THRESHOLD LEVELS FOR THERMAL COMFORT UNDER EXPOSURES TO A LOCALIZED, NON-AMBIENT TEMPERATURE AIR JET

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BY

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CHAPTER I

INTRODUCTION

During recent years the exposure to localized air jets (drafts) has been used increasingly to compensate for a person's feeling of discomfort when exposed to a thermal environment differing from a normal optimal comfort temperature.

This concept is used especially in commercial aircraft where a uniform thermal environment is difficult to establish because of highly varying rates of heat transfer. There may be, for example, high heat transfer through walls due to large temperature differences (approx. 70 °F under normal cruise conditions), high heat loss at doors and emergency exits due to increased heat conduction, and possible one sided heat gain due to exposure to high intensity solar radiation.

In cars and other air conditioned vehicles and in air conditioned houses persons are exposed to localized drafts. However, in this type of exposure drafts are undesireable and caused by poorly designed air distribution system or unusual thermal conditions.

Overmeyer (12) investigated the effect of face air velocity on airplane passenger comfort. This study was done for one of the commercial aircraft manufacturing companies shortly after the entry into the age of commercial jet airliners. High pressure cold air was easily available so that the installation of individual, velocity adjustable, air outlet nozzles was feasible. From this study it was concluded that passengers would feel comfortable at a lower face velocity if the cabin ambient temperature was reduced or the temperature of the outlet air was reduced. No data were reported concerning the subject's reaction to the nonuniform exposure (warm ambient temperature and cold outlet temperature).

Azer and Nevins (1) and Azer et al. (2) investigated the relationship between sensory votes, average skin temperature and sweat rate under exposure to localized ventilation applied frontally to the head of each individual in a group of six subjects while seated in a hot environment (heat stress).

The effect of localized draft related to a persons subjective feelings and skin temperature drop was investigated by Houghten et al., (7). In this study Houghten worked with fixed ambient conditions of 70 °F and 50% RH. He found the degree of comfort was a function of air velocity and draft temperature, without obtaining information on the effect of the ambient conditions on each subject's overall comfort feeling. After studies done by Fanger (4) and Rohles and Nevins (13) it should be expected that the desired draft temperature is very closely connected to each individual persons optimal comfort temperature and the difference between this temperature and the actual exposure temperature. Draft temperature is defined in this presentation as the temperature of the air flow at the location where it impinges on the subject's skin.

With this background, the present study was undertaken. Sixteen subjects were used and each participated in six tests of which the two first tests were used to find each subject's "comfort temperature". In the last four tests the subjects were exposed to four combinations of two localized air jet velocities and two ambient temperatures above and below their comfort temperature. The upper and lower temperature limits of the "comfortable" draft were determined. Correlations were found between comfort vote, the subjects comfort temperature, the difference between the latter and the actual ambient temperature, jet velocity, and the desired mean temperature of the impinging air jet.

CHAPTER II

FACILITIES

The environmental chamber was a Sherer-Gillett (Model CER 810) which was modified to provide closely controlled conditions of room temperature, relative humidity, and overall air movement. An adjustable nozzle with fan, air conditioning unit, and necessary duct system was installed to provide a controlled jet air velocity and temperature.

To accomplish a uniform, low air velocity in the test area, a chamber inside the chamber was constructed (Fig. 2.1). The original air flow system was changed so that the air flow was downward from the ceiling. The ceiling of the inner chamber consisted of two layers of 26 gage steel screen perforated with 0.027 in. holes providing an 18% net opening which produced a downward velocity distribution as shown in Fig. 2.2. It was found that the three fans built into the heat exchanger had a flow characteristic such that the velocity stayed nearly constant above 60% voltage, and only the noise level increased. Table 2.1 gives the calculated means and standard deviations of overall downward velocity and measured noise level in dB in A, B, and C scales for 30, 40, 50, 60, and 70% voltage applied to the fans. A graph of the velocity and the noise level in dBA as a function of fan voltage is shown in Fig. 2.3. Forty percent voltage was used during the tests since this velocity gave both a sufficient air change rate for temperature control (125 air changes per hour), a low mean velocity, 0.073 ± 0.032 m/s (15 ± 7 fpm), and a low noise level (64 dBA).

The inside dimensions of the chamber were 81 inches wide by 104 inches long by 83 inches high. The distance between the new inner wall and the inside of the insulated wall was 2¼ inches which created a mean return

