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MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Meeting of the Z21/CSA Lint Dust and Oil Working Group

PLACE: Raddison Hotel Cleveland Southwest, Cleveland, OH

MEETING DATE: January 29, 2002

LOG ENTRY SOURCE: Donald W. Switzer *DWS*

ENTRY DATE: April 2, 2002

COMMISSION ATTENDEES:

Donald W. Switzer ES

NON-COMMISSION ATTENDEES:

See attached

MEETING SUMMARY

The minutes of the January 29, 2002 meeting of the Z21/CSA Lint, Dust, and Oil Working Group are attached. They accurately reflect actions taken at the meeting.

2/11/02
10:00 AM - 3:00 PM





CSA AMERICA INC

March 18, 2002

Z21/CSA LINT DUST AND OIL WORKING GROUP:

The minutes of your January 29, 2002 meeting were issued to the working group on February 1, 2002. The minutes are now being released for general distribution.

If there are any questions, please contact me at 216-524-4990 ext. 8213 or via email at julie.cairns@csa-america.org.

Sincerely,

JULIE A. CAIRNS
Standards Engineer

Enc.

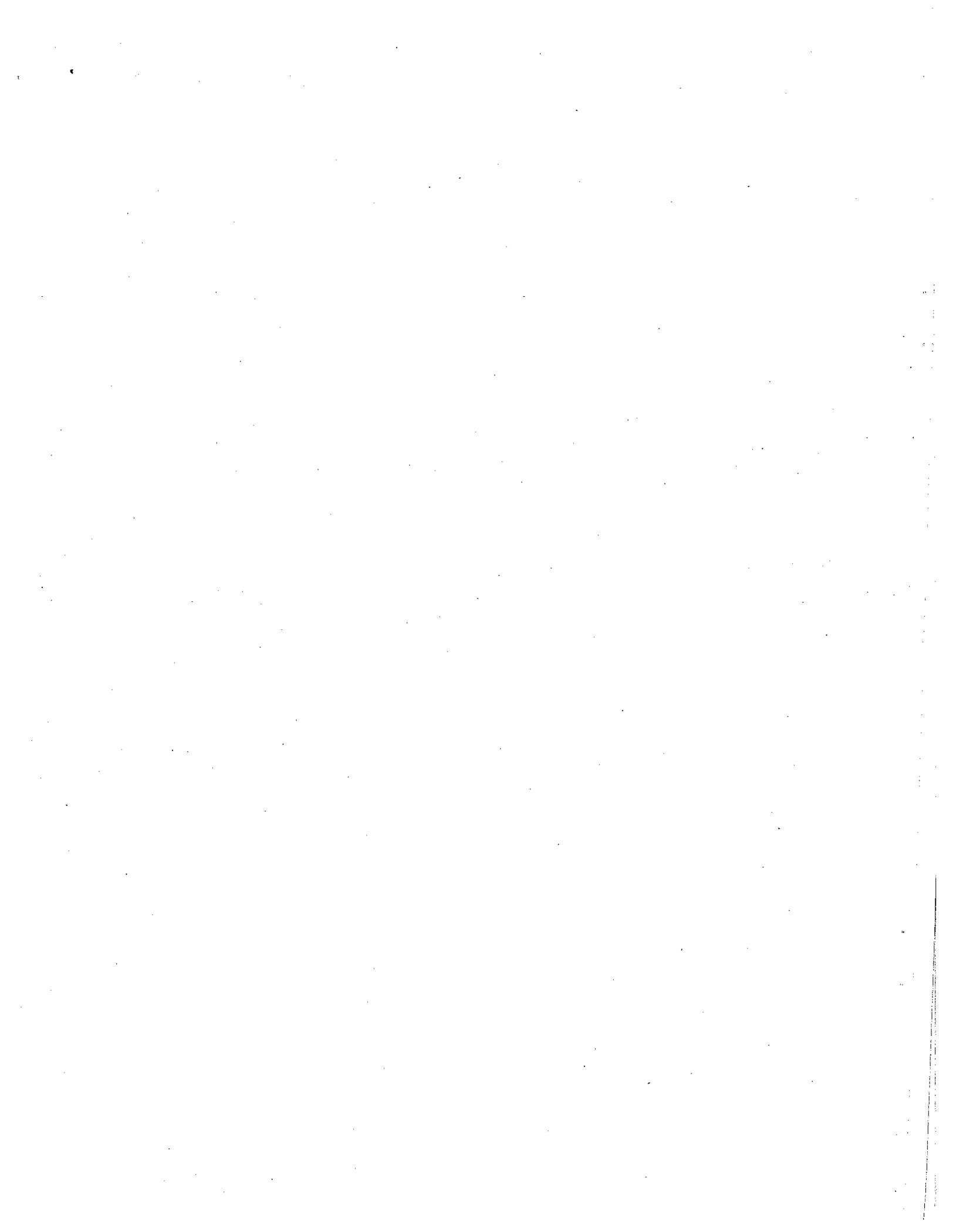
cc: D. Hosler
D. Switzer
B. Swiecicki
F. Stanonik
L. Wethje
G. Tubrett
Senka Krsikapa



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Lint, Dust and Oil Working Group of the
Z21/CSA Joint Subcommittee on Standards for Gas Water Heaters

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Minutes of Meeting
of
Lint, Dust and Oil Working Group of the
Z21/CSA JOINT SUBCOMMITTEE ON STANDARDS
FOR GAS WATER HEATERS

Held at
Radisson Hotel Cleveland Southwest
7230 Engle Road
Middleburg Heights, OH 44130

January 29, 2002

The meeting of the working group was called to order by the chairman at 9:10 a.m., Eastern Standard Time, Tuesday, January 29, 2002. Self-introductions followed. During the course of the meeting, the following were in attendance.

Members Present or Represented

Charles W. Adams (Chairman)
William T. Harrigill
Larry Kidd (represented by Mark Taylor)
Jim Ranfone
Tim Shellenberger
Drew Smith
Donald Switzer

Administrative Staff

Julie A. Cairns, Acting Secretary

Guests

Bob DeRemer, CSA International
Dale Shropshire, A. O. Smith Water Products Company
Rodney Syler, State Industries Inc.
James York, American Water Heater Company

Members Absent

David Baxter
Ronnie Ray Frazier
David Johnston
John Paisley
John Overall

Approval of Minutes of October 30, 2001 Meeting

Subject

Approve the minutes of the October 30, 2001 meeting.

**Minutes of Lint, Dust and Oil Working Group of the
Z21/CSA Joint Subcommittee on Standards for Gas Water Heaters
October 30, 2001**

History

The minutes of the October 30, 2001 meeting were issued to members of the Lint, Dust and Oil Working Group on January 7, 2002 for 30-day review. No comments were received on the draft minutes.

Subcommittee Action

The minutes of the working group's October 30, 2001 meeting were approved as recorded.

- Item 1. Proposed Lint, Dust and Oil Test Protocol For Volume I Water Heaters**
[reconsideration in light of comments received on the November 2001 review and comment text]

Subject:

Reconsider, in light of comments received, proposed revisions to the proposed Harmonized American National Standard/CSA Standard for Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less, Z21.10.1•CSA 4.1, and accompanying rationale statements, distributed for review and comment during November 2001.

The working group was requested to make recommendations to the joint subcommittee concerning:

- 1) adopting proposals without substantive change for presentation to Accredited Standards Committee Z21/83 and the CSA Technical Committee for consideration of approval.
- 2) Adopting substantive revisions for redistribution for review and comment.

History:

By letter ballot dated November 5, 2001, the joint water heater subcommittee adopted proposed revisions to the harmonized American National Standard/ CSA Standard for Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less, Z21.10.1•CSA 4.1, for distribution for review and comment. The proposed revisions to incorporate a lint, dust and oil test protocol in the volume I water heater standard were distributed for review and comment during November 2001.

At its December 12, 2001 meeting, the joint water heater subcommittee reviewed comments received on the proposed coverage as a result of the November 2001 distribution for review and comment. The joint subcommittee reconsidered proposed coverage through "Method of Test", Set-up paragraph "e" in light of comments received. The joint subcommittee unanimously referred the proposed coverage to the lint, dust and oil working group for review in light of the remainder of comments received. The subcommittee noted that the actions taken by the joint subcommittee at this meeting on other comments are to be retained. The comments received and subcommittee actions at the December 12, 2001 meeting and the proposed lint, dust and oil test protocol as modified by joint subcommittee were presented to the working group for review.

Working group was advised that the recommendations from this meeting will be presented to the joint subcommittee for consideration by letter ballot. The joint subcommittee indicated its intent that the proposed lint, dust and oil test be presented to the parent committees for approval at their April 2002 meeting.

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The working group proceeded to review the proposed lint, dust and oil test protocol in light of comments received. All of the comments received are included below. Where the joint subcommittee had already acted on a comment, no working group action is recorded.

SECTION: General

COMMENTOR(S):

Ronnie Ray Frazier, TXU Electric & Gas

Comments:

1. I believe the extremely short amount of time allowed for comment on this proposal can not be considered a proper public review period.

2. I believe that the proposed test is overly complicated and Subject: to implementation and environment variations by different listing agencies creating a condition that would allow a flame arrestor type water heater to pass at one location and fail at another. A simpler test that would restrict the combustion air can be devised and will not be proprietary to location or personnel conducting the test.

Subcommittee Discussion:

During discussion, one member expressed concern that the proposed test is too complicated and a simpler test should be developed. In addition, comment was made that additional studies should be conducted to determine the affects of humidity on the test results and whether there are other issues yet to be determined.

Subcommittee Action

No action.

SECTION: General

COMMENTOR(S):

Jim Ranfone, American gas Association

Comments

I am voting no for the following reasons: First, in reviewing the Rationale statement, it states that independent research in a number of areas was conducted. That information needs to be made available for public review in order to be able to constructively comment on the methodology being proposed. The Rationale statement goes on to state that the protocol "most closely represents environmental conditions found in North America". The proposed test method appears to be an onerous procedure that leaves a substantial amount of technician judgement that may be suitable for product development, but does not belong in a standard. For example, the LDO Rate and Composition section states that the injection cycle noted below is to be performed repeatedly throughout the test. How is repeatedly defined? That same section requires that the lint and dust injections be made "uniformly", but goes on to permit instantaneous spikes that are "evenly distributed". Once again, this procedure is very subjective and can result in units either passing or failing depending on individuals test technique. I also do not believe that such a test should apply to all residential gas water heaters. If it is determined that one is needed, it should only be applied to water heaters with flame arrestor technology since this is the design option that has been allegedly found to be susceptible to lint blockage in certain circumstances. I would also recommend that, if

**Minutes of Lint, Dust and Oil Working Group of the
Z21/CSAJoint Subcommittee on Standards for Gas Water Heaters
October 30, 2001**

there is a determination that an inlet blockage test is necessary, a less complicated gradual inlet restriction test could have been easily developed.

It is my understanding that all water heater manufacturers support this proposed LDO test. The September 10, 2001 letter from CSA International that establishes the effective date for water heaters to meet the flammable vapor test protocol and a lint test protocol states that as of October 1, 2001 CSA is accepting product for design certification testing including a "lint test protocol". I am aware that gas fired water heaters equipped with flame arrestor technology have been sold and installed for over two years and have not been a source of any problems that would require this type of severe test being made a requirement in the standard. Because of these facts, there is no need to accelerate the process of proposing a LDO test until the requested backup information is available and a decision is made to propose incorporation of this or a similar test is determined.

I believe that it is prudent to obtain adequate field evaluation before another test requirement is proposed for adoption into the standard to minimize any negative unintended consequences on the products performance. It would be a major concern to everyone if flame arrestors have had to be redesigned in order to pass the proposed LDO test resulting in premature, nuisance shut downs of water heaters in the field.

The flammable vapor resistance test currently in the standard was approved for adoption based on the statements that the water heater manufacturers were ready to go and there were many units on lengthy field test with no reported problems. We should not be adding requirements into the standard without fully evaluating the implications of such requirements.

Finally, I believe that the 14-day turn around to comment on this proposal is not adequate especially since it included the 2-day Thanksgiving Day holiday. It certainly appears to be counter to reasonableness and the spirit of the public review process.

Subcommittee Discussion:

The joint subcommittee was informed that during the development of the proposed lint dust and oil test, there was a lot of work done to determine whether an alternate test could be developed. Further comment was made that the results of the alternative tests were not repeatable. Evaluation of units using the proposed test method produce repeatable results. The proposed test allows the appliance to interact with the environment and is not difficult to perform.

The subcommittee was also informed that the suggestion to incorporate a simpler test was reviewed by the lint, dust and oil working group at its October 30, 2001 meeting. (i.e, gradually restricting the flame arrestor to total blockage that would result in the unit shutting down prior to exceeding .04 percent carbon monoxide (CO) in an air-free sample of flue gases.)

The manufacturer members commented that the variations in design of the water heaters does not make this option feasible. Further comment was made that since the water heater designs vary, the method for blocking the flame arrestor would also vary and it would be difficult to standardize a test method thus increasing the potential for human error. It was noted that this approach was considered during the early stages of development and was not repeatable and further is not representative of known field conditions.

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During discussion, some members commented that they are not aware of problems with lint in the field and since the issue was brought up in regards to information on problems with lint build up on water heaters using the flame arrestor technology the test should be restricted to units using that technology. In response, it was noted that there are other sensor technologies used that are susceptible to lint, dust and oil and therefore it should not be restricted to the flame arrestor technology. It was further noted that while to date there have been no known problems with lint build up in the field, the subcommittee is aware of the potential and agreed therefore the issue should be addressed in the standard. The joint subcommittee noted that the proposed test would apply to all water flammable resistant water heaters.

Subcommittee Action

The joint subcommittee endorsed the concept of inclusion of the lint dust and oil coverage in the standard after it is reviewed in light of comments received.

One member objected stating the following reasons:

1. The proposed LDO test is much too complex for the information contained. It reduces mass flow through the water heater, which can be done in many ways much simpler than this test.
2. If the test were to test the self-cleaning features of a water heater, then some benefit would be derived.
3. The written substantiation is inadequate.
4. If adequate substantiation is developed or discovered, the water heaters need to be self-cleaning and/or those that shutdown need to be designed so they may be cleaned, reset and re-lit.
5. This extensive testing is designed to verify compliance with a 400 ppm CO standard, which has no (or little) scientific basis.
6. The LDO test is not enough like field conditions to be worth it. There is no dust bunny test nor a floating plastic bag test.

