

COMMERCIAL STANDARD CS101-63

FLUE-CONNECTED OIL-BURNING SPACE HEATERS AND RECESSED HEATERS
WITH VAPORIZING POT-TYPE BURNERS

(Effective August 1, 1963)

1. PURPOSE

1.1 This standard provides requirements for the quality and performance of oil-fired heaters of the types covered herein, for the guidance of manufacturers, distributors, installers, contractors, and purchasers.

2. SCOPE

2.1 This standard applies to oil-fired, flue-connected space heaters and recessed heaters equipped with vaporizing pot-type burners, with or without mechanical draft, and includes the following sections:

SECTION	PAGE
1. Purpose	3
2. Scope	3
3. Definitions of Space Heater and Recessed Heater	3
4. General Requirements	3 - 4
5. Heater Design and Construction	4 - 5
6. Performance	5 - 6
7. Laboratory Test Code	6 - 11
8. Publication of Heater Ratings	11
9. Labeling	11
10. Installation Requirements and Performance Tests	11 - 12

3. DEFINITIONS OF SPACE HEATER AND RECESSED HEATER

3.1 A space heater is here defined as "an above the floor device for the direct heating of the space in and adjacent to that in which the device is located, without the use of external pipes or ducts, other than a flue, as integral parts of such heating device."

3.2 A recessed heater is a self-contained indirect-fired appliance designed for incorporation in, insertion into, or permanent attachment to a wall or partition, and furnishing heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing.

4. GENERAL REQUIREMENTS¹

4.1 Safety. - A space heater shall meet the standards of Underwriters' Laboratories Inc., Standards for Oil-Burning Stoves, Subject 896, published March 1957; a recessed heater shall meet the standards of Underwriters' Laboratories, Inc., Standards for Oil-Fired Recessed Heaters, Subject 730, published May 1955, or such revisions of these standards as may be approved by the Standing Committee of CS101-63. Presence on the heater of the label of the Underwriters' Laboratories, Inc., shall be evidence of compliance with these requirements.

4.2 Durability. - The design and construction of the heater shall be as outlined in Section 5 and shall be such as to insure its durability in service.

¹ In this standard, where requirements covering durability, dependability, reliability or corrosion resistance are given, without specifications as to how these qualities are to be determined, presence on the heater of Underwriters' Laboratories, Inc., label shall be evidence of compliance.

4.3 Dependability. - The heater shall be capable of functioning uniformly and reliably when installed and adjusted in accordance with the manufacturer's instructions.

4.4 Heater testing for rating and performance. - A heater of each model shall be tested and rated according to this Commercial Standard, as outlined in Sections 6 and 7. The manufacturer's test data and certification are acceptable under this standard for publication of furnace ratings. Where compliance with CSI01-63 has been certified by a manufacturer, such certification shall be based on rating and performance tests conducted in the manufacturer's laboratory or other adequately equipped laboratory which he may elect.

4.5 Over-all efficiency. - The heater shall be capable of meeting the minimum efficiency requirements outlined in Section 6 of this standard.

4.6 Operating instructions. - Each heater shall be accompanied by a complete set of instructions covering essential points with respect to selection of fuel, operation, and upkeep.

5. HEATER DESIGN, CONSTRUCTION AND DURABILITY

5.1 Outer casing, or jacket, if used, shall be constructed of material of such strength that it is not readily damaged or dented in shipment or use.

5.2 Oil burners shall be of the vaporizing pot type constructed of steel, not less than No. 20 gage (See par. 5.7.) or other suitable material of equal resistance to heat, corrosion, and fuel leakage.

5.3 Combustion chambers, radiating drums, and/or other surfaces exposed to the direct heat of the burner flame and/or to the products of combustion shall be constructed of sheet steel in accordance with the following tabulation, or of other suitable materials of equal resistance to heat and corrosion.

Rated capacity gal/24 hr	Minimum manufacturers' standard-practice gage (See par. 5.7)
4 to 8	24
8 to 11	22
11 up	20

Combustion chambers shall be fitted with doors or equivalent means for permitting access to interior surfaces of the burner and other heater surfaces as required for lighting, cleaning, servicing, etc.

5.4 Flue collar shall be constructed of a material conforming to that specified in paragraph 5.3 for the combustion chamber, and shall be rigidly attached at the flue outlet of the heater. It shall afford convenient, suitable means for attaching the smoke pipe securely to the heater.

5.5 Fuel tank, when furnished for use as an integral part of the heater, shall be substantially constructed of corrosion-resisting metal or metal suitably coated to resist corrosion, having minimum thicknesses as follows: 3-gallon capacity, 26 gage; 3.1 to 6 gallons, 24 gage; 6.1 to 10 gallons, 22 gage (See par. 5.7 for table of gage thicknesses); joints shall be brazed, welded, riveted, or of the lockseam type, and when not continuously brazed or welded, the joints shall be sweated with solder. The tank shall be so constructed as to assure its being rigidly mounted on the heater in its proper position. It shall have ample filler opening. The fuel tank, when furnished, for use as an integral part of the heater, shall be equipped with a valve for stopping the flow of oil at the tank when removing the tank from the heater or servicing the constant-level valve. (Tanks not furnished as integral parts of the heater must comply with requirements of NFPA No. 31,

Standards for the Installation of Oil Burning Equipment².)

5.6 Baffles used to deflect heat from the outer casing, the fuel-supply tank or the floor, shall be constructed of not less than 28-gage sheet steel or material of equal permanence, and be securely attached.

5.7 Sheet-steel gages. - All sheet-steel gages specified in this standard shall be interpreted as indicated below:

Sheet steel gage number	Gage Thickness	Minimum metal thicknesses
	inch	inch
20	0.0359	0.0319
22	.0299	.0269
24	.0239	.0209
26	.0179	.0159
28	.0149	.0129

5.8 Finish. - Outside metal surfaces of heater casings, grilles, tanks, and accessories shall be adequately protected against rust or corrosion and against damage during manufacture, test, shipment, and reasonable conditions of storage.

5.9 Heater accessories and fittings. -

5.9.1 Oil-control valve shall be of substantial construction of corrosion-resistant parts and be rigidly attached to the heater, or it may be furnished integrally with a constant-level valve. The control valve shall be easily accessible for operation and servicing and shall have means for (a) controlling the desired oil flow, (b) indicating the approximate high-and low-fire settings, and (c) restricting the maximum setting.

