UL 391

STANDARD FOR SAFETY

Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER
REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

UL Standard for Safety for Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces, UL 391

Sixth Edition, Dated October 21, 2024

Summary of Topics

This sixth edition of ANSI/UL 391 dated October 21, 2024 includes updated Referenced Publications, Section 4, Conversion correction, 53.2.1; and Editorial updates throughout the Standard.

The requirements are substantially in accordance with Proposal(s) on this subject dated July 12, 2024 and August 23, 2024.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of ULSE Inc. (ULSE).

ULSE provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will ULSE be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if ULSE or an authorized ULSE representative has been advised of the possibility of such damage. In no event shall ULSE's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

Users of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold ULSE harmless from and against any loss, expense, liability, damage, claim, or judgment (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

No Text on This Page

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

UL 391

Standard for Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces

First Edition – July, 1981
Second Edition – August, 1991
Third Edition – April, 1995
Fourth Edition – October, 2006
Fifth Edition – September, 2010

Sixth Edition

October 21, 2024

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

The most recent designation of ANSI/UL 391 as an American National Standard (ANSI) occurred on October 21, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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

Our Standards for Safety are copyrighted by ULSE Inc. Neither a printed nor electronic copy of a Standard should be altered in any way. All of our Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of ULSE Inc.

© 2024 ULSE Inc. All rights reserved.

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

No Text on This Page

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

CONTENTS

INTRODUCTION

1 Scope 7
2 Components 7
3 Units of Measurement 7
4 Referenced Publications 8
5 Glossary 8

CONSTRUCTION

6 General 10
7 Accessibility for Servicing 13
8 Protection of Users and Service Personnel 13
9 Base 16
10 Casings 16
11 Radiation Shields or Liners 17
12 Materials in Air-Handling Compartments 17
13 Air Filters 18
14 Combustion Chambers 18
15 Radiators 18
16 Heating Surface Joints 18
17 Baffles 19
18 Flue Collars 19
19 Disposal of Combustion Products 20
20 Dampers, Shutters and Draft Regulators 20
21 Electrical Enclosures 20
21.1 General 20
21.2 Doors and covers 23
21.3 Field wiring system connections 25
22 Accessibility of Uninsulated Live Parts, Film-Coated Wire and Moving Parts 25

FIELD WIRING

23 General 30
24 Leads and Terminals 32

INTERNAL WIRING

25 General 33
26 Methods 33
27 Short-Circuit Protection 36
28 Separation of Circuits 37
29 Bonding for Grounding 38

ELECTRICAL COMPONENTS

30 General 41
31 Mounting of Electrical Components 41
32 Electrical Insulating Material 42
33 Capacitors 42
34 Receptacles 42
35 Motors and Motor (Overload) Protection 43

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

36 Safety Controls and Circuits 47
36.1 General 47
36.2 Fan, limit, and thermostatic damper controls 47
36.3 Supplementary central furnace controls 48
36.4 Primary safety control 48
37 Switches and Controllers 48

SPACINGS

38 High-Voltage Circuits 49
39 Low-Voltage Circuits 50

PERFORMANCE

40 General 51

TEST INSTALLATION FOR CENTRAL FURNACES

41 Enclosure 51
42 Chimney Connector 52
43 Supply-and Return-Air Plenums and Ducts – Forced-Air Furnace 54

TEST INSTALLATION FOR SUPPLEMENTARY CENTRAL FURNACES

44 General 56

INSTRUMENTATION

45 Draft 56
46 Fuel Input 57
47 Power Measurement 57
48 Speed Measurement 57
49 Static Pressure 57
50 Temperature Measurement 59

INITIAL TEST CONDITIONS

51 General 61
52 Static Pressures for Tests 62
53 Solid Fuels and Test Firing Procedures 63
53.1 General 63
53.2 Firebrands 63
53.3 Charcoal 65

INITIAL TESTS

54 Combustion Test – Oil Burner and Furnace 66
55 Operation Test 66
56 Limit Control Cutout Test 67
56.1 General 67
56.2 Combination oil-fired and solid-fuel-fired central furnaces 67
56.3 Solid-fuel-fired central furnaces 68
56.4 Supplementary central furnaces 68

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

TEMPERATURE TESTS

57 General 69
58 Continuous Operation Test 73
58.1 General 73
58.2 Continuous operation 73
58.3 Loss of electrical power 74
58.4 Simultaneous firing 74
59 Air Flow Restriction and Disruption Tests 74
59.1 General 74
59.2 Preparatory test procedures 75
59.3 Restricted inlet test 75
59.4 Fan failure test 75
59.5 Blocked outlet test 75

OTHER TESTS

60 Delayed Oil Ignition Test 76
61 Dielectric Voltage Withstand Test 76
62 Bonding Joint Test 76
63 Bonding Conductor Test 77
64 Knockout Security Test 77
65 Lead Stress Test 77
66 Surface Burning Test 77
67 Polymeric Materials Tests 77
67.1 General 77
67.2 Aging test 78
67.3 Flammability test 78
68 Short Circuit Test 78

MANUFACTURING AND PRODUCTION TESTS

69 General 80
70 Production Line Dielectric Voltage Withstand Tests 81

MARKING

71 Nameplate 81
72 Supplementary 83
73 Instructions 85

Appendix A

Standards for Components 87

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

No Text on This Page

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.

INTRODUCTION

1 Scope

1.1 These requirements apply to manually fueled, solid-fuel-fired central furnaces. Included are supplementary central furnaces intended for interconnection with forced-air central furnaces utilizing other fuels, and combination oil-fired and solid-fuel-fired, forced-air central furnaces.

1.2 The furnaces are intended to burn solid fuels, such as wood, coal, or any other biomass fuel, as specified by the manufacturer.

1.3 The furnaces are intended for connection to chimneys for residential and building heating appliances in compliance with the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances, NFPA 211, and intended for installation in compliance with the Standard for Installation of Warm Air Heating and Air Conditioning Systems, NFPA 90B; and the National Electrical Code, NFPA 70; and applicable mechanical codes such as the International Mechanical Code, the Standard Mechanical Code, and the Uniform Mechanical Code.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.2 A component need not comply with a specific requirement that:

a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

2.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions for which they have been recognized.

3 Units of Measurement

3.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

ULSE INC. COPYRIGHTED MATERIAL – NOT AUTHORIZED FOR FURTHER REPRODUCTION OR DISTRIBUTION WITHOUT PERMISSION FROM ULSE INC.