.

The most significant purpose of this standard is to characterize the unique features of fire pump controllers. A further purpose is to prescribe a procedure for exercising the controllers to verify that the unique features are operative. For the purpose of this standard, this procedure is described as the “fire pump controller test protocol”.

The object of this standard is to state the following:

- a) the unique characteristics of fire pump controllers, their associated equipment and their operational functions;
- b) the tests intended for confirming that these conditions have been met, and the methods to be adopted for these tests;
- c) the information to be given with the equipment, or in the manufacturer's literature.

In this context, this standard gives the requirements for all of the electrical functions associated with both the electric motor-driven and the diesel engine-driven fire pumps. Special applications such as explosive atmospheres, nuclear installations, ships, aircraft, etc. are not covered by this standard. Referring to electric power sources, the requirements of this standard apply only to the extent that they place limits on the nature, behaviour and characteristics of the electrical energy that is supplied to the service entrance (see IEC 60364-5-55).

The requirements of this standard apply neither to the method nor to the means by which the electrical energy is generated. In addition, they do not apply to the installation between the origin of the installation and the fire pump controller, which are to be found in the IEC 60364 series. This standard does not apply to diesel engine-driven electric generators which may be associated with a stationary fire pump installation.

EMC considerations are correlated with other IEC standards for similar products:

- a) for electric fire pump controllers, EMC considerations are covered by this standard, and
- b) for diesel engine fire pump controllers, d.c. batteries are the intended source of electrical control power.

1DV D2 Modification to Clause 1 by adding the following:

1DV.1 This equipment includes limited service and medium voltage. Controllers may be suitable for use as service equipment. This equipment is for installation in non-hazardous locations in accordance with Annex [DVA](#), item 2.

1DV.2 Controllers for electric motor driven, centrifugal fire pumps and positive displacement pumps are intended for use with squirrel cage or wound rotor motors. Controllers for squirrel cage motors may be for across-the-line or reduced inrush current starting.

1DV.3 Variable speed fire pump controllers for electric motor driven, centrifugal fire pumps and positive displacement pumps are intended for use with squirrel cage induction, inverter duty rated, motors, and rated for 50 Hz or 60 Hz.

1DV.4 Limited service controllers are intended for across-the-line starting of squirrel cage motors rated 22 kW (30 hp) or less, 600 V or less.

1DV.5 Medium voltage fire pump controllers are intended for use with squirrel cage motors rated 601 V – 7.2 kV AC.

1DV.6 Residential fire pump controllers are intended for use with single-phase squirrel cage motors rated 240 V or less. Residential fire pump controllers are intended to be used in one or two family dwelling units in accordance with the requirements of item 35 in Annex [DVA](#).

1DV.7 Diesel engine fire pump controllers rated nominal 24 V DC or less are intended for use with fire pump engines. Where required, AC Voltage is limited to 600 V AC or less.

1DV.8 An automatic transfer switch intended to be used in fire pump circuits, and that is provided separate from a controller, is covered by the requirements of item 11, Annex [DVA](#).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60364 (all parts), *Electrical installations of buildings*

IEC 60364-5-55:2001, *Electrical installations of buildings – Part 5-55: Selection and erection of electrical equipment – Other equipment*;
Amendment 1 (2001)

IEC 60439-1:1999, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*;
Amendment 1 (2004)

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*;
Amendment 1 (1999)

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*;
Amendment 1(2000);
Amendment 2 (2002)

IEC 60695-11-10:1999, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*;
Amendment 1 (2003)

IEC 60947-1:2004, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-2:2006, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3:1999, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*;
Amendment 1 (2001);
Amendment 2 (2005)

IEC 60947-4-1:2000, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*;
Amendment 1 (2002);
Amendment 2 (2005)

IEC 60947-4-2:1999, *Low-voltage switchgear and controlgear – Part 4-2: Contactors and motor-starters – AC semiconductor motor controllers and starters*;
Amendment 1 (2001)

IEC 60947-6-1:2005, *Low-voltage switchgear and controlgear – Part 6-1: Multiple function equipment – Transfer switching equipment*

IEC 61000-3-12:2004, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*;
Amendment 1 (1998);
Amendment 2 (2000)

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2003, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*;
Amendment 1 (2004);
Amendment 2 (2006)

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

CISPR 11:2003, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*;

Amendment 1 (2004);

Amendment 2 (2006)

2DV D2 Modification to Clause 2 by adding the following:

2DV.1 See Annex [DVA](#) for normative references and Annex [DVB](#) for component standards.

2DV.2 The normative references listed in Annex [DVA](#) contain provisions which, through reference in this text, constitute provisions of this Standard. For undated references to standards, such reference shall be considered to refer to the latest edition and all revisions to that edition up to the time when this Standard was approved. For dated references to standards, such reference shall be considered to refer to the dated edition and all revisions published to that edition up to the time the standard was approved.

2DV.3 In Canada, general requirements applicable to this standard are given in the latest edition of item 17 of Annex [DVA](#). In addition the requirements of Annex [DVA](#) item 18 also apply unless specifically modified by this standard.

3 Terms and definitions

For the purposes of this document, the relevant terms and definitions given in IEC 60947-1, together with the following terms and definitions, apply.

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3.1

fire pump controller (FPC)

controller intended to control a fire pump electric motor or a fire pump diesel engine

3.2

controller

device or equipment that serves to control, in some predetermined manner, the electric power delivered to the apparatus to which it is connected

3.3

fire pump

pump dedicated to delivering a specified rate of water flow at a specified pressure to the fire extinguishing system of a premises

3.4

fire pump controller test protocol

procedure for exercising fire pump controllers to verify their compliance with the requirements of this standard

3.5

foam pump

pump dedicated to delivering a specified rate of foam concentrate to the system proportioner in the water fire extinguishing system of a premises

3.6

system proportioner

device or coordinated group of devices which introduces foam concentrate in a prescribed proportion into the fire water stream

3.7

foam pump controller

controller intended to control a foam concentrate pump for use in fire suppression

3.8

driver

electric motor or diesel engine that drives the fire pump

3.9

pumping unit

pump, driver and controller

3.10

diesel engine fire pump controller

controller intended to control a diesel engine-driven fire pump

3.11

diesel engine foam pump controller

controller intended to control a diesel engine-driven foam concentrate pump

3.12

electric fire pump controller

controller intended to control an electric motor-driven fire pump

3.13

residential fire pump controller

controller intended to control an electric motor-driven residential fire pump

NOTE Residential fire pumps are fire pumps intended for use primarily in domestic residences. They are typically limited to one- and two-family units, and are generally single-phase devices.