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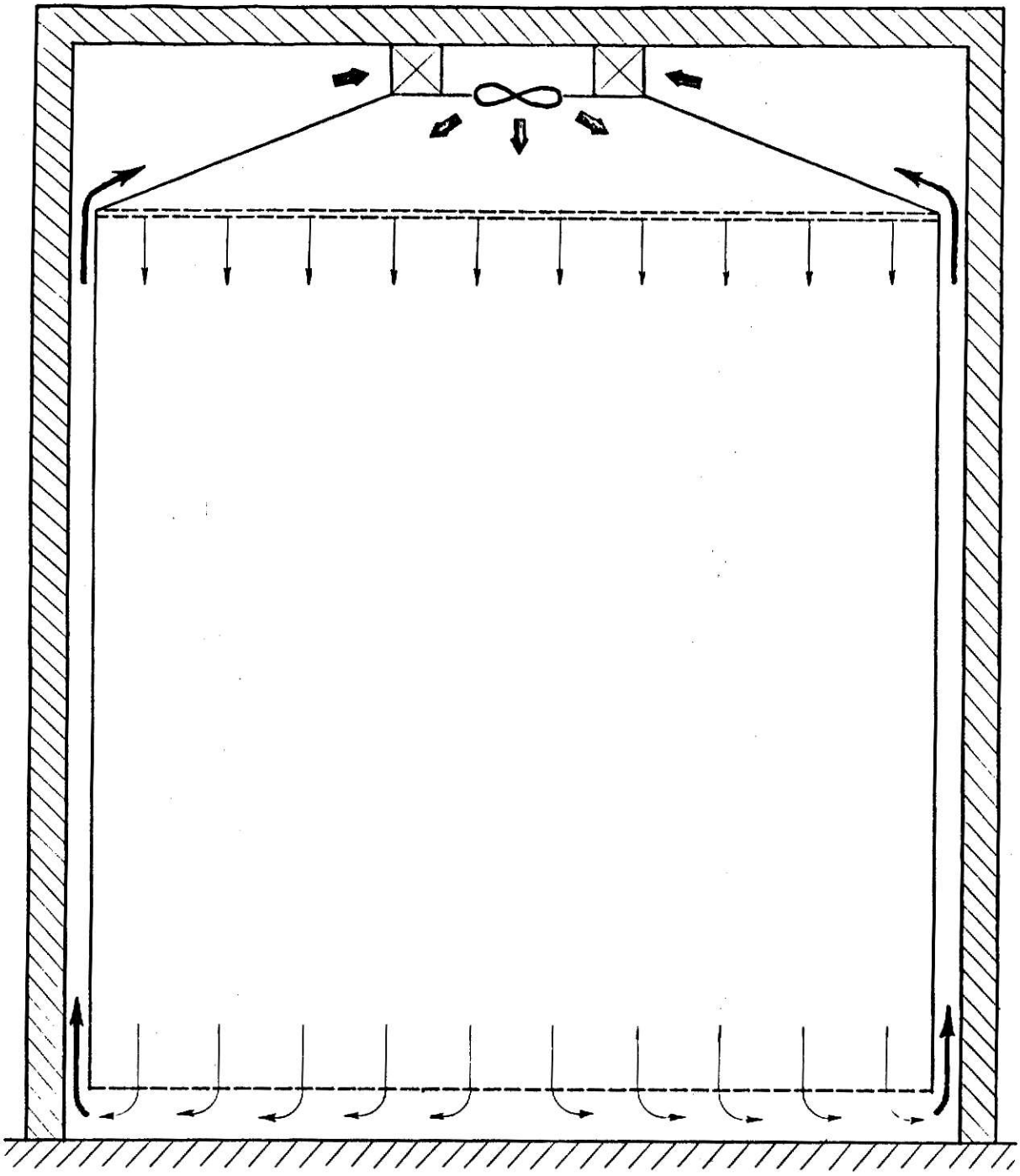


Fig. 2.1 A Schematic cross section view showing the air flow in the constructed "chamber inside the chamber" with inside dimensions of 81 inches wide by 83 inches high.

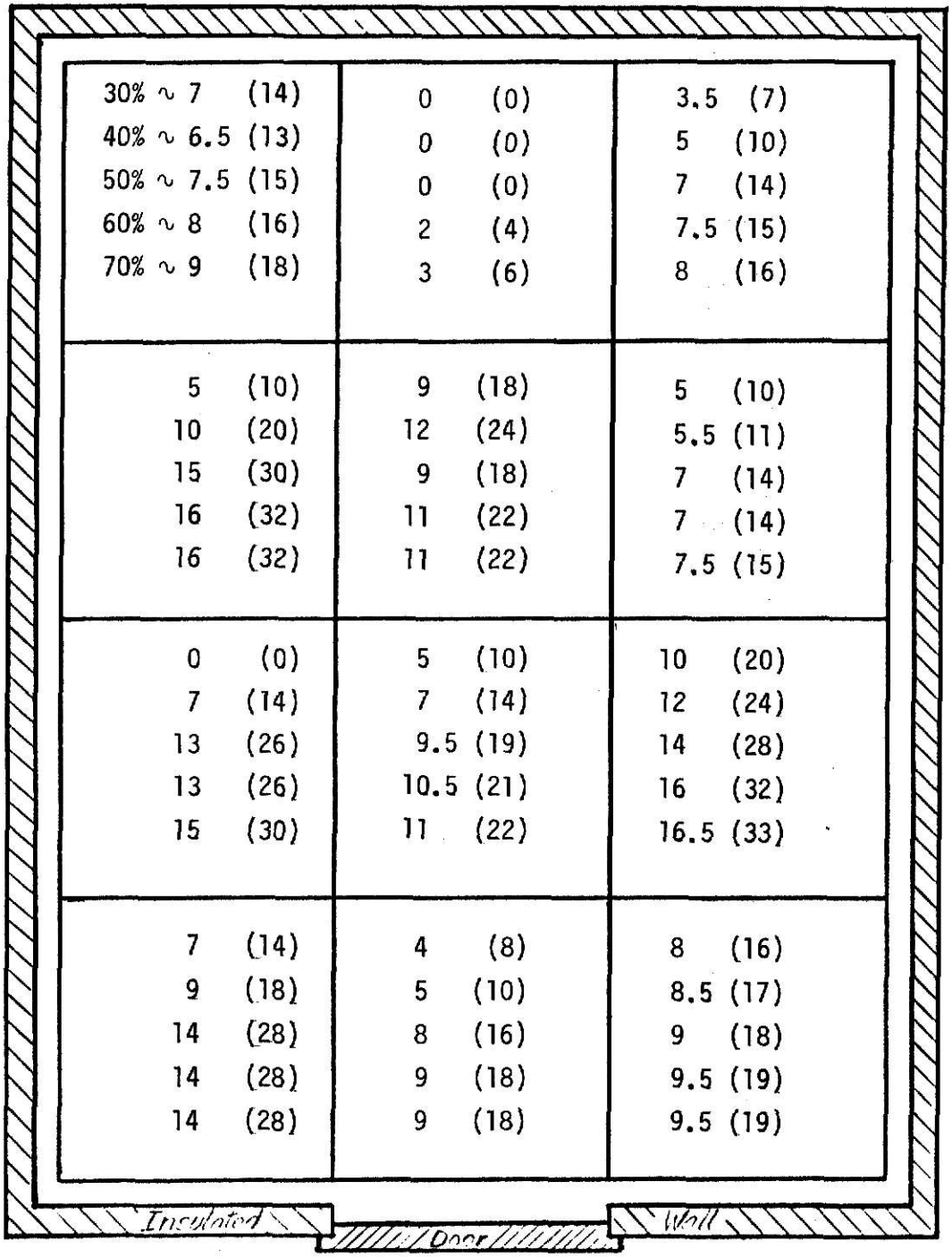


Fig. 2.2. Velocity distribution downward from the ceiling for five different percentage voltage applied to the fans in the room heat exchange system. Velocity measured in cm/s and in parenthesis in fpm.