5.9.2 Constant-level valve, when used, shall be of the manual reset, float, and trip type permitting air escapement, or otherwise be so constructed as to prevent excessive accumulations of oil in the valve. It shall be rigidly mounted on the heater and supported independently of the piping. All parts shall be made of corrosion-resistant material.

5.9.3 Automatic draft regulator shall be furnished with each oil heater. It may be furnished integrally with the heater, or with complete instructions for its installation.

5.9.4 Gaskets, where required for fuel-handling parts, shall be of soft copper, copper asbestos, hard lead, or UL approved equivalent for screwed joints, and of Underwriters' listed sheet packing or its equivalent for bolted joints.

6. PERFORMANCE

6.1 When tested as outlined in Section 7 of this standard, the heater shall meet the following minimum performance requirements:

6.1.1 Lighting and warming up burner. - Provision shall be made to insure ease of lighting, and to insure against the burner flame being extinguished after lighting and before the burner has become thoroughly heated.

6.1.2 Operation of burner and controls. -

² Available from National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts.

6.1.2.1. Controls for fuel and draft shall function easily and reliably.

6.1.2.2 The burner shall be capable of functioning uniformly and reliably without carbonization or other phenomena to the extent that would impair its safe and proper operation on the grades of fuel recommended by the manufacturer for use therein.

6.1.2.3 The heater shall pass the high fire rating test without emitting smoke in excess of #6 spot on the Shell-Bacharach scale as covered in paragraph 7.6.4.

6.1.2.4 If the heater has provision for operation at low or pilot fire, the fuel rate at minimum fire shall not be in excess of 0.7 pound per hour, or 25% of the rate during the high fire rating test, whichever is the greater. At the minimum rate the smoke shall not exceed #6 spot on the Shell-Bacharach scale.

6.1.2.5 Combustion shall be stable at all firing rates allowed by the metering device. Presence on the device of the UL label shall be evidence of compliance with this requirement.

6.2 Heating capacity. -

6.2.1 The heater shall be capable of delivering heat to a room as claimed by the manufacturer when tested as outlined in Section 7 of this standard.

6.3 Operating efficiency. -

6.3.1 The heater shall be capable of operating with an over-all efficiency of not less than 70 percent when tested at 0.06-inch draft as outlined in Section 7 of this standard.

6.3.2 In cases where the manufacturer recommends less than 0.06-inch draft for the high-fire operation of the heater, the "maximum recommended draft" may be substituted for the 0.06-inch draft specified in paragraph 6.3.1.

7. LABORATORY TEST CODE

7.1 The purpose of this code is to provide a uniform standard method for checking the high-fire rated heat output in Btu per hour of flue-connected oil-burning space heaters and recessed heaters of the types covered by this standard when operating under normal service conditions.

7.2 Principle. -

7.2.1 Since no simple and accurate method is known for measuring the heat output of an oil heater, directly, a heat-loss calculation must be relied upon.

7.2.2 This method is based on the principle that A, the total heat of the fuel used, minus B, the heat lost in the flue gases, equals C, the net heat delivered to the room. Then

$$C/A = E, \text{ efficiency}$$

7.2.3 Care must be used in setting up and adjusting the heater, as well as in selecting, calibrating, and accurately reading the instruments used for rating tests.

7.3 Heater test setup. -

7.3.1 A space heater shall be installed in accordance with the instructions of the manufacturer, in a standard Underwriters' type booth or black corner in a room free from drafts, with flue connections, accessories and draft regulator as shown in figures 1 to 4 of this standard.

7.3.2 A recessed heater shall be installed in accordance with the instructions of the

manufacturer in a test structure of one of the types shown and described in Underwriters' Laboratories, Inc., Standards for Safety Covering Oil-Fired Recessed Heaters, Subject 730. Flue connections, test equipment and draft regulator shall be installed as shown in figures 2 to 4 of this standard.

7.3.3 Provision shall be made for the draft recommended by the manufacturer for high-fire operation of the heater with draft fluctuations not to exceed plus or minus 0.005-inch of water column. Provision shall also be made for maintaining a room temperature of at least 70° F throughout the test.

7.4 Instruments and their location. -

7.4.1 A calibrated laboratory-type thermometer shall be located behind the shield in the Underwriters' black corner, as shown in figure 1, A and B, to measure room temperature, in the space heater test.

7.4.2 The temperature of the air entering a recessed heater is to be measured as described in Underwriters' Laboratories, Inc., Standards for Safety Covering Oil-Fired Recessed Heaters, Subject 730.

7.4.3 A draft gage with an accuracy of plus or minus 0.0025-inch of water column shall be connected as shown in figure 3.

7.4.4 A potentiometer (suggested range 0° to 1,200° F or equal).

7.4.5 A No. 20 gage iron-constantan thermocouple or equivalent thermocouple with holder, as shown in figures 3 and 4.

7.4.6 Gas analysis apparatus, preferably of the Orsat type, capable of determining CO₂ with an accuracy of plus or minus one-fourth of one percent or better, and a suitable method of measuring CO, such as that based on the dry-chemical colorimetric type of reaction.³

7.4.7 Suitable means for measuring the flow of oil to the heater (measurement by weight preferred).

7.4.8 A Shell-Bacharach smoke meter, see figures 5 to 7.

7.4.9 A stop watch or interval timer.

7.5 Selection and heating value of fuel oil. - The fuel used for heater-rating tests shall be Commercial Standard Grade No. 1 (CS12-48 or latest revision thereof) and shall be assumed to have a gross heating value of 19,750 Btu per pound.

7.6 Test procedure and conditions. -

7.6.1 Heater shall be operated under rating-test conditions until steady state conditions of room temperature, fuel-flow rate, and flue-gas temperature have been established.

7.6.2 Average draft during the test shall be that recommended by the manufacturer for high-fire operation of the heater. In no case shall the draft be more than 0.06 inch of water column. The maximum fluctuation in draft during the test shall not exceed plus or minus 0.005 inch of water column.

7.6.3 Fuel-feed rate shall be slowly increased to the desired rate, but in no case shall

³ Instruments employing this principle are commercially available and inquiry regarding current sources of supply should be directed to Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois. One such source of supply is Mine Safety Appliance Company, 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania.

that rate exceed the maximum rate at which the heater will burn the fuel completely without the appearance of smoke or unburned gases in the flue in excess of the amounts specified in paragraphs 7.6.4 and 7.6.5 of this standard. The fuel feed rate shall then be maintained constant throughout the test. This condition may be said to have been met if three consecutive fuel readings taken at approximately equal intervals throughout the test period do not vary by more than 5 percent of the largest reading taken.