3.14

electric foam pump controller

controller intended to control an electric motor-driven foam concentrate pump

3.15

automatic control

control of an operation without human intervention

3.16

non-automatic control

control of an operation by human intervention

3.17

externally operable

capable of being operated without the need to remove covers or open an enclosure

3.18

lockout feature

externally accessible means to preclude an automatic controller from responding to a start signal

3.19

over-current

current exceeding the rated current

NOTE For the purpose of this standard, over-current protection includes motor locked-rotor and short-circuit protection only.

3.20

service equipment

necessary equipment, usually consisting of a circuit-breaker or switch and fuses and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means to cut-off the supply

3.21

type-tested device

device conforming to an established type, comprised of elements (components, devices, equipment) combined and rated as a unit, replicating the constructional and performance features of the typical device which has been verified previously to be in accordance with a designated standard

3.22

electromagnetic contactor

contactor in which the force for closing the normally open main contacts or opening the normally closed main contacts is provided by an electromagnet (see IEC 60947-4-1)

3.23

automatic transfer switching equipment (automatic power transfer switch)

self-acting equipment containing the transfer switching device (s) and other necessary devices for monitoring supply circuits and for transferring one or more load circuits from one supply to another (see IEC 60947-6-1)

3.24

disconnector

mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements

NOTE A disconnecter is capable of opening and closing a circuit when either negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the poles of the disconnecter occurs. It is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short circuit.

[IEV 441-14-05]

3.25

short-circuit protective device

SCPD

device intended to protect a circuit or parts of a circuit against short-circuit currents by interrupting them

3.26

electromagnetic environment

totality of electromagnetic phenomena existing at a given location

NOTE In general, the electromagnetic environment is time-dependent and its description may need a statistical approach.

[IEV 161-01-01]

3.27

electromagnetic disturbance

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

[IEV 161-01-05]

3.28

electromagnetic compatibility

EMC (abbreviation)

ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[IEV 161-01-07]

3.29

emission (electromagnetic)

phenomenon by which electromagnetic energy emanates from a source

[IEV 161-01-08]

3.30

radio (frequency) disturbance

electromagnetic disturbance having components in the radio frequency range

[IEV 161-01-13]

3.31

radio frequency interference

RFI (abbreviation)

degradation of the reception of a wanted signal caused by radio frequency disturbance

NOTE The English words "interference" and "disturbance" are often used indiscriminately. The expression "radio frequency interference" is also commonly applied to a radio-frequency disturbance of an unwanted signal.

[IEV 161-01-14]

3.32

immunity (to an electromagnetic disturbance)

ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEV 161-01-20]

3.33

transient (adjective and noun)

pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval short compared with the time-scale of interest

[IEV 161-02-01]

3.34

burst (of pulses or oscillations)

sequence of a limited number of distinct pulses or an oscillation of limited duration

[IEV 161-02-07]

3.35

voltage surge

transient voltage wave propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease of the voltage

[IEV 161-08-11]

3.36DV D1 Add the following:

3.36DV.1

AUXILIARY CIRCUIT

Circuits not essential for the performance of the fire pump controller.

3.36DV.2

CENTRIFUGAL PUMP

A pump in which the pressure is developed principally by the action of centrifugal force.

3.36DV.3

CIRCUIT-BREAKERS

Circuit-Breaker (as applied to fire pump controllers) – For the purposes of this standard, the term “circuit-breaker (disconnecting means)” refers to either thermal-magnetic or inverse time circuit-breakers (for residential fire pump controllers only) or to instantaneous-only circuit-breakers.

Circuit-Breaker – A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its rating.

Instantaneous-Only Circuit-Breaker – One intended to provide short-circuit protection only.

Instantaneous Trip (as applied to circuit breakers) – A qualifying term indicating that no delay is purposely introduced in the tripping action of the circuit breaker.

Inverse Time (as applied to circuit breakers) – A qualifying term indicating that there is a purposely introduced delay in the tripping action of the circuit breaker, which delay decreases as the magnitude of the current increases.

Thermal-Magnetic Circuit-Breaker – A device designed to open and close a circuit by non-automatic means, and to open the circuit automatically on a predetermined overcurrent (overload and short-circuit), without damage to itself when properly applied within its rating.

3.36DV.4

CONTROL CIRCUIT

A circuit that carries the electric signals directing the performance of a fire pump controller, but which does not carry the main power circuit. A control circuit is generally limited to 15 A.

3.36DV.5

CONTROLLER (Electric motor)

A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

3.36DV.6

CONTROLLER (Diesel engine)

A device or group of devices that serves to govern, in some predetermined manner, the engine power delivered to the apparatus to which it is connected.

3.36DV.7

CONTROLLER – LIMITED SERVICE

A controller, as defined in [1DV.1](#), that is limited in application when approved by the authority having jurisdiction.

3.36DV.8

CURRENT LIMITERS

Melting link-type devices that, when used as an integral part of a circuit breaker, limit the current during a short-circuit to less than the interrupting capacity of the circuit breaker.

3.36DV.9

DISCONNECTING MEANS

A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

3.36DV.10

DROP-OUT RELAY

A relay that, when de-energized, initiates the control function.

3.36DV.11

ENCLOSURE

The case or housing of apparatus constructed to provide a degree of protection against incidental contact with the enclosed equipment, and to provide a degree of protection against specified environmental conditions.

3.36DV.12**ISOLATING SWITCH**

A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating, and it is intended to be operated only after the circuit has been opened by some other means.

3.36DV.13**MEDIUM VOLTAGE**

(For Mexico and the United States)

An AC voltage in the range of 1501 to 7200 V.

For Canada

An AC voltage in the range of 751 to 7200 V.

3.36DV.14**READILY ACCESSIBLE**

Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, and so forth.

3.36DV.15**SERVICE BOX**

(For Canada)

An approved assembly consisting of a metal box or enclosure constructed so that it may be effectually locked or sealed, containing either service fuses and a service switch or a circuit breaker, and of such design that either the switch or circuit breaker may be manually operated when the box is closed.

3.36DV.16**SERVICE EQUIPMENT**

(For Mexico and the United States)

The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

In Canada, this definition does not apply.

3.36DV.17**SERVICE EQUIPMENT**

(For Canada)

In addition to the specifications of [3.36DV.15](#), the service circuit breaker or fused switch is located in a service box.

3.36DV.18**TRANSFER SWITCH (AUTOMATIC)**

Self-acting equipment for transferring the connected load from one power source to another power source.

4 Classification

4.1 Electric fire pump controller

4.1.1 Automatic electric fire pump controller

4.1.1.1 Pressure activated

Starting of the motor is initiated by detecting a reduction in water pressure.