Table 2.1. Means and Standard Deviations of the measure velocities and noise levels in the environmental chamber as a function of % voltage applied to the fans in the heat exchanger system.

Voltage %	Velocity (mean & std. dev.) cm/s	fpm	Noise level dBA	dBB	dBC
30	5.3 ± 3.0	10.6 ± 6.0	60.1	66.9	79.0
40	7.3 ± 3.2	14.6 ± 6.4	63.9	68.9	78.6
50	9.4 ± 4.0	18.8 ± 8.0	65.8	71.2	79.5
60	10.3 ± 3.9	20.6 ± 7.8	67.8	72.8	80.3
70	10.8 ± 3.8	21.6 ± 7.6	68.8	73.3	80.2

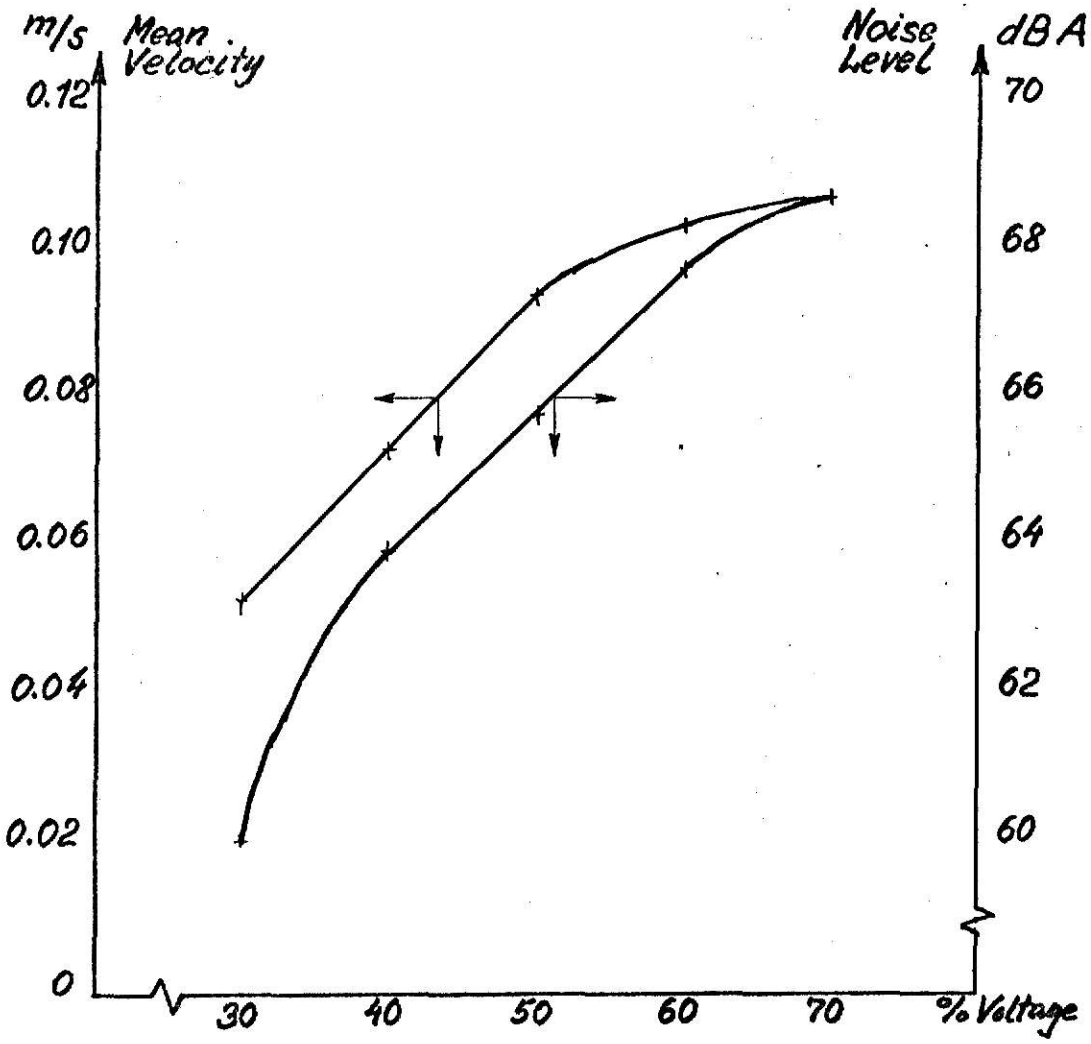


Fig. 2.3. Mean downward velocity (m/s) and noise level (dBA) inside the environmental chamber as a function of % Voltage applied to the fans in the heat exchanger system.

velocity of 10 times the downward velocity from the ceiling. Forty percent fan voltage created a return velocity along the walls of 0.7 m/s (140 fpm) which is sufficiently high to provide a fast heat exchange between the air flow and the inner wall so the radiant temperature in the chamber at all times would be equal to or very close to the air temperature in the chamber. The floor was constructed of expanded metal with approximately 35% opening for the air circulation, and was supported with a rosette like structure to allow an equal distribution of return air to each wall.

Conditioned air was supplied to the chamber at constant flow of 50 cfm (85 m^3/h) of air with lower vapor pressure than the desired condition of the air in the chamber from either a fan or a dehumidifier depending on the moisture content of the outside air. The vapor pressure inside the chamber was controlled with a 1 kw steam humidifier controlled by a Yellow Springs Model 72 proportional controller. The humidifier system was built into the heat exchanger system. Two Yellow Springs 9101 Series "Bobbin" Probes were used for controlling and recording the dew point temperature. The system could maintain a vapor pressure at any level from 0.25 in Hg to 1.25 in Hg and be held within ± 0.025 in Hg (∿ ± 3% RH at 75 °F).