One member abstained stating the following reasons:

"While the test procedure itself is well-developed and robust, I do not believe that sufficient consideration has been given to the need for coverage of this scope and magnitude in the standard, nor have other alternatives been sufficiently explored."

SECTION: (Page 1) 2.XX

COMMENTOR(S):

David T. Berning, A. O. Smith Water Products Co.

Suggested Revision:

2.XX Resistance to Lint, Dust and Oil Accumulation

Water heaters shall not produce flue gases that contain a concentration of carbon monoxide in excess of 0.04 percent on an air free basis, in an air free sample of flue gas when exposed to lint, dust and oil under the following Method of Test. This requirement shall be considered met when:

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- a. The water heater completes the Burner Cycle Sequence and the carbon monoxide concentration reaches equilibrium, as defined in the following Method of Test, not in excess of 0.04 percent in an air free sample of flue gases; or
- b. the water heater shuts down prior to producing a carbon monoxide concentration in excess of 0.04 percent in an air free sample of the flue gases, and requires a manual restart to resume operation.

Rationale: Use the improved wording as in 2.4.1 Eliminate repetition.

Subcommittee Action

Accept. Editorial.

SECTION: (Page 1) "Method of Test"

COMMENTOR(S):

William Harrigill, Rheem Water Heater Division

Suggested Revision:

"Prior to beginning the test, at the manufacturer's request, the water heater may be cleaned allowed to operate to remove machining oils from manufacturing that may cause erroneous test results."

Rationale: The intent of this provision is to better represent the condition of units as they will be exposed to lint, dust and oil over time in actual installations. The provision as stated would permit cleaning in any manner including disassembly that would not be representative of actual use.

Subcommittee Discussion:

The joint subcommittee noted that allowing the unit to run for a period of time to burn off machine oils most closely represents field usage. It was further noted that there is no need to specify the amount of time. The manufacturer can specify whatever time he believes will burn off the oils from the manufacturing process.

Subcommittee Action

Accept in principal.

"Prior to beginning the test, at the manufacturer's request, the water heater may be cleaned operated to remove machining oils from the manufacturing process that may cause erroneous test results."

SECTION: (Page 1) "Method of Test", first paragraph

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

This paragraph should be revised to "Prior to beginning the test, at the manufacturer's request, the water heater may be operated, with the main burner on, to remove machining oils from the manufacturing process that may cause erroneous test results."

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Rationale:

Subcommittee Action

Accept in principle. See previous action on "William Harrigill" comment.

SECTION: (Page 1) "Method of Test", fifth paragraph

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

The viscosity of the corn oil should be specified in this paragraph.

Rationale:

Subcommittee Action

Accept. The joint subcommittee directed staff to obtain range of viscosity specifications for the corn oil used during the verification testing. The subcommittee agreed this would require redistribution for review and comment. It was agreed the proposed coverage could go forward to the parent committee for processing without the viscosity specifications. (*Also see discussion under Item 2 of these minutes.*)

SECTION: (Page 1) "Set-up," 3rd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Figure "XX" should be Figure "14"

Rationale: Figure 14 is the next available figure in ANSI Z21.10.1/CSA 4.1

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section b

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Metric conversion of 100 square inches is 645 cm² (was 484 cm²)

Rationale: Editorial

Subcommittee Action

Accept. Editorial.

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SECTION: (Page 2) "Method of Test", Set-up paragraph "b"

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

A second sentence should be added "Located as specified in Figure XX."

Rationale:

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section c

COMMENTOR(S):

Bruce Geren, General Services Administration

Suggested Revision:

For consistency of like symbols, recommend expressing 80 "+/-" as 80 "±"

Rationale:

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section c

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Strike "(See Appendix G.)"

Rationale: Information is reference only and is not required to be part of Standard.

Subcommittee Action

Withdrawn by submitter at the meeting.

SECTION: (Page 2) Section c, 2nd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Add "(See Figure 15 & 16)" after "duct" and before ","

Rationale: The lint & dust injection tube is the only item needing detail from Appendix G. This will simplify the standard and allow for manufacturers to identify other means of mixing & introducing lint & dust to the injection tube.

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Subcommittee Action

Accept. Editorial.

SECTION: : (Page 2) Section c, 2nd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Replace the word "to" after "perpendicular" with "and flush with"

Rationale: Clarifies lint & dust injection tube outlet location.

Subcommittee Action

Accept. Editorial. Replace the word "to" after "perpendicular" with "and flush with the insider wall surface".

SECTION: (Page 2) Section c, 2nd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Figure "xx" should be figure "14"

Rationale: Figure 14 is the next available figure in ANSI Z21.10.1/CSA 4.1

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section d, 1st Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

"Micrometers" should be "Microns"

Rationale: Metric standard for 10^{-6} .

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section d, 2nd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Add "...and extending $5/8 \pm 1/8$ " (1.58 cm \pm .32 cm) into the test chamber"

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Rationale: Clarified oil nozzle outlet location currently used today.

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) Section d, 2nd Sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Figure "xx" should be "14"

Rationale: Figure 14 is the next available figure in ANSI Z21.10.1/CSA 4.1

Subcommittee Action

Accept. Editorial.

SECTION: (Page 2) "Method of Test", Set-up paragraph "d"

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

There are two holes in Figure XX for oil injection. Are there two spray guns?

Rationale:

Subcommittee Discussion:

During discussion, it was noted that the proposed drawing shows two openings. Further comment was made that if two nozzles are used, the standard should specify the injection rate because this could be handled with one nozzle/gun. Two manufacturers noted that they are currently conducting the test using only one nozzle. The joint subcommittee agreed that revising the test to specify a fixed horizontal line for atomizer openings would address this issue and eliminate any confusion or discrepancies of using one or more atomizer nozzles.

Subcommittee Action

Accept. Editorial. The joint subcommittee revised the proposed coverage as follows:

- a. An atomizer spray gun, capable of producing oil droplets less than 10 micrometer in diameter, to introduce the oil into the test room. The axis of the atomizer nozzle shall be installed perpendicular to the wall of the test chamber at the location specified in Figure XX.

Working Group Recommendation

The working group recommended subcommittee adoption of modifications of the "Front View" drawing in Figure 14 to specify the location of the atomizer opening on a fixed horizontal line as agreed to by the joint subcommittee at its December 12, 2001 meeting for submittal to the

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Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 2) "Method of Test," Set-up paragraph "e"
COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

Comment (1) - The Ambient air temperature should be defined as "inside the lint test room" or "surrounding the outside of the lint test room".

Comment (2) -a sample tube with multiple inlet openings (minimum 3 @ 120° apart) to average the sample taken and be configured to minimize resistance.....

Rationale:

Subcommittee Discussion:

During discussion it was noted that the test does not specify measurement of the ambient air temperature in the chamber and the temperature in the chamber is not maintained. Additional comment was made that based on experience room temperature is between 68°F and 80°F degrees there is no data to indicate temperature variances have affected the test results. The joint subcommittee agreed for consistency to use the same specifications as specified in the resistance to flammable vapors test plus or minus 10 degrees rather than 5. During discussion it was noted that specifying a 5°F degree tolerance could require additional conditioning of the air and may alter conditions.

Subcommittee Action

Accept in Principle. The joint subcommittee agreed to modify the proposed coverage as follows:

b. Instruments to measure and record the following:

- Test room pressure
- Ambient air temperature
- Water heater flue carbon monoxide concentrations*
- Water heater flue carbon dioxide concentrations*
- Water heater inlet supply water temperature
- Water heater outlet water temperature
- Manifold pressure
- Pilot millivoltage

*Measurement of CO and CO₂ shall be made continuously using a sample tube with multiple inlet openings (minimum 3 @ 120° apart) to average the sample taken and be configured to of a size and configuration that will minimize resistance to the flow of flue gases. During each burner cycle, sampling shall begin after 15 minutes of burner operation.

Working Group Recommendation

The working group recommended modifications to section "b" and accompanying footnote for subcommittee adoption for submittal to the Z21/83 Committee and the CSA Technical

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Committee, as shown in Appendix A to these minutes.. The working group commented that the joint subcommittee had agreed the ambient temperature at the beginning of the test would be 70 ± 10 degrees but no means would be introduced to control the ambient temperature. The working group recommends that a sentence be added in the opening paragraphs of the Method of Test with this specification. In addition, the working group recommends that the statement that means be provided to measure the ambient air temperature be retained.

The commentor clarified to the working group that the intent of the proposal to use a sample tube with "multiple inlet openings" to measure the CO and CO₂ on both sides of a flue baffle since experience has shown CO and CO₂ levels can vary from one side to the other side of the baffle. The intent of measuring on both sides is to obtain an average of the flue gas and overcome the potential of measurement spikes, during the test, that are false readings. It was clarified that the desire is to obtain one sampling but to use an average of sample results from both sides of the flue baffle. The working group agreed a "wye" type sample tube, laid into the flue of the tank, would average the CO and CO₂ from the samples taken on both sides of the flue baffle.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of the following proposed modification of the footnote for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

b. Instruments to measure and record the following:

- Test room pressure
- ~~Ambient air temperature (inside the test room)~~
- Water heater flue carbon monoxide concentrations*
- Water heater flue carbon dioxide concentrations*
- Water heater inlet supply water temperature
- Water heater outlet water temperature
- Manifold pressure
- Pilot millivoltage

*Measurement of CO and CO₂ shall be made continuously using a ~~wye type~~ wye type sample tube ~~to average the CO/CO₂ readings of the water heater flue~~ of a size and configuration that will minimize resistance to the flow of flue gases. During each burner cycle, sampling shall begin after 15 minutes of burner operation.

SECTION: (Page 2) "Method of Test", Set-up paragraph "g"
COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

"The water heater shall be installed at the location specified in Figure XX." There is no water heater shown in Figure XX. Nor are there dimensions where the water heater is placed. This information should be added to Figure XX with a drawing of a gas water heater in the room.

Rationale:

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Subcommittee Action

Refer to working group for consideration.

Working Group Discussion

It was agreed the water heater should be positioned in the room to the distance from the LDO injector to the front of the jacket remains constant regardless of the size of the water heater.

Comment was made that this may affect whether the standard can specify a fixed vertical vent because the location of the vent outlet of the water heater may not be positioned so center of flue tube is directly below opening in the room. Additional comment was made that it would not be appropriate to use flexible vent or change from a vertical orientation since this could introduce airflow changes through the unit. The location and dimension of the test rooms were verified. The working group suggested that a sliding panel be used for the vent opening in the roof of the test room, this will allow a vertical vent for installation of the water heater in the test room.

During discussion of the appropriate distance, it was noted that a distance 6 feet from the LDO injector is the equivalent of installing a water heater with a 2 inch cavity and an 18 inch diameter tank and the vent centered under the vent opening 7 feet from the front wall. The working group noted that test data confirms the location of the water heater in the test room is not critical, however for consistency and comparability of data, the working group agreed to specify a consistent distance from the front of the water heater to the LDO injector.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of the proposed revisions to Figure 14 for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 2) 1st paragraph after "g"

COMMENTOR(S):

Thomas J. Harris, Naval Facilities Engineering Command, Code EICO

Suggested Revision:

On page 2, last paragraph, revise the first sentence to describe in detail the water heater "location", or revise the Figure XX to so indicate the water heater location. As the Figure XX exists now, only the location of the "vent opening" is indicated, not the location of the water heater. For a vertical exhaust venting water heater, the water heater may or may not be coaxial with the vent. For a horizontal exhaust venting water heater, the water will probably not be coaxial with the vertical section of the vent duct.

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

See previous working group recommendation on Drew Smith's comment.

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SECTION: (Page 2) 1st paragraph after "g"

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Figure "xx" should be "14"

Rationale: Figure 14 is the next available figure in ANSI Z21.10.1/CSA 4.1

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 3) 2.XX, Set-Up, 2nd paragraph after "g"

COMMENTOR(S):

David T. Berning, A. O. Smith Water Products Co.

Suggested Revision:

The water heater shall be supplied with water at a temperature of 70 +/- 2°F (21 +/- 1°C). A flow restricting device shall be installed in the inlet water supply line to maintain the outlet water temperature at 135 +/- 5°F (57 +/- 3°C).

A suitable temperature measuring device shall be placed in the outflow stream at the outlet connection of the storage vessel.

The temperature adjustment means on thermostats provided with adjustable features for consumer use shall be set against the high stop.

A quick-acting valve shall be installed on the outlet connection of the storage vessel. A flow restricting device shall be connected to the outlet of this valve. The system shall be filled with 70 +/- 2°F (21 +/- 1°C). The flow restricting device shall be adjusted until the outlet water temperature attains equilibrium at 135 +/- 5°F (57 +/- 3°C) (or lower if 135°F is not attainable by the thermostat. A water pressure regulator shall be located between the inlet connection to the storage vessel and the water supply line and adjusted so that the pressure at the inlet connection will be 40 pound per square inch (275.8 kPa).

Rationale: Facilitate the use of same piping arrangement used in 2.13.1

Subcommittee Action

Refer to working group for consideration.

Working Group Discussion

The working group noted the proposed language is consistent with other specifications currently in the standard.

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Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 3) 2.XX, Set-Up, 4th paragraph after "g"
COMMENTOR(S):

David T. Berning, A. O. Smith Water Products Co.