4.1.1.2 Non-pressure-actuated

Starting of the motor is initiated by means other than by detecting a reduction in water pressure, such as deluge valve, flow switch or fire detection equipment.

4.1.2 Non-automatic electric fire pump controller

Starting of the motor is initiated by manual electrical means (e.g. push button) or manual mechanical means (e.g. emergency-run mechanical control, see [8.5.1.2](#)).

4.1.3 Electric fire pump controller with or without power transfer switch

Controllers may be provided for one or two sources of electrical power.

4.1.4 Full voltage or reduced voltage starting

Controllers may be provided for direct on-line starting (full voltage) or for starting with reduced motor inrush current (reduced voltage). See [8.4.7](#) and [8.4.8](#).

4.2 Residential fire pump controller (pump driven by an electric motor only)

Controllers may be provided as single or dual pump configuration.

4.3 Diesel engine fire pump controller

4.3.1 Pressure-actuated

Starting of the engine is initiated by detecting a reduction in water pressure.

4.3.2 Non-pressure-actuated

Starting of the engine is initiated by means other than by detecting a reduction in water pressure, such as deluge valve, flow switch or fire detection equipment.

4.4 Foam pump controller (pump driven either by an electric motor or by a diesel engine)

Special electric fire pump controllers or special diesel engine fire pump controllers intended for the unique requirements of foam concentrate pumps.

5 Characteristics

5.1 Electrical quantities

5.1.1 Rated operational voltage (U_e)

The rated operational voltage for a fire pump controller is a value of voltage which, combined with a rated operational current, determines the application of the equipment and to which relevant tests are referred.

5.1.2 Rated operational current (I_e) or rated operational power

The rated operational current for an electric fire pump controller is a value of current which is dictated by the rated operational current of the electric motor which drives the fire pump. The rated operational a.c. input current for a diesel engine fire pump controller is a value of current which is dictated by the maximum load current of the battery charger(s) supply within the controller.

In the case of an equipment for direct switching of individual electric motors, the indication of a rated operational current may be replaced (or supplemented) by an indication of the maximum rated power output, at the rated operational voltage of the motor for which the equipment is intended to be connected.

5.2 Hierarchy of importance for the various characteristics

5.2.1 General

The hierarchy of importance is divided into two levels: A-priority and B-priority. A-priority functions shall override B-priority functions.

5.2.2 Functions assigned to A-priority

Operations that are assigned to A-priority are designed with the capability to take over normal operations under prescribed circumstances.

For example, non-automatic control is assigned to the premier level in the hierarchy of importance. By definition, non-automatic control is characterized by manual intervention. The ability to apply manual intervention to override all other functions is of premier importance during any exercise for suppressing a fire.

The requirements for compliance with this premier role are given in [8.3](#) and [8.8.1](#).

5.2.3 Functions assigned to B-priority

Operations that are assigned to B-priority are designed with the capacity to be inhibited, or to be subordinated, under prescribed circumstances.

For example, automatic control describes the capability for self-initiated action without human intervention. Therefore, all forms of automatic control shall be subordinated to any form of deliberated human intervention.

The requirements for compliance with this subordinate role are given in [8.3](#) and [8.8.1](#).

5.3 Electric fire pump controller

5.3.1 Basic functions

An electric fire pump controller shall perform the following basic functions:

- a) connects (or transfers) the electric motor to the appropriate power supply (primary, alternative, second utility);
- b) starts, controls and stops the operations of the electric drive motor;
- c) provides over-current protection against locked rotor currents and short-circuit currents;
- d) monitors and supervises the operation of the system, and provides appropriate signals and alarms;
- e) to have a general arrangement in compliance with [Figure 1](#), [Figure 2](#), [Figure 3](#) or [Figure 4](#);
- f) initiates a periodic test of the system, e.g. weekly.

The requirements for performing these functions are given in [Clause 8](#).

5.3.2 Standard equipment

The electric fire pump controller shall comprise the following equipment:

- a) enclosure;
- b) components (see [8.1](#));
- c) voltage surge arrester;
- d) pressure recorder, when appropriate;
- e) sensors, detectors, monitoring devices, alarms and appropriate signal devices;
- f) periodic test timer (e.g. weekly) or other safe and reliable means providing a minimum running time.

The controller may include other optional equipment that is the subject of agreement between the manufacturer and the user.

The constructional, functional and performance requirements are given in [8.6](#).

5.4 Residential fire pump controller

Residential fire pump controllers are a sub-class of electric fire pump controllers with a restricted scope of application (e.g. domestic residences).

The constructional, functional and performance requirements are given in [8.7](#).

5.5 Diesel engine fire pump controller

5.5.1 General

A diesel engine is the pump driver for this class of fire pump controller. Starting of the diesel engine is made by means of a controlled signal to initiate starting using auxiliary power other than from the main electrical power circuit, e.g. battery.

5.5.2 Basic functions

The diesel engine fire pump controller shall provide four basic functions:

- a) controls electrical means to start the engine;
- b) monitors the engine and other system conditions and performs supervisory functions where appropriate;
- c) maintains the electric charge on the engine starting batteries;
- d) initiates a periodic test of the system, e.g. weekly.

The requirements for performing these functions are given in [8.8](#).

5.5.3 Standard equipment

The diesel engine fire pump controller shall be equipped with the following standard equipment (the controller may include other optional equipment that is the subject of agreement between the manufacturer and user):

- a) moisture resistant, lockable enclosure with a breakable glass panel which permits access for emergency manual start;
- b) manually operated electrical actuators to start the engine;
- c) visual indicators and audible alarms;
- d) electrical contacts to initiate remote alarm;
- e) battery charger;
- f) pressure recorders, when appropriate;
- g) periodic test timer (e.g. weekly) or other safe and reliable means providing a minimum running time.

The constructional, functional and performance requirements are given in [8.8](#).

5.6 Foam pump controller

This class of controller may be associated with either an electric motor-driven system or a diesel engine-driven system. All of the relevant requirements for electric-driven or engine-driven systems apply.

The unique requirements are dictated by the fact that, unlike water, the foam concentrate is supplied in measured quantities. The result is a set of special requirements to govern the situation wherein the store of foam concentrate has been depleted during the exercise of suppressing a fire.

The requirements for foam pump controllers are given in [8.6.5](#) and [8.13](#).

5.7 Fire pump controller test protocol

The requirements for the fire pump controller test protocol are given in [9.1](#).

