By Authority Of THE UNITED STATES OF AMERICA Legally Binding Document

CERTIFICATE

By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly INCORPORATED BY REFERENCE and shall be considered legally binding upon all citizens and residents of the United States of America. <u>HEED THIS NOTICE</u>: Criminal penalties may apply for noncompliance.



Document Name:	AHAM HLD-1: Performance Evaluation Procedure for Household Tumble Type Clothes Dryers
CFR Section(s):	10 CFR 430 Subpart B

Standards Body: Association of Home Appliance Manufacturers



Official Incorporator:

THE EXECUTIVE DIRECTOR OFFICE OF THE FEDERAL REGISTER WASHINGTON, D.C.



REREGRMAN (GEISVALUAMON (PROCEDURE LEORIHOUSIEHOLD TUMBLETYPE CLOTHESTORYERS

2.19

SIMMINARD

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

Ŋ

20-

AHAM PERFORMANCE EVALUATION PROCEDURE

FOR HOUSEHOLD TUMBLE TYPE

CLOTHES DRYERS

STANDARD

NO. HLD-1

The Association of Home Appliance Manufacturers' Standards are adopted voluntarily by AHAM's members in the public interest. They are designed to eliminate misunderstanding between manufacturers and consumers and to assist the consumer in buying home appliances.

June, 1974 Price \$1.00 Published by

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS 20 North Wacker Drive Chicago Illinois 60606

PREFACE

The Association of Home Appliance Manufacturers recommends that all appliance products — both major and portable appliances — manufactured or marketed in the United States be submitted to an appropriate independent laboratory such as Underwriters Laboratories or the American Gas Association for inspection and listing in conformance with the safety standards and procedures followed by such laboratories.

This recommended Dryer Performance Evaluation Procedure has been developed by AHAM's Home Laundry Engineering Committee through its Dryer Subcommittee in accordance with the following policy:

All recommended procedures should be readily applied, and as representative of actual use conditions as possible, consistent with good laboratory techniques and be theoretically sound.

All recommended procedures should follow procedures currently in use in the industry unless there is good reason for change.

The procedure as written necessarily contains specific values for essential points, such as temperature, time and load weights. These "Benchmarks" which establish the AHAM Recommended Dryer Performance Evaluation Procedure may be varied for purposes of investigation. In reporting results, the investigator should note prominently all deviations from the recommended procedures.

Objective is to obtain a measure of performance with a given machine under a given set of test conditions. A more efficient experiment design procedure can be used for multiple comparisons among several test machines under several test conditions — multiple comparison is not the original intent of these procedures, although they may be adapted for this purpose.

In evaluating Dryers, the procedures in this book should be used. However, there are other factors, too, which may be considered — such as wear, lint removal, tangling, noise, uniformity of moisture retention, snagging, etc. Together they form a basic profile which should be included in every dryer performance evaluation procedure.

It is anticipated that this standard will be revised regularly.

CONTENTS

	Page
SECTION 1	Purpose
SECTION 2	Scope
SECTION 3	General Conditions
$3.1 \\ 3.2 \\ 3.3 \\ 3.4 \\ 3.5 \\ 3.6$	Definitions.6Clothes Load6Test Conditions8Method of Loading10Procedural Check Off List10Pitfalls and Cautions11
SECTION 4	Moisture Removal
$\begin{array}{c} 4.1 \\ 4.2 \\ 4.3 \\ 4.4 \\ 4.5 \end{array}$	Purpose12Equipment12Material12Procedure12Data Analysis14
SECTION 5	Clothes Temperature Measurement
$5.1 \\ 5.2 \\ 5.3 \\ 5.4 \\ 5.5$	Purpose18Equipment18Material18Procedure18Data Analysis20
SECTION 6	Wrinkling
$egin{array}{c} 6.1 \\ 6.2 \\ 6.3 \\ 6.4 \\ 6.5 \end{array}$	Purpose24Equipment24Material24Procedure24Data Analysis28
Appendix A	Bulk Numbers
Appendix B	Test Materials
Appendix C	Procedural Check Off List
Appendix D	Sample of Electric Dryer Calculations
Appendix E	Sample of Gas Dryer Calculations

M 1

1

į

P 1

٠

SECTION 1 - PURPOSE

- 1.1 The purpose of this standard is to establish a uniform procedure for evaluating the performance of home laundry equipment as indicated in 2.1.
- 1.2 This standard is not intended to prevent improvement in product design and performance.
- 1.3 Through this standard it is intended that dryers can be evaluated with respect to performance factors of importance in the ultimate use of the product by the consumer.

SECTION 2 - SCOPE

- 2.1 This standard applies to automatic, semi-automatic and non-automatic home laundry clothes drying equipment.
- 2.2 This standard includes definitions, methods for testing and evaluating performance and safety of home laundry equipment of the types indicated.

SECTION 3 - GENERAL CONDITIONS FOR AHAM'S PROPOSED DOMESTIC CLOTHES DRYER PERFORMANCE EVALUATION TEST PROCEDURE

3.1 Definitions

Unless otherwise stated, definitions of terms shall be as in "Home Laundering Terms" published by AHAM. Copies are available from AHAM offices.

3.2 <u>Clothes Load</u>

The recommended AHAM Standard Mixed Cotton Test Load (Table I) describes what is considered by the AHAM Home Laundry Engineering Committee to more nearly represent family mixed cotton loads than do the cotton stuffer loads which previously have been used for soil removal testing of home laundry equipment. Variations in actual consumer laundry loads are rather large. Surveys have indicated a great variety in load weights, composition and usage. Therefore, this mixed cotton test load table does not purport to represent actual consumer usage. It is a step in the continuing process of developing more appropriate test loads.

3.2.1 AHAM Standard Mixed Cotton Test Loads

The AHAM Standard Cotton Test Loads are shown in Table I, page 7.

Appendix A gives the details used in determining the composition of loads in relation to bulk numbers. See Appendix B for information pertaining to supplier.

TABI	LE I
------	------

ø

100

.