Suggested Revision:

The water heater shall be connected to an minimum 5 foot (1.52m) length of uninsulated vent pipe the same size as the draft hood outlet or flue collar (on water heaters not equipped with draft hood). , unless otherwise specified. If the vent does not discharge vertically, a suitable elbow shall be installed first. The vent pipe shall be arranged as follows: If 5 feet is not sufficient to vent combustion products out of the test room the vent pipe length can be extended to ensure that the flue products are vented out of the test room.

a. For Water Heaters with Vertical Flue Outlets

A sufficient length of vertical pipe to provide a total height of 5 feet (1.52m) measured from the highest point of the draft hood relief opening(s) or flue collar to the top of the vertical vent pipe. If 5 feet is not sufficient to vent combustion products out of the test room the vent pipe length can be extended to ensure that the flue products are vented out of the test room or, or

b. For Water Heaters with Horizontal Flue Outlets

An elbow and a sufficient length of vertical pipe to provide a total height of 5 feet (1.52m) measured from the highest point of the draft hood relief opening(s) or flue collar to the top of the vertical vent pipe. If 5 feet is not sufficient to vent combustion products out of the test room the vent pipe length can be extended to ensure that the flue products are vented out of the test room

Rationale: To facilitate the use of an existing vent pipe (Doe 24 hour vent stack)

Subcommittee Action

Refer to working group for consideration.

Working Group Discussion

The working group concurred with the commentors suggestion agreeing the wording clarifies the intent. Additional comment was made that the standard contains specifications for vertical venting but does not address those for horizontal venting. The working group was advised that there have been no horizontally vented units submitted for test. It was further commented that the manufacturers instructions would be followed water heaters intended for horizontal venting only.

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If a unit is for either horizontal or vertical venting, it would be installed with a vertical vent as outlined in the proposed test method.

Working Group Recommendation

The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. In addition, the working group added a sentence to clarify water heaters intended for horizontal venting only shall be installed in accordance with the manufacturers instructions. The working group agreed this was an editorial clarification of how the water heater is to be installed in the test room.

SECTION: (Page 3) Section (a)

COMMENTOR(S):

Bruce Geren, General Services Administration

Suggested Revision:

There is an extra "or" at the end of Para.

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Handled by previous action on David Berning comment.

SECTION: (Page 3) Item a, last sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Delete "," after "room" and delete "or" after "or,"

Rationale: Editorial.

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Handled by previous action on David Berning comment.

SECTION: (Page 3) Set Up, paragraph "a"

COMMENTOR(S):

Jerry Miller, American Water Heater Company

Suggested Revision:

Delete second "or" at the end of paragraph.

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Rationale: Double word.

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Handled by previous action on David Berning comment.

SECTION: (Page 3) 2.XX, Operation, 1st paragraph

COMMENTOR(S):

David T. Berning, A. O. Smith Water Products Co.

Suggested Revision:

Operation

~~The water heater shall be filled with water shall be filled with water at $70^{\circ} \pm 2^{\circ}\text{F}$ ($21 \pm 1^{\circ}\text{C}$). The thermostat shall be set to its highest setting and the water heater operated at the manufacturer's specified input rate (± 2 percent) and manifold pressure. The water flow rate through the heater shall be adjusted until the outlet water temperature attains equilibrium at $135 \pm 5^{\circ}\text{F}$ ($57 \pm 3^{\circ}\text{C}$).~~

~~Equilibrium is defined as an outlet water temperature that does not vary more than 5°F (3°C) for one hour. The water outlet temperature shall be maintained at $135 \pm 5^{\circ}\text{F}$ ($57 \pm 3^{\circ}\text{C}$) throughout the test.~~

Rationale: Eliminate repetition from "Set-Up"

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 3) Operation section, 3rd sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Add the word "water" between "...the" and "heater..."

Rationale: Editorial

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Handled by previous action on David Berning comment.

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SECTION: (Page 3) Last paragraph, 1st sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

“preconditioning” should be hyphenated (“pre-conditioning”)

Rationale: Editorial

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Not applicable. The working group recommended subcommittee adoption of an editorial revision deleting this sentence, therefore the comment is no longer applicable.

SECTION: (Page 3) Last paragraph, 1st sentence

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Strike after “...with the following” through “...following injection cycle”. Sentence now reads “Immediately following the 30 minute pre-conditioning period, the water heater shall be operated in accordance with the following sequences.”

Rationale: Clarification

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. The working group noted the deleted wording refers to a previous method of test when there were different cycles. The proposed wording is consistent with wording specified in the proposed test.

SECTION: (Page 4) “Lint, dust and oil injection sequence”

COMMENTOR(S):

Thomas J. Harris, Naval Facilities Engineering Command, Code EICO

Suggested Revision:

On page 4, “Lint, dust and oil injection sequence”, revise the first sentence to read as follows: “The lint, dust and oil injection sequence shall consist of ~~the~~ injection cycle noted below ~~repeating continuously~~ throughout the test.” The term “one” was carried over from the prior draft, which had three injection cycles. Left in here, “one” could be read to require only one sequence of the below described LDO injection cycle. The phrase “performed repeatedly” does not have the same meaning as “repeating

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continuously". The sun performs sunrise "repeatedly" for a single location, but not "continuously", on a time scale of one hour or four hour burner cycles.

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept in part. The working group recommended subcommittee adoption of the editorial revision of replacing the word "one" with "the" for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. The working group recommended rejection of revising the proposal to specify "repeating continuously" as unnecessary.

SECTION: (Page 4) Operation, LDO Rate and Composition Table

COMMENTOR(S):

William Harrigill, Rheem Water Heater Division

Suggested Revision:

Change the tolerance on the volumetric airflow rate to 5%.

Rationale: The tolerance was established for the original proposal when the volumetric airflow was specified at the higher rate of 200 CFM. A more appropriate tolerance for the 80 CFM flow rate should be 5% to be equivalent to the 10 CFM tolerance for 200 CFM.

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision to specify ± 5 percent for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. The working group noted that this revision is consistent with the air flow previously specified in the proposed LDO test.

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SECTION: (Page 4) LDO Rate & Composition Section

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

Add metric & English equivalents as listed below:

80± 10 fcm (.038± .005 m³/sec)

37± 3 g/hr (1.31± .1 oz/hr)

100± 5 g/hr (3.53± .88 oz/hr)

.8 cu/min (.049 in³/min)

1.33 cu/min (.081 in³/min)

Rationale: Editorial-consistency within the standard

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of these editorial revisions for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: (Page 4) "Lint, dust and oil injection sequence"

COMMENTOR(S):

Thomas J. Harris, Naval Facilities Engineering Command, Code EICO

Suggested Revision:

On page 4, last paragraph, revise the first sentence to read in part as follows: "The test shall ... until the first occurrence of one of the following conditions are met: ...". The original sentence will cause termination of the test ONLY when item "a." occurs, the first of the "following conditions".

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. The working group recommended inclusion of the word "or" at the end of paragraph "a."

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SECTION: (Pages 4 & 5) Operation, Lint, Dust and Oil Sequence

COMMENTOR(S):

William Harrigill, Rheem Water Heater Division

Suggested Revision:

CO₂ concentrations should be used in addition to the carbon monoxide concentrations as an indication of achieving equilibrium. Include this indicator in Part b as follows:

“Carbon monoxide air free and carbon dioxide concentrations have reached equilibrium, as evidenced by readings taken during or after burner cycle # 14. For the purpose of this test, equilibrium shall be considered as having been achieved when carbon monoxide air free concentrations do not increase by more than 0.001%, and carbon dioxide concentrations do not vary by more than 0.1% between the beginning and last thirty minutes of the burner operating cycle, or ”

Rationale: As excess combustion air is being reduced, CO₂ concentration change is a much better indicator of combustion equilibrium during the time prior to reaching the ultimate value. If combustion air is being reduced during burner cycle # 14, indicating a non-equilibrium condition, it may not be detected using only the carbon monoxide concentrations.

Subcommittee Action

Refer to working group for consideration.

Working Group Discussion

The working group noted that paragraph “b” of the test termination criteria is predicated on a water heater having reached a state of equilibrium. It was noted that a change in concentration of carbon dioxide (CO₂) rather than carbon monoxide (CO) is a better indicator of combustion equilibrium and trending. It was also commented that this is a more stable indicator of equilibrium being reached. Further comment was made that it is hard to see trending in a carbon monoxide concentration 0.001 percentage points.

The working group noted that the lint, dust and oil test protocol originally included CO and CO₂ measurement as suggested. The working group had deleted CO₂ based on the assumption that air free CO would take into account CO₂ and provide similar criteria for test termination. The working group agreed to recommend for distribution for review and comment that CO₂ be added to the test termination criteria since CO₂ concentration change is a better indicator of combustion equilibrium and trending.

Working Group Recommendation

Accept. The working group recommended the coverage, modified as shown in Appendix A to these minutes, to the subcommittee for adoption for submittal to the Z21/83 Committee and the CSA Technical Committee.

The working group also recommended , for adoption by the joint water heater subcommittee for distribution for review and comment the proposed revision to this section as shown in the Appendix B to these minutes

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SECTION: (Page 4) Lint, Dust and Oil Injection Sequence "b"

COMMENTOR(S):

Edwin a. Nordstrom, Viessmann Manufacturing Company (US) Inc.

Suggested Revision:

The definition of "equilibrium" is not clear. It says, "...0.001% between the beginning and last thirty minutes..." What is the beginning? There are not two separate 30 minute periods in a 55 burner cycle. How can one be sure that only single value results in "the last thirty minutes?" or is it an average of some unknown # of readings?

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Discussion

The working group noted that the test protocol specifies sampling shall begin after 15 minutes of burner operation, therefore, the first reading would be taken at 15 minutes into burner cycle. It was noted that this situation has not occurred to date, however, it was agreed there is confusion over when the reading should be taken. There was some discussion over averaging readings over a 5-minute period. There was agreement that 5 minutes is an excessive length of time for this reading, especially when readings are taken every 5 seconds. Additional comment was made that taking readings every five seconds for one minute and averaging those readings would be acceptable. The working group noted that in previous years using sampling bottles as opposed to electronic measuring devices, the sample obtained would represent an average of flue gases over a one minute period.

The working group agreed that specifying an average of readings taken over a one minute span 25 minutes after the burner starts (T24-T25) and during the last minute of burner operation in a 55 minute burner cycle (T54-T55), and then comparing those averages would be the truest representation of the combustion of a particular unit.

Working Group Recommendation

Accept in Principal. The working group recommended the following editorial revisions to the subcommittee for adoption for submittal to the Z21/83 Committee and the CSA Technical Committee. (Also shown in Appendix A to these minutes,)

- b. Carbon monoxide air free concentrations have reached equilibrium, as evidenced by readings taken during or after burner cycle #14. For the purposes of this test, equilibrium shall be considered as having been achieved when carbon monoxide air free concentrations do not increase by more than 0.001% percentage points when the average of the combustion sample taken from T24 to T25 minute is compared to the sample taken at T54 to T55 minutes of the burner operating cycle between the beginning and during the last thirty minutes of the burner operating cycle, or

Staff Remarks: Clarification of the definition of "equilibrium" and when combustion sample readings are to be taken. The change from "%" to "percentage points is

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clarify the original intent that CO shall not increase by more than 10 ppm
(0.001 percentage points).

SECTION: (Page 5) 2nd sentence

COMMENTOR(S):

Bruce Geren, General Services Administration

Suggested Revision:

Add space between “%” and “between”

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept in Principal. Handled by previous action to change “%” to “percentage points.”

SECTION: (Page 7) (Figure XX)

COMMENTOR(S):

Thomas J. Harris, Naval Facilities Engineering Command, Code EICO

Suggested Revision:

On page 7, indicate the location(s) of the water heater within the test room, in order to coordinate with item 1. above.

(see previous Thomas J. Harris comment on page 2, last paragraph, concerning revising the first sentence to describe in detail the water heater “location”, or revise the Figure XX to so indicate the water heater location.)

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept in Principal. Handled by previous action to revise figures to reflect heater location in the test room.

SECTION: (Page 7) Figure XX

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

The drawing should include a water heater in the room with dimensions specified for the water heater location and orientation of the front of the water heater. Also, two holes are shown for oil injection. Is a single spray nozzle used or is it two?

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Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept in Principal. Handled by previous action to revise figures to reflect heater location in the test room.

SECTION: (Page 7) Figure XX

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

1. Figure "xx" should be "14"
2. Add metric equivalents to all dimensions listed

Rationale:

1. Figure 14 is the next available figure in ANSI Z21.10.1/CSA 4.1
2. Editorial – consistency within Standard

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

SECTION: (Pages 8 & 9) Appendix G

COMMENTOR(S):

Mark Taylor/Larry Kidd, Bradford White Corporation

Suggested Revision:

1. Strike entire appendix.
2. Relabel figure "8" & "8A" to figures "15" & "16" & include in body of ANSI Z21.10.1/CSA 4.1

Rationale:

1. Information is for reference only & is not required to be part of Standard.
2. The Lint & Dust injection tube is the only item needing detail from Appendix G. This will simplify the Standard and allow for manufacturers to identify other means of mixing & introducing lint & dust to the injection tube.

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

No Action Necessary. Withdrawn by commentor at the meeting.

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SECTION: (Page 8) 5th line

COMMENTOR(S):

Bruce Geren, General Services Administration

Suggested Revision:

Remove "2.5" above the word "original"

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

SECTION: (Page 8) Appendix G, Pre-mixing the lint and dust paragraph

COMMENTOR(S):

Jerry Miller, American Water Heater Company

Suggested Revision:

Remove "2.5" from paragraph

Rationale: Misprint or overprint

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

SECTION: (Pages 8 & 9) Appendix G, "Pre-mixing the lint and dust."

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

the words "mixture that is achieved with the original clothes dryer method" should be deleted since it has not bearing on the test protocol.

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

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SECTION: (Pages 8 & 9) Appendix G, Material Injection Tube 1st and 2nd paragraphs
COMMENTOR(S):

Jerry Miller, American Water Heater Company

Suggested Revision:

Change word "wye" to "tee" in all locations in these paragraphs

Rationale: Correct these paragraphs to correspond with Figure 8 of Appendix G

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

SECTION: (Pages 8 & 9) Appendix G, Material Injection Tube
COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

the word "wye" should be replaced with the word "tee" in all references in this section.
The actual part and drawing in Figure 8 reflect a tee not a wye.

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept.

SECTION: (Pages 8 & 9) Appendix G
COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

There should be a paragraph in Appendix G describing Figure 10 as the "Ventilation System". Suggested wording:

"Ventilation System: A ventilation system is used to vent the flue products of the water heater. A decoupling spacing of 14 inches from the top of the room is intended to allow air pressure balancing within the test room during water heater operation. Figure 10" Also, the amount of vent pipe protruding through the ceiling of the test room should be specified as "4 inches" on Figure 10.

