



# UL 296A

## **STANDARD FOR SAFETY**

### Waste Oil-Burning Air-Heating Appliances



UL Standard for Safety for Waste Oil-Burning Air-Heating Appliances, UL 296A

Third Edition, Dated August 2, 2018

### **Summary of Topics**

***This revision of ANSI/UL 296A is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.***

The requirements are substantially in accordance with Proposal(s) on this subject dated August 17, 2018.

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.

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 UL.

UL 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 UL 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 UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL'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 UL 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.

No Text on This Page

**AUGUST 2, 2018**

(Title Page Reprinted: October 8, 2018)



**UL/ANSI 296A-2013 (R2018)**

**1**

## **UL 296A**

### **Standard for Waste Oil-Burning Air-Heating Appliances**

Previous numbered and unnumbered editions of standards covering heating appliances have been published since 1987.

First Edition – November, 1990

Second Edition – October, 1995

#### **Third Edition**

**August 2, 2018**

This ANSI/UL Standard for Safety consists of the Third Edition including revisions through October 8, 2018.

The most recent designation of ANSI/UL 296A as a Reaffirmed American National Standard (ANS) occurred on October 8, 2018. 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 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>.

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

**COPYRIGHT © 2018 UNDERWRITERS LABORATORIES INC.**

No Text on This Page

## CONTENTS

### PART I – ALL WASTE OIL-BURNING AIR-HEATING APPLIANCES

#### INTRODUCTION

1 Scope .....	8
2 General .....	8
3 Glossary .....	9
4 Components .....	14

#### CONSTRUCTION

5 Protection of Users and Service Personnel .....	15
6 Enclosures .....	19
6.1 General .....	19
6.2 Doors and covers .....	26
6.3 Field wiring system connections .....	28
7 Field Wiring .....	29
7.1 General .....	29
7.2 Leads and terminals .....	31
8 Internal Wiring .....	32
8.1 General .....	32
8.2 Methods .....	33
8.3 Short circuit protection .....	36
9 Separation of Circuits .....	36
10 Grounding and Bonding .....	38

#### ELECTRICAL COMPONENTS

11 General .....	41
12 Mounting of Electrical Components .....	41
13 Motors and Motor Overload Protection .....	42
14 Overcurrent Protection of High-Voltage Control-Circuit Conductors .....	46
14.1 General .....	46
14.2 Direct-connected high-voltage control circuit .....	46
14.3 Tapped high-voltage control circuits .....	46
14.4 Overcurrent-protective devices .....	47
15 Overcurrent Protection of Transformers .....	48
15.1 High-voltage transformers .....	48
15.2 Low-voltage transformers .....	50
15.3 Overcurrent protective devices .....	50
16 Switches and Controllers .....	51
17 Capacitors .....	52
18 Electrical Insulating Materials .....	52

#### SPACINGS

19 High-Voltage Circuits .....	52
20 Low-Voltage Circuits .....	54

**PERFORMANCE**

21	General	54
22	Test Fuels	55
23	Instrumentation	56
23.1	Draft	56
23.2	Fuel input	56
23.3	Power measurement	56
23.4	Speed measurement	56
23.5	Static pressure	57
23.6	Temperature measurement	59
24	Test Voltage	61
25	Power Input Test	62
26	Temperature Test	62
27	Stalled Fan Motor Test	65
28	Short-Circuit Test	65
29	Overload Test, High-Voltage Transformers	68
30	Burnout Test, High-Voltage Transformers	69
31	Dielectric Voltage-Withstand Test – Appliance	70

**MANUFACTURING AND PRODUCTION TESTS**

32	General	70
33	Production Line Dielectric Voltage-Withstand Test	71

**MARKINGS**

34	Nameplate	72
35	Supplementary	75

**INSTRUCTIONS**

36	General	76
----	---------	----

**PART II – BURNERS****CONSTRUCTION**

37	General	77
38	Materials	78
39	Assembly	78
40	Accessibility for Servicing	79
41	Fan Housings and Air Tubes	80
42	Combustion Air Controls	80
43	Fuel Strainers	81
44	Fittings, Piping, and Tubing	85
45	Valves	87
46	Gauges	88
47	Ignition Systems	88
48	Electric High-Tension Ignition	89
48.1	Assembly	89
48.2	Electrode and bus bars	89



48.3 Insulators .....	89
48.4 Leads .....	90
48.5 Transformers .....	90
49 Gas Pilots .....	91
50 Control Applications .....	91
51 Primary Safety Controls .....	92
52 Oil Atomization Control .....	93
53 Interlocks .....	93
54 Oil Heating Equipment .....	93
55 Air Atomizing Equipment .....	93
56 Combination Gas-Oil Burners .....	94