7.6.4 Amount of smoke in the flue gas shall not exceed that indicated by a #6 spot on the Shell-Bacharach smoke scale on any of three samples drawn at 20 minute intervals at the point indicated in figures 2 and 3 of this standard.

7.6.5 Unburned fuel gases shall not occur in the flue products in sufficient quantities to be measurable by recognized methods of gas analysis as unburned fuel gas or vapors in excess of 0.1 percent by volume.

7.6.6 Stack temperature shall not exceed 920° F above room temperature.

7.7 Observations during test. - After equilibrium conditions have been established, the actual rating test shall be started and continued for at least 1 hour.

7.7.1 The following observations shall be made and recorded at the start of the test and at two approximately equal intervals throughout the test. The form of data sheet shown on page 13 is recommended for recording the test data.

7.7.1.1 Draft in flue pipe. -

7.7.1.2 Room temperature. -

7.7.1.3 Rate of flow of oil to heater. -

7.7.1.4 Flue-gas temperature (read immediately before taking flue-gas sample.)

7.7.1.5 Percentage of CO₂ and percentage of CO in the flue gas.

7.8 Smoke determination. - Shell-Bacharach filter paper method for determining smoke density in flue gases shall be conducted as outlined in paragraph 7.8.1 through 7.8.6 inclusive.

7.8.1 Outline of method. - The filter paper method for determining smoke density in flue gases involves passing through filter paper, as specified below, a test flue-gas volume of 2,250 (± 100) cubic inches (standard conditions) for each square inch effective surface area of filter paper used. Sampling device shall be of such construction that total travel of flue-gas sample from flue to filter paper shall not exceed 16 inches. Suitable laboratory and portable field service equipments are illustrated in figures 5 and 6.

The resultant test smoke spot on the test filter paper is measured to establish its color density by visual matching with a smoke scale, as specified below, consisting of 10 graded numbered spots ranging from white to black. The closest match determines the gross smoke spot number of the test spot. When making this comparison, test filter paper must be backed by a white surface having absolute surface reflectance of not less than 75 percent.

Net smoke spot number shall be determined by deducting from the gross smoke spot number, the smoke spot number obtained by matching the spot obtained on filter paper through which has been drawn a sample of air from the space from which the combustion air is being supplied, using the same equipment, filter paper, test volume, and evaluation as were used in measuring gross smoke spot number. In case of disagreement on the visual net or gross test spot number evaluation, the photometric smoke spot number evaluation described in 7.8.4 shall be employed.

7.8.2 Specification of filter paper. - Test filter paper is required, made from white

filter paper stock having absolute surface reflectance of between 82.5 percent and 87.5 percent determined by photometric measurement. When making this reflectance measurement, filter paper must be backed by a white surface having absolute surface reflectance of not less than 75 percent. When clean air is drawn through clean filter paper at a rate of 1,125 cubic inches (60° F, 1 atmosphere pressure) per square inch effective surface area of filter paper per minute, the pressure drop across the filter paper should fall between limits of 0.5 inch and 2.5 inches of mercury.

7.8.3 Specifications of smoke scale. - The smoke scale required for use with the filter paper method consists of 11 spots consecutively numbered from 0 to 10⁴ ranging in equal photometric steps from white through neutral shades of gray to black, imprinted or otherwise processed on white paper or plastic stock having an absolute surface reflectance of between 82.5 and 87.5 percent, determined photometrically. The smoke scale spot number is defined as the reduction in reflected incident light (due to existence of soot) divided by 10. Thus, the first (perfectly white) spot, which is the color of the unimprinted scale, will be number 0, since there will be in the case of this spot no reduction in reflected incident light directed thereon. The last spot, however, is very dark, reflecting none of the incident light directed thereon; thus in this case the reduction in reflected incident light is 100 percent, which, divided by 10, gives to this darkest spot the number 10⁴. Intermediate spot numbers are similarly established. Limit of permissible reflectance variation of any smoke scale spot is not to exceed ± 3 percent relative reflectance. Such smoke scales are sufficiently accurate for field use and for many laboratory smoke testing applications. However, specially calibrated scales, known as certified smoke scales, sometimes will be required (as in the case of Underwriters' Laboratories, Inc., burner performance rating tests), for which the specifications are given in the following paragraph.

A certified smoke scale is obtained by individually calibrating each smoke spot of a normal smoke scale. The normal smoke scale is first mounted in the light beam of a suitable type of reflectance photometer, and the photometer is adjusted to read 100 percent when the light beam is directed at spot number 0. Each imprinted smoke scale spot is then in turn exposed to the photometer light beam and the percentage reduction in reflected light due to the imprinting measured. Each smoke scale spot number is then established by the percentage reduction in incident light divided by 10. These precise smoke spot numbers expressed in decimal values to the nearest tenth shall then be furnished with the suitably identified scale.

Where the smoke scale is protected with a plastic or transparent cover, the construction employed shall be such that when the smoke spot on the filter paper is viewed for matching with the numbered spots on the smoke scale, both shall be visible through the same thickness and number of sheets of transparent protective cover.

7.8.4 Photometric test spot number evaluation. - The human factor involved in visually comparing filter paper test spots with smoke scale spots can be eliminated by resort to direct use of a suitable photometer for evaluating test spots. To make this direct photometric test spot evaluation, the following procedure shall be employed: Filter paper backed by material having absolute surface reflectance of not less than 75 percent shall be mounted in the light beam of a suitable type of reflectance photometer with beam focused on a clean, unused surface of the filter paper adjacent to the smoke spot, and the photometer adjusted to read 100 percent reflectance in terms of the light reflected from this clean surface. Test smoke spot on filter paper shall then be exposed to the photometer light beam and the percentage reduction in reflected light due to the presence of smoke particles on and in the filter paper shall be measured. Gross smoke spot number shall be defined as equal to this percentage reduction in reflected light divided by 10. Net smoke spot number shall be determined by deducting from the gross smoke spot number the smoke spot number determined by measurement of a filter paper through which has been drawn a duplicate sample of air from the space from which combustion air is being supplied, using the same equipment,

⁴ It is permissible to omit the number 10 spot from the smoke meter scale, since the number 9 spot is sufficiently dark for fuel oil combustion applications (See fig. 7.)

filter paper, test volume, and calculation as were used in measuring gross smoke spot number.

7.8.5 Specification of photometer. - The photometer to be employed for direct test spot number evaluation shall be of the electrically operated reflectance type employing a barrier layer cell, fitted with special means to accommodate filter paper test disks. It is to be furnished complete with green tristimulus filter and with reflectance standards of approximately 20, 40, 60, and 80 percent absolute reflectance, to permit photometer readings between 10 and 90 percent relative reflectance (relative to clean filter paper) to be made within ± 2 percent.