Rationale:

Subcommittee Action

Refer to working group for consideration.

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Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision to revise Figure 10 of Appendix G to specify a 4 inch minimum dimension for the water heater vent outlet and a 10 inch minimum distance from the water heater vent outlet to the vent pipe inlet for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes. The working group noted that this revision is consistent with current practice.

SECTION: (Page 9) Appendix G, Air Filtration System

COMMENTOR(S):

Drew Smith, State Industries, Inc.

Suggested Revision:

"Drawing #9" should be referred to as "Figure 9"

Rationale:

Subcommittee Action

Refer to working group for consideration.

Working Group Recommendation

Accept. The working group recommended subcommittee adoption of this editorial revision for submittal to the Z21/83 Committee and the CSA Technical Committee, as shown in Appendix A to these minutes.

SECTION: General

COMMENTOR(S):

John M. Halliwill, IAPMO

Comments:

Nothing is being shown as changed have no comparison

Subcommittee Action

No action.

Working Group Recommendation

No action necessary.

FINAL Working Group Recommendation

The working group recommended the proposed lint, dust and oil test and accompanying rational statements, modified as shown in the Appendix A to these minutes, for adoption by the joint water heater subcommittee for recommendation to Accredited Standards Committee Z21/83 and the CSA Technical Committee for approval for submittal to the American National Standards Institute. There were no dissenting views expressed at the working group meeting.

The working group also recommended, for adoption by the joint water heater subcommittee for distribution for review and comment the proposed revisions to the lint, dust and oil test protocol as shown in the Appendix B to these minutes.

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Item 2. Proposed Lint, Dust and Oil Test Protocol for Volume I Water Heaters

Subject

Consider recommending to the joint water heater subcommittee, for distribution for review and comment, a range of viscosity specifications for the corn oil to be used in the lint, dust and oil test.

History

At its December 12, 2001 meeting, the joint water heater subcommittee reviewed the following comment:

SECTION: (Page 1) "Method of Test", fifth paragraph

COMMENTOR(S): Drew Smith, State Industries, Inc.

Suggested Revision: The viscosity of the corn oil should be specified in this paragraph.

The joint subcommittee directed staff to obtain range of viscosity specifications for the corn oil used during the verification testing. The subcommittee agreed this would require redistribution for review and comment. It was agreed the proposed coverage could go forward to the parent committee for processing without the viscosity specifications.

The working group reviewed the following viscosity specifications for three types of corn oil obtained by CSA International.

VISCOSITY ASTM Method D4040M

(Analyzed 1/18/02-1/21/02 by ACG)

Client I.D.	Enviromatrix I.D.	Vixcosity @ Room Temp.
Food Club 100% Corn Oil	A0218-5	56.2 centipoise
Mazola 100% Corn Oil	A0218-6	59.5 centipoise
Seaway 100% Corn Oil	A0218-7	55.9 centipoise

Working Group Recommendation

The working group recommended subcommittee adoption of a revision to the corn oil specification to include a range of 55-60 centipoise viscosity when measured by ASTM test method D4040M, for adoption by the joint water heater subcommittee for distribution for review and comment the proposed revisions to the lint, dust and oil test protocol as shown in the Appendix B to these minutes. The working group has based the information on the viscosity of readily available corn oils.

CONCLUSION

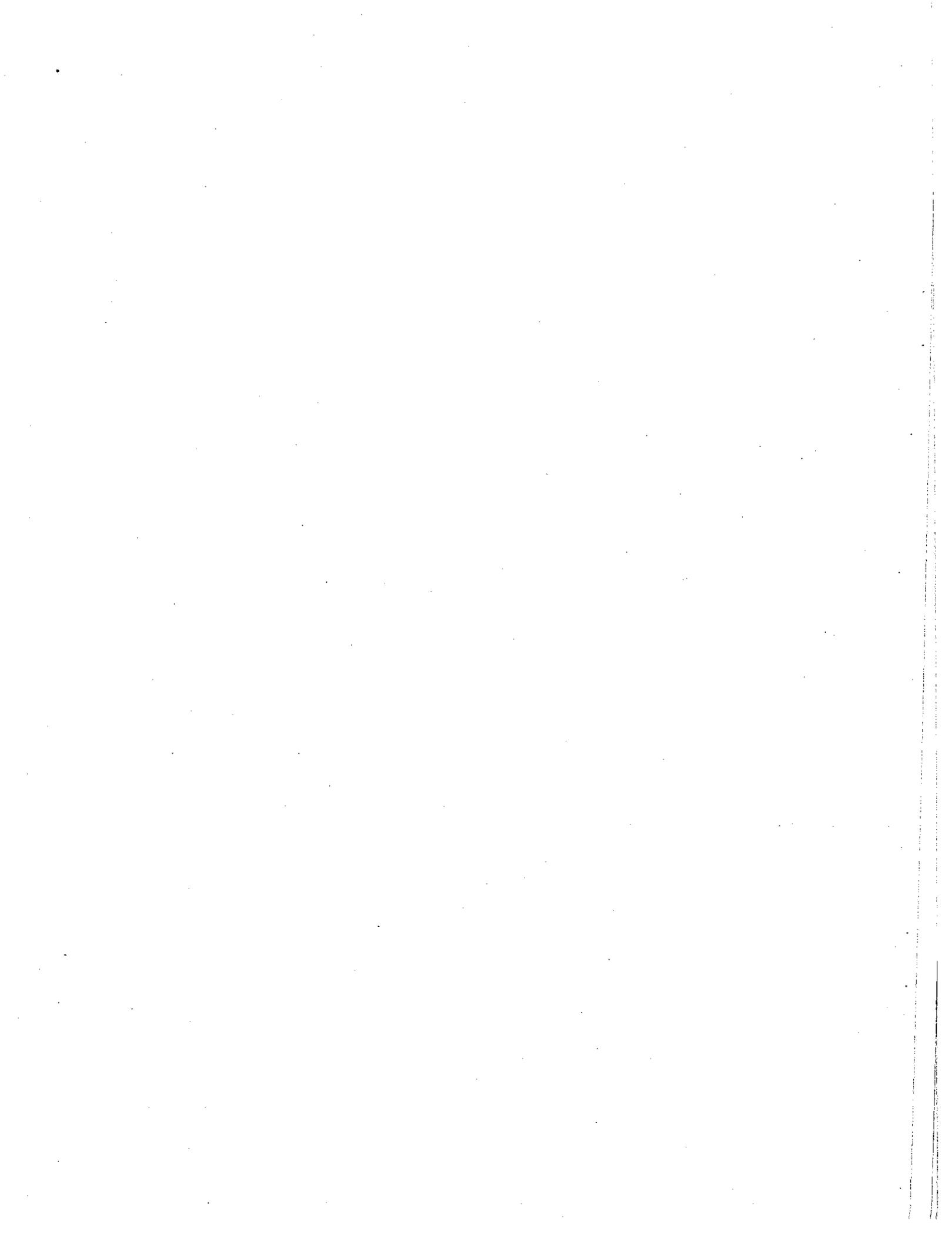
At the December 12, 2001 meeting, the joint subcommittee indicated its intent that the proposed lint, dust and oil test be presented to Accredited Standards Committee Z21/83 and the CSA Technical Committee for approval at their April 2002 meeting(s).

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The chairman advised that the working group recommendations will be presented to the joint subcommittee by letter ballot dated February 1, 2002. The subcommittee letter ballot will have a closing date of February 15, 2002. Revisions adopted by the joint water heater subcommittee will be presented to Accredited Standards Committee Z21/38 and the CSA Technical Committee at the April 18, 2002 meeting.

There being no further business the Chairman thanked the members and guests for their participation and adjourned the meeting at 12:08 p.m.

Acting Secretary
Julie Ann Cairns



APPENDIX A

to the Minutes of the January 29, 2002 Meeting of

Lint, Dust and Oil Working Group

Note: Proposed revisions to the harmonized Standard for Gas Water Heaters, Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less , distributed for review and comment during November 2001, were referred to the lint, dust and oil working group for review in light of comments received.

The revisions in this Appendix have been recommended to the joint subcommittee for recommendation to Accredited Standards Committee Z21/83 and the CSA Technical Committee for approval for submittal to the American National Standards Institute.

The proposed revisions are based on: (1) the harmonized Standard for Gas Water Heaters, Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less, ANSI Z21.10.1-CSA 4.1-1998, Z21.10.1a-CSA 4.1a-2000 and Z21.10.1b-CSA 4.1b-2001, and (2) proposed revisions recommended to Accredited Standards Committee Z21/83 and CSA Technical Committee, by the subcommittee at its September 2000 meeting,.

Additions are "redlined" (~~shaded and underlined~~) and "strike-out" is used to show deletions (e.g. ~~proposed deletion~~).

2.36 Resistance to Lint, Dust and Oil Accumulation

Water heaters shall not produce flue gases that contain a concentration of carbon monoxide in excess of 0.04 percent on an air-free basis, in an air-free sample of the flue gases when exposed to lint, dust and oil under the following Method of Test. This requirement shall be considered met when:

- a. the water heater completes the Burner Cycle Sequence and the carbon monoxide concentration reaches equilibrium, as defined in the following Method of Test, not in excess of 0.04 percent in an air-free sample of flue gases; or
- b. the water heater shuts down prior to producing a carbon monoxide concentration in excess of 0.04 percent in an air free sample of the flue gases, and requires a manual restart to resume operation.

This provision does not apply to direct vent water heaters, or to water heaters for installation in recreational vehicles, or to water heaters intended for installation outdoors.

Method of Test

Prior to beginning the test, at the manufacturer's request, the water heater may be cleaned operated to remove machining oils from the manufacturing process that may cause erroneous test results.

This test shall be conducted at normal inlet test pressure and input rating. At the beginning of the testing ambient room temperature shall be 70 ± 10° F (21 ± 5° C)

The lint material used for this test shall be cotton second-cut linters removed from the cotton seed and ground in a revolving knife shearing type mill fitted with a 4 mm screen classifier.

The dust material used for the test shall be ISO Fine Test Dust, 12103-1, A2.

The oil used for the test shall be 100 percent corn oil.

Set-Up

The water heater shall be installed according to the manufacturer's instructions in a room with an internal volume of 864 ± 25 cubic feet (24.5 ± 0.71 m³). The nominal dimensions of the room shall be 12 feet \pm 6 inches wide x 9 feet \pm 6 inches long x 8 feet \pm 6 inches high (3.66 ± 0.15 m x 2.74 ± 0.15 m x 2.44 ± 0.15 m). A diagram of the test room is shown in Figure XX . The test room shall have:

- a. Means to maintain neutral internal pressure with respect to the pressure external to the test room to within a tolerance of ± 0.005 inches water column (± 1.24 Pa). Pressure transients that occur when the injection apparatus operates are allowable provided that the magnitude of the transient does not fall outside of the range of +0.00 inches water column to -0.02 inches water column (+0.00 Pa to -4.98 Pa), and the duration of the transient does not exceed 3 seconds.

NOT FOR PUBLICATION

- b. Two air openings, each with an area of 100 square inches (484 ~~645~~ cm²). ~~Located as specified in Figure 14.~~
- c. Means to inject lint and dust entrained in an air flow of 80 ± 10 cubic feet per minute (0.038 ± 0.005 m³/s) into the test room. (See Appendix G.) The discharge of the lint and dust injection apparatus shall be a 2.5-inch (6.35 cm) diameter duct ~~(see Figure 15 and 16), installed perpendicular and flush with the inside wall surface~~ the wall of the test room at the location specified in Figure XX 14.
- d. An atomizer ~~spray gun~~, capable of producing oil droplets less than 10 ~~microns~~ micrometer in diameter, to introduce the oil into the test room. The axis of the atomizer nozzle shall be installed perpendicular to the wall ~~and extending $5/8 \pm 1/8$ inch (1.58 cm \pm 3.2 cm)~~ into ~~of the~~ test chamber at the location specified in Figure XX 14.
- e. Instruments to measure and record the following:

Test room pressure
~~Ambient air temperature (inside the test room)~~
Water heater flue carbon monoxide concentrations*
Water heater flue carbon dioxide concentrations*
Water heater inlet supply water temperature
Water heater outlet water temperature
Manifold pressure
Pilot millivoltage

*Measurement of CO and CO₂ shall be made continuously using a ~~wye type~~ sample tube ~~to average the CO/CO₂ readings on the water heater flue.~~ of a size and configuration that will minimize resistance to the flow of flue gases. During each burner cycle, sampling shall begin after 15 minutes of burner operation.

- f. Means to remotely operate the water heater thermostat to enable cycling of the main burner.
- g. Means to cause water flow through the heater, as specified under "Operation" in this Method of Test.

The water heater shall be installed at the location specified in Figure XX 14. The water heater shall be tested with all access doors in their normal position. If the lighting instructions call for the opening or removal of any door(s) to light the pilot and if the main burner(s) will operate with those door(s) removed or opened, the test shall be repeated with removable door(s) removed, and sliding or hinged door(s) left in a fully open position unless self-closing.

~~The water heater shall be supplied with water at a temperature of $70 \pm 2^{\circ}\text{F}$ ($21 \pm 1^{\circ}\text{C}$). A flow restricting device shall be installed in the inlet water supply line to maintain the outlet water temperature at $135 \pm 5^{\circ}\text{F}$ ($57 \pm 3^{\circ}\text{C}$).~~

~~A suitable temperature measuring device shall be placed in the outflow stream at the outlet connection of the storage vessel.~~

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The temperature adjustment means on thermostats provided with adjustable features for consumer use shall be set against the high stop.

A quick-acting valve shall be installed on the outlet connection of the storage vessel. A flow restricting device shall be connected to the outlet of this valve. The system shall be filled with 70 +/- 2°F (21 +/- 1°C). The flow restricting device shall be adjusted until the outlet water temperature attains equilibrium at 135 +/- 5°F (57 +/- 3°C) (or lower if 135°F is not attainable by the thermostat. A water pressure regulator shall be located between the inlet connection to the storage vessel and the water supply line and adjusted so that the pressure at the inlet connection will be 40 pound per square inch (275.8 kPa).