## PERFORMANCE

57 General .....	94
58 Combustion Tests .....	95
58.1 Mechanical-atomizing burners general .....	95
58.2 Extended operation .....	95
59 Combustion Air Failure Test .....	97
60 Interruption of Atomization Test .....	98
61 Undervoltage Operation Test .....	98
62 Power Interruption Test .....	99
63 Continuous Operation Temperature Test .....	100
64 Ignition Tests, Multiple Igniters .....	100
65 Ignition Tests, Electric High-Tension .....	100
65.1 Reduced voltage – cold oil .....	100
65.2 Combustion detectors .....	101
66 Ignition Tests, Gas Pilot .....	102
66.1 Reduced voltage .....	102
66.2 Pilot supervision .....	102
66.3 Flame failure response .....	103
66.4 Stability .....	103
67 Ignition Test, Gas-Electric System .....	103
68 Ignition Tests, Gas-Electric High-Tension System .....	104
68.1 Reduced voltage – cold oil .....	104
68.2 Dielectric voltage-withstand – burner .....	104
68.3 Dielectric voltage-withstand – electrode insulators .....	105
69 Ignition Test, Multiple-Atomizer Burner .....	105
70 Abnormal Operation Test – Oil Heating .....	106

## PART III - BOILERS, FURNACES, AND HEATERS

### CONSTRUCTION

71 Assembly .....	106
72 Accessibility for Servicing .....	109
73 Disposal of Combustion Products .....	109
74 Base .....	109
75 Casing .....	111
76 Radiation Shields or Liners .....	112
77 Materials in Air Handling Compartments .....	112
78 Air Filters .....	114

79	Combustion Chamber .....	114
80	Radiators .....	114
81	Heating Surface Joints .....	115
82	Baffles .....	115
83	Flue Collars .....	116
84	Dampers and Draft Regulators .....	116
85	Controls .....	116
85.1	Application .....	116
85.2	Limit control .....	117
85.3	Fan control .....	118

## PERFORMANCE – CENTRAL FURNACES

86	General .....	118
87	Test Installation for Standard Clearances .....	119
87.1	Downflow and upflow furnaces enclosure .....	119
87.2	Chimney connector .....	120
87.3	Air outlet and inlet – forced air furnace .....	123
87.4	Horizontal furnace enclosure .....	127
87.5	Chimney connector .....	128
87.6	Air outlet and inlet .....	128
88	Initial Test Conditions .....	132
89	Combustion Test – Burner and Furnace .....	133
90	Operation Tests .....	133
91	Limit Control Cutout Test .....	134
92	Continuity of Operation Test .....	135
93	Airflow Test – Downflow and Horizontal Furnaces .....	136
94	Temperature Tests – General .....	137
95	Continuous Operation Test .....	137
96	Restricted Inlet Test .....	138
97	Fan Failure Test .....	138
98	Blocked Outlet Test .....	139

## PERFORMANCE – UNIT HEATERS

99	General .....	139
100	Test Installation .....	140
100.1	Floor-mounted heaters .....	140
100.2	Suspended type heaters .....	144
101	Initial Test Conditions .....	146
102	Combustion Test – Burner and Heater .....	146
103	Operation Tests .....	147
104	Limit Control Cutout Test .....	147
105	Continuity of Operation Test .....	148
106	Temperature Tests – General .....	148
107	Continuous Operation Test .....	149
108	Restricted Inlet Test .....	149
109	Fan Failure Test .....	150

## PERFORMANCE – BOILERS

110	General .....	150
-----	---------------	-----

**PART IV – OUTDOOR USE EQUIPMENT****CONSTRUCTION**

111	General .....	151
112	Enclosure .....	151
112.1	General .....	151
112.2	Corrosion protection .....	152
113	Field-Wiring Connections .....	154
114	Internal Wiring .....	154
115	Electrical Insulating Material .....	154

**PERFORMANCE**

116	Rain Test .....	155
117	Wind Test .....	158
117.1	Wind velocity 40 miles per hour .....	158
117.2	Wind velocity 10 miles per hour .....	159
118	Accelerated Aging Test – Gaskets, Adhesives, and Sealing Compounds .....	159
119	Metallic Coating Thickness Test .....	160

**MARKING**

120	General .....	162
-----	---------------	-----

**APPENDIX A**

Standards for Components.....	A1
-------------------------------	----