UL 471

STANDARD FOR SAFETY

Commercial Refrigerators and Freezers

UL Standard for Safety for Commercial Refrigerators and Freezers, UL 471

Tenth Edition, Dated November 24, 2010

Summary of Topics

This revision of ANSI/UL 471 dated September 12, 2019 includes requirements for beverage product system pressure and miscellaneous editorial corrections.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated June 21, 2019.

No Text on This Page

NOVEMBER 24, 2010
(Title Page Reprinted: September 12, 2019)

ANSI/UL 471-2019

UL 471

Standard for Commercial Refrigerators and Freezers

The First through Third editions were titled Standard for Commercial Refrigerators.

First Edition – October, 1957
Second Edition – June, 1962
Third Edition – May, 1973
Fourth Edition – September, 1975
Fifth Edition – May, 1978
Sixth Edition – January, 1985
Seventh Edition – July, 1992
Eighth Edition – November, 1995
Ninth Edition – January, 2006

Tenth Edition

November 24, 2010

This ANSI/UL Standard for Safety consists of the Tenth Edition including revisions through September 12, 2019.

The most recent designation of ANSI/UL 471 as an American National Standard (ANSI) occurred on September 12, 2019. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 471 on March 23, 1976. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

INTRODUCTION

1 Scope 9
2 General 9
2.1 Components 9
2.2 Units of measurement 9
2.3 Terminology 9
2.4 Undated references 9
3 Glossary 10
3A Definitions Relating to Classes of Control Functions 13

CONSTRUCTION

4 General 14
5 Assembly 15
5.1 General 15
5.2 Pressurized product system 15
5.3 Mechanical protection 16
5.4 Electrical protection 19
5.5 Refrigerators and freezers intended for installation within a motor fuel dispensing facility 24
6 Accessories 24
7 Enclosures 25
7.1 General 25
7.2 Doors and covers 28
7.3 Enclosures exposed to weather 29
8 Nonmetallic Materials 31
8.1 General 31
8.2 Classification 32
8.3 Application 32

ELECTRICAL SYSTEM

9 Field Supply Connections 34
9.1 General 34
9.2 Permanently connected refrigerators 34
9.3 Cord-connected refrigerators 37
9.4 Grounding 39
10 Internal Wiring And Wiring Methods 40
10.1 General 40
10.2 High voltage circuits 41
10.3 Low voltage circuits 43
10.4 Wiring method 43
10.5 Short circuit protection 45
11 Secondary Circuits 45
11.1 General 45
11.2 Class 2 circuits 46
11.3 Limited voltage/current circuits 46
12 Separation Of Circuits 47
13 Bonding For Grounding 48

ELECTRICAL COMPONENTS

14 Current-Carrying Parts 50
15 Insulating Material 50
16 Switches And Controllers 51
16.1 General 51
16.2 Motor controllers 56
17 Motors 57
18 Motor Protection 60
18.1 General 60
18.2 Protection of single-phase nonhermetic motors 60
18.3 Protection of three-phase motors 61
18.4 Protection of hermetic refrigerant motor-compressors or Stirling engines 61
19 Electric Heaters 62
19.1 Heater elements 62
19.2 Heater control 63
20 Fuseholders And Circuit Breakers 64
20.1 Fuseholders 64
20.2 Circuit breakers 64
20A Fuses and Supplementary Protectors 65
21 Electric-Discharge Lighting Systems 65
22 Lighted and Associated Components 66
23 Incandescent Lighting Systems 67
24 Guarding Of Lamps 67
25 Receptacles 67
26 Receptacle And Lighting Circuits Overcurrent Protection 68
27 Capacitors 68
27A Valves and Solenoids 70
27B Outlet Boxes, Electrical Cable, Conduit and Tubing 70
27C Electromagnetic Interference Filters 70
27D Relays and Contactors 70
27E Wireways, Auxiliary Gutters and Associated Fittings 71
27F Batteries and Battery Chargers 71
27G Optical Isolators and Semiconductor Devices 71
27H Terminal Blocks 72
27I Printed-Wiring Boards 72
28 Transformer Protection 72
28.1 General 72
28.2 High-voltage transformers – thermal protection 72
28.3 High-voltage transformers – overcurrent protection 73
28.4 Overcurrent protective device 74
29 High-Voltage Control Circuit Conductor Overcurrent Protection 74
29.1 General 74
29.2 Direct-connected high-voltage control circuit 74
29.3 Tapped high-voltage control circuit 74

SPACINGS

30 High-Voltage Circuits 76
31 Low-Voltage Circuits 77
32 Alternate Spacings – Clearances and Creepage Distances 78

REFRIGERATION SYSTEM

33 Refrigerants 79

33.1 General 79
33.2 Testing 80
34 Pump-Down Capacity 80
35 Refrigerant Tubing And Fittings 80
36 Refrigerant-Containing Parts 81
37 Pressure-Limiting Device 82
38 Pressure Relief 82
38.1 General 82
38.2 Relief valves 83
38.3 Fusible plugs or rupture members 84
38A Thermoelectric System 84