6 Product information

6.1 Rated values and other electrical characteristics

6.1.1 Electric fire pump controller with or without fire pump power transfer switch

The following ratings and electrical characteristics apply:

- a) rated operational voltage and number of phases;
- b) rated operational current (or rated operational power if dedicated to a particular motor);
- c) rated frequency/frequencies or the indication “d.c.” or the symbol --- ;
- d) rated conditional short-circuit current;
- e) maximum water sensing pressure.

6.1.1DV D2 Modification to Clause 6 by adding the following:

6.1.1DV.1 In Canada and the United States, controllers driving electric motor fire pumps shall be rated in volts, horsepower, or kilowatts and full load amperes complying with [Table 8DV](#) and [Table 9DV](#), frequency, and short-circuit current in amperes rms symmetrical. The rating shall indicate whether the equipment is for direct or alternating current. The rating of alternating-current equipment shall include the number of phases.

6.1.1DV.2 In Mexico, controllers driving electric motor fire pumps shall be rated in volts, kilowatts, and full load amperes complying with [Table 8DV](#) and [Table 9DV](#), frequency, and short-circuit current in amperes rms symmetrical. The rating shall indicate whether the equipment is for direct or alternating current. The rating of alternating-current equipment shall include the number of phases.

Note: The rating of equipment obviously intended for single-phase use only is not required to include the number of phases.

6.1.2 Diesel engine fire pump controller

The following ratings and electrical characteristics apply:

- a) rated operational a.c. voltage and number of phases;

- b) rated operational supply current;
- c) rated frequency/frequencies;
- d) battery voltage;
- e) type of battery;
- f) engine earth polarity;
- g) engine stopping method (energize fuel solenoid or de-energize fuel solenoid);
- h) maximum water-sensing pressure.

6.1.3 Foam pump controller

Subclause [6.1.1](#) applies for electric foam pump controllers. Subclause [6.1.2](#) applies for diesel engine foam pump controllers.

6.1.4 Residential fire pump controller

Subclause [6.1.1](#) applies to residential fire pump controllers.

6.2 Marking

6.2.1 General

Markings shall be indelible and easily legible.

Marking of the manufacturer's name or trade mark and type designation or serial number is mandatory on the equipment and preferably on the nameplate, if any, in order to permit the complete data to be obtained from the manufacturer.

NOTE In the USA and Canada, the rated operational voltage U_e may be marked as follows:

- a) on equipment for use on three-phase – four-wire systems, by both the value of phase-to-earth voltage and that of phase-to-phase voltage, e.g. 277/480 V;
- b) on equipment for use on three-phase – three-wire systems, by the value of phase-to-phase voltage, e.g. 480 V.

The following information shall also be marked and visible after installation:

- direction of movement of the actuator (see [8.5.1.2](#) c) and d)), if applicable;
- indication of the position of the actuator (see [8.5.1.2](#) c) and d));
- approval or certification mark, if applicable;
- terminal identification and marking.

6.2.1DV D2 Modification of Clause 6.2.1 by adding the following:

6.2.1DV.1 All markings shall be in the appropriate language (or symbols as noted in this standard), as necessary, for the country in which the fire pump controller will be installed. A manufacturer may choose to utilize multiple languages on a fire pump controller.

Note 1DV: In Canada, there are two official languages, English and French, and in Mexico, the official language is Spanish. Annex [DVC](#) provides translations in French and Spanish of the English markings specified in this standard. Markings required by this standard could be required in other languages to conform to the language requirements of the country where the product is to be used.

6.2.1DV.2 All fire pump controllers shall be provided with a warning marking to alert qualified persons of potential electric arc flash hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

6.2.2 Identification

Controllers shall be marked, in a position visible after installation, with the following information:

- a) enclosure IP rating;
- b) reference “IEC 62091”, if the manufacturer claims compliance with this standard;
- c) electric fire pump controller or diesel engine fire pump controller;
- d) non-pressure-actuated fire pump controller (not required if not equipped with water pressure control).

These identifications shall be installed on the equipment, preferably on the nameplate.

NOTE The purpose of these identifications is to provide the user with additional application information.

Controllers shall be provided with a marking, visible during installation, stating:

- e) that no ancillary apparatus (e.g. jockey (make-up) pump) shall be connected to the fire pump controller;
- f) that only those devices indicated on the controller diagram(s) shall be connected to the controller;
- g) EMC rating for environment A, B or A and B (see [7.5](#));
- h) type of system earthing for which the assembly is designed;
- i) short-circuit withstand rating (see [6.2.4](#)).

6.2.2DV D2 Modification of Clause 6.2.2 by adding the following:

Controllers shall also be marked where visible after installation with the following:

- a) an enclosure type number, indicating the external environmental conditions for which it is intended. See [8.2.12DV](#).

Clause [6.2.2](#) a) does not apply. An enclosure type designation is required and in addition, it shall be permitted to be marked with an ingress protection (IP) designation;

b) rated operating pressure;

c) rated ambient temperature range;

d) [6.2.2](#) b) does not apply; and

e) Suitable for use in EMC Immunity Environment A and Emission Environment B Environments.

6.2.3 Components

Each operating component of a controller shall be marked to plainly indicate an identification symbol appearing on the electrical schematic diagram. The markings shall be visible when the enclosure is open after installation of the controller.

6.2.3DV D2 Modification of 6.2.3 by adding the following:

6.2.3DV.1 If a fuse used to determine compliance with item 3 of [Table 21DV](#) is a Class G or K, there shall be a marking near the fuseholder specifying the class of the replacement fuse.

6.2.3DV.2 An electrical schematic/field connection diagram, indicating all internal wiring, circuits, test terminals, provisions for alarm circuits, all power sources, and other components, shall be permanently attached to the inside of the controller enclosure.

6.2.4 Prospective short-circuit current

Electric fire pump controllers (normal and alternative power side when equipped with power transfer switch) shall be marked as follows:

“SUITABLE FOR USE ON A CIRCUIT CAPABLE OF DELIVERING NOT MORE THAN
< RATED CURRENT > AMPERES RMS AT < RATED VOLTAGE > VOLTS AC”

The rated current and voltage values shall be indicated.

The prospective short-circuit current marked value shall be equal to the conditional short-circuit current value according to [9.3.3.4.1.7](#) or, if applicable, to [9.3.3.4.1.8](#).

6.2.5 Marking for specific components and controllers

6.2.5.1 Disconnecter

A disconnecter shall be marked with the signal word “**WARNING**” and the following statement (or equivalent):

“RISK OF ELECTRIC SHOCK - DO NOT OPEN OR CLOSE THIS DISCONNECTOR
WHILE THE FPC-SHORT-CIRCUIT PROTECTIVE DEVICE IS IN THE CLOSED POSITION”

If the disconnecter is rated with sufficient fault-make, load-break capacity or when the disconnecter is prevented from being either opened or closed while the FPC-short-circuit protective device is closed, the warning label is not required.