AHAM STANDARD MIXED COTTON TEST LOADS (BONE DRY ITEMS)

L0. (L) (K)	AD bs.) g.)	2.0	<u>3.0</u> 1.4	<u>4.0</u> 1.8	<u>5.0</u> 2.3	6.0 2.7	7.0 3.2	8.0 3.6	<u>9.0</u> 4.1	10.0	<u>11.0</u> 5.0	<u>12.0</u> 5.4	<u>13.0</u> 5.9	<u>14.0</u> 6.4	<u>15.0</u> 6.8	<u>16.0</u> 7.3	<u>17.0</u> 7.7	<u>18.0</u> 8.2	<u>19.0</u> 8.6	<u>20.0</u> 9.1	<u>21.0</u> 9.5	<u>22.0</u> 10.0	<u>23.0</u> 10.4
11		· · · · -	• • • •			<u> </u>	. <u>.</u>		<u>-</u>											<u> </u>			
1.	Sheets	0	0	0	Ţ	1	ı	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
2.	Table- cloths	0	0	0	0	1	1	1	1	١	2	2	2	2	2	2	2	3	3	3	3	4	4
3.	Shirts	٦	2	2	2	2	2	2	2	3	3	3	4	4	4	4	5	5	5	5	5	5	5
4.	Bath Towels	١	1	2	2	2	3	3	4	4	4	4	5	5	6	6	6	6	7	7	8	8	9
5.	"T" Shirts	1	1	٦	1	1	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6
6.	Pillow Cases	٦	1	2	2	2	2	2	3	3	4	4	4	4	4	4	5	5	6	6	6	6	6
7.	Shorts	1	2	2	2	3	2	3	3	3	3	3	2	4	6	5	6	5	6	6	8	7	9
8.	Wash Cloths	2	4	6	2	2	7	٦	3	6	6	2	5	7	6	6	6	10	9	5	4	8	6
9.	Hand- kerchiefs	0	4	5	3	5	7	2	3	4	5	3	4	6	5	4	3	4	3	2	1	2	3

-7-

(

3.2.2 Load Weights

All weights are "bone dry" weights when load is dried in accordance with 3.3.1 following. The "bone dry" weight must be determined prior to the start of each test series of five runs.

Minor variations in individual item weights may occur.

If the load is over or under weight more than 0.20 pounds (90 g), add or subtract a pair of shorts. Then add or subtract wash cloths and handkerchiefs to obtain the proper weights. If the load is off less than 0.20 pounds (90 g), add or subtract wash cloths and handkerchiefs.

Use each test load no more than 25 times.

Dryers may be tested for loads of any or all sizes.

3.3 Test Conditions

3.3.1 Bone Dry

To obtain consistency in determining load weight, the load should be dried to a condition defined as "<u>bone dry</u>" weight. It is recommended that drying be done in a gas commercial dryer with a basket volume of 12 to 20 cubic feet (0.34 -0.57 cubic meters), heat input of 75,000 to 150,000 Btu/hr and an air flow of 350 to 800 cubic feet per minute.

•

"Bone dry" weight is obtained by the following procedure:

Place dry load in a gas commercial dryer with control set for maximum temperature and dry for 10 to 40 minutes depending upon the load size. Remove and weigh before cool down. Continue drying for ten minute periods until the final weight change is 1% or less.

3.3.2 Damp Load

The moisture content of a dryer test load--before test-shall be equal to the weight of the load, "bone dry". The load should be agitated in $100 \pm 5^{\circ}F$ (38 \pm 3°C) water of 0 to 17 parts per million hardness for approximately two minutes to saturate the fabric, then extracted by spinning to within 5% of twice the "bone dry" weight. Make a final weight adjustment, if necessary, to within 1% of twice the "bone dry" weight by sprinkling load uniformly or by continuing extraction.

3.3.3 Power Source

Total watts input for electric dryers should be in accordance with the manufacturer's nameplate rating $\pm 2_{25}$ (or record deviations) with the dryer connected to a voltage source of 120/240 or 208Y/120 measured and maintained at the dryer terminal block.

Power input for gas dryers should be maintained in accordance with the manufacturer's nameplate Btu rating \pm 5% and a voltage of 120 \pm 2% (or record deviations).

3.3.4 Test Room Conditions

The test room conditions should be maintained at $75 \pm 5^{\circ}F$ (24 \pm 3°C) and 50 \pm 10% Relative Humidity (or record deviations).

3.3.5 Exhausting

The dryer exhaust shall be restricted by adding the AHAM Exhaust Simulator, see Figure 1. All external joints should be taped to prevent air leakage.

The Exhaust Simulator represents 8 feet (2.4 m) of 4 inch (10 mm) pipe, 2-90° elbows and a standard weather hood.

Exhaust inside test room to avoid pressure gradients.

For condenser dryers, conditions should be as recommended by manufacturer.

3.3.6 Lint Trap

If dryer is equipped with lint trap it should be thoroughly cleaned before each test run.

3.3.7 Control of Test

All operations should be performed in sequence with minimum delay to avoid excessive change of conditions.

AHAM EXHAUST SIMULATOR

ŧ

0

FIGURE 1



NOTE: Recommended material for the Simulator is 22 gauge steel or equivalent.

3.4 Method of Loading

Follow the manufacturer's recommendations. If none are given or if standard conditions are desired, proceed as follows:

Load sheets, pillow cases, tablecloths and other flat items by grasping them in the center, shaking them to hang loosely, and folding them in thirds (to take letter "N" configuration), see Figure 2.

Load unbuttoned shirts by shaking from yoke and folding in thirds as above.

Load small items such as shorts, handkerchiefs and "T" shirts by dropping in at random.

Alternately load large and small items.

3.5 Procedural Check Off List

A recommended Procedural Check Off List for Performing Dryer Evaluation Tests in accordance with the standard is shown as Appendix C.

3.6 Pitfalls and Cautions

67

The Home Laundry Engineering Committee of AHAM recognizes that, as in all scientific work, and especially that applied to consumer products, there are certain technical limitations and pitfalls in interpretation which are easy to overlook. Users are urged to watch for these and send them to AHAM Headquarters to be added to future editions.

3.6.1 Do not compare machines tested under unlike conditions unless differences are clearly stated.

FIGURE 2 AHAM LOADING METHOD (1) Grasp center of article



(2) Hold, shaking it to hang loosely



(3) Fold in thirds to form letter "N"



(4) Compress lightly and place in machine

SECTION 4 - MOISTURE REMOVAL

4.1 Purpose

To determine drying time and drying efficiency.

4.2 Equipment

- 4.2.1 Stopwatch or clock.
- 4.2.2 Scale--pound and 0.02 pound graduations.
- 4.2.3 Platform scale--optional (see 4.4.5).
- 4.2.4 Wattmeter, voltmeter, ammeter, auto transformer and watthour-meter.
- 4.2.5 Plastic laundry bag.
- 4.2.6 Gas meter--cubic feet and 0.001 cubic feet graduations.
- 4.2.7 Thermometer or other temperature measuring device.
- 4.2.8 Barometer.
- 4.2.9 Hygrometer or psychrometer.
- 4.3 Material

Standard load as defined in Section 3.

- 4.4 Procedure
 - 4.4.1 Power source, test room conditions, load preparation and exhausting as in Section 3.