The heat exchange system consisted of an R-12 refrigeration system with direct expansion evaporator and a 1 or 4 kw (115/230 volt) on/off controlled resistance heater. The control system was improved by removing the on/off controller and installing a Barber Coleman Model MU-501-504 proportional controller to regulate the suction pressure of the 4 kw R-12 cooling system and apply step heat inputs of 0, 1 or 4 kw depending on the inside/outside temperature levels. A control accuracy of ± 0.3 °F (or ± 0.15 °F std. dev.) was obtained with this system.

A 3 kw air conditioner unit with a built-in 2½ kw resistance heating element was installed outside the environmental chamber for temperature control of the air jet. A duct system with a recirculation duct, damper, and a built-in orifice for control purpose (Fig. 2.4) was designed and constructed. The outlet velocity was determined from the pressure drop across the orifice and was adjusted by changing the speed of the fan in the air conditioner. The recirculation damper was adjusted so that the recirculation was as high as possible for fast response and lower temperature limits, but not so high that there was insufficient pressure head for maintaining the velocity under possible evaporator coil freeze-up condition. The temperature was regulated by varying the voltage to the resistance heater while the cooling unit was operated on/off. Outlet temperatures from about 45 to 130 °F could be produced. The outlet nozzle could be adjusted to any position so the distance from the outlet to the forehead of the subjects was always 15 inches, and the angle between the jet center-line and the vertical was 45 degrees.

To control the velocity with sufficient accuracy within the available pressure range two different interchangeable orifices could be inserted into the duct system. Both orifices, the outlet nozzle, and a Disa Low Velocity Anemometer (CCAA-Mode) used to measure the velocity at the location of the subject's forehead, were calibrated using the following procedure:

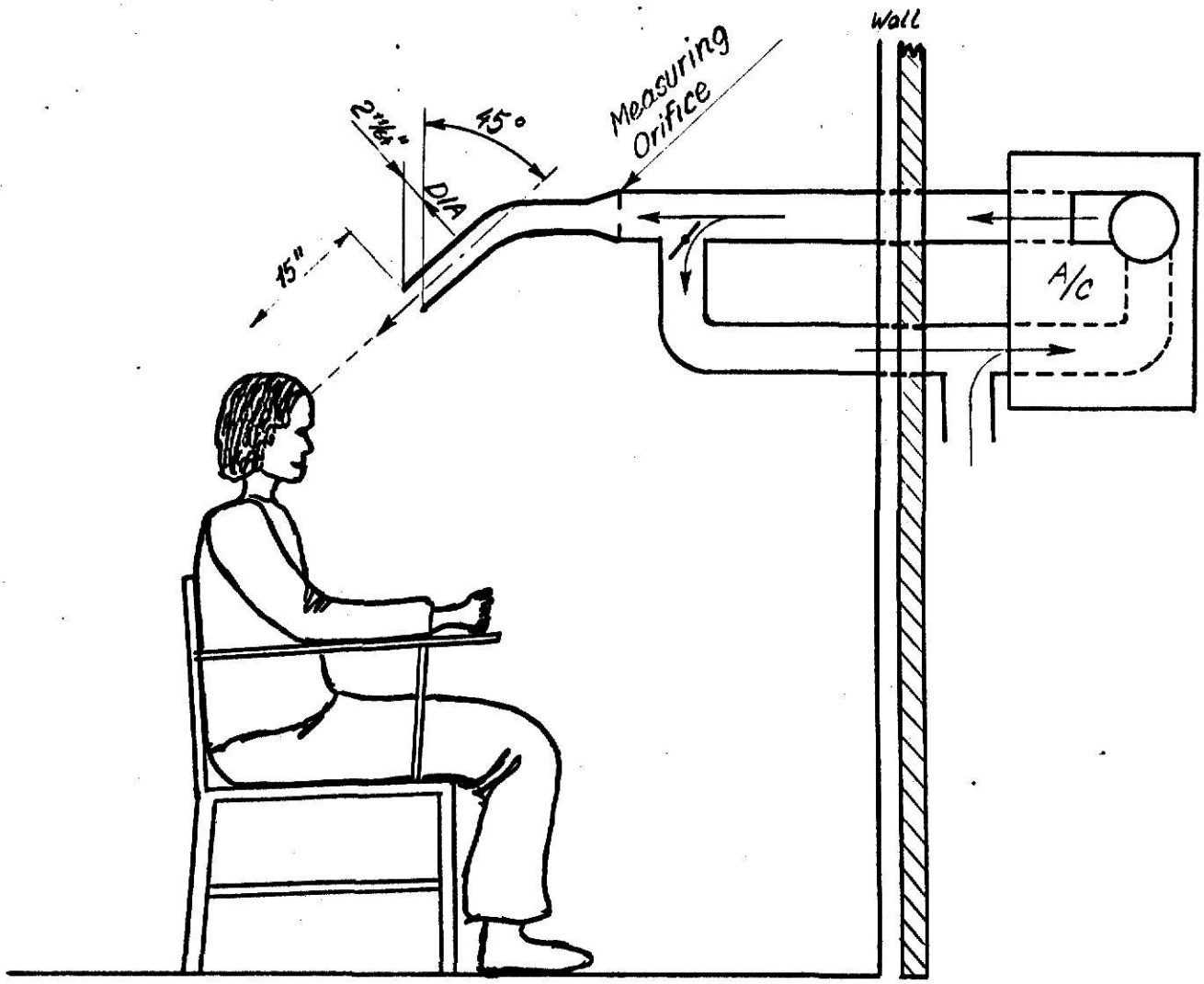


Fig. 2.4. Schematic drawing of the draft exposure air supply system (including air conditioner unit, fan, outlet nozzle, and duct system with damper and flow control orifice). Dimensions show the subject's position with respect to the air jet.

At Windtunnel (Mechanical Engineering KSU):

Outlet velocity and pressure drop for small orifice (1-11/16 inches diameter in a 4 inch round duct,) and large orifice (2-7/16 inches diameter in a 4 inch round duct,) against a 1 inch dia ASME nozzle.