6.2.5.1DV D2 Modification of 6.2.5.1 by adding the following:

6.2.5.1DV.1 With reference to [8.4.3DV.1](#), and except as permitted by [6.2.5.1DV.2](#), an isolating switch shall be marked on the outside of the enclosure adjacent to the operating handle with the signal word "WARNING" and the following or equivalent statement:

"RISK OF ELECTRIC SHOCK – DO NOT OPEN OR CLOSE THIS SWITCH WHILE THE CIRCUIT BREAKER (DISCONNECTING MEANS) IS IN THE CLOSED POSITION."

6.2.5.1DV.2 when the isolating switch and the circuit breaker are so interlocked that the isolating switch can neither be opened nor closed while the circuit breaker is closed, the warning label described in [6.2.5.1DV.1](#) is not required. When omitted, the label shall be replaced with an instruction label which directs the order of operation.

6.2.5.2 FPC-short-circuit protective device (FPC-SCPD)

The short-circuit protective device (see [8.4.4](#)) shall be provided with an information plate with the legend in letters not less than 10 mm high:

"FPC-SHORT-CIRCUIT PROTECTIVE DEVICE – SWITCHING MEANS"

The information plate shall be located on the outside of the controller enclosure adjacent to the switching means, if provided, for operating the FPC-short-circuit protective device.

6.2.5.2DV D2 Modification to 6.2.5.2 by adding the following:

6.2.5.2DV.1 The circuit breaker defined in [8.4.4.2DV](#) shall be provided with a nameplate with the legend "CIRCUIT BREAKER – DISCONNECTING MEANS" in letters not less than 10 mm (3/8 in) high, located on the outside of the controller enclosure adjacent to the means for operating the circuit breaker.

6.2.5.3 Service equipment

When electric fire pump controllers and fire pump power transfer switches shall be used as service equipment,

- a) the equipment shall be marked on the outside of the enclosure "SUITABLE FOR USE AS SERVICE EQUIPMENT";
- b) the marking shall be provided separately or as part of the nameplate containing the manufacturer's name or trademark, and other ratings;
- c) when provided on a separate label, the marking shall include the manufacturer's name or trademark;
- d) a separate loose label, marked "SERVICE DISCONNECT", shall be included with the controller with instructions indicating that the label shall be applied on the outside of the enclosure adjacent to the operating handle of the supply disconnecting device.

6.2.5.3DV D2 Modification to 6.2.5.3 by adding the following:

In Mexico and the United States, with reference to [8.2.3.1DV.1](#), controllers shall be marked "Suitable for Use as Service Equipment" on the outside of the controller enclosure. The marking shall be provided separately or as part of the nameplate containing the manufacturer's name or trademark, and other ratings. When provided on a separate label, the marking shall include the manufacturer's name or trademark.

In Canada, controllers are not permitted to be utilized as service equipment.

In the United States controllers marked "Suitable for Use as Service Equipment" shall be additionally marked to reference Article 230 of the National Electrical Code for installation requirements.

6.2.5.4 Enclosure

The enclosure of a controller shall be marked with the IP code indicating the degree of protection against ingress. When a water pressure-actuated controller is intended for outdoor use, a marking shall be provided on the enclosure indicating that the controller shall be used only where the temperature of the water in the pressure sensing means and pressure sensing line cannot fall below +4 °C.

6.2.5.4DV D2 Modification to 6.2.5.4 by adding the following:

6.2.5.4DV.1 Each accessible enclosure surface in excess of the maximum temperatures specified in [Table 23DV](#) shall be marked "WARNING – HOT SURFACE – RISK OF BURN", or the equivalent.

6.2.5.4DV.2 The enclosure of a controller shall be marked with the enclosure Type designation. In addition, it shall be permitted to be marked with an ingress protection (IP) designation.

6.2.5.5 Field wiring

Terminals for user connection intended to be used only with copper conductors shall be marked to indicate the use of copper conductors only. All field wiring terminals provided in the controller shall be plainly marked to correspond with the field connection diagram provided with the controller.

6.2.5.5DV D2 Modification to 6.2.5.5 by adding the following:

6.2.5.5DV.1 In Mexico and the United States, a field-wiring pressure wire connector intended to be used only with copper conductors in accordance with 6.4.5(a) shall be marked to indicate the use of copper conductors only.

In Canada, this requirement does not apply.

6.2.5.5DV.2 In Canada, a field-wiring pressure wire connector shall be used only with copper conductors. No marking is required to identify this condition.

In Mexico and the United States, this requirement does not apply.

6.2.5.5DV.3 For external diesel engine connections, the field connection terminals shall be commonly numbered between the controller and engine terminals.

6.2.5.5DV.4 Controllers shall be marked to indicate the temperature rating (60°C only, 60/75 or 75°C only) of the field installed conductors for which the equipment has been investigated. A field-wiring terminal need not be marked to indicate the temperature rating if it is intended for the connection of a control circuit conductor only.

6.2.5.5DV.5 Field wiring terminals shall comply with [8.2.8DV.2](#) and shall be suitable for the field wiring of stranded type conductors.

6.2.5.6 Electric fire pump controller

A controller with this classification shall be marked "ELECTRIC FIRE PUMP CONTROLLER".

6.2.5.7 Residential fire pump controller

A controller with this classification shall be marked "RESIDENTIAL FIRE PUMP CONTROLLER".

6.2.5.7DV D2 Modification to 6.2.5.7 by replacing with the following:

A controller with this classification shall be marked "Residential Fire Pump Controller – for installation in one- and two-family dwellings and manufactured homes in accordance with NFPA 13D".

6.2.5.8 Fire pump power transfer switches

A fire pump power transfer switch shall be marked "FIRE PUMP POWER TRANSFER SWITCH". The electric fire pump controller and fire pump power transfer switch shall each be marked with a cautionary marking to indicate that the disconnectors, on both the controller and fire pump power transfer switch, shall be opened before servicing the controller, fire pump power transfer switch or motor.

6.2.5.8DV D2 Modification to 6.2.5.8 by adding the following:

A combination fire pump controller/transfer switch of a design such that it is not compatible for use with both a generator and second utility shall be marked to indicate that the alternate source shall be provided by a second utility power source.

6.2.5.9 Diesel engine fire pump controller

A diesel engine fire pump controller shall be marked "DIESEL ENGINE FIRE PUMP CONTROLLER".