Ô

ŧ,

- 4.4.2 For dryers controlled by timers, operate at maximum timer time and maximum temperature setting and dry load to 5 + 1% moisture retention as in 4.4.5 or 4.4.6, but do not permit dryer to advance into cool down; reset timer if required and record number of times reset.
- 4.4.3 For dryers equipped with automatic dry controls without timer, operate at maximum temperature setting but do not permit dryer to advance into cool down.

(Cool down period can be indicated by use of an incandescent bulb properly applied to circuit.)

Set dryness setting to dry to a moisture retention of 5 + 1% as in 4.4.5 or 4.4.6; reset automatic dry control if required and record. If this cannot be done, dry to maximum dry setting and record moisture retention.

- 4.4.4 For dryer without timer or automatic dry control, terminate manually at 5 + 1% moisture retention as in 4.4.5 or 4.4.6.
- 4.4.5 Platform Scale Method
 - **4.4.5.1** Place dryer on platform scale that can be locked out of balance.
 - **4.4.5.2** Insert damp load (see 3.3.2) in dryer using the procedure in 3.4.
 - 4.4.5.3 As load approaches dryness (must be estimated based on experience), unlock scale, record weight and time.
 - 4.4.5.4 If load has not been dried to as low as 6% retention, lock scale.
 - 4.4.5.5 Repeat 4.4.5.3.
 - 4.4.5.6 When 5 + 1% retention is indicated on platform scale, stop dryer, unlock scale and record weight and time, remove load from dryer, place in a plastic laundry bag (4.2.5) and tie bag securely. Confirm net weight on scale with pound and 0.02 pound graduations (4.2.2).
 - 4.4.5.7 Before each run, operate dryer without heat until exhaust temperature is within 10°F (6°C) of the ambient temperature. Immediately (3.3.7) rewet load per 3.3.2, reload dryer as in 4.4.5.2 and run test to approximate time as determined in 4.4.5.6.
 - 4.4.5.8 Run test of 4.4.5.2 through 4.4.5.7 repeatedly until five runs for each load size tested have been completed which well result in $5 \pm 1\%$ moisture retention as weighed on scale with 0.02 pound graduations.
- 4.4.6 Table Scale Method
 - 4.4.6.1 Insert damp load (see 3.3.2) in dryer using the procedure in 3.4.
 - 4.4.6.2 As load approaches dryness (must be estimated based on experience) stop dryer, remove load, place in a plastic laundry bag (4.2.5), the bag securely and record net weight of clothes on scale with pound and 0.02 pound graduations.
 - 4.4.6.3 If moisture retention is greater than 6.0% or less than 4.0%, run must be rejected. Do not put load back in dryer.

- 4.4.6.4 Before each run, operate dryer without heat until exhaust temperature is within 10°F (6°C) of the ambient temperature. Immediately (see 3.3.7) rewet load per 3.3.2, reload dryer as in 4.4.6.1 and run test to approximate control time as determined in 4.4.6.2.
- 4.4.6.5 Run test of 4.4.6.1 repeatedly until five runs for each load size tested have been completed which result in $5 \pm 1\%$ moisture retention.

4.5 Data Recording and Analysis

۲

:

- 4.5.1 Record for each run (on forms, Figures 3 and 4):
 - 4.5.1.1 Clothes load "bone dry" weight.
 - 4.5.1.2 Weight of wet clothes load, before test.
 - 4.5.1.3 Time required to dry load to $5 \pm 1\%$ moisture retention.
 - 4.5.1.4 Weight of dry clothes load, after test.
 - 4.5.1.5 Test room conditions, temperature and percent relative humidity.
 - 4.5.1.6 Heat energy consumption.
 - 4.5.1.7 Total energy consumption exclusive of lamps used for illuminating the exterior of the dryer.
 - 4.5.1.8 Btu per cubic foot rating of test gas corrected to standard conditions (see 4.5.4.2).
- 4.5.2 Compute for each run (on forms, Figures 3 and 4):
 - 4.5.2.1 Water removed from clothes load during run.
 - 4.5.2.2 Water remaining in clothes load after run.
 - 4.5.2.3 Evaporation rate (pounds per minute).
 - 4.5.2.4 Efficiency (pounds water removed per kwh for electric dryers or pounds of water removed per 1000 Btu for gas dryers).
 - NOTE: See Appendix D for sample of Electric Dryer Calculations and Appendix E for sample of Gas Dryer Calculations.

3

4.5.3 Compute for each test of five runs:

.

(**(*****

- 4.5.3.1 Average evaporation rate (pounds per minute).
- 4.5.3.2 Average efficiency (pounds water removed per kWh or per 1000 Btu).
- 4.5.3.3 Time to dry the nominal load size tested from 100.00 to 5.00% moisture retention (using the average evaporation rate).

FIGURE 3

٠

MOISTURE REMOVAL TEST DATA PLATFORM SCALES

NOMINAL	LOAD WT. L	Β.	LAB	TECHNICIAN
RUN NO.			DRYER	VOLTAGE
-			DATE	

I ITEM	MEASUREMEN	RESULT	
A	Plastic Bag Wt., Lb. (Table Scale)		
R	Rone-Dry Load + Plastic Bag Wt Lh	· · · · · · · · · · · · · · · · · · ·	
	Pone Dry Load Mt Lb	Table Scale	
H	Dome-Dry Load WC., LD.	(P-h)	
UU	wet Load Wt., Lb. (Should Equal 2xL)	(lable Scale)	
E	<u>Starting Test Wt. Lb. (Dryer + Wet</u>	Load)	
{ F	Desired Final Test Wt. Range Lb. [(E	-(Cx0.96) to E-(Cx0.94)]	tò
Gl	Time Test Started, Min. (Helpful to	Start Timer at Zero)	
G2	Time to First Stop-To-Weigh, Min.		·····
G3	Test Wt Th		
сл	If not within weight mange E recta	nt driver	······································
	The of Destant Min		
65	Time of Residri, Min.		
60	lime to Second Stop-Io-Weigh, Min.		
<u> </u>	Test Wt., Lb.		
G8	If still not within weight range, F,	restart dryer	
<u>G9</u>	Time of restart, Min.		
GIO	Time to Third Stop-To-Weigh. Min.		
<u> </u>	Test Wt., 1b. (Should be within range	e. F. by now)	
<u> </u>	Dried Load + Plastic Bad Wt 1h /1	able Scale)	
······	WITCH LUAU " FLASLIC DAY MELL LD. (10	ibic scale/	
<u> </u>	Heat Energy, kWh		
J	Total Energy, kWh		
K	Room Temperature, F.		
	Room Relative Humidity, %		<u> </u>
	DESCRIPTION	CALCULATION	
GIZ	lime to first Stop-Io-Weigh, Min.	G2-G1	
G13	Load Wt., Lb.	G3-(E-D)	
G14	Water Retention, %	$f(G13-C)/C_{1} \times 100$	
G15	Duration of First Stop. Min.	G5-G2	······
G16	Time to Second Stop-To-Weigh, Min.	66-61	
617	load Mt 1b		
618	Water Retention %		
	Bunation of Speard Stan Min		
	Time to Think Char To Videl Mar		
<u>620</u>	Time to Third Stop-10-Weign, Min.		
GZI	LOAD WC., LD.	<u> G -(L-D)</u>	
G22	Water Retention, %	<u>[(G21-C)/C1x100</u>	
M	Dried Load Wt., Lb.	<u> H-A</u>	
N ·	Water Retention, %	r(M-C)/C1x100	
0 1	Total Stop Time, Min.	1615 + 619	
<u>p</u> 1	Drving Time Including Stop Time Min	620 616 on 612	
'	erging time including stop time, Min.	Whichoven is First	
	Unuing Time Evoluting Chen Time Man	winichever is rinal	
	We too for pointed 15		
<u>к</u>	water Evaporated, LD.	<u>U~M</u>	
5	water Left in Load, Lb.	<u>M-C</u>	
T	Evaporation Rate Including Stop Time		· ·······
	Lb./Min.	R/P	
<u> </u>	Evaporation Rate Excluding Stop Time		
-	Lb./Min	R/Ó	
	Buying Efficiency 15 /118	671	
V	Drying Erriciency, LD./KWh		