The water heater shall be connected to an minimum 5 foot (1.52m) length of uninsulated vent pipe the same size as the draft hood outlet or flue collar (on water heaters not equipped with draft hood). unless otherwise specified. If the vent does not discharge vertically, a suitable elbow shall be installed first. The vent pipe shall be arranged as follows: If 5 feet is not sufficient to vent combustion products out of the test room the vent pipe length can be extended to ensure that the flue products are vented out of the test room.

a. For Water Heaters with Vertical Flue Outlets

A sufficient length of vertical pipe to provide a total height of 5 feet (1.52 m) measured from the highest point of the draft hood relief opening(s) or flue collar to the top of the vertical vent pipe. If 5 feet is not sufficient to vent combustion products out of the test room the pipe length can be extended to ensure that flue products are vented out of the test room, or, or

b. For Water Heaters with Horizontal Flue Outlets

An elbow and a sufficient length of vertical pipe to provide a total height of 5 feet (1.52 m) measured from the highest point of the draft hood relief opening(s) or flue collar to the top of the vertical vent pipe. If 5 feet is not sufficient to vent combustion products out of the test room the pipe length can be extended to ensure that flue products are vented out of the test room. Sheet metal elbows shall be 90 degrees (1.57 rad), four piece, sheet metal elbows.

Operation

The water heater shall be filled with water at 70 + 2°F (21 + 1°C). The thermostat shall be set to its highest setting and the water heater operated at the manufacturer's specified input rate (+ 2 percent) and manifold pressure. The water flow rate through the heater shall be adjusted until the outlet water temperature attains equilibrium at 135 + 5°F (57 + 3°C). Equilibrium is defined as an outlet water temperature that does not vary more than 5°F (3°C) for one hour. The outlet water temperature shall be maintained at 135 + 5°F (57 + 3°C) throughout the test.

While operating at the input rate and water flow rate established above, the water heater shall be exposed to a thirty minute pre-conditioning period during which the water heater shall be subjected to oil spray at a rate of 1.1 cc/min for 10 minutes, followed by 20 minutes with no additional oil spray.

Immediately following the 30 minute preconditioning period, the water heater shall be operated in accordance with the following burner cycle sequence and water flow cycle sequence, and the apparatus for injecting (1) lint and dust, and (2) atomizer oil spray shall be operated according to the following injection cycle sequences:

Burner cycle sequence

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Burner Cycle #	Duty cycle
1 through 10	55 min. ON / 5 min OFF
11 through 12	3 hour-55 min. ON / 5 min OFF
13 through end	55 min. ON / 5 min. OFF

Water flow cycle sequence

During conduct of this test, water flow through the heater shall be cycled simultaneously with the burner in accordance with the Burner Cycle Sequence described above. The water flow rate shall be adjusted as necessary to maintain an equilibrium outlet water temperature of $135 \pm 5^\circ\text{F}$ ($57 \pm 3^\circ\text{C}$) throughout the "on" times of the Burner Cycle Sequence.

Lint, dust and oil injection sequence

The lint, dust and oil injection sequence shall consist of ~~one~~ ~~the~~ injection cycle noted below performed repeatedly throughout the test:

LDO Rate and Composition	
Air:	Continuous @ 80 ± 10 cfm ($0.04 \text{ m}^3/\text{s}$) = 5%
Lint:	37 ± 3 g/hr ($1.31 \text{ g}/\text{hr}$) injected uniformly throughout the test. Instantaneous spikes in the injection rate are permitted provided they are of one second or less in duration, they inject no more than 2 grams of lint per spike, and they are evenly distributed throughout the test.
Dust:	100 ± 5 g/hr ($3.53 \text{ g}/\text{hr}$) injected uniformly throughout the test. Instantaneous spikes in the injection rate are permitted provided they are of one second or less in duration, they inject no more than 6 grams of dust per spike, and they are evenly distributed throughout the test.
Oil:	1 st sequence: 30 min. no oil, followed by 5 min @ 0.8 cc/min ($0.049 \text{ m}^3/\text{min}$), followed by 25 min. no oil.
	All subsequent sequences: 30 min. no oil, followed by 3 min @ 1.33 cc/min ($0.081 \text{ m}^3/\text{min}$), followed by 27 min. no oil.

The test shall be allowed to continue until the first ~~occurrence~~ of ~~one~~ of the following conditions are met:

- a. The water heater emits carbon monoxide concentrations in excess of 0.04 percent on an air free basis, ~~or~~
- b. Carbon monoxide air free concentrations have reached equilibrium, as evidenced by readings taken during or after burner cycle #14. For the purposes of this test, equilibrium shall be considered as having been achieved when carbon air free concentrations do not increase by more than 0.001 ~~percentage points when the average of the combustion sample taken from 1:24 to 1:25 minutes is compared to the sample taken at 1:54 to 1:55 minutes of the burner operating cycle between the beginning and the last thirty minutes of the burner operating cycle, or~~

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- c. The water heater shuts down by design, and requires a manual restart to resume operation.

onale: Reports on flammable vapor ignition incidents involving gas water heaters led to the development and subsequent adoption for inclusion in the volume I water heater standard (ANSI Z21.10.1•CSA 4.1) of a method of test to evaluate a water heater design's ability to resist the ignition of flammable vapors outside the confines of the water heater.

One common approach to make the water heater resistant to ignition of flammable vapors is to modify the combustion air intake with a device that has been designed to act as a flame arrestor. Research has shown that this device may accumulate lint, dust and oil over the life of the water heater. The accumulation of lint dust and oil may affect the performance of the water heater in other areas (e.g., carbon monoxide (CO) emissions). Consequently, a test for resistance to accumulations of lint, dust and oil, (LDO) has been developed, and it is intended that this test should be required as part of the certification of flammable vapor-resistant water heaters.

In development of the proposed test method, independent research is conducted in the following areas:

1. A global document search for relevant lint, dust and/or oil tests on appliances,
2. A review of existing standards and reports on indoor particulates,
3. A review of studies on domestic water heater usage patterns,
4. A collection and evaluation of samples of indoor particulates gathered from homes across the country,
5. A development of a draft test protocol, and
6. Verification of the test protocol with actual testing.

The results of the work in steps 1 through 4 concluded that an existing Japanese test (LDO test-1986) protocol most closely represented environmental conditions found in North America. However, the Japanese test did not address the issue in the context of water heaters equipped with flame arrestor technology. An independent research organization is contracted to develop a lint, dust and oil test protocol for inclusion in the ANSI/CSA volume I water heater standard (Z21.10.1•CSA 4.1). A proposed test method is developed using the Japanese LDO test protocol as a baseline LDO-protocol. Technical modifications are made to provide a standardized, calibrated, realistic, reproducible and discriminating evaluation of LDO-safety in residential flammable vapor resistant water heaters.

Intensive verification work has been conducted using the proposed test method. The proposed LDO test protocol has been found to be both discriminating and reproducible.

All Dimensions are inside dimensions
 Tolerance is +/- 6" (0.15m) on building dimensions only
 All other tolerances are +/- 1/2"(1.27cm)

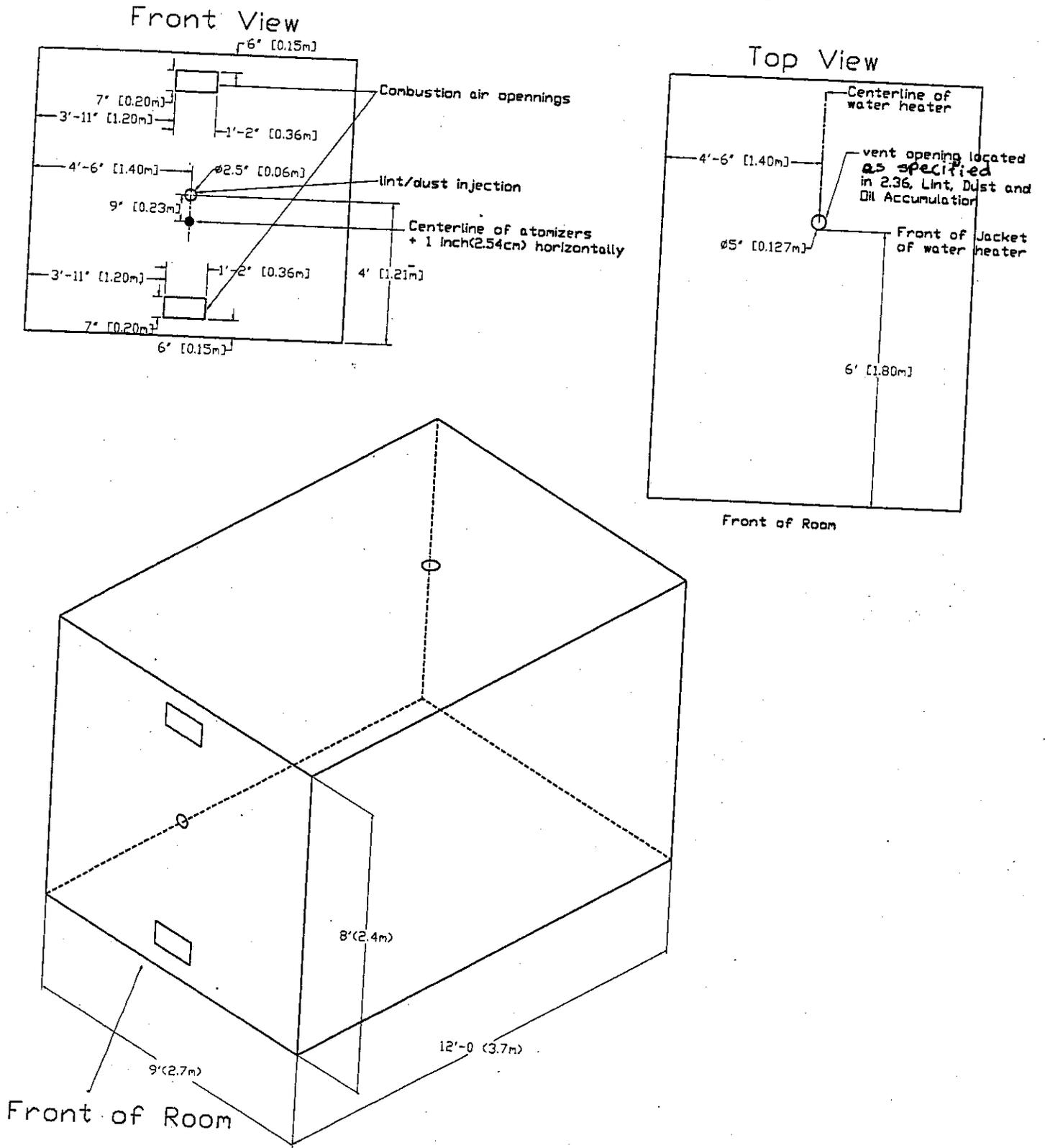


Figure 14

(A-7)

APPENDIX G (ADDED)
LINT DUST AND OIL TEST EQUIPMENT AND PROCEDURES (2.XX)

The test equipment used to inject the lint and dust are shown in Figure #'s 1 through 10. Key elements of the equipment and procedure are described below.

Pre-mixing the lint and dust:

In order to most closely simulate the condition of the lint and dust mixture that is achieved with the original clothes dryer method, the lint and dust are pre-mixed before being placed into the lint/dust sifter (described below). One hundred grams of lint and 16 grams of dust are placed into an empty 1-gallon (nom.) container. This mixture allows for complete saturation of the lint with dust. The container is shaken vigorously until the dust and lint are thoroughly mixed. The contents are then poured into the hopper on the lint/dust sifter. This process is repeated until hopper is full.

Lint / Dust Sifter:

The lint/dust sifter is described in Figure #'s 1 through 7. The agitator bars force the lint/dust mixture through a stainless steel screen of 0.032 in dia.wire, 8 x 8 wires per inch. The agitator is turned at 100 rpm.

Weighing the lint and dust:

The lint/dust mixture is dispensed through the lint/dust sifter into a 10" long metal tray until there are 12 grams of mixture uniformly distributed in the tray. The contents of the tray are then placed onto the conveyor belt. The same 10" long metal tray is then filled with 33 grams of dust, uniformly distributed throughout the tray. The dust is placed on top of the mixture that was already on the conveyor belt. The process of loading the belt with lint and dust is repeated until the belt is full, placing the next load of material immediately behind the previous load. Additional loads are placed on the belt as necessary throughout each test.

Conveyor System:

The conveyor system used has a 72-inch long x 6-inch wide bed. 30 inches of lint and dust are loaded on the belt for every hour of test. The belt speed is adjusted to 0.5 inches per minute and is operated continuously.

As the belt progressed, the lint and dust fell off the end of the belt into the material injection tube (described below).

Material Injection Tube:

The material injection tube configuration is shown in Figure 8. A blower (not shown) forces air into the tube, through the "wye tee" fitting, and into the lint chamber. The stop is removed from the inlet end of the "wye tee" fitting to allow the inlet tube to be inserted further into the "wye tee". At the proper insertion, a negative pressure is developed in the stub end of the "wye tee", causing additional air, along with the lint

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and dust, to be drawn into the flow tube and blown into the chamber. Pressure taps are located upstream of the “wye tee” fitting.

The tube is calibrated by adjusting the flow restricting iris on the inlet of the blower to achieve the appropriate air flow (80 cfm) at the outlet of the tube. Note that this air flow includes the air from both the blower and the stub on the “wye tee”. Once the flow is set, the differential pressure across the pressure taps is noted. This differential pressure measurement is the operating parameter used to verify proper air flow during a test.

Air Filtration System:

An air filtration system is used to minimize lint and dust escaping from the lint chamber during each test, and to allow purging of the chamber with fresh air following each test. The filtration system is operated continuously during the test. The configuration of the air filtration system is shown in Drawing # Figure 9.