Controller terminals shall be numbered as indicated in [Table 1](#).

The diesel engine fire pump controller manufacturer shall provide specifications and instructions for the size of wire and the maximum distance for the connections between the controller and the diesel engine.

6.2.5.10 Foam pump controllers

6.2.5.10.1 Electric foam pump controllers

Electric foam pump controllers shall be marked "ELECTRIC FOAM PUMP CONTROLLER".

6.2.5.10.1DV D2 Modification to 6.2.5.10.1 by adding the following:

Controllers shall be marked where visible after installation with: "Limited Service Additive Pump Controller" or "Electric Additive Pump Controller".

6.2.5.10.2 Diesel engine foam pump controller

Diesel engine foam pump controllers shall be marked "DIESEL ENGINE FOAM PUMP CONTROLLER".

6.2.6 Electrical diagrams and instructions

6.2.6.1 Diagrams

An electrical schematic diagram, indicating all internal wiring, circuits, test terminals, provisions for alarm circuits, all power supplies and other components, shall be permanently attached to the inside of the controller enclosure.

6.2.6.2 Operating instructions

Instructions for starting and stopping the pump motor and for emergency operation of the fire pump shall be provided on the front of the controller in a position visible after installation.

NOTE It should be taken into account that instructions may be required to be read quickly in a smoky atmosphere.

6.2.6.2DV D2 Modification to 6.2.6.2 by adding the following:

The emergency run mechanical control described in [8.4.8.4DV.1](#), shall be marked as to function and operation.

6.3 Instructions for installation, operation and maintenance

The requirements of 5.3 of IEC 60947-1 apply.

In addition, the manufacturer shall specify in his documents or catalogues the conditions for installation, operation and maintenance (including spare parts) of the controller. This information shall include, as a minimum, any specific information on connecting conductor size together with information necessary for the maintenance of EMC compliance with the declared equipment class and immunity levels (see 7.3.2 of IEC 60947-1).

7 Normal service, mounting and transport conditions

7.1 General

Clause 6 of IEC 60947-1 applies with the following additional requirements.

7.2 Water temperature

When a water pressure-actuated controller is intended for outdoor use, a marking shall be provided on the enclosure indicating that the controller shall be used only where the temperature of the water in the pressure sensing means and pressure sensing line cannot fall below +4 °C.

7.3 Humidity

Subclause 6.1.3.1 of IEC 60947-1 applies.

7.4 Degrees of pollution

Unless otherwise stated by the manufacturer, fire pump controllers are intended for use in pollution degree 3 environmental conditions, as defined in 6.1.3.2 of IEC 60947-1. However, other pollution degrees may be considered to apply depending upon the environment.

7.5 EMC considerations

Fire pump controllers shall be suitable for use in environment A or/and B (see 7.3.1 of IEC 60947-1).

Information shall be provided by the manufacturer to advise the user on the measures to be taken concerning EMC.

7.5DV D2 Modification to 7.5 by replacing the first paragraph with the following:

Fire pump controllers shall be suitable for use in EMC Immunity Environment A and Emissions Environment B.

8 Constructional, functional and performance requirements

8.1 General

Critical components of a fire pump controller are:

- a) actuators ([8.2.5](#));
- b) disconnecting device ([8.4.3](#));
- c) FPC-overcurrent protective devices (SCPD and locked rotor protective device) ([8.4.4](#));
- d) full voltage starting means ([8.4.7](#));
- e) reduced voltage starting means ([8.4.8](#));
- f) power transfer switch ([8.6.9](#));
- g) battery charger ([8.8.4.1](#)).

All components shall comply with their own relevant IEC product standard, where applicable, and the additional requirements of this standard.

8.1DV D2 Modification to 8.1 by adding the following:

A component of a product covered by this standard shall comply with the requirements for that component. See Annex [DVB](#) for a list of standards covering components generally used in the products covered by this standard. A component shall comply with the ANCE, CSA, or UL standards as appropriate for the country where the product is to be used.

8.2 Constructional requirements for the type-tested devices**8.2.1 General**

Subclause 7.1 of IEC 60947-1 applies with the following additions:

- a) controllers shall be completely assembled, wired and tested by the manufacturer before installation;
- b) enclosures for controllers shall be as defined in [8.2.12](#);
- c) the constructional requirements for the type-tested device shall be verified by examining the manufacturer's records and by visual inspection during the set-up for exercising the fire pump controller test protocol;
- d) the distance between the end of a pressure wire connector (or terminal block) for connection to a field installed wire and the wall of the enclosure toward which the wire is directed shall be not less than the values given in [Table 2](#). The distance shall be measured in a straight line from the centre of the opening in the connector in the direction in which the wire leaves the terminal, perpendicular to the enclosure wall.

8.2.1DV D2 Modification of 8.2.1 by replacing with the following:

8.2.1DV.1 The distance between the end of a pressure wire connector or terminal block for connection of a field installed wire and the wall of the enclosure toward which the wire is directed shall be not less than that indicated in [Table 10DV](#). The distance shall be measured in a straight line from the center of the opening in the connector, in the direction in which the wire leaves the terminal, perpendicular to the enclosure wall.

8.2.1DV.2 In Canada, for equipment rated 1000 V or less, the wire bending space required by [8.2.1DV.1](#) shall be determined by Annex [DVA](#), item 20.

In Mexico and the United States, this requirement does not apply.

8.2.1DV.3 The required bending space shall be based on the size of field wire to be connected to the connector or terminal in accordance with [8.2.8DV.1](#).

8.2.2 Materials

Subclause 7.1.1 of IEC 60947-1 applies with the following addition.

All components which are installed within the fire pump controller enclosure shall be mounted in accordance with their manufacturer's instructions on a supporting structure of noncombustible materials. The assessment criteria for non-combustible materials, in accordance with IEC 60695-11-10, are given in [Table 3](#).

Flammability of materials shall be verified by the procedure stated in Annex M of IEC 60947-1.

8.2.3 Current-carrying parts and their connections

Subclause 7.1.2 of IEC 60947-1 applies with the following additions.

8.2.3DV D2 Modification to 8.2.3 by adding the following:

8.2.3DV.1 Insulated conductors shall be suitable for the service intended with respect to voltage, temperature, and grouping. Conductors shall be copper and shall be not smaller than 0.2 mm² (24 AWG). The temperature rating shall be not less than 90°C (194°F) unless investigation proves the suitability of other conductors.

8.2.3DV.2 The requirements of [8.2.3DV.1](#) apply only to the wiring furnished on or in industrial control equipment as a part of the equipment. They do not apply to the supply wiring run to control equipment, to motors, or to other apparatus.