7.8.6 Availability of smoke meters, filter paper, scales and photometers. - Suitable instruments and accessories for both field and laboratory testing are commercially available. Inquiry regarding current sources of supply should be directed to Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois.

7.9 Corrections for altitude. -

7.9.1 The appropriate correction factor from the following table may be used for converting the maximum fuel feed input rate as determined in paragraph 7.6.3, when the test is conducted at higher altitudes, to the corresponding fuel input rate at sea level; by multiplying the rate determined by test by the correction factor given in the table for the altitude at which the test was run. (In no case, however, shall the corrected fuel-input rate used for heater rating purposes exceed the maximum fuel flow rate obtainable at high-fire valve setting with recommended fuels.)

7.9.2 Table of altitude correction factors

Approximate altitude	Barometric pressure	Correction factor
<u>ft</u>	<u>In. of Hg</u>	
0	30.0	1.00
500	29.5	1.02
1000	29.0	1.04
1500	28.5	1.06
2000	28.0	1.08
2500	27.5	1.10
3000	27.0	1.12
3500	26.5	1.14
4000	26.0	1.16
4500	25.5	1.18
5000	25.0	1.20
5500	24.5	1.22
6000	24.0	1.24
6500	23.5	1.26
7000	23.0	1.28

Note: The effective heater-output rating at the draft recommended by the manufacturer for regions higher than sea level may be estimated by dividing the rated hourly heat output at sea level by the correction factor corresponding to the higher altitude indicated in the above table.

7.10 Calculation of heater efficiencies, ratings, etc. -

7.10.1 The calculation of results on all combustion data shall be based on figures

8 and 9 of this standard (on which allowances have been made for heat losses in the flue gas).

7.10.2 Readings and calculations shall be recorded on Data and Report Sheet similar to that included herein. (See page 13.)

8. PUBLICATION OF HEATER RATINGS

8.1 No published, listed, or labeled rating shall be based on efficiencies of less than 70 percent. All such ratings shall be determined as above outlined and shall be expressed thus:

"Output Btu per hr at draft with CS No. 1 oil."

8.2 The manufacturer's test data and certificate, recorded on a Data and Report Sheet similar to that included herein, and based on rating and performance tests conducted according to this standard either in the manufacturer's laboratory, or other adequately equipped laboratory which he may elect, are acceptable under this standard for publication of heater ratings.

9. LABELING

9.1 The following data shall be permanently affixed to each heater as evidence of compliance with the provisions of this standard:

(a) - At top of plate the wording "Commercial Standard CS101-63" in a size and style of type corresponding to that on the cover page of the printed standard (10 point Franklin gothic) or larger size type.

(b) - The manufacturer's or distributor's name.

(c) - Model number.

(d) - Output in Btu per hour at draft with CS #1 oil.

(e) - Heaviest grade of oil for which the heater is approved.

Note: The information required for commercial standard labeling may be combined with Underwriters' label or may be carried on a separate adjacent label.

10. INSTALLATION REQUIREMENTS AND PERFORMANCE TESTS

10.1 Installation. -

10.1.1 The heater must be connected to a chimney capable of producing the required draft.

10.1.2 The heater must be installed in accordance with the manufacturer's instructions.

10.1.3 The installation must comply with all local regulations, and should meet the requirements of N.F.P.A. Bulletin #31, published by the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts.

10.2 Field tests of installed heaters. - For the purpose of making field tests, the following minimum equipment and procedure are recommended.

10.2.1. Instruments required. - (1) A mercury-type flue-gas thermometer, long enough to reach the center of the stove pipe, and accurate within plus or minus 5° F. (2) Apparatus suitable for measuring the CO₂ content of the flue gas with an accuracy of plus or minus 0.5 percent. (3) A draft gage of suitable capacity with an accuracy of plus or minus

0.005-inch of water column. (4) Means for accurately measuring the flow rate of oil to the heater, either during the test or as adjusted for the test.

10.2.2 Test setup. - (1) Provide one or more openings in the stove pipe 18 inches from the flue outlet elbow (See fig. 2.) on the heater, for the flue-gas thermometer, the gas-sampling tube, and the draft tube. Do not insulate the stove pipe. (2) Provide for chimney draft slightly in excess of that shown on the heater name plate to insure proper operation of the draft regulator and heater.

10.2.3 Test procedure. - Light and warm up the heater, using the grade of oil recommended by the manufacturer. Adjust the draft to the value shown on the heater name plate. Adjust the fuel-input rate to the maximum recommended by the manufacturer, and operate the heater at this rate for at least 15 minutes. After this period, take draft and flue-gas temperature readings, then take flue gas sample and analyze for CO₂. Take three or more sets of readings and average the results. The observed flue gas temperatures and CO₂ values must fall within the limits given in the following table.

10.2.4 Table for checking results of oil-heater performance tests

Observed flue-gas temperature	Acceptable corresponding CO ₂ values from flue-gas analysis
Above 1000° F	Heater fails test
1000° F	9½% or more
900° to 999° F	8½% or more
800° to 899° F	7½% or more
700° to 799° F	6% or more
600° to 699° F	5% or more

Example: If a field test shows a flue-gas temperature of 950° F and a CO₂ reading of 8½ percent or more, the heater is performing satisfactorily.

STANDARD OIL-HEATER RATING TEST
Data and Report Sheet

Manufacturer's test No. -----

Oil heater -----
(Make) (Model, type, or No.) (Number and size of burners)
Fuel used for test -----
(Brand) (API gravity No. at 60° F)
Date of test ----- Tested by -----