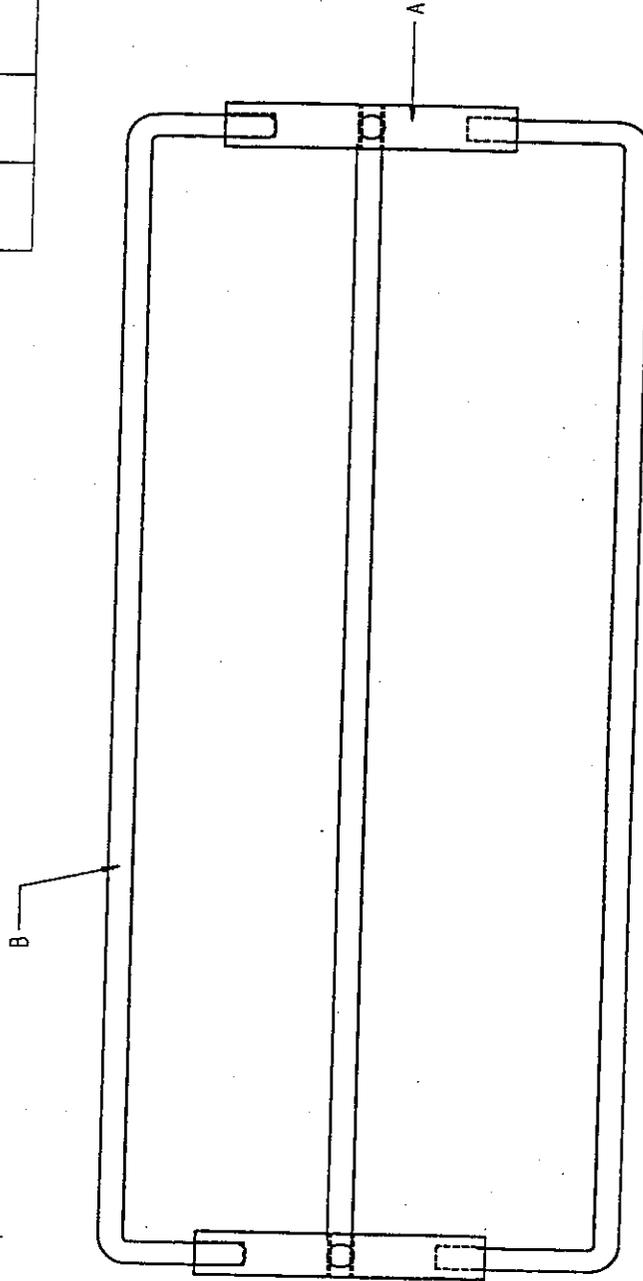
The purpose of the de-coupler boxes is to allow the chamber internal pressure to be in equilibrium with pressure surrounding the chamber, while effectively minimizing lint and dust escape.

Ventilation System

A ventilation system is used to vent the flue products of the water heater. A decoupling spacing of 10 inches minimum from the top of the water heater vent is intended to allow air pressure balancing within the test room during water heater operation. See Figure 10”

LINT AGITATOR ASSEMBLY

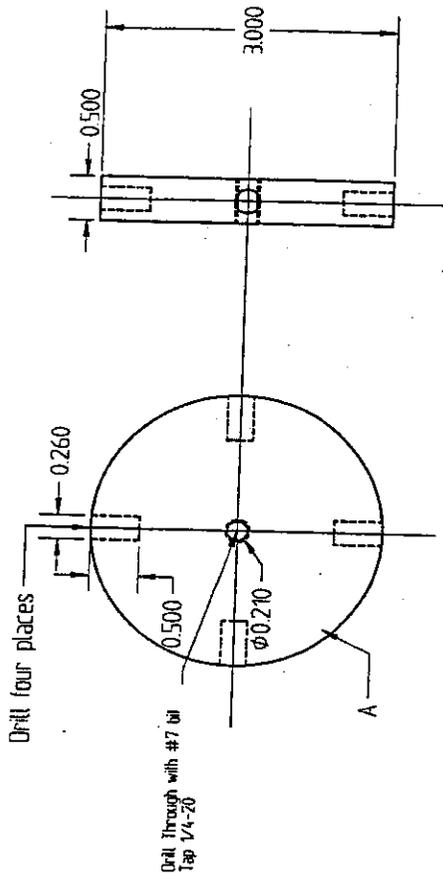
PART	QTY.	description
A	2	3" x 1/2 Aluminum Disc
B	4	1/4" x 15 11/16" 304 S.S.



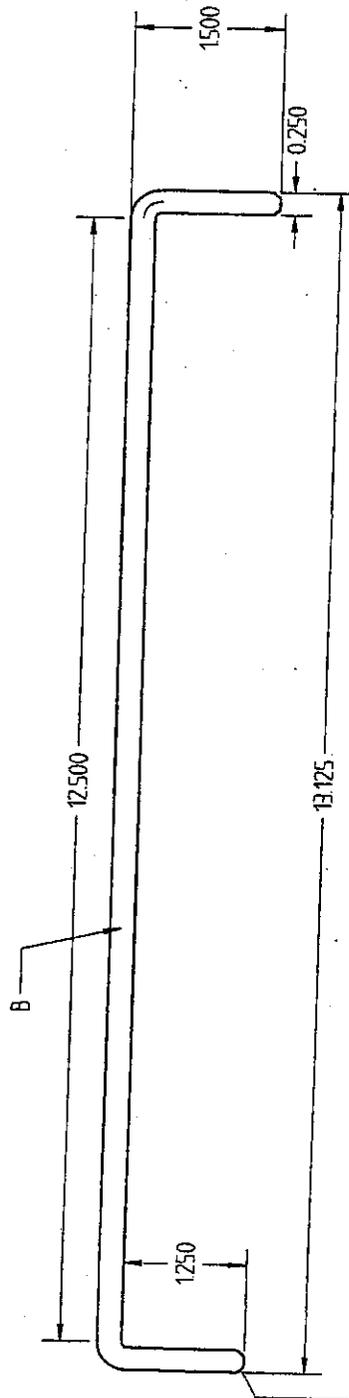
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LINT AGITATOR

PART	QTY.	description
A	2	3" x 1/2" Aluminum Disc
B	4	1/4" x 15 11/16" 304 S.S.



Dwg A tolerance +/- .0625"
 Dwg B tolerance +/- .0625"
 dimensions are in inches

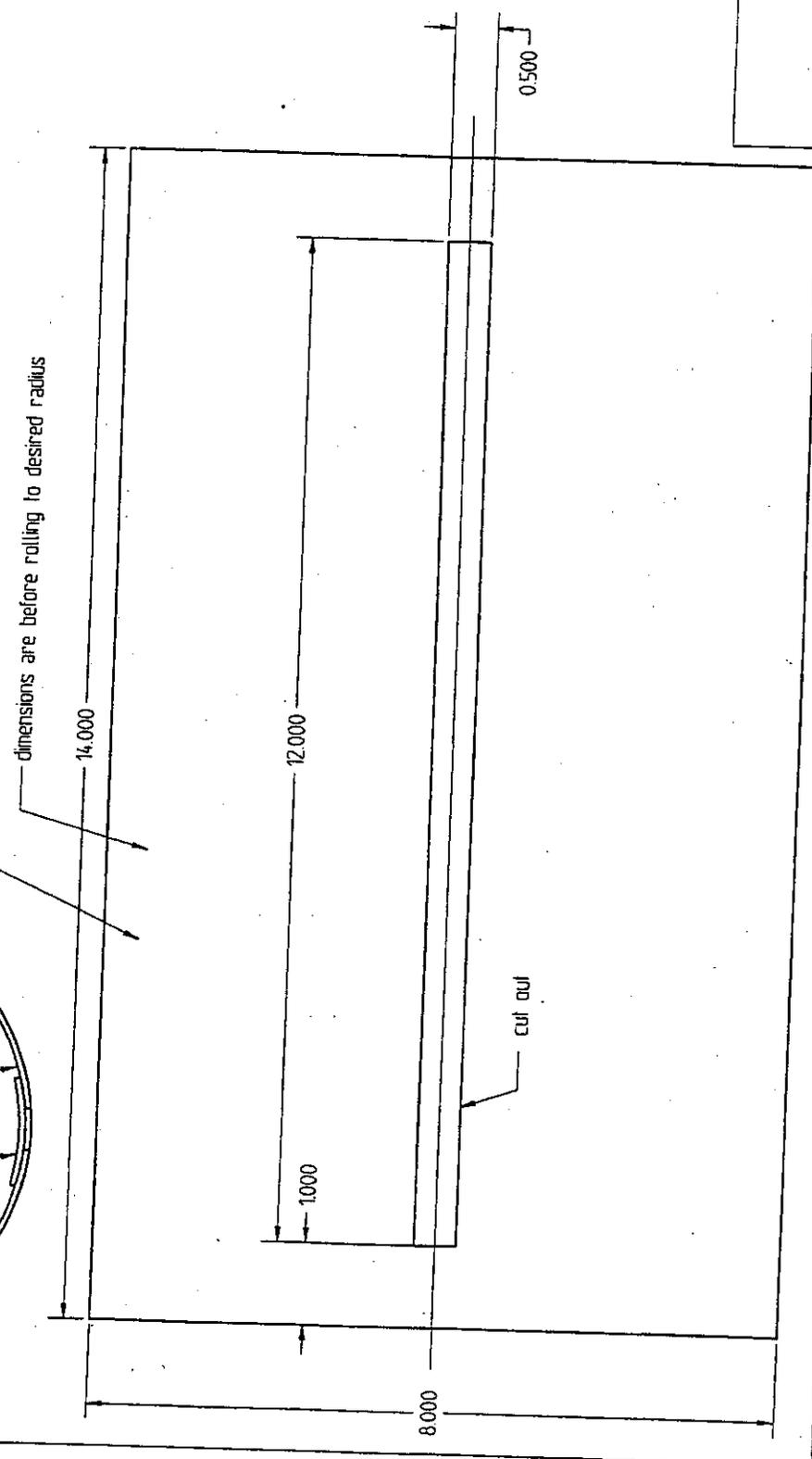
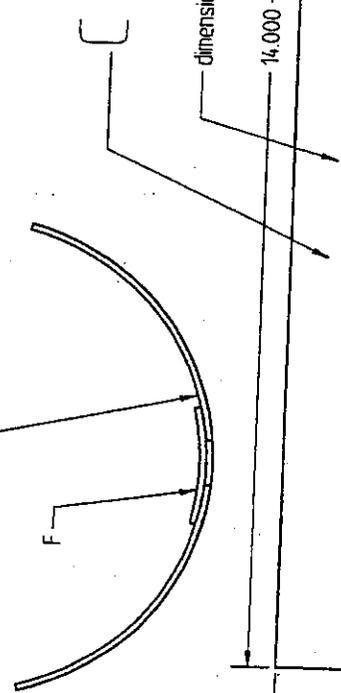


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Lint Lower Hopper

PART	QTY.	description
C	1	10 gage steel 8"x14"
F	1	3" x 12" mesh screen 8 x 8 mesh .032 diameter wire

Dwg. A tolerance +/- .0625"
Dimensions are in inches

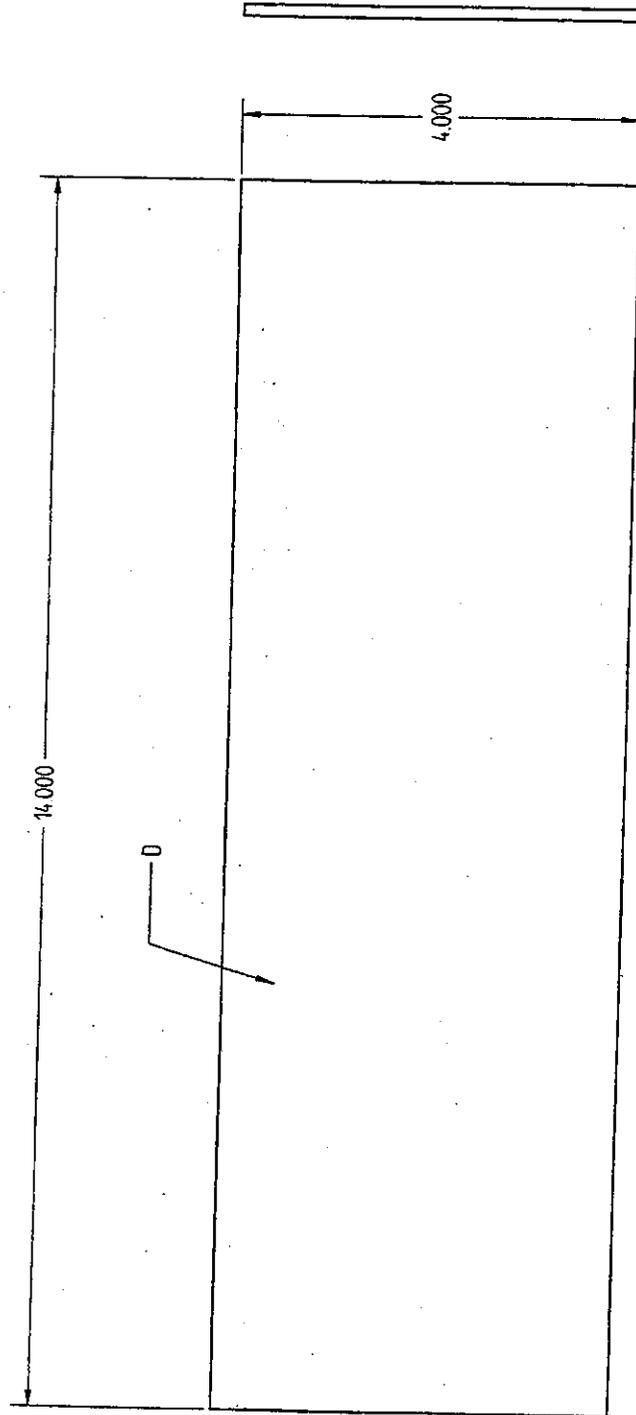


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Lint Lower Hopper

PART	QTY.	description
D	2	10 gage steel 4" x 14"