FIGURE 4

MOISTURE REMOVAL TEST DATA TABLE SCALES

NOMINAL LOAD WT., LB._____

.

LAB_____

TECHNICIAN______VOLTAGE_____

RUN NO._____

DRYER_____

	ITEM	DESCRIPTION	CALCULATION	RESULT
	A	Plastic Bag Wt., Lb.		
	В	Bone-Dry Load + Plastic Bag Weight, Lb.		
	С	Bone-Dry Load Wt. Lb.	B-A	
	D	Wet Load Wt., Lb.		
	Е	Drying Time, Min.		
(P)	F	Dried Load Wt., Lb.	90 441	
Ì	G	Item "F" must be within range (See Note Below)	Cx1.06 to Cx1.04	to
				0K NG
	Н	Heat Energy, kWh		
	Ī	Total Energy, kWh		
	J	Room Temp., F		
	К	Room Relative Humidity, %		
ļ	L	Water Evaporated, Lb.	D-F	
	М	Water Left in Load, Lb.	F-C	
	N	Water Retention, %	(M/C) x 100	
	0	Evaporation Rate, Lb./Min.	L/E	
	Р	Drying Efficiency, Lb./kWh	L/I	

(

NOTE: If the dried load weight, F, does not meet the criterion of G, the test is not acceptable.

SECTION 5 - CLOTHES TEMPERATURE MEASUREMENT

5.1 Purpose

Ŧ

To provide a procedure for measuring the fabric temperature in dryers.

- 5.2 Equipment
 - 5.2.1 Stopwatch or clock.
 - 5.2.2 Scale--pound and 0.02 pound graduations.
 - 5.2.3 Wattmeter, voltmeter, ammeter, auto transformer and watthour meter.
 - 5.2.4 Gasmeter--cubic feet and 0.001 cubic feet graduations.
 - 5.2.5 Thermometer.
 - 5.2.6 Thermocouple and potentiometer.
 - 5.2.7 Barometer.
- 5.3 Material
 - 5.3.1 Thermotubes.

See Appendix B.

- 5.3.2 Standard load as defined in Section 3 with thermotube pockets as described in 5.4.2.
- 5.4 Procedure

.

.

- 5.4.1 Energy source, test room conditions, load preparation and exhausting as in Section 3.
 - NOTE: "Bone dry" weight of clothes load used for this test series should be determined after the cloth pockets for holding thermotubes as described in 5.4.2 have been affixed to the garments.

If, during the test, weights are determined with the thermotubes in place, the weight of the thermotubes must be added to the "bone dry" weight of the clothes load.

5.4.2 Prepare cloth pockets for holding thermotubes by stitching a 4 1/2" X 5 1/2" (100 X 130 mm) (approximately) piece of cotton sheeting (of the type used in the AHAM test load) to the garment. Stitching should be on three sides leaving one 5 1/2 inch (130 mm) side open. The cotton sheeting should be affixed in the position indicated in Table 2. Individual thermotube compartments approximately 1/2 inch X 4 1/2 inches (13 mm X 100 mm) are formed by additional stitching from the open end of the cotton sheeting to the closed 5 1/2 inch (130 mm end). One end of each compartment is left open for insertion of the thermotubes. Single straight stitching should be used throughout. No hem should be used on the cotton sheeting.

Caution: There should be no more than one thickness of material on either side of the thermotube when it is inserted into the compartment.

5.4.3 Select thermotubes with ratings at 10°F (6°C) increments; attempt to bracket anticipated maximum clothes temperatures.

1

÷

i

ł

- NOTE: Experience has indicated that seven thermotubes per pocket are necessary for loads up to eight pounds (3.6 kg); eight thermotubes per pocket for loads up to 14 pounds (6.4 kg); and nine thermotubes per pocket for loads greater than 14 pounds (6.4 kg).
- 5.4.4 See Table 2 for appropriate number of sets of thermotubes to be used.
- 5.4.5 Insert thermotubes selected into each pocket and close the open end of thermotube pockets by stapling or sewing.
- 5.4.6 Insert damp load (see 3.3.2) in dryer using the procedure in 3.4.
- 5.4.7 Run dryer for the longer of A or B utilizing temperature setting and loads used in 4.4.2, 4.4.3 or 4.4.4.
 - A. Time to dry to 5% moisture retention as determined per Section 4 plus 50% excluding cool down;
 - B. Time to dry to 5% moisture retention as determined per Section 4 plus 20 minutes excluding cool down.

Immediately following completion of this time, run through the cool down period (when provided) in the "normal" cycle on the machine.

5.4.8 At the conclusion of the drying cycle immediately following cool down insert three thermocouples, one into approximate center of the clothes load, the other two within a three inch radius of center. Press down on the top of the clothes load to insure thermocouple contact with load items until temperature is stabilized. All readings to be taken within three minutes. Record maximum temperature. 5.4.9 Remove clothes load from dryer and record for each pocket, either (a) the temperature midway between the lowest temperature thermotube which did not turn color and the highest temperature thermotube which did turn color, or (b) if one thermotube is partially turned, record the temperature of that thermotube.

If all thermotubes turned color in any one pocket, or none in the entire load turned color, repeat the run with thermotubes covering a more appropriate temperature range. ř.