Disa Low Velocity Anemometer (CCA Mode) at the outlet of 6 inches dia ASME nozzle against 2 inches dia ASME nozzle.

In the Environmental Chamber:

Velocities 15 inches downstream of nozzle outlet (location of forehead during tests) were measured with a DISA Low Velocity Anemometer as a function of outlet velocity determined from orifice flow rates.

The calibration data are given in Appendix E.

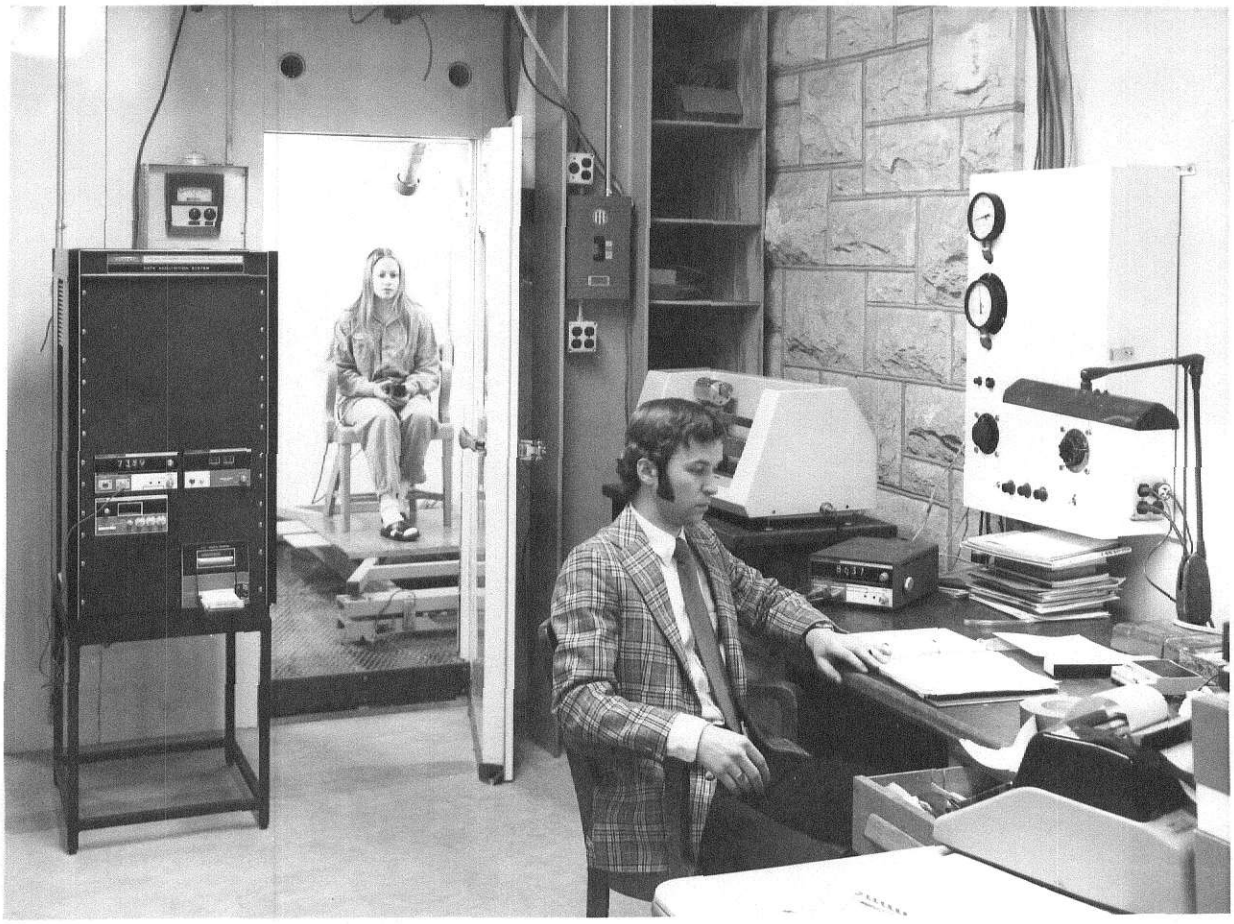


Fig. 2.5. Photo showing the environmental chamber with a subject seated in the chamber, Data Acquisition System control panel and operator.

The outer door to the chamber was provided with a one-way window to monitor the subject to insure that the subject was seated in the right position relative to the airflow from the nozzle. To avoid unnecessary door openings a communication system between subject and the outside operator was installed.

The temperatures for both room air, walls, dew point and air jet were recorded with a Digitec Data Aquisition System, Fig. 2.5, using 700 and 9101 Series Yellow Springs Thermistor probes.

CHAPTER III

EXPERIMENTAL PLAN

The experimental program was designed to give information about all physical and environmental parameters and subjective impressions involved in a person's feeling of thermal comfort. The following physiological and environmental parameters were kept constant for each subject in all six tests.

Table 3.1

Activity level:	Sedentary (reading) ∿50 kcal/m^2h
Clothing:	KSU Standard Uniform 0.6 clo (Ref. 12)
Relative Humidity:	50% RH
Mean air velocity in room:	$\leq$ 0.1 m/s ($\leq$ 20 fpm)
Wall Temperature:	equal to air temperature
Exposure duration:	2½ hours (results from last 2 hours used in the analyses)

Since the main objective of this research was to determine a person's reaction when exposed to an ambient temperature differing slightly above and below his comfort temperature and at the same time letting him adjust his comfort response by self-adjusting the temperature of a localized air jet impinging on his forehead, each subject was first tested in two experiments to find his particular comfort temperature. Each subject's comfort temperature was then used to determine the conditions for four additional tests using four combinations of ambient temperatures and draft velocities as shown in Table 3.2.