8.2.3DV.3 In Mexico and the United States, for motor and control-circuit applications, the use of [Table 15DV](#) as a guide in selecting the conductor sizes in a controller may obviate the need to perform a temperature test on the wire. See the temperature test in Annex [DVA](#), item 9.

8.2.3DV.4 In Canada, for motor and control circuit applications, the use of Table 2 in Annex [DVA](#), item 2, for selecting the conductor sizes, will obviate the need to perform a temperature test on the wire.

8.2.3DV.5 Conductors that are in a circuit only during the motor starting period are not required to be sized for continuous duty but shall be sized according to their duty cycle.

8.2.3DV.6 Notwithstanding [8.2.3DV.1](#), conductors smaller than 0.2 mm² (24 AWG) may be used for wiring of printed circuit boards and interconnecting wiring between electronic modules and subassemblies.

8.2.3DV.7 Conductors in an assembly intended for use in a complete enclosure shall be insulated for the highest voltage normally occurring between such conductors unless the wires are grouped so as to segregate the several voltages.

8.2.3DV.8 Wires shall be supported or secured or otherwise run in suitable raceways, in order that they will not come into contact with moving parts or rest on sharp edges or projections that might cause abrasion of the insulation. Wires shall be of flexible or extra-flexible construction where they make connection to electrical equipment mounted on a hinged door. If the flexing section of the wiring is liable to come in contact with grounded metal parts, that portion of the wiring shall be given additional protection with wrappings of tape or the equivalent or enclosed in nonmetallic flexible tubing or conduit.

8.2.3DV.9 Additional insulation is not required if the test described in [DVE.2](#) is completed without evidence of damage to the wiring.

8.2.3DV.10 Internal wiring shall not be in contact with bare live parts of opposite polarity or with bare live parts of other circuits.

8.2.3DV.11 A bare conductor, including pigtails and coil leads, shall be supported so that the spacings required elsewhere in this Standard will be maintained unless covered by suitable insulating sleeving or tubing.

8.2.3DV.12 All busbars and connections shall be readily accessible after installation of the controller.

8.2.3DV.13 All busbars and connections shall be arranged so that disconnection of the external circuit conductors will not be required.

8.2.3DV.14 Fuses shall be readily accessible.

8.2.3DV.15 Clamps and guides, either metallic or nonmetallic, used for routing stationary internal wiring shall be provided with smooth, well-rounded edges. The clamping action and bearing surface shall be such that abrasion or cold flow of the insulation does not occur. Auxiliary nonconducting mechanical protection shall be provided under a metallic clamp that exerts pressure on a conductor having thermoplastic insulation less than 0.8 mm (1/32 inch) thick and having no overall braid.

8.2.3DV.16 Insulated grounding and bonding conductors shall be identified by the color green with or without one or more yellow stripes. No other leads shall be so identified in the field wiring area.

8.2.3DV.17 All splices and connections shall be mechanically secure and shall provide electrical continuity.

8.2.3DV.18 Electrical connections shall be soldered, welded, crimped, or otherwise securely connected. A soldered joint shall be mechanically secure before soldering.

8.2.3DV.19 A printed circuit board joint is not required to be mechanically secure before soldering.

8.2.3DV.20 A lead shall be considered to be mechanically secure when it is:

- a) wrapped at least halfway (180 degrees) around a terminal;
- b) provided with at least one right angle bend when passed through an eyelet or opening; or
- c) twisted with other conductors.

8.2.3DV.21 If stranded internal wiring is connected to a wire-binding screw, the construction shall be such that loose strands of wire cannot contact other uninsulated live parts not always of the same polarity as the wire, and de-energized metal parts. This may be accomplished by any acceptable means including use of machine- or tool-applied pressure terminal connectors, soldering lugs, or crimped eyelets, or soldering all strands of the wire together.

8.2.3DV.22 In Mexico and the United States, a splice shall be provided with insulation equivalent to that of the wires involved.

In Canada, splices are not allowed.

8.2.3DV.23 In determining if splice insulation consisting of coated-fabric, thermoplastic, or other types of tubing is acceptable, consideration shall be given to electrical and mechanical properties, including dielectric voltage-withstand ability, heat resistance, and moisture resistance. Thermoplastic tape shall not be wrapped over a sharp edge or connection.

8.2.3.1 Service equipment

Controllers for use with electric motor-driven fire pumps and intended for use as service equipment shall be fitted for direct connection to incoming premises power supply conductors. Requirements for circuits supplying the controller are given in IEC 60364.

8.2.3.1DV D2 Modification to 8.2.3.1 by adding the following:

8.2.3.1DV.1 In the United States, controllers for use with electric motor driven fire pumps and intended for use as service equipment shall comply with the requirements in Annex [DVA](#), item 10. See [6.2.5.3DV](#) for markings.

In Canada and Mexico, this requirement does not apply.

8.2.3.1DV.2 In Canada, a separate service box is required.

8.2.3.2 Main circuits

All busbars and connections shall be readily accessible after installation of the controller and arranged so the disconnection of the external circuit conductors shall not be required for maintenance. Busbars, wiring, and wiring terminals of the main circuit shall be sized for continuous duty in accordance with the rated operational currents. Conductors that are in a circuit only during the motor starting period shall be sized according to their own intermittent duty cycle. Conductors and devices in the main circuit shall be capable of withstanding two 20 s locked-rotor tests spaced at 1 min intervals without sustaining damage.

Fire pump controllers shall not be equipped to permit the connection of any ancillary apparatus to the fire pump controller. The fire pump controller shall be equipped to accommodate the service conductors, the earthing electrode conductor, the earthing (bonding) connection and conductors going to the motor, as required by the national regulations of the country in which the fire pump controller is to be used.

8.2.4 Clearance and creepage distances

Subclause 7.1.3 of IEC 60947-1 applies.

8.2.4DV D2 Modification to 8.2.4 by adding the following:

8.2.4DV.1 Electrical spacings through air, over surface, and between uninsulated live parts and the enclosure walls shall be at least those specified in [Table 7DV](#).

8.2.4DV.2 For printed circuit boards, the minimum spacings shall be as specified in [Table 17DV](#).

8.2.4DV.3 The spacings at a field-wiring terminal shall be measured with wire connected to the terminal as in service. The connected wire shall be the next larger size than normally

required if the terminal will accommodate it, or if the equipment is not marked to restrict its use.