Test data	Three sets of readings at equal intervals not less than 20 minutes apart.			Average.
1. Draft----- (in. of water) --	----	----	----	----
2. Room temperature----- (° F) --	----	----	----	----
3. Smoke-meter readings (spot #-) --	----	----	----	----
4. Fuel-temperature readings----- (° F) --	----	----	----	----
5. Time intervals used for fuel readings-----	----	----	----	----
6. Fuel input readings (specify units used)-----	----	----	----	----
7. Fuel-oil input rate ----- (lb/hr avg) --	----	----	----	----
8. Barometric pressure ----- (in. of mercury) --	----	----	----	----
9. Factor to correct fuel-oil input to sea level (see par. 7.9.2) --	----	----	----	----
10. Fuel-oil input (corrected to sea level)----- (lb/hr avg) --	----	----	----	----
11. Gross heating value of oil ----- (Btu/lb) --	----	----	----	----
12. Gross heat input (corrected to sea level) ----- (Btu/hr) --	----	----	----	----
13. Flue-gas temperature----- (° F) --	----	----	----	----
14. Flue-gas temp. rise above room temp-- (° F) --	----	----	----	----
15. CO ₂ in dry flue gas----- (%) --	----	----	----	----
16. CO ----- (%) --	----	----	----	----
17. Efficiency for complete combustion from charts (figs. 8 and 9) ----- (%) --	----	----	----	----
18. Heat output to room equals item 12 times item 17 (Btu/hr avg) --	----	----	----	----
19. Fuel-input rate for low-fire smoke test ----- (lb/hr) --	----	----	----	----
20. Smoke-meter readings at 20-min. intervals (low-fire test)----- (spot #-) --	----	----	----	----

We hereby certify that the above is a true and accurate copy of the data obtained when the above heater was tested in strict accordance with section 7 of Flue-Connected Oil-Burning Space Heaters and Recessed Heaters Equipped with Vaporizing Pot-Type Burners, Commercial Standard CS101-63

Date _____
For _____
Address _____
By _____

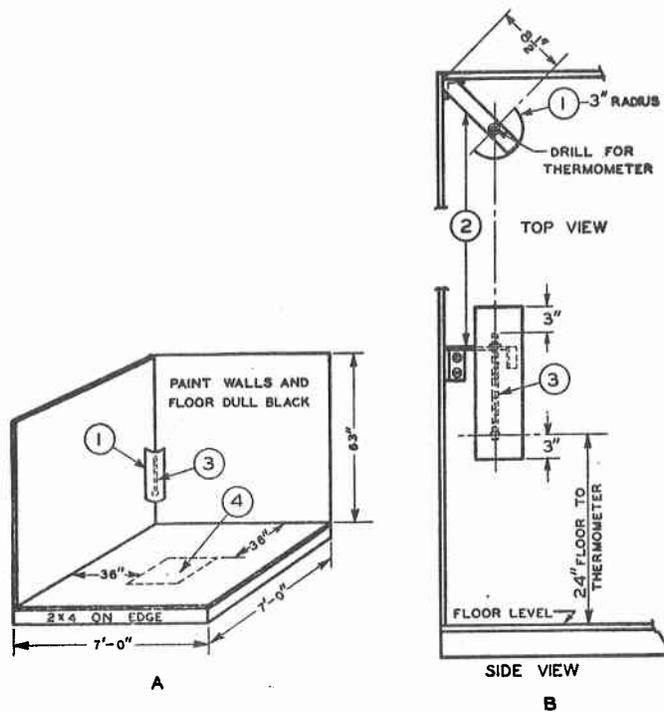


FIGURE 1.—Standard Underwriters' booth, or black corner.

1. Bright-aluminum baffle (No. 24 gage) 6 inches longer than item 3.
2. Bracket material $\frac{1}{4}$ -by-1-by-3-inch angle and $\frac{1}{4}$ -by-1-by-16-inch strap iron.
3. Thermometer, supported by bracket.
4. Location of heater on platform.

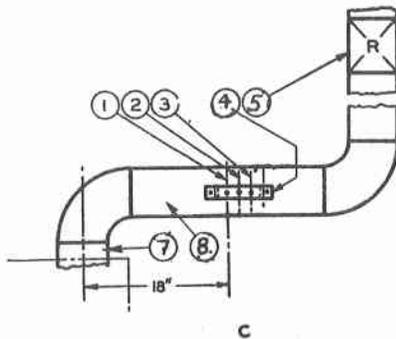


FIGURE 2.—Heater flue connections.

1. Center line of thermocouple, see figures 3 and 4.
2. Gas-sampling tube, see figure 3.
3. Draft tube, see figure 3.
4. Support bracket, see figure 3.
5. Draft regulator.
6. Seal all openings in stove pipe below gas-sampling tube.
7. Heater flue collar.
8. Section of stove pipe, same nominal diameter as heater flue collar.

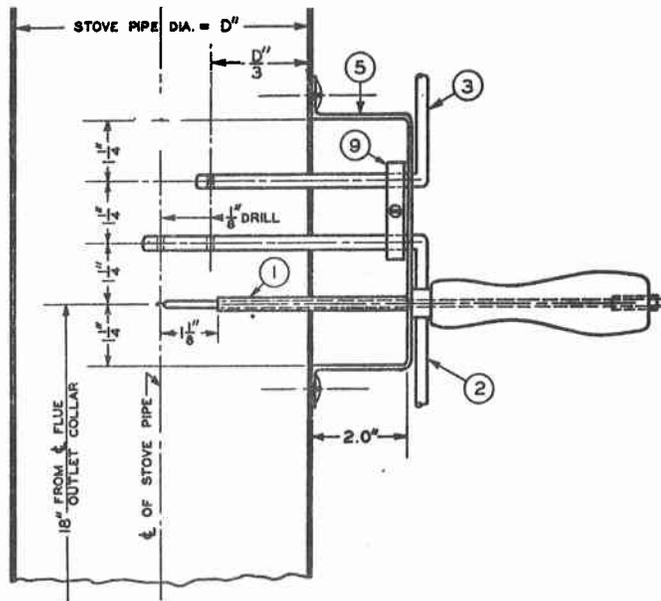


FIGURE 3.—Gas-sampling and draft tubes, thermocouple and support bracket assembly.

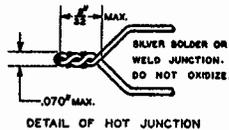
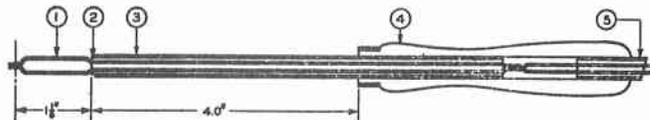


FIGURE 4.—Standard thermocouple for flue-gas temperature measurement.

1. 10'—No. 20 B&S gage iron-constantan, asbestos, or woven glass-covered thermocouple wire extending from hot junction to potentiometer or reference junction.
2. 1—Leeds & Northrup standard 714B, or equal, 1/4 inch O. D.—2-hole porcelain insulator cut 6.0 in. long and ends beveled on two sides.
3. 1—1/4-inch O. D. by 0.032-inch wall half-hard yellow-brass tubing cut 6 3/4 inches long. Ream, if necessary, to fit over insulator then crimp ends over beveled ends of insulator.
4. 1—Small wooden handle.
5. 1—Piece of rubber tubing, 3/16 by 3/16 by 2 inches long.]