5.4.10 Repeat 5.4.3 through 5.4.9 four additional times for each load size tested.

5.5 Data Analysis

1 0

.

- 5.5.1 Record time, test room conditions (temperature and percent relative humidity), heat energy input, and total energy input on form, Figure 5.
- 5.5.2 Record clothes load dry weight.
- 5.5.3 Record the dryer temperature control setting.
- 5.5.4 Plot each temperature recorded in 5.4.9 on a frequency histogram as illustrated in Figure 6.
- 5.5.5 Record final clothes load temperature from 5.4.8.
- 5.5.6 Average highest maximum temperature using 10% of the highest values recorded and record same for each load size tested.

Using the data recorded per 5.4.9 for all five runs constituting a Clothes Temperature Test, report the average of the highest values per the following table:

Load Size, Pounds	Kilograms	No. of Pockets Per Run (Ref. 5.4.4)	Total No. of Recorded Values	No. of Highest Values to Average for Result
2.0	0.9	2	10	1
3.04.0	1.41.8	4	20	2
5.06.0	2.32.7	5	25	- 3
7.0-10.0	3.24.5	6	30	3
11.0-14.0	5.06.4	8	40	Ŭ 4
15.0-18.0	6.88.2	10	50	5
19.0-23.0	8.610.4	12	60	Ē

TABLE 2



Pockets on the following number of garments:

۰.

٠

A

*

ł

Pounds	<u>2.0#</u>	3.0-4.0#	<u>5.0-6.0#</u>	<u>7.0-10.0#</u>	11.0-14.0#	15.0-18.0#	19.0-23.0#
Kilogram	0.9	1.4-1.8	2.3-2.7	3.2- 4.5	5.0-6.4	6.8-8.2	8.6-10.4
Sheets	-	-	1	1	2	2	3
Pillow cases	1	1	1	1	1]	ĩ
Shirts	1	1	1	1	1	2	3
Shorts	-	-	-	-	1	ר	1
"T" Shirts	-	1	1	1	1	1	1
Towels .	-	1	1	1	1	2	2
Tablecloths	-	<u> </u>	··]	1]	1
Number of							
sets of pocke	ts						
per load	2	4	5	6	8	10	12

-21-

FIGURE 5

CLOTHES TEMPERATURE MEASUREMENTS

NOMINAL LOAD WT., LB._____ RUN NO._____

LAB DRYER___

DATE

TECHNICIAN_____ VOLTAGE_____ ŕ

TEST DATA

ITEM	PARAMETER	CALCULATIONS	RESULT
A	Bone Dry Load Wt., Lb.	None Required	
8	Dryer Max, Temperature Control		
	Setting	None Required	
С	Room Temperature, F	None Required	
D	Room R.H., %	None Required	
E	Heater Energy, kWh	None Required	
F	Total Energy, kWh	None Required	
G	Final Clothes Temp., F	None Required	
H	Average Time to Dry to 5%, Min.	Calculate Average	
I	Added Drying Time, Min.	0.5H or 20 Min. Minimum	
J	Total Drying Time, Min.	H + I	

Thermo-				N	UMBER	OF THE	RMOTUB	<u>es</u> cha r	NGED	······································		
Temp. F	1	2	3	4	5	6	7	8	9	10	11	12
Item											ļ	
	 	<u> </u>										
	 	 										
				<u> </u>	<u> </u> ;							
	ļ			 								
Max, lemp,	L	I		Ĺ				L		· 		

Changed - J; Unchanged - ----; Partially Changed - P

REPORT: Maximum Temperature for Each Clothes Item



6.1 Purpose

To evaluate garment wrinkling in a finished dryer load.

6.2 Equipment

- 6.2.1 Modified AATCC Wrinkle Test Machine (see Appendix B).
- 6.2.2 Lighting equipment for viewing test specimens with overhead lighting as shown in Figure 7.
- 6.2.3 Set of six full size plastic replicas used with overhead lighting for AATCC Test Method 124-1969-T. See Appendix B.
- 6.2.4 Stopwatch or clock.
- 6.2.5 Scale--pound and 0.02 pound graduations.
- 6.2.6 Wattmeter, voltmeter, ammeter, auto transformer and watthour meter.
- 6.2.7 Gasmeter--cubic feet and 0.001 cubic feet graduations.
- 6.2.8 Barometer.
- 6.3 Material
 - 6.3.1 15" X 15" (380 mm X 380 mm) permanent press pinked swatches, per Appendix B.
- 6.4 Procedure
 - 6.4.1 Energy source, test room conditions, load preparation and exhausting as in Section 3.
 - 6.4.2 Place 15" X 15" (380 mm X 380 mm) permanent press swatches in load as follows:

Load Size

Number Swatches

帅]

i la

2.0-5.0 lbs.	(0.9-2.3 kg)	3
6.0-10.0 lbs.	(2.7-4.5 kg)	4
11.0-15.0 lbs.	(5.0-6.8 kg)	5
16.0-20.0 lbs.	(7.3-9.1 kg)	6

NOTE: Swatch weight of 0.538 oz. (15.2 grams) per swatch is to be included as part of total load weight.

6.4.3 For the evaluation of wrinkling characteristics, it is recommended that a load composed of permanent press materials be used as follows:

	<u>Item</u>	Size	<u>Blend</u>
۱.	Men's Dress Shirt	17-34	65% Polyester 35% Cotton
2.	Sheets	81" X 104"	50% Polyester 50% Cotton
3.	Pillow Cases	36" X 42"	50% Polyester 50% Cotton
4.	"T" Shirts	46	50% Polyester 50% Cotton
5.	Trousers	34" Waist	100% Polyester
6.	Handkerchiefs		50% Polyester 50% Cotton

NOTE: These items are available commercially.

6.4.4 The load composition for various load sizes is recommended as follows:

Item	Load Size	$\frac{4.0 \text{ lbs.}}{(1.0 \text{ lbs.})}$	$\frac{6.0 \text{ lbs.}}{(2.7 \text{ bs.})}$	8.0 lbs.	10.0 1bs.	<u>12.0 lbs.</u>
Chinta		(1.8 Kg)	(2./ kg)	(3.6 Kg)	(4.5_Kg)	(5.4_kg)
Shirts		I	3	3	5	5
Sheets		1	1	2	2	3
Pillow Case	es	3	4	4	6	6
"T" Shirts		2	2	3	3	5
Trousers		1	2	2	3	3
Handkerchie	efs	1	4	2	5	4

NOTE: Handkerchiefs should be added or deleted to adjust load weights.