Table 3.2

Experimental Plan

Test No.	Ambient Temperature	Jet Velocity*
2CO1	t_{c1} (experimentally determined)	∿ 0.1 m/s (no jet) (20 fpm)
2CO2	t_{c2} (experimentally determined)	∿ 0.1 m/s (no jet) (20 fpm)
4WL1	$t_c^{\dagger}$ + 3.3 °F (fixed)	0.5 m/s (100 fpm)
4WH2	t_c + 3.3 °F (fixed)	1.0 m/s (200 fpm)
6CL1	t_c - 3.3 °F (fixed)	0.5 m/s (100 fpm)
6CH2	t_c - 3.3 °F (fixed)	1.0 m/s (200 fpm)

* at location of the subjects forehead

† $t_c = \frac{1}{2}(t_{c1} + t_{c2})$

The comfort temperature was taken as the mean value determined from two comfort tests, $t_c = \frac{1}{2}(t_{c1} + t_{c2})$. Skin and body temperatures and weight loss due to evaporation were obtained also.

The procedure used to find a subject's comfort temperature was developed and has been used for many years at the Laboratory for Heating and Air Conditioning, The Technical University of Denmark, by Olesen and Fanger (10) and Ostergaard et al. (11).

The subjects were exposed singly, and the optimal temperature (comfort temperature) for each subject was determined by adjusting the ambient temperature according to his desires. This was done by asking the subject over the intercom every 5 min throughout the entire experiment, if he wanted the room temperature to be cooler, warmer or kept the same and altering the temperature accordingly. The mean of the preferred temperatures during each comfort test was calculated as described later. The first one-half hour exposure was disregarded in this computation and only used for accommodating the subjects in the new environment.

After obtaining each subject's comfort temperature t_c, each subject was, in four separate tests, exposed to two temperature conditions (t_c + 3.3 °F) and (t_c - 3.3 °F) and to two draft velocities 0.5 m/s (100 fpm) and 1.0 m/s (200 fpm), as shown in Table 3.2. The temperature difference of 3.3 °F between comfort and draft exposure was chosen to be the change in ambient temperature for a change of 0.5 in comfort vote as determined by Rohles and Nevins (13) using the voting scale in Table 3.3. The resulting correlation for predicted thermal sensation, Y (vote number from Table 3.3) is:

$$Y = 0.152\ T + 0.010\ H - 8.371 \qquad [3.1]$$

where: T = dry-bulb temperature, °F

H = relative humidity, %

Table 3.3

Voting scale for room and draft temperature sensation after Rohles and Nevins (13)

1. cold
2. cool
3. slightly cool
4. comfortable
5. slightly warm
6. warm
7. hot

During both comfort and draft exposures, the subjects were asked to give their reaction (vote) every 5 min about both the air jet impinging on their forehead and the room condition using the voting scale in Table 3.3.

The room temperature during the draft exposure was held constant (the standard deviation for one randomly selected test was found to be 0.15 °F). The temperature of the impinging air jet was slowly increased until the subject voted that the temperature of the jet was "slightly warm." The operator then slowly decreased the jet temperature until the subject voted "slightly cool," see Fig. 3.1. The experimental procedure began at time = 0 so that the possibility of the outlet temperature peak, after 30 minutes exposure, being a maximum or a minimum was random. Also the sequence of exposure to the experimental conditions for the different subjects was random to avoid any trend or adaptation effect.