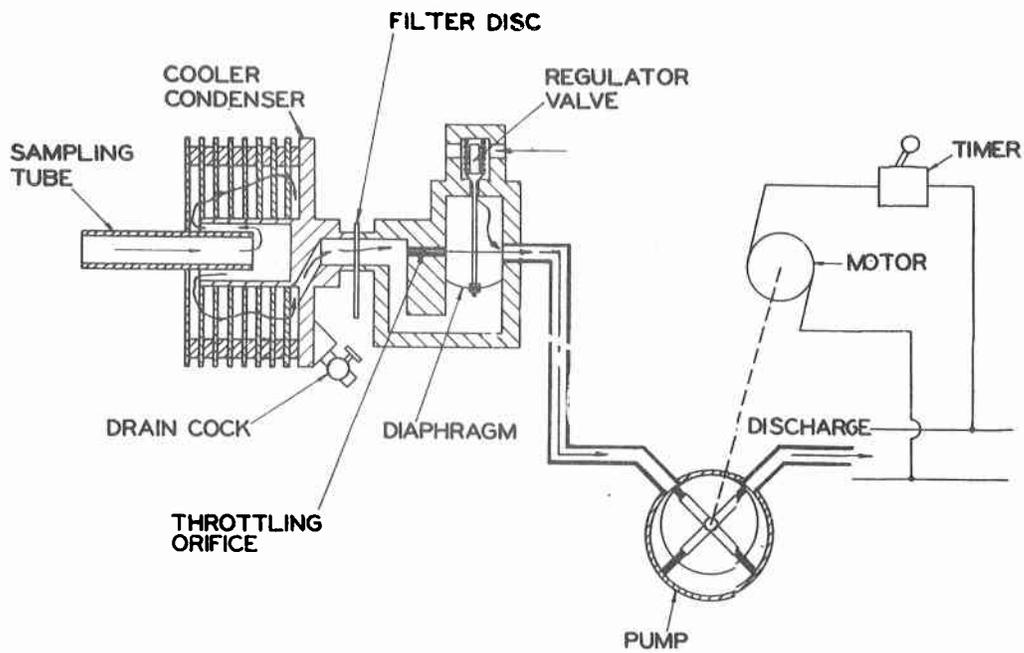


Figure 5. Laboratory-type smoke meter.

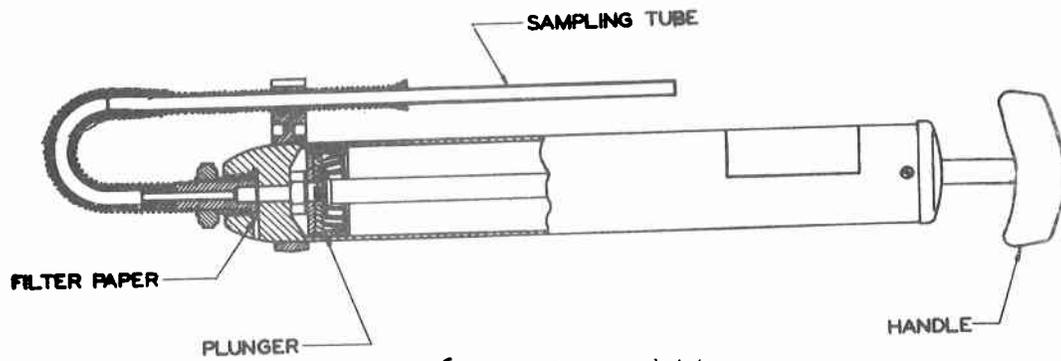


FIGURE 6 *Field-service-type smoke tester.*

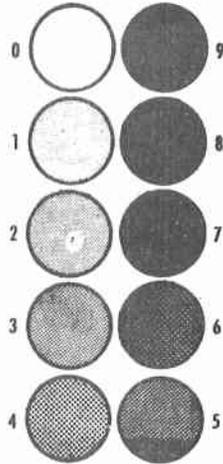


FIGURE 7. Smoke scale for filter-paper method for determining smoke density of flue gases.
 (Caution: Above illustration is not a usable smoke scale.)

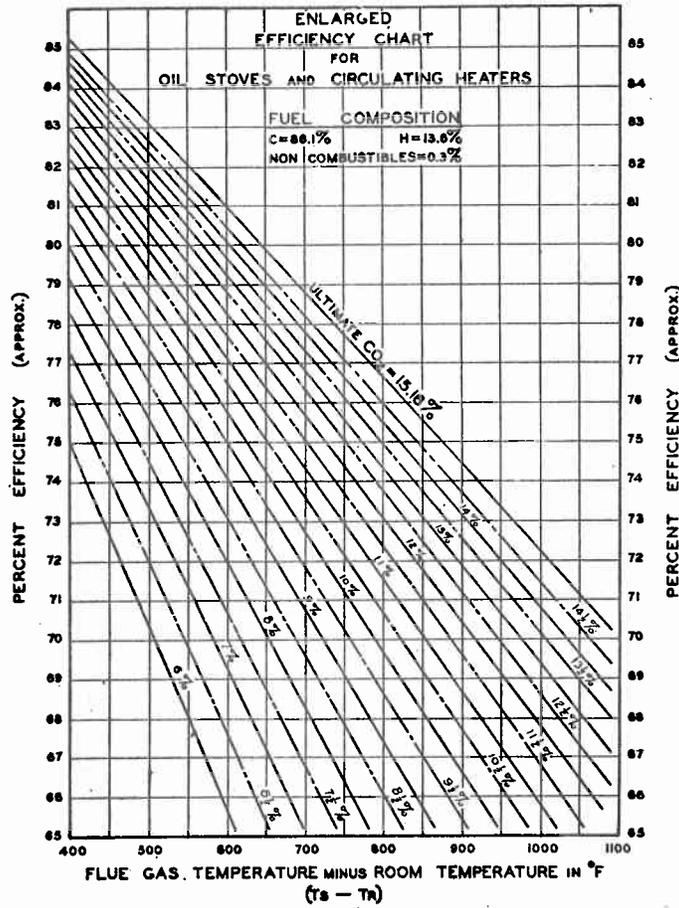


Figure 8. Enlarged efficiency chart

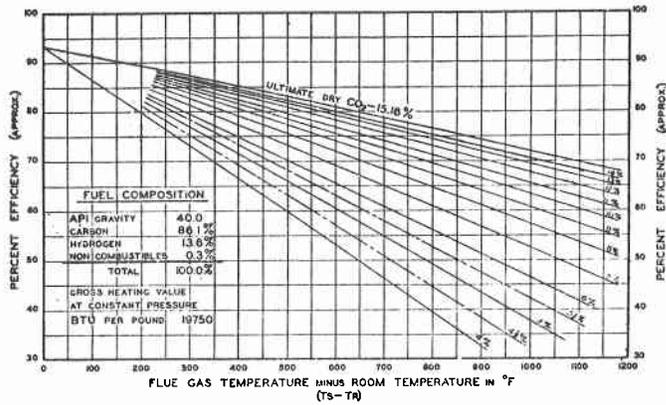


FIGURE 9.—Efficiency chart.