- 6.4.5 Using temperature setting specified by the manufacturer for permanent press determine the dry time to $5 \pm 1\%$ moisture retention for each load size as in 4.4.
- 6.4.6 Dampen load until moisture content is 65% of "bone dry" weight (use procedure shown in 3.3.2), but remove swatches before final spin portion of cycle.
- 6.4.7 Wrinkling Procedure

へ

- 6.4.7.1 Initial Preparation of Wrinkle Test Swatches and Test Load
 - 6.4.7.1.1 Wash ten minutes in hot solution (140 \pm 5°F) (60 \pm 3°C) of 3 grams of AHAM Standard Test Detergent IIA per gallon (3.8 liters) of softened water (0.9 grains maximum).

, , , ,

- 6.4.7.1.2 Extract.
- 6.4.7.1.3 Rinse in warm water (approximately 100°F) (38°C).
- 6.4.7.1.4 Extract.
- 6.4.7.1.5 Perform steps 6.4.7.1.1 through 6.4.7.1.4, except omit detergent, a total of 3 times.
- 6.4.7.1.6 Determine that swatches are wrinkle free. If necessary, remove wrinkles by ironing lightly with a steam iron.
- 6.4.7.2 Procedures for Wrinkling of Swatches
 - 6.4.7.2.1 Use modified AATCC Wrinkle Tester. This device for introducing wrinkles into fabric consists of:
 - a. 2 metal bands with spring tension.
 - b. 2 clips to secure metal bands.
 - c. Weight.
 - d. Stand and base.
 - 6.4.7.2.2 Attach wet swatch (or swatches)* to upper portion of Wrinkle Tester:
 - a. Hold swatch in place.
 - b. Wrap band around swatch.
 - c. Place clip over ends of band to hold into position.
 - NOTE: Hold band securely as it tends to spring back.
 - 6.4.7.2.3 Attach wet swatch (or swatches) to lower portion of Wrinkle Tester:
 - a. Hold swatch in place (pull tautly).
 - b. Wrap band around swatch.
 - c. Place clip over ends of band to hold into position.
 - NOTE: Hold band securely as it tends to spring back.
 - Do not wrinkle more than 3 swatches at one time.

-26-

- 6.4.7.2.4 Lower machine to wrinkling position.
 - a. Grasp metal rod firmly and lift up.
 - Pull pin through until rod will slide down as grasp is released.
 - c. Lower gradually.
 - d. Put additional weight into place.
 - e. Time for exactly 5 minutes.
- 6.4.7.2.5 Remove swatches at the end of five minutes:
 - a. Remove weight.
 - b. Lift top portion of machine and secure into place with pin.
 - c. Remove clips and bands carefully to avoid their snapping away.
 - d. Quickly rate wet wrinkles against AATCC Durable Press Standards.
 - e. Place wrinkle swatches between two sections of plastic film (e.g. dry cleaning bag) in a single layer. Do not stretch, pull, press, etc.
 - f. Hold swatches between layers of plastic film until all swatches have been wrinkled.
 - g. Add swatches to washed load of permanent press.
- 6.4.8 Place entire load in dryer.

ł

- 6.4.9 Dry load to $5 \pm 1\%$ as determined in 4.4 and then add cool down time per the manufacturer's specification for permanent press.
- 6.4.10 Remove swatches immediately from dryer and mount each (to be judged in turn) in the center of the viewing board as illustrated in Figure 7.
- 6.4.11 Place plastic replicas on each side of the swatch panel to facilitate comparative rating.

- 6.4.12 With the overhead fluorescent light the only light source (darkened room) for the viewing board, the observer (or judge) stands directly in front of the swatch, four feet away from the board (height of person judging has no significance).
- 6.4.13 Assign the plastic replica number (AATCC standard 1 to 5) which most nearly matches each of the swatch panels under judgment. Three separate people shall independently rate each swatch.
- 6.4.14 Five runs shall be made for each load size tested. The value of each swatch is the average of the number of ob-servations.
- 6.5 Data Analysis

۰.

- 6.5.1 Record for each test run and report results on form, Figure 8.
 - 6.5.1.1 AATCC rating by each observer for each swatch.
 - 6.5.1.2 Load dry weight.
 - 6.5.1.3 Time, test room conditions (temperature and percent relative humidity), heat energy input and total energy input.
 - 6.5.1.4 Dryer temperature control setting.
 - 6.5.1.5 Time required to dry load to $5 \pm 1\%$ moisture retention.
 - 6.5.1.6 Machine identification
- 6.5.2 Compute
 - 6.5.2.1 Average time for each load size.
 - 6.5.2.2 Average AATCC rating for each swatch.
 - 6.5.2.3 Report results on form (Figure 8).



FIGURE 7

LIGHTING EQUIPMENT FOR VIEWING TEST SPECIMENS

- 2 4' (1.2 m) Type F 40 CW (Cool-White) Preheat Rapid Start Fluorescent Lamp (without baffle or glass).
- 1 White enamel reflector (without baffle or glass).
- 1 General-type swatch mount, spring-loaded. Fabricate using light sheet metal (22 ga).
 - 1 1/4" (6 mm) Plywood mounting board; OD 6' X 4' (1.8 m X 1.2 m). Paint gray to match No. 2 rating on International Gray Scale for Staining.

FIGURE 8

WRINKLE TEST REPORTING FORM

MACHINE IDENTIFICATION

ſ

		-	TEST RUN NU	MBER		
	1	2	3	4	5	Average
AATCC Rating for Each						
Swatch		i 				
						····
Average						
Load Dry Weight	 					
<u>Test Room</u> Conditions						
Temperature	<u> </u>				· · · · · · · · · · · · · · · · · · ·	
% R.H.			 			
Heat Energy Input						
Total Energy Input						
Dryer Temp. Control Setting						
Time Required to Dry Load t 5 <u>+</u> 1% Moistu Retention	o re					Avg Time

REPORT: Average AATCC rating for each run.

(

Ś.

€¶.

Appendix A

BULK NUMBERS

Bulk number is the sum of:

1. A dry weight index,

2. A wet weight index, and

3. An area index.

ĵ,

The indexes are determined by relating the dry weight (or wet weight, or area) for the smallest item to the item whose index is being computed. For example:

A tablecloth is 20.235 times as heavy, dry, as a handkerchief so its dry weight index is 20.235.

A tablecloth is 19.890 times as heavy, wet, as a handkerchief so its wet weight index is 19.890.

A tablecloth has 19.008 times as many surface inches as a wash cloth so its area index is 19.008.

The sum of these is the bulk number of the tablecloth and is 59.133.