DWG. A tolerance is +/- .0625"
Dimensions are in inches

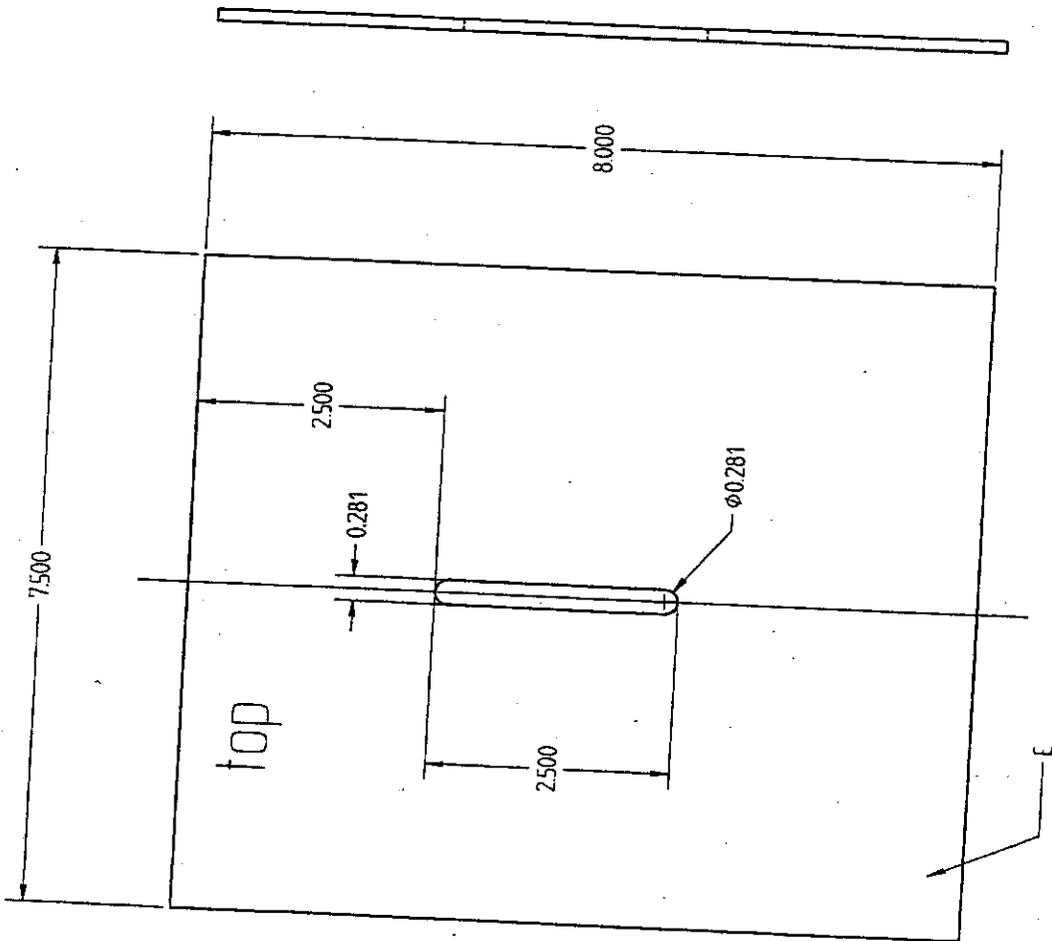


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Lint Lower Hopper

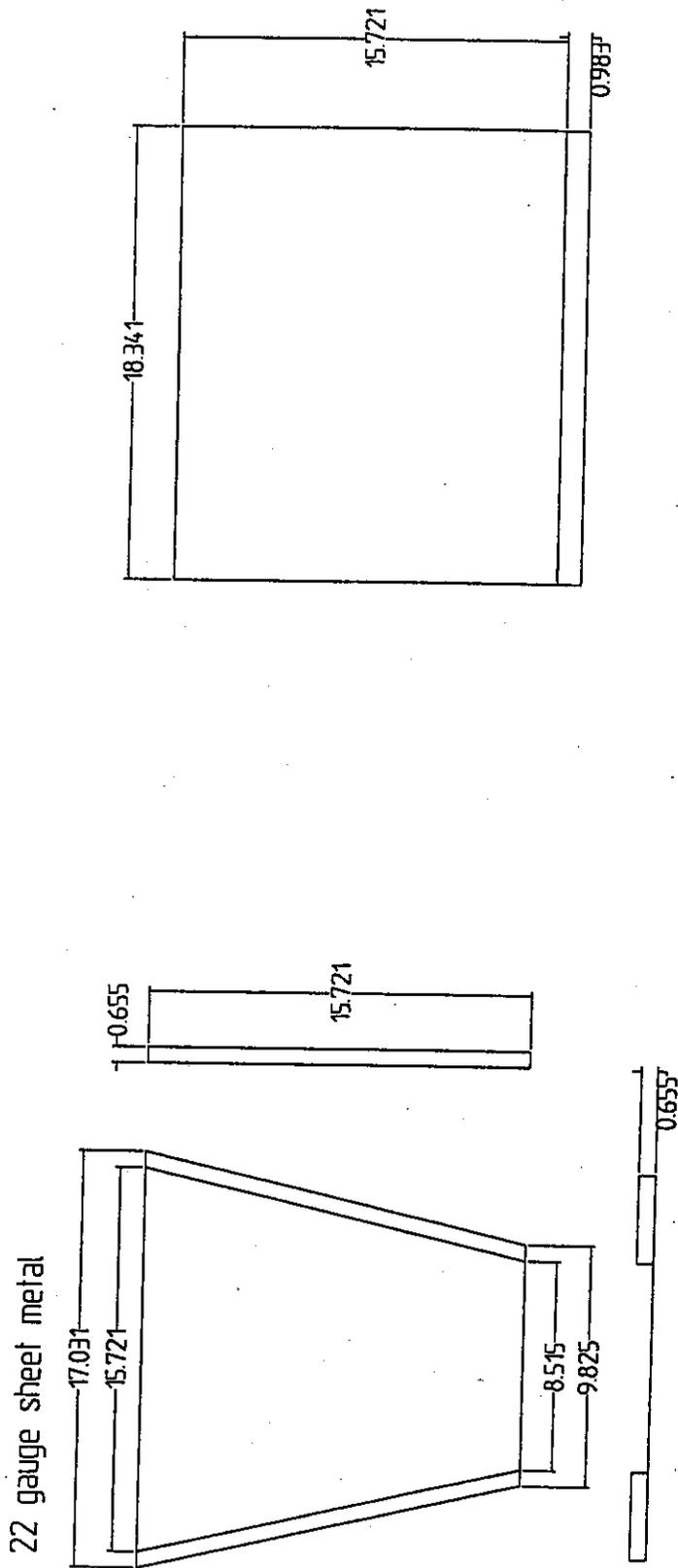
PART	QTY.	description
E	2	10 gage steel 7 1/2" x 8"

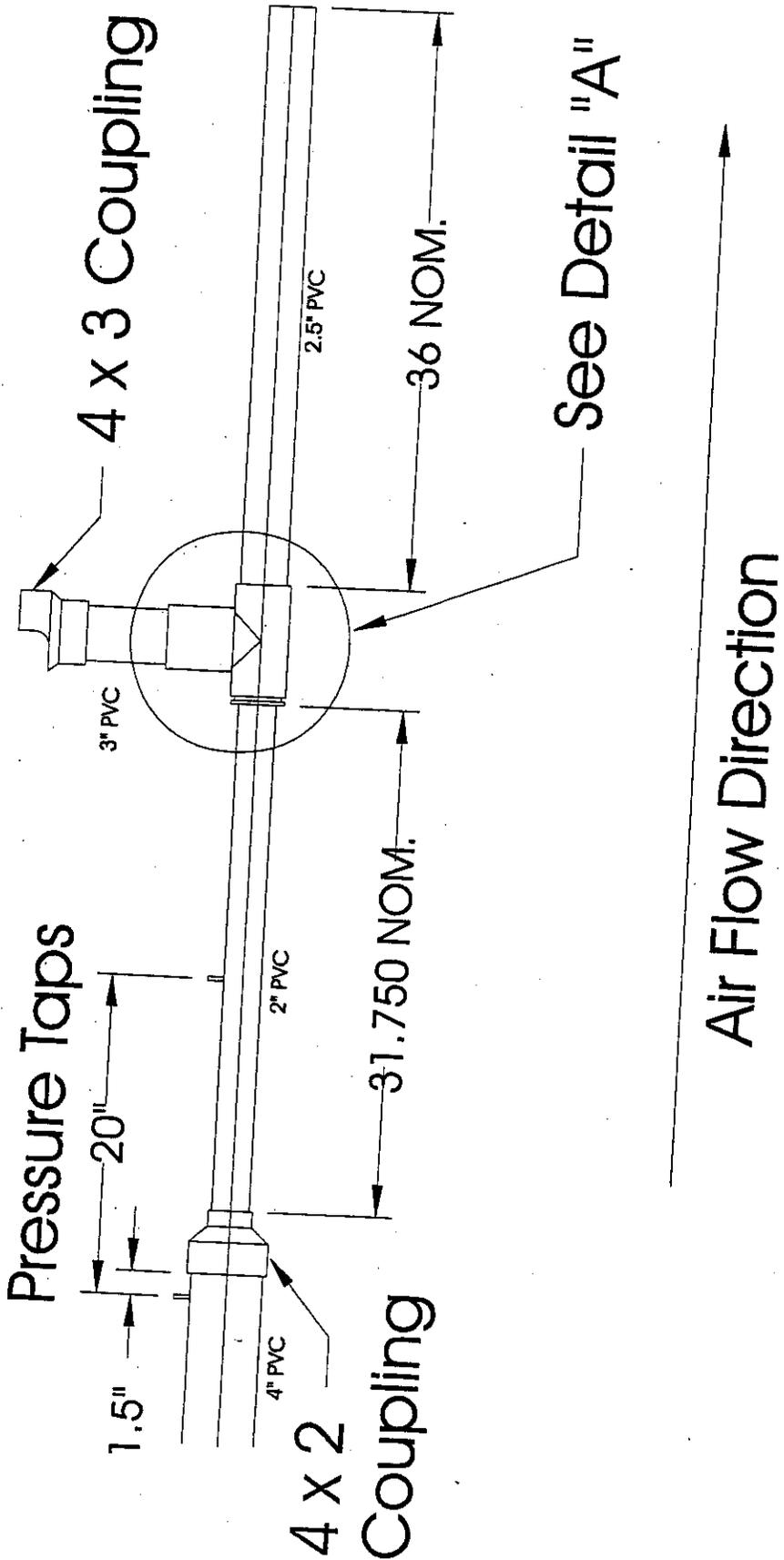
Dwg A tolerance +/- .0625"
All dimensions are in inches