PERFORMANCE

39 Instrumentation 84
39.1 Temperature measurements 84
39.2 Pressure measurements 86
40 Test Voltage 86
41 Leakage Current Test – Cord Connected Refrigerators 86
42 Input Test 87
43 Starting Test 88
44 Temperature and Pressure Test 88
45 Heating Test – Condensation Wiring 93
46 Heating Test – Ballasts And Wiring 93
47 Defrost Test 94
48 Dielectric-Voltage Withstand Test 95
49 Condenser or Heat Rejection Fan Motor Failure Test 96
50 Condenser or Heat Rejection Water Failure Test 97
51 Evaporator Fan Motor Failure Test 98
52 Overflow Test 98
53 Rain Test 99
54 Stability Test 103
55 Static Load Test 104
56 Strain Relief Test 104
57 Heater Control Tests 104
57.1 Endurance test 104
57.2 Calibration test 105
58 Condensate Water Evaporator Test 105
59 Abnormal Operation Test – Electric Heater 105
60 Burnout Tests – Electromagnetic Components 106
61 Burnout Test – High-Voltage Transformers 106
62 Overload Test – High-Voltage Transformers 107
63 Overvoltage And Undervoltage Tests 107
64 Current Overload Test 108
65 Insulation Resistance Test 108
65.1 Heaters 108
65.2 Thermal and acoustical insulating material 108
66 Limited Short-Circuit Test 109
66.1 General 109
66.2 Motor overload protective device 110
66.3 Bonding conductors and connections 110
66.4 Motor circuit conductors and connections 110
67 Protective Devices – Maximum Continuous Current Test 110
68 Strength Tests – Pressure Containing Components 112
68.1 Refrigeration system 112
68.2 Beverage product system 115

69 Fatigue Test Analysis ... 116
69.1 General ... 116
69.2 Initial test ... 116
69.3 Material specifications ... 116
69.4 Cycling test specifications ... 117
69.5 Test method ... 117
69.6 Test parameters ... 117
69.7 Cycle test pressure specification ... 118
70 Start-To-Discharge Test ... 118
71 Regulating Relief Valve Endurance Test ... 118
72 Shelf Strength Test ... 119
73 Component Restraint Test ... 120
74 Glass Strength Test ... 120
75 Door Latch Release and Door Opening Test ... 121
75.1 Door Latch Release Test ... 121
75.2 Door Opening Test ... 121
76 Accelerated Aging Test – Electric Heaters ... 122
77 Reliability Test – Heater Terminations ... 122
78 Accelerated Aging Tests ... 123
79 Metallic Coating Thickness Test ... 123
80 Fastener Strength Test ... 125
81 Burnout Test – Impedance Protected Motors ... 126
82 Tests on Nonmetallic Materials ... 126
83 Label Adhesion Tests ... 127
83A Static Pressure Test ... 127
83B Reserved ... 128
83C Component Failure Test ... 128
83D Tests on Thermoelectric Refrigerators and Freezers ... 129
83D.1 General ... 129
83D.2 Thermoelectric cooling appliances without fans ... 130
83D.3 Thermoelectric cooling appliances with fans ... 130
83D.4 Thermoelectric circuits powered by other than a low voltage class 2 or limited power source supply ... 130
83D.5 Dielectric voltage withstand – 5000 volt test ... 130

MANUFACTURING AND PRODUCTION TESTS

84 Pressure Tests ... 130
85 Production Line Dielectric Voltage Withstand Tests ... 131
86 Grounding Continuity Tests ... 133

MARKING

87 General ... 133
87.1 Details ... 133
87.2 Refrigerant ... 134
87.3 Other markings ... 136
87.4 Accessories ... 138
88 Permanently Connected Refrigerators ... 138
89 Cord Connected Refrigerators ... 144

INSTRUCTIONS

90 Installation And Operating Instructions ... 144

SUPPLEMENT SA – COMMERCIAL REFRIGERATORS AND FREEZERS FOR MARINE USE

INTRODUCTION

SA1 Scope 147

CONSTRUCTION

SA2 General 147
SA3 Protection Against Corrosion 147
SA4 Supply Connections 148
SA5 Wiring 148
SA6 Insulating Material 148
SA7 Electrical Connections 148

PERFORMANCE

SA8 Vibration Test 148
SA9 Shock Test 149
SA10 Pitch And Roll Tests 149
SA10.1 General 149
SA10.2 Pitch 149
SA10.3 Roll 149
SA11 Salt-Spray Corrosion Test 149
SA12 Ignition Protection Test 150

MARKING

SA13 General 150

SUPPLEMENT SB – REQUIREMENTS FOR REFRIGERATORS AND FREEZERS EMPLOYING A FLAMMABLE REFRIGERANT IN THE REFRIGERATING SYSTEM

SB1 Scope 151
SB2 Definitions 151
SB3 General 152
SB4 Construction 153
SB4.1 General 153
SB4.2 Refrigeration system 153
SB4.3 Resistance to corrosion 154
SB4.4 Laboratory refrigerators or freezers using a flammable refrigerant with a convenience outlet or similar power receptacle inside the refrigerated compartment 154
SB5 Performance 154
SB5.1 Leakage test 154
SB5.2 Ignition protection test 157
SB5.3 Temperature test 158
SB5.4 Scratch test 159
SB6 Marking, Installation and Operating Instructions 161
SB6.1 Marking 161
SB6.2 Installation and operating instructions 162

SUPPLEMENT SC – UL 60335-1 BASED REQUIREMENTS FOR THE EVALUATION OF ELECTRONIC CIRCUITS