	Bone Dry				
Item	Weight	<u>Material</u>	<u>Color</u>	<u>Trade Size</u>	<u>Remarks</u>
Sheets Tablecloths	1.315 0.688	Muslin Cotton	White Colorfast	81" X 99" 52" X 52"	Flat, Double
Shirts	0.485	Cotton Broadcloth	White	17" X 34"	Men's Non-Resin
Bath Towels	0.565	Cotton Terry	White	22" X 44"	Rectangular
"T" Shirts	0.285	Cotton	White	46"	Flat, Knit, nylon reinforced collar
Pillow Cases	0.27	Muslin	White	36" X 42"	Flat
Shorts	0.26	Combed Cotton	White	44"	Boxer
Wash Cloths	0.065	Cotton Terry	White	12" X 12"	
Handkerchiefs	0,034	Cotton	White	16" X 17"	

Description of Load Component Items

SUMMARY OF LOAD DETERMINATION FACTORS

(DRY WEIGHT, WET WEIGHT, AND BULK)

] Bone Drv	2** Drip Wet	3*** Material	A Dry	B Wet	С	4 Buľk
	Wgt. Lbs.	Wgt. Lbs.	Area Sq. In.	Wgt. I <u>ndex</u>	Wgt. Index	Area Index	Number A+B+C
Sheet	1.315	3.915	7291.068	33.676	28.787	55.048	122.511
Pillow Case	0.270	1.823	1317.234	7.941	13,404	9.945	31.290
Shirt []]	0,485	1.345	2760.150	14.265	<u>9.890</u>	20.839	44.994
Shorts	0.260	0.825	1356.515	7.647	6.066	10.242	23.955
"T" Shirt	0.285	1.188	1351.326	8.382	8.735	10.203	27.320
Bath Towel	0.565	3.028	920.22 <u>8</u>	16.618	22.265	6.948	45.831
<u>Wash Cloth</u>	0.065	0.323	132.449*	1.912	2.375	1.000	5.287
Handkerchief	0.034*	0.136*	278.438	1.00	1.00	2.102	4.102
Tablecloth	0.688	2,705	2517.605	20.235	19.840	19.008	59.133

* = Base Item for Index Calc.

Ex:
$$A = \frac{1.315}{0.034} = 38.676$$
 $B = \frac{3.915}{0.136} = 28.787$ $C = \frac{7921.068}{132.449} = 55.048$

** Determination of Drip Wet Weight

1.0 Procedure

1

ŧ :

1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、1997年1月1日に、199

- 1.1 Select new article as under "Description of Load Component Items".
- 1.2 Completely submerge article in three (3) gallons (11.4 1) of softened water at room temperature.

(s

- 1.3 Agitate (Stir) article for about five (5) minutes until article is thoroughly wet.
- 1.4 Remove article from water and hang (lengthwise on clothes line) for a period of five (5) minutes.
- 1.5 Remove article from line, weigh accurately, record weight.
- 1.6 Repeat 1.1 through 1.5 two more times using a new article each time.
- 1.7 Use average of the three weighings as the "Drip Weight".
- *** Determination of Material Area

2.0 Procedure

- 2.1 Select new article as under "Description of Load Component Items".
- 2.2 "Bone dry" article as described in Section 3, paragraph 3.3.1, Drying Procedure.
- 2.3 Weigh article accurately and record weight.@
- 2.4 Cut large sample of fabric (swatch) from article (being careful to include only single thickness sections).
- 2.5 Determine area (A) of swatch by measuring both the width (w) and length (1) of swatch (\pm 0.030 inches) (\pm 0.26 mm). Keep swatch in a flat relaxed condition while measuring w X 1 = A of swatch in square inches or square mm.
- 2.6 "Bone dry" swatch sample as in 2.2 above.
- 2.7 Weigh swatch accurately and record weight.
- 2.8 Repeat 2.1 through 2.7 two more times using a new article each time.
- 2.9 Determine the average of the weight and measurements.
- 2.10 Determine Fabric Area as follows:

Area of Article = A' x $\frac{Wa'}{Ws'}$

where
A' = Average area of swatches
Wa' = Average "bone dry" weight of articles
Ws' = Average "bone dry" weight of swatches

@ NOTE: Articles with buttons should have buttons removed before weighing.

-33-

TEST MATERIALS

Detergent

The detergent shall be the AHAM Standard Test Detergent, II-A, available in 50 pound (22.7 kg) bags.

Order from: Association of Home Appliance Manufacturers 20 North Wacker Drive Chicago, Illinois 60606

2. AHAM Standard Preconditioned Test Loads

Test loads shall be purchased from: 2 East End Avenue New York, New York 10021 Attn: R. H. Tompkins, Chief Chemist

3. Thermotubes

Order from:

The Paper Thermometer Company 10 Stag Drive Natick, Massachusetts

4. AATCC Test Replicas

AATCC Test Method 124-1969-T set of 6 plastic replicas

Order from:

American Association of Textile Chemists and Colorists P. O. Box 12215 Research Triangle Park, North Carolina 27709 Ű,

Ş.

5. Wrinkling Swatches

15 inch X 15 inch permanent press pinked swatches. Swatch material is identified as 65% polyester, 35% cotton shirting fabric, with the two fibers intimately blended in warp and filling. Thread count to be 138 X 70. Finished weight to be 3.0 to 3.2 ounces per square yard.

Order from:	Spring Mills Lancaster, Pennsylvania 29720				
	Dan River Mills Danville, Virginia 24541				
	Klopman Div., Burlington Industries Greensboro, North Carolina 27400				
Wrinkle Test Machine					

Prints available from:

6.

Association of Home Appliance Manufacturers 20 North Wacker Drive Chicago, Illinois 60606

Appendix C

RECOMMENDED PROCEDURAL CHECK OFF LIST FOR PERFORMING DRYER EVALUATION TESTS IN ACCORDANCE WITH AHAM DRYER STANDARD PERFORMANCE EVALUATION PROCEDURE HLD-1

- 1. Review test procedure in detail.
- 2. Prepare test loads.
- 3. Set up a dryer to be operational.
- 4. Run through table scale test (Section 4) to establish procedure.
- 5. Run through temperature test (Section 5) to establish procedure.
- 6. Proceed to run performance evaluation tests.
 - a. Run two moisture removal tests with platform scales.
 - Run two moisture removal tests with <u>table scales</u> using same load as 6a.
 - c. Run two tests for cloth temperatures measurements using same load as 6a.
- NOTE: This list may be expanded to include additional detail such as procedural items that may be pertinent to a particular laboratory.