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LINT UPPER HOPPER

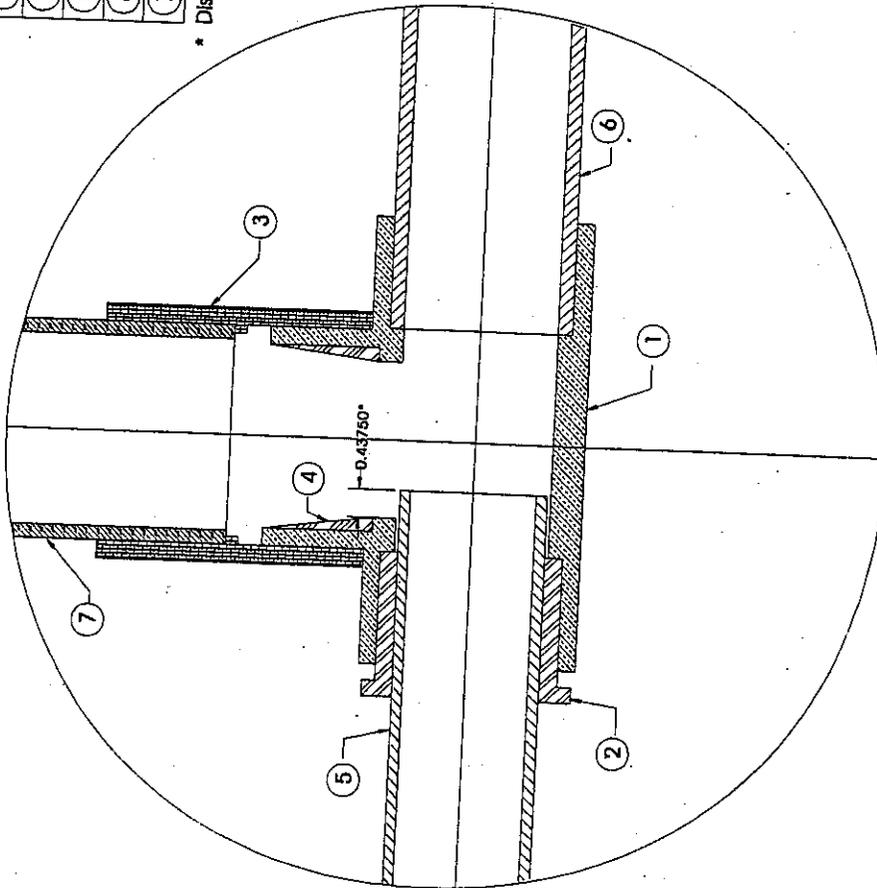




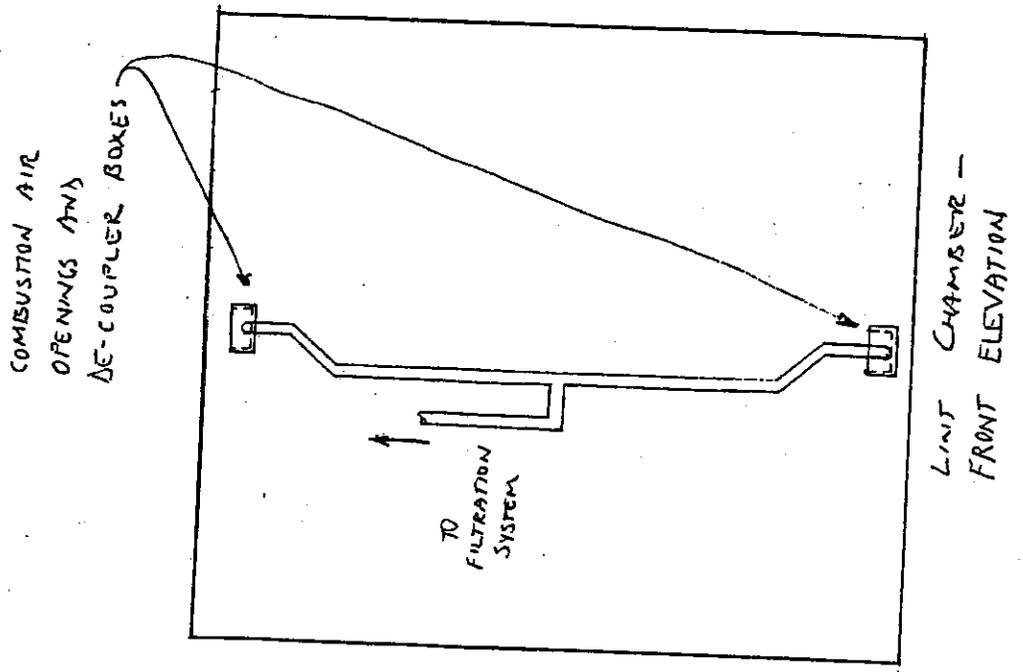
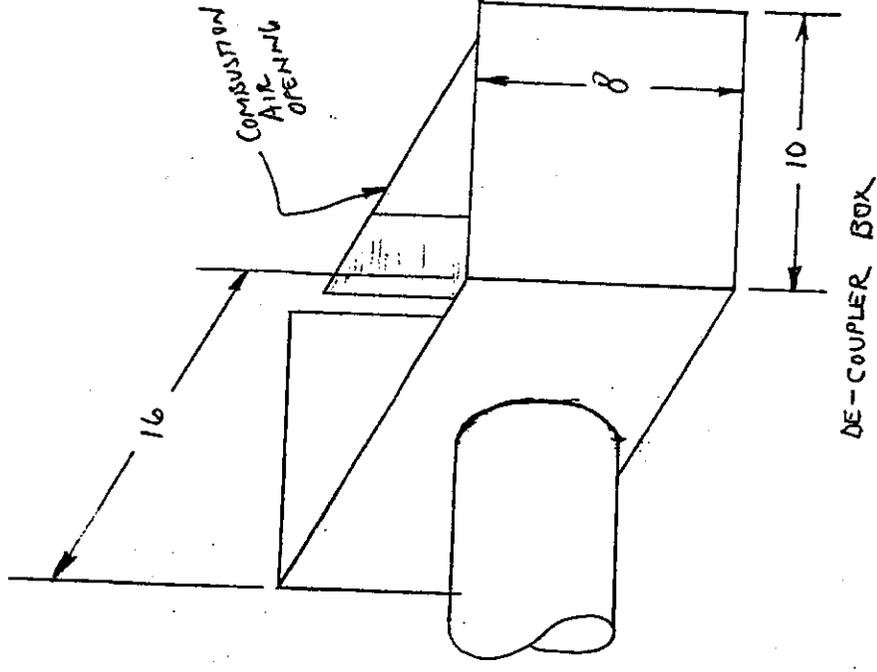
Detail "A"

①	2.5" Tee
②	2.5" x 2" Bushing with stop removed
③	3" Coupling
④	Tapered Section
⑤	2" Pipe
⑥	2.5" Pipe
⑦	3" Pipe

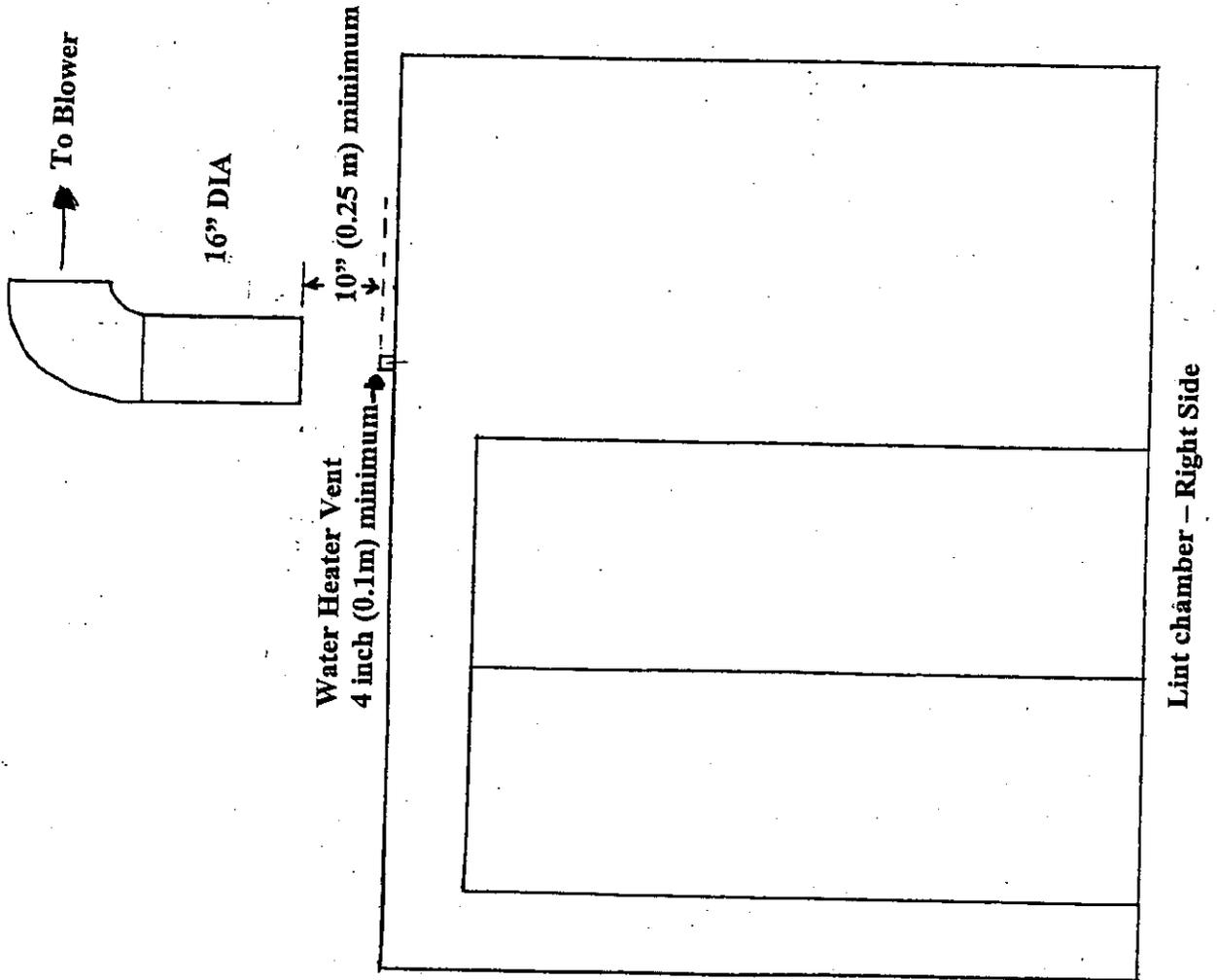
* Distance set to maximize suction pressure in stub



AIR FILTRATION SYSTEM



Ventilation System



APPENDIX B

to the Minutes of the January 29, 2002 Meeting of

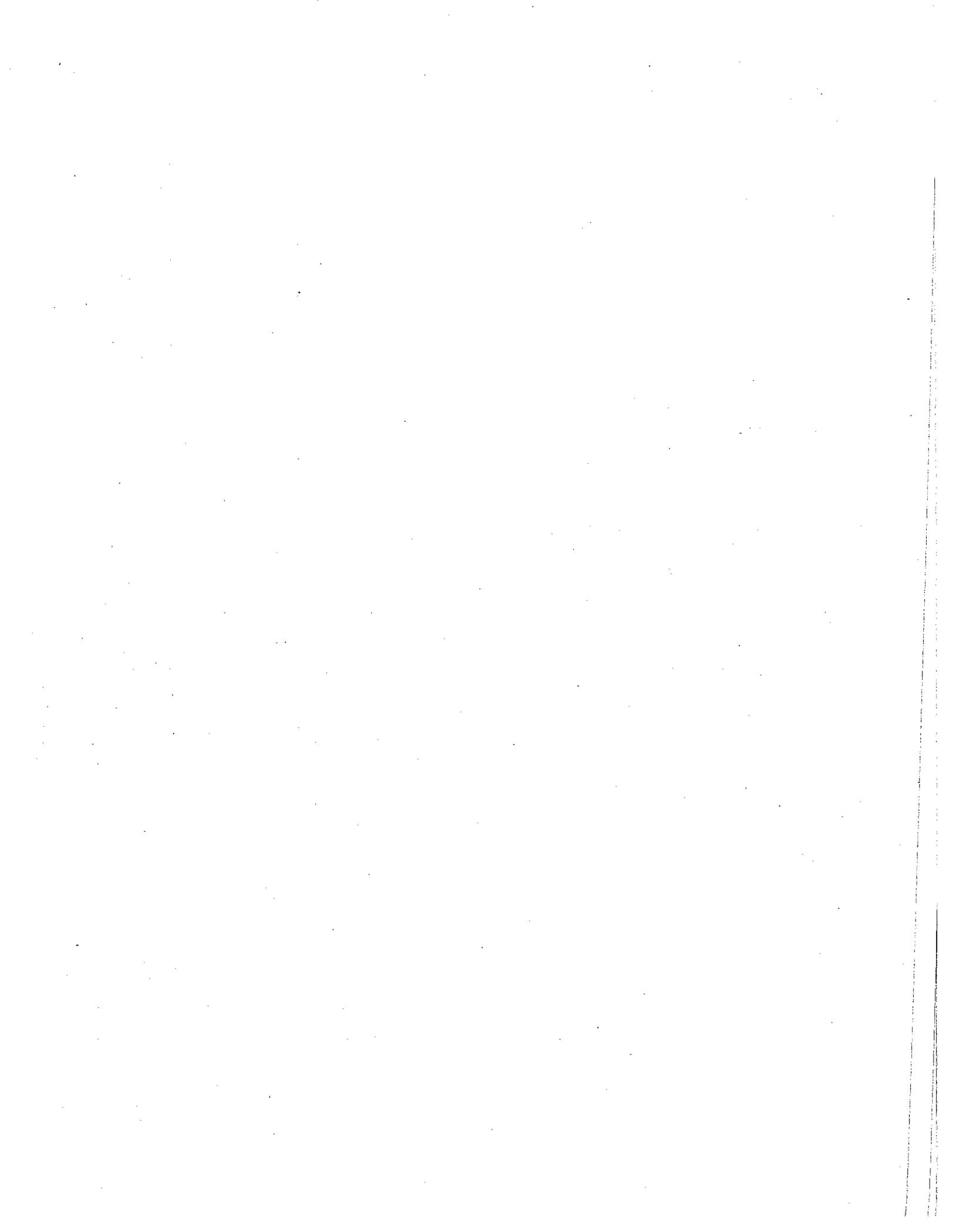
Lint, Dust and Oil Working Group

Note: Proposed revisions to the harmonized Standard for Gas Water Heaters, Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less , distributed for review and comment during November 2001, were referred to the lint, dust and oil working group for review in light of comments received.

The revisions in this Appendix have been recommended to the joint subcommittee for distribution for review and comment.

The proposed revisions are based on: (1) the harmonized Standard for Gas Water Heaters, Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less, ANSI Z21.10.1•CSA 4.1-1998, Z21.10.1a•CSA 4.1a-2000 and Z21.10.1b•CSA 4.1b-2001, and (2) proposed revisions recommended to Accredited Standards Committee Z21/83 and CSA Technical Committee, by the subcommittee at its September 2000 meeting, (3) proposed revisions recommended to the Z21/83 Committee as shown in Appendix A to these minutes.

Additions are "redlined" ~~shaded and~~ ~~underlined~~ and "strike-out" is used to show deletions (e.g. ~~proposed deletion~~).



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PART II
PERFORMANCE

2.36 Resistance to Lint, Dust and Oil Accumulation

Water heaters shall not produce flue gases that contain carbon monoxide in excess of 0.04 percent on an air free basis, in a sample of the flue gases when exposed to lint, dust and oil under the following Method of Test. This requirement shall be considered met when:

- a. the water heater completes the Burner Cycle Sequence and the carbon monoxide concentration reaches equilibrium, as defined in the following Method of Test; or
- b. the water heater shuts down, and requires a manual restart to resume operation.

This provision does not apply to direct vent water heaters, or to water heaters for installation in recreational vehicles, or to water heaters intended for installation outdoors.

Method of Test

Prior to beginning the test, at the manufacturer's request, the water heater may be operated to remove machining oils from the manufacturing process that may cause erroneous test results.

This test shall be conducted at normal inlet test pressure and input rating. At the beginning of the test the ambient room temperature shall be $70 \pm 10^{\circ}\text{F}$ ($21 \pm 5.5^{\circ}\text{C}$).

The lint material used for this test shall be cotton second-cut linters removed from the cotton seed and ground in a revolving knife shearing type mill fitted with a 4 mm screen classifier.

The dust material used for the test shall be ISO Fine Test Dust, 12103-1, A2.

The oil used for the test shall be 100 percent corn oil with a viscosity of 55-60 centipoise when measured by ASTM test method D4040M.

Staff Remarks: A survey of readily available corn oils revealed this would be an acceptable range specification.

(Present "Set-Up," "Operation," "Burner Cycle Sequence," "Water Flow Cycle Sequence," and "Lint, Dust and Oil Injection Sequence" unchanged.)

The test shall be allowed to continue until the first occurrence of one of the following conditions is met:

- a. The water heater emits carbon monoxide concentrations in excess of 0.04 percent on an air free basis, or
- b. Carbon monoxide air free and carbon dioxide concentrations have reached equilibrium, as evidenced by the average flue gas sample readings taken between the 24th and 25th minutes when compared to the flue gas sample readings taken between the 54th and 55th

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minutes, during burner cycle #14 or subsequent burner cycles. For the purposes of this test, equilibrium is defined as follows:

The average carbon monoxide concentration does not increase by more than 0.001 percentage points on an air free basis and carbon dioxide concentrations do not vary by more than 0.1 percentage points;

Staff Remarks: CO₂ concentration change is a better indicator of combustion equilibrium and trending.

- c. The water heater shuts down by design, and requires a manual restart to resume operation.