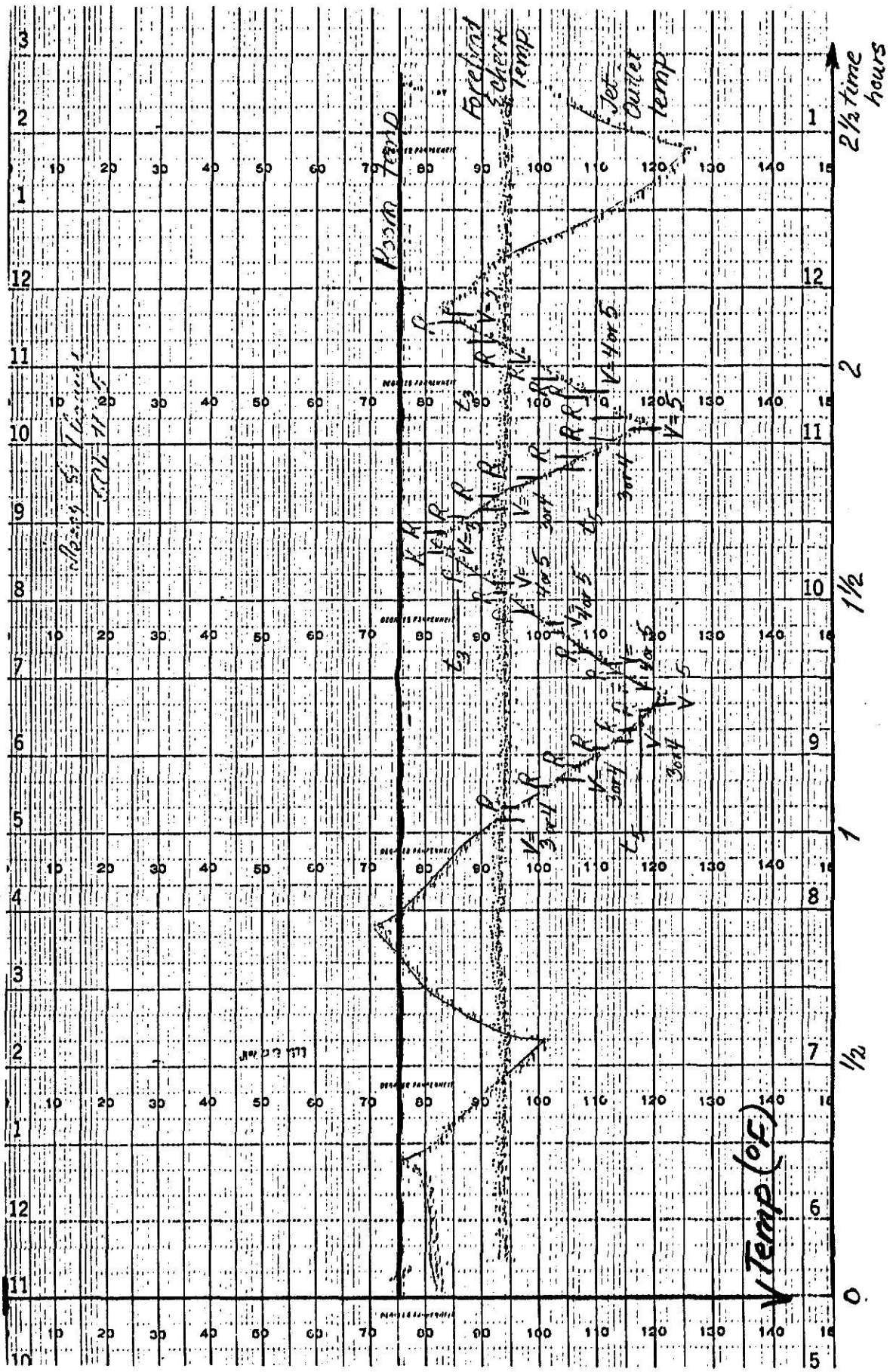


Fig. 3.1. Temperature recording from a draft exposure test showing the jet outlet temperature as a function of time.

CHAPTER IV

DATA

Sixteen voluntary subject (8 female and 8 male) were used in these experiments, all of college age (between 18 and 24). Anthropometric data for the subjects are listed in Table 4.1. They were paid $5 per test for participating and each participated in the six different types of exposures.

The following variables were recorded every 5 minutes:

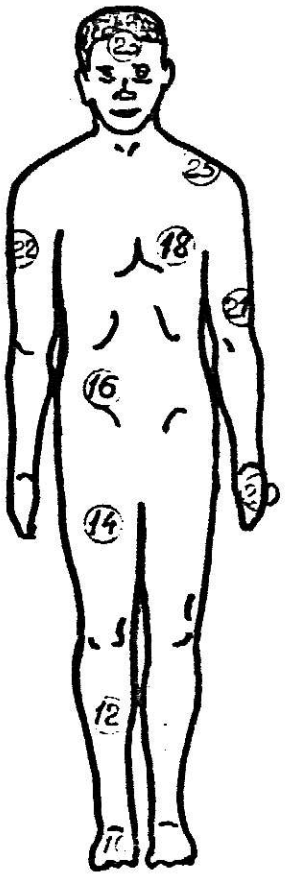
No. of observations every 5 min	location
17	skin temperatures
1	rectal temperature
2	air temperatures (1 of the 2 recorded every 2 1/2 min)
4	wall temperatures
1	Dew point temperature
1	jet outlet air temperature (recorded every 2 1/2 min)

The 15 thermistor probes for recording skin temperature were attached to the skin of the subjects with surgical tape at the locations shown on Fig 4.1, and the sequence and time of readout for all probes and the related time of voting is shown in Fig. 4.2. The subject's mean skin temperature was calculated as the non-weighted mean of 14 recorded skin temperatures shown in Fig. 4.1 (cheek, shoulder, and upper neck temperatures excluded). The temperatures of the forehead and cheek were used as a measure of the subject's localized temperature feeling due to the draft and the upper neck and the shoulder temperatures were recorded for use in proposed future tests

Table 4.1. Anthropometric Data for the Subjects.

Sex	Subject No.	Age Years	Height cm	Weight kg	DuBois Area m^2
Female	11	21	157	53	1.53
	12	24	168	60	1.68
	13	19	169	60	1.70
	14	19	159	47	1.46
	15	23	168	63	1.72
	16	20	165	51	1.55
	17	21	170	71	1.83
	18	19	168	73	1.83
Mean for Females		20.8 ± 1.8†	165.5 ± 4.6	59.8 ± 8.6	1.66 ± 0.13
Male	31	20	173	63	1.75
	32	18	190	82	2.10
	33	20	169	61	1.71
	34	22	188	80	2.07
	35	22	182	92	2.13
	36	23	180	80	2.01
	37	23	180	67	1.86
	38	18	190	76	2.05
Mean for Males		20.8 ± 1.9	181.5 ± 7.3	75.1 ± 10.0	1.96 ± 0.15
Overall Mean	F/M	20.8 ± 1.9	173.5 ± 10.0	67.4 ± 12.1	1.81 ± 0.21

†Standard deviation.



10	R Foot
11	L Calf
12	R Shin
13	L Posterior Thigh
14	R Anterior Thigh
15	L Lower Back
16	R Abdomen
17	R Scapula
18	L Upper Chest
19	Lower Occiput
20	L Hand
21	L Outer Lower Arm
22	R Outer Upper Arm
23	Forehead
24	L Cheek
25	L Shoulder
26	Upper Neck

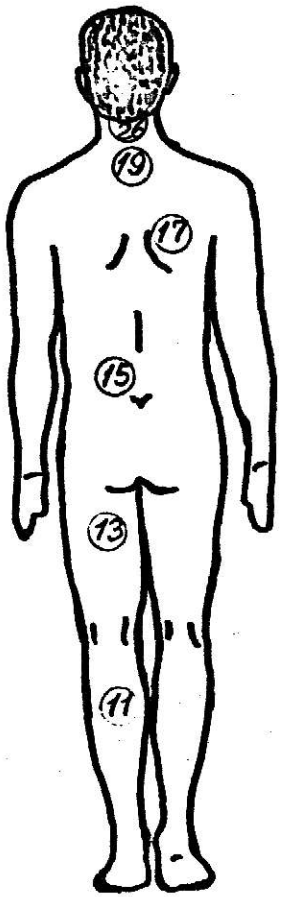


Fig. 4.1. Locations of the skin temperature sensors. Non-weighted Mean Skin Temperature was determined from sensors 10 through 23.

time (min)	Probe No.	Scanning position
0	000	room air temp (start of temperature scanning cycles)
	001	jet outlet temp
	002	room air temp
	003	11% RH temp (bobbin probe)
	004	wall temp
½	005	wall temp
	006	wall temp
	007	wall temp
	008	control purpose
	009	control purpose
	010	R foot temp
1	011	L calf temp
	012	R shin temp
	013	L posterior thigh temp
	014	R anterior thigh temp
	015	L lower back
	016	R abdomen temp
1½	017	R scapula temp
	018	L upper chest temp
	019	lower occiput temp
	020	L hand temp
	021	L outer lower arm temp
	022	R outer upper arm temp
2	023	Forehead temp
	024	L cheek temp
	025	L shoulder temp
	026	upper neck temp
	027	rectal temp
2½	028	room air temp (probe No. 000)
	029	jet outlet temp (probe No. 001)
3		
3½		Vote
5	000	room air temp (start of new temperature scanning cycles)
		etc.