HISTORY OF PROJECT

First edition. - At the request of the Institute of Cooking & Heating Appliance Manufacturers (now the Institute of Appliance Manufacturers) the Commercial Standard for oil-burning space heaters was initiated on April 29, 1941. Proposals were considered in conferences in Cincinnati, Ohio and Chicago, Illinois, and the adopted draft was circulated to the trade on February 2, 1942. It was generally accepted by the industry and was announced on April 3, 1942 as Commercial Standard CSL01-43, effective January 1, 1943.

First revision. - With the cooperation of the Oil Division, Institute of Appliance Manufacturers a revision of the Commercial Standard was initiated in June 1958 and a draft was developed. At a meeting in connection with the Institute's Annual Convention in Cincinnati, Ohio on June 3, 1959, the equipment manufacturers considered various comments on the draft and recommended a number of improvements.

After further development in 1960 and 1961, the proposed revision was submitted to the Commodity Standards Division on August 24, 1962. It was circulated as a recommended revision of CSL01-43, on November 1, 1962, to producers, distributors, users and others interested in oil-burning space heaters and recessed heaters for consideration and endorsement.

The signed acceptances subsequently received were satisfactorily representative of the industry, and an announcement was issued on July 1, 1963 that the revised standard, designated CSL01-63 would become effective August 1, 1963.

Project Manager: H. A. Bonnet, Office of Commodity Standards, National Bureau of Standards, U.S. Department of Commerce.

Technical Advisors: James V. Ryan, Fire Research Section, National Bureau of Standards, U.S. Department of Commerce.
Marc Resek, Institute of Appliance Manufacturers' Engineering Consultant

STANDING COMMITTEE

The Standing Committee was being formed when this standard was published. The chief functions of the committee are to consider proposed revisions, and make recommendations for keeping the standard abreast of progress. Such changes are circulated for industry review and acceptance prior to adoption and issue.

Comments on the standard and suggestions for revision may be referred to a member of the committee or to the Office of Commodity Standards, National Bureau of Standards, U.S. Department of Commerce, which acts as secretary for the committee. Further information on the committee may be obtained from the Office of Commodity Standards.

ACCEPTORS

The manufacturers, distributors, users, and others listed below have individually indicated in writing their acceptance of this Commercial Standard prior to its publication. The acceptances indicate an intention to utilize the Standard as far as practicable, but reserve the right to depart from it as may be deemed desirable. The list is published to show the extent of recorded public support for the Standard, and should not be construed as indicating that all products made by the acceptors actually comply with its requirements.

Products that meet all requirements of the standard may be identified as such by a certificate, grade mark or label. Purchasers are encouraged to require such specific representation of compliance, which may be given by the manufacturer whether or not he is listed as an acceptor.

ASSOCIATIONS (General Support)

American Institute of Architects, Washington, D.C.
American Specification Institute, Chicago, Ill.
Associated General Contractors of America, Washington, D.C.
Institute of Appliance Manufacturers, Washington, D.C.

Sears, Roebuck and Co., Chicago, Ill.
Shell Oil Co., New York, N.Y.

Underwriters' Laboratories, Inc., Chicago, Ill.
United States Testing Co., Inc., Hoboken, N.J.

Vann Industries, Inc., Clinton, N.C.

FIRMS AND OTHER INTERESTS

Albion Division, McGraw-Edison Co., Albion, Mich.
Atchison, Topeka & Santa Fe Railway Co., The, Topeka, Kans.

Coleman Co., Inc., The, Wichita, Kans.
Controls Co. of America, Heating & Air Conditioning Division, Milwaukee, Wis.

Detroit Testing Laboratory, Inc., The, Detroit, Mich.

Heil-Quaker Corp., Nashville, Tenn.

Kresky Mfg. Co., Inc., Petaluma, Calif.

Lear Siegler, Inc., Siegler Heater Division, Centralia, Ill.

Monogram Industries, Inc., Quincy, Ill.

New York State Building Codes Bureau, Division of Housing & Community Renewal, New York, N.Y. (General Support).
Northwest Metal Products, Inc., Kent, Wash.

Preway, Inc., Wisconsin Rapids, Wis.

Resek, Marc, Research & Development, Inc., Shaker Heights, Ohio (General Support)

U.S. GOVERNMENT

Department of the Army, Chief of Engineers, Washington, D.C. (General Support).
Department of Health, Education and Welfare, Procurement & Supply Management Branch, Washington, D.C.
Department of the Interior, Division of Property Management, Washington, D.C.
Housing and Home Finance Agency, Public Housing Administration, Washington, D.C.
Post Office Department, Bureau of Facilities, Washington, D.C.
Veterans Administration, Washington, D.C.

ACCEPTANCE OF COMMERCIAL STANDARD

CS101-63 Flue-Connected Oil-Burning Space Heaters and Recessed Heaters
With Vaporizing Pot-Type Burners

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this Commercial Standard.

Date _____

Office of Commodity Standards
National Bureau of Standards
U.S. Department of Commerce
Washington, D.C. 20234

Gentlemen:

We believe that this Commercial Standard constitutes a useful standard of practice, and we individually plan to utilize it as far as practicable in the

production¹ distribution¹ purchase¹ testing¹
of this commodity.

We reserve the right to depart from the standard as we deem advisable.

We understand, of course, that only those articles which actually comply with the standard in all respects can be identified or labeled as conforming thereto.

Signature of authorized officer _____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer _____

Organization _____
(Fill in exactly as it should be listed)

Street address _____

City, State, and ZIP code _____

¹ Underscore the applicable words. Please see that separate acceptances are filed for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interest, trade associations, trade papers, etc., desiring to record their general support, the words "General Support" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. Enforcement. - Commercial Standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. The acceptor's responsibility. - The purpose of Commercial Standards is to establish, for specific commodities, nationally recognized grades or consumer criteria, and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the standard, where practicable, in the production, distribution, or consumption of the article in question.