Appendix D

SAMPLE OF ELECTRIC DRYER CALCULATIONS

8# DRY LOAD

٠

مىسىر يەرىپىدىنى بەرمۇرىيى يەرىپىدىنى بەرمۇرىيىنى بەرمۇرىيىنىيە بەرمۇرىيىنىيە بەرمۇرىيىنى بەرمۇرىيىنى بەرمۇرىيى مەرمۇرىيە بەرمۇرىيە بەرمۇرىيى بەرمۇرىيە بەرمۇرىيى بەرمۇرىيىنىيە بەرمۇرىيىنىيە بەرمۇرىيى بەرمۇرىيى بەرمۇرىيى بەر

TEST	1	2	3	4	5	<u>Avg.</u>
"Bone dry" weight of load, pounds	8.00	8.00	8.00	8.00	8.00	
Weight of wet load, pounds 100 <u>+</u> 1%	16.02	15.98	16.00	16.05	16.06	
Time to dry, minutes	45.00	47.00	47.00	46.00	46.00	46.20
Weight of dry clothes after test, pounds	8.40	8.35	8.32	8.34	8.39	
Water removed, pounds	7.62	7.63	7.68	7.71	7.67	
Water remaining, pounds	0.40	0.35	0.32	0.34	0.39	
Total load retention	5.00%	4.38%	4.00%	4.25%	4.88%	4.50
Evaporation rate pounds per minute	0.169	0.162	0.163	0.168	0.167	0.166
Heat energy only, kWh	2.71	2.85	2.80	2.76	2.88	2.82
Total energy kWh	2.90	3.06	3.02	2.99	3.10	<u>3.01</u>
Efficiency, pounds water removed per kWh	2.63	2.49	2.54	2.58	2.48	2.54
Řoom temperature, F	76	77	77	78	77	
Barometric pressure, in Hg	29.96	29.96	29.97	29.97	29.97	
Room relative humidity	41%	43%	45%	48%	47%	
Number of timer or automatic control resets	0	O	0	0	0	

Ś

Į

Average evaporation rate = $\frac{0.169 + 0.162 + 0.163 + 0.168 + 0.167}{5}$ = .166 pounds per minute Average efficiency = $\frac{2.63 + 2.49 + 2.54 + 2.58 + 2.48}{5}$

= 2.54 pounds per kWh

.

Time to dry

= 45.8 minutes

NOTE: To connect kWh to BTU, multiply by 3415 BTU/kWh.

•

ſ

Q

SAMPLE OF GAS DRYER CALCULATIONS

3

<u>8# DRY LOAD</u>								
TEST	1	2	33	4	5	AVG.		
"Bone dry" weight of load, pounds	8.00	8.00	8.00	8.00	8.00	8.00		
Weight of wet load, pounds 100 <u>+</u> 1%	16.00	16.06	15.98	16.00	16.02	16.01		
Time to dry, minutes	45.00	44.00	45.00	45.00	43.00	44.40		
Weight of dry clothes after test, pounds	8.32	8.39	8.35	8.32	8.40	8.36		
Water removed, pounds	7.68	7.67	7.63	7.68	7.62	7.66		
Water remaining, pounds	0.32	0.39	0.35	0.32	0.40	0.36		
Total load retention	4.00%	4.88%	4.38%	4.00%	5.00%	4.45%		
Evaporation rate pounds per minute	0.171	0.174	0.170	0.171	0.177	<u>0.173</u>		
Heat energy only, M BTU	12.18	11.38	11.78	12.36	11.57	11.85		
Total energy, M BTU	12.83	12.06	12.45	13.02	12.21	12.51		
Efficiency, pounds water removed per M BTU	0.60	0.64	0.61	0.59	0.62	<u>0.61</u>		
Room temperature, F	77	78	77	77	76			
Barometric pressure, in Hg	29.97	29.97	29.97	29.96	29,96			
Room relative humidity	47%	48%	45%	43%	41%			
No. of timer or automatic control resets	0	0	0	0	0	0		

Average gas temperature		
<u>66 + 65 + 64 + 64 + 66</u>	2	65F
5		
Average gas pressure at meter		
$\frac{7.1 + 7.1 + 7.0 + 6.9 + 6.9}{5}$	=	7 inches water
5		
Average gas volume consumed		
10.90 + 11.32 + 12.15 + 11.01 + 12.22	=	11.52 cubic feet
5		
Average barometric pressure		
<u> 29.96 + 29.96 + 29.97 + 29.97 + 29.97</u>	=	29.97 inch Hg
5		

6

Ø

Sample Calculations for Gas Dryer

<u>Heat Er</u>	<u>Sample</u>				
Gas Tem	Gas Temperature				
Baromet a)	er Correctionsuse barometer reading Certificate Corrections (obtained from barometer)	29.97 inch Hg O inch Hg			
b)	Temperature Correction (obtained from table* for 29.97 inch Hg and ambient temperature of 77°F)	-0.125 inch Hg			
, c)	Latitude Correction (assume 40 ⁰ latitude-obtain from table*)	+0.01 inch Hg			
d)	Altitude Correction (.01% for each 1000 feetassuming 1200 feet then .00012 X 29.97)	negligible			
	Corrected Barometric Pressure	29.855 inch Hg			

* Table referred to is published by the U. S. Weather Bureau for barometric pressure correction and is available from AHAM Headquarters.

Gas Pressure

Corrected Barometric Pressure	29.855 inch Hg
Gage Pressure at Meter (7.0 inches water column) 7.0 inches water/13.6 specific gravity of Hg =	0.515
Corrected Gas Pressure	30.370 inch Hg
Heat Content of Gas (varies depending on source)	1025 Btu/ft ³
Gas Volume (read from meter)	11.52 ft ³

Correction Factor for Gas Volume

Obtained from U. S. Bureau of Standards, Circular C 417, 1938, at gas temperature of 65°F, and corrected gas pressure of 30.370 inches of mercury.

Excerpt from Table 3--Correction Factor for Gas Volume

Temperature	Total Gas	s Pressure	Inches of	F Mercury
F	30.2	30.3	30.4	30.5
65	0.9938	0.9972	1.0006	1.0039

Extrapolation Yields:

$$CF = (30.370 - 30.3) (1.0006 - 0.9972) + 0.9972$$
$$(30.4 - 30.3)$$
$$= 0.0024 + 0.9972$$
$$= 0.9996$$

Heat Energy, Btu

Heat content of Gas x Gas Volume x Correction Factor

1025 x 11.52 x 0.9996 = 11,803 Btu

Electric Energy, kWh

Energy consumed by motor, interior light and all other electrical components (assume 0.31 kWh)

Convert kWh to Btu

0.31 kWh x 3415 Btu/kWh

1,059 Btu

=

<u>Total Energy =</u>

۲

:

đ.

(SP)

Electrical Energy + Gas Energy

1059 + 11,803 = 12,862 Btu

Dryer Water Evaporation Rate

<u>7.66 pounds of water</u> = 0.166 pound/minute 46.2 minutes - average dry time

Dryer Efficiency

7.66 pounds of water	=	0.00060 pounds water/Btu
12,862 Btu - total energy		
-	=	0.60 pounds water/M Btu