8.2.4DV.4 In Mexico and the United States, the spacings specified in [Table 7DV](#) for devices having limited rating shall apply to:

- a) devices rated 0.75 kW (1 hp) or less; 720 VA or less (break pilot duty); or not more than 15 A at 51 – 150 V, 10 A at 151 – 300 V, or 5 A at 301 – 600 V; or any combination thereof; and
- b) these same devices, when multipole and controlling more than one load, provided that the total load connected to the line at one time does not exceed 1.5 kW (2 hp), 1440 VA, or have a current rating greater than 30 A at 51 – 150 V, 20 A at 151 – 300 V, or 10 A at 301 – 600 V, and provided also that the loading on any one pole does not exceed its marked rating.

In Canada, reduced spacings for limited ratings are only allowed in control circuits.

8.2.4DV.5 In a circuit involving voltages of 50 V or less, spacings at field-wiring terminals may be 3.2 mm (0.125 inch) through air and 6.3 mm (0.25 inch) over surface.

8.2.4DV.6 In a circuit involving voltages of 50 V or less, other than field wiring terminals, the spacings shall be 1.6 mm (0.06 inch) through air or over surface, provided that the insulation and clearances between such circuits and any circuits of more than 50 V are in accordance with the requirements for the higher voltage circuit.

8.2.4DV.7 An insulating barrier or liner used as the sole separation between uninsulated live parts and grounded dead metal parts, including the enclosure, or between uninsulated live parts of opposite polarity shall be of a material specified in [Table 20DV](#).

8.2.4DV.8 An insulating barrier or liner that is used in addition to not less than one-half the required spacing through air shall be of a material specified in [Table 20DV](#) and shall be:

- a) of a material that is intended for the support of uninsulated live parts (see [Table 22DV](#));
- b) of the mechanical strength required to withstand mechanical damage;
- c) held in place; and
- d) located so that it is not adversely affected by operation of the equipment in service.

8.2.4DV.9 Insulating material barriers or liners having a thickness less than that specified in [Table 20DV](#) may be used when subjected to the Barrier Dielectric Strength Test in [DVE.4.10](#).

8.2.5 Actuators

Subclause 7.1.4 of IEC 60947-1 applies with the additional requirements in [8.4](#) through [8.8](#).

8.2.5.1 External controls

All switching equipment for manual use in connecting or disconnecting, or starting or stopping the motor shall be externally operable.

8.2.5.2 Use of sensing devices

Sensing devices, such as undervoltage, phase loss, frequency sensitive, earth leakage protection, etc., shall not be connected in any manner that prevents the automatic and/or manual operation of the fire pump controller.

8.2.5.2DV D2 Modification to 8.2.5.2 by adding the following:

8.2.5.2DV.1 No undervoltage, phase loss, frequency sensitive, ground-fault, or other sensor(s) shall be installed that automatically or manually prohibit electrical actuation of the motor contactor.

8.2.5.2DV.2 Sensors may prevent a three-phase motor from starting under single-phase conditions. These shall not cause disconnection of the motor when running at the time of a single-phase occurrence. Such sensors shall be monitored to provide a local visible alarm in the event of malfunction of the sensors. When single-phase (loss of phase) motor protection is provided:

- a) The failure of any circuit or component whose primary function is the detection, signaling, or response to a loss of phase of the power source shall not prevent the motor from electrically starting under restored power conditions.
- b) If the single phase loss condition occurs while the motor is running, any circuit or component whose primary function is the detection, signaling, or response to a loss of phase of the power source shall not interrupt the power to the motor, including low rpm and locked rotor conditions.
- c) The voltage threshold (drop out) for any circuit or component whose primary function is protection of the motor from a loss of phase of the power source shall not exceed 70 percent of the nominal line voltage.
- d) When the motor is protected from a loss of phase of the power source, electrical starting capability shall be automatically restored within 10 s upon the restoration of power.

8.2.6 Indication of the electromagnetic contactor position

8.2.6.1 Indicating means

Subclause 7.1.5.1 of IEC 60947-1 applies with the additional requirements in [8.4](#) through [8.9](#).

8.2.6.2 Indication by the actuator

Subclause 7.1.5.2 of IEC 60947-1 applies with the additional requirements in [8.4](#) through [8.9](#).

8.2.7 Additional safety requirements for equipment with isolating function

Subclause 7.1.6 of IEC 60947-1 applies with the additional requirements in [8.4](#) through [8.9](#).

8.2.8 Terminals

Subclause 7.1.7 of IEC 60947-1 applies with the following additions.

- a) A fire pump controller shall be provided with wiring terminals or leads for connection of conductors having a continuous current-carrying capacity not less than 125 % of the rated operational motor current.
- b) In the case of power conversion equipment in which the input current is different from rated operational motor current, the continuous current-carrying capacity shall be based upon 125 % of the maximum rated input current.
- c) Field wiring terminals for a diesel engine fire pump controller shall be suitable for use with stranded wire.

8.2.8DV D2 Modification to 8.2.8 by adding the following:

8.2.8DV.1 A controller shall be provided with wiring terminals for connection of conductors having an ampacity or wire size not less than the following:

- a) for power circuits, 125 percent of the full-load motor current specified in [Table 8DV](#) and [Table 9DV](#) for the horsepower rating or, in the case of power conversion equipment in which the input current is different from motor full-load current, 125 percent of maximum rated input current;
- b) for service use, not less than 5.3 mm² (10 AWG); and
- c) for control circuits, not less than 2.1 mm² (14 AWG).

See [Table 11DV](#) for field conductor ampacities.

8.2.8DV.2 All wiring terminals intended for field connection shall:

- a) be evaluated in accordance with Annex [DVA](#), items 7 or 12, and marked for the wire size or range;
- b) be part of a device evaluated and marked for the wire size or range; or
- c) comply with the secureness and pullout requirements of [8.2.8DV.5](#) for the next larger size conductor than that specified in [8.2.8DV.1](#), unless the equipment is marked to restrict its use to only the smaller size conductor.

8.2.8DV.3 A terminal to which field wiring is to be connected shall be a pressure wire connector.

8.2.8DV.4 A terminal to which 5.3 mm² (10 AWG) or smaller wiring connections are to be made may consist of a clamp or wire-binding screw with a terminal plate having upturned lugs or the equivalent to hold the wire in position. See [8.2.8DV.6](#) – [8.2.8DV.10](#).

8.2.8DV.5 A field-wiring pressure wire connector provided with or specified for use with industrial control equipment shall comply with one or more of the following, as applicable:

- a) the performance requirements in Annex [DVA](#), item 6 (see [6.2.5.5DV.1](#));
- b) the performance requirements in Annex [DVA](#), item 7; or
- c) the performance requirements in Annex [DVA](#), item 12.