3. The Department's responsibility. - The major function, performed by the Department of Commerce in the voluntary establishment of Commercial Standards on a nationwide basis is fourfold: First, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. Announcement and promulgation. - When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or of the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

DEPARTMENT OF COMMERCE

National Bureau of Standards

VOLUNTARY PRODUCT STANDARDS

Notice of Intent To Withdraw Certain Standards

In accordance with § 10.12 of the Department of Commerce Procedures for the Development of Voluntary Product Standards (15 CFR Part 10, as revised, 35 F.R. 8349 dated May 28, 1970), notice is hereby given of the Department's intent to withdraw the 62 standards identified below. It has been tentatively determined that each of these Commercial Standards (CS) and Simplified Practice Recommendations (SPR) are obsolete, no longer technically adequate, no longer generally acceptable to and used by the industry, inconsistent with established policy, or otherwise inappropriate, and revision is not feasible or would serve no useful purpose.

- CS 14-51 Boys' Sport and Dress Shirt (Woven Fabrics) Size Measurements.
- CS 33-43 Knit Underwear (Exclusive of Rayon).
- CS 56-60 Strip Oak Flooring.
- CS 70-41 Phenolic Disinfectant (Emulsifying Type).
- CS 71-41 Phenolic Disinfectant (Soluble Type).
- CS 90-53 Power Cranes and Shovels.
- CS 101-63 Flue-Connected Oil-Burning Space Heaters and Recessed Heaters with Vaporizing Pot-Type Burners.
- CS 104-63 Warm-Air Furnaces Equipped with Vaporizing-Type Oil Burners.
- CS 106-57 Boys' Pajama Sizes (Woven Fabrics).
- CS 109-44 Solid-Fuel-Burning Forced-Air Furnaces.
- CS 111-43 Earthenware (Vitreous-Glazed) Plumbing Fixtures.
- CS 113-63 Oil-Burning Floor Furnaces Equipped with Vaporizing Pot-Type Burners.
- CS 128-52 Men's Sport Shirt Sizes-Woven Fabrics (Other than Those Marked with Regular Neckband Sizes).
- CS 129-47 Materials for Safety Wearing Apparel.
- CS 131-46 Industrial Mineral Wool Products, All Types—Testing and Reporting.
- CS 134-46 Cast Aluminum Cooking Utensils (Metal Composition).
- CS 135-46 Men's Shirt Sizes (Exclusive of Work Shirts).
- CS 145-47 Testing and Rating Hand-Fired Hot Water Supply Boilers.
- CS 152-48 Copper Naphthenate Wood Preservative (Spray, Brush, Dip Applications).
- CS 158-49 Model Forms for Girls' Apparel.
- CS 165-50 Zinc Naphthenate Wood Preservative (Spray, Brush, Dip Applications).
- CS 174-41 140-F Drycleaning Solvent.
- CS 177-62 Bituminous-Coated Metal Septic Tanks (Residential).
- CS 178-51 Testing and Rating Ventilating Fans (Axial and Propeller Types).
- CS 180-52 Model Forms for Boys' Apparel.
- CS 183-51 Boys' Trouser Size Measurements.
- CS 185-52 Wool Felt.
- CS 186-52 Boys' Sport Outerwear Size Measurements.

- CS 195-60 Warm-Air Furnace Burner Units Equipped with Pressure-Atomizing or Rotary Type Oil Burners.
- CS 196-55 Model Forms for Toddlers' and Children's Apparel.
- CS 198-55 Infants', Children's, Girls' and Boys' Knit Underwear (Exclusive of Rayon, Acetate, and Nylon).
- CS 216-58 Asphalt Insulating Siding.
- CS 235-61 Pressure Treated Wood Fence Posts (With Oil-Type Preservatives).
- CS 249-62 Pressure-Treated Douglas Fir Marine Piles.
- CS 250-62 Pressure-Treated Southern Pine Marine Piles.
- CS 271-65 Grading of Abrasive Grain for Grinding Wheels.
- SPR 17-47 Heavy Forged Hand Tools.
- SPR 44-49 Boxboard Thicknesses.
- SPR 60-55 Machine, Carriage and Lag Bolts, and Nuts (Case Quantity and Gross Weight).
- SPR 72-27 Solid Section Steel Windows.
- SPR 77-45 Hickory Handles.
- SPR 100-47 Welded Chain.
- SPR 125-31 Waxed Tissue Paper.
- SPR 136-32 Flax and Hemp Twine.
- SPR 147-42 Wire Diameters for Mineral Aggregate Production Screens.
- SPR 157-50 Steel Firebox Boilers and Steel Heating Boilers (Commercial and Residential).
- SPR 163-48 Coarse Aggregates (Crushed Stone, Gravel, and Slag).
- SPR 168-37 Braided Shoe Laces.
- SPR 180-41 Copper Conductors for Building Purposes.
- SPR 183-48 Brass or Bronze Valves (Gate, Globe, Angle, and Check).
- SPR 184-47 Iron Valves (Gate, Globe, Angle, and Check).
- SPR 185-47 Pipe Fittings (Gray Cast-Iron, Malleable Iron, and Brass or Bronze).
- SPR 190-42 Stove Pipe and Accessories.
- SPR 198-50 Wire Rope.
- SPR 207-60 Pipes, Ducts, and Fittings for Warm Air Heating and Air-Conditioning Systems.
- SPR 214-55 Metal-Cutting Band Saws (Hard Edge Flexible Back).
- SPR 220-46 Open-End and Box Wrenches.
- SPR 227-47 Plumbing Fixture Fittings and Trim for Housing.
- SPR 229-63 Vises (Machinists' and Other Bench-Mounted Vises).
- SPR 238-50 Convectors.
- SPR 245-51 Weldless Chain and Chain Products.
- SPR 259-56 Hexagon-Head Cap Screws (Case Quantity and Gross Weight).

Any comments or objections concerning the intended withdrawal of any of these standards should be made in writing and directed to the Office of Engineering Standards Services, National Bureau of Standards, Washington, D.C. 20234, within 45 days of the publication of this notice. The effective date of withdrawal, where appropriate, will be not less than 60 days after the final notice of withdrawal. Withdrawal action terminates the authority to refer to a published standard as a voluntary standard developed under the Department of Commerce procedures, from the effective date of the withdrawal.

Dated: June 16, 1972.

LAWRENCE M. KUSHNER,
Acting Director.

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