Fig. 4.2. Sequence of scanning positions and related time for recording temperatures and votes.

using other exposure positions. In addition, four thermocouples were used to measure jet air temperature at the outlet, room temperature, forehead and cheek temperatures recorded with a multiple channel chart recorder for control purposes.

The subject's weight loss due to evaporation during the time of exposure was obtained by weighing the subject before and after each exposure.

CHAPTER V

ANALYSIS

The first ½ hour of the exposure period was used to adapt subject to the test environment. The first observations used in the computation of the mean values for each test parameter were those obtained at 0:35 and the last observations from the scanning cycle at 2:30. This gave 24 observations for each variable (48 for jet outlet temperature and for one of the two room air temperature measurements).

The analysis of data from the comfort tests and draft exposure tests were performed separately since some of the results from the comfort tests were used to establish the ambient conditions used in the draft exposures. The statistical analyses were performed on only the draft exposure test data.

Comfort Tests:

For the two comfort tests, the means for the following observations were calculated for each test.

Table 5.1. Comfort test temperature observations

channel	observed temperature
000	Room air temperature
002	Room air temperature
003	11% RH, "bobbin" temperature
004-007	Wall temperature
010-023	Skin mean temperature
023	Forehead
024	Cheek
027	Rectal
028	Room air temp (channel 000 repeated)
	Room temperature sensation vote (Table 3.3)

The vapor pressure was computed using a calculated correlation equation between "bobbin" temperature and dew point temperature (both °F)

$$t_{dwp} = -45.526 + 0.88379*t_{Bob} - 0.0007095337*t_{Bob}^2 \quad (°F) \qquad [5.1]$$

The associated vapor pressure (VP) (in. HG) was calculated using the vapor pressure and dew-point temperature relationship reported by Goff and Gratch (6)

$$Y1 = (16.386396 + (0.00137804*t_{dwp})) - (5656.0/(459.67 + t_{dwp})) \qquad [5.2]$$

$$Y2 = \ln((459.67 + t_{dwp})/100.0) \qquad [5.3]$$

$$Y3 = Y1 - (3.560573 * Y2) \qquad [5.4]$$

$$VP = 10^{Y3} \qquad (\text{in HG}) \qquad [5.5]$$

The relative humidity RH (%) was calculated using vapor pressure (VP) and the saturated vapor pressure (VP_s).

Using Fanger's (2) comfort equation, the adjusted ambient temperature was calculated as being the temperature at which a person would express the same feeling of comfort as at the observed conditions if wall temperature was equal to air temperature and relative humidity was 50%.

$$t_{air} = 1/2(t_{air(probe\ 000)} + t_{air(probe\ 002)}) \quad (°F) \qquad [5.6]$$

$$t_{air/wall\ adj} = t_{air} + (t_{wall} - t_{air}) * \frac{58}{130} \quad (°F) \qquad [5.7]$$

$$t_{amb} = t_{air/wall\ adj} + (RH - 50) * 0.047 \quad (°F) \qquad [5.8]$$

The mean values and standard deviations of observed and calculated parameters from the two comfort tests for all subjects are shown in Table 5.3. Data for each single comfort test are listed in Appendix B.

Weight loss:

The weight loss during exposure was calculated from the weights determined before and after each exposure and reported as weight loss per unit time and

unit body area. The results for both comfort and draft exposure tests are shown in Appendix D. The DuBois-area A_{Du} was calculated from (5):

$$A_{Du} = 0.203\ W^{0.425}\ H^{0.725} \qquad (m^2) \qquad [5.9]$$

where W is weight (kg) and

H is height (m) of the subject

Draft Exposure Tests:

All observations (temperatures and votes) needed for the analyses were transferred to data processing cards and the entire computation was performed by computer. The observations shown in Table 5.2 were used for the data processing and were transferred to data cards.

Table 5.2. Draft exposure test temperature observations.

Channel	Observed temperature
000	Room air
1	Jet outlet
2	Room air
3	11% RH, "bobbin" temperature
004-007	Mean wall
010-023	Mean skin
023	Forehead
024	Cheek
027	Rectal
028	Room air (channel 000 repeated)
029	Jet outlet (channel 001 repeated)
	Room temperature sensation vote (Table 3.3)
	Jet temperature sensation vote (Table 3.3)

The mean values for all the observations listed in Table 5.2 were calculated for each test. Similar computations as described under "Comfort Tests" were performed to find vapor pressure, relative humidity, adjusted

room temperature and weight loss. The final results together with results of computations described later are listed in Appendix A.

The temperature of the air jet $t_{jet\ 15}$ at the location of the subjects forehead (15 inches = 0.38 m from the outlet of the draft exposure nozzle) was calculated using the measured velocity 15 inches downstream from the outlet (14).

$$\Delta t_o = \frac{v_o}{v_x} \Delta t_x \qquad (°F) \qquad [5.10]$$

where Δt_o under or over temperature of air jet at outlet (°F)

Δt_x under or over temperature of air jet at distance x from outlet (°F)

v_o air velocity in outlet opening (m/s)

v_x air velocity at distance x from outlet opening (m/s)

The threshold limits of draft temperature for comfort were defined as the means of the draft temperatures at which the subject voted that the jet was slightly cool (Vote = 3) or slightly warm (Vote = 5). Each of these single lower or upper comfort limits of the draft temperature was calculated as the mean of the temperatures recorded 1 and 3½ minutes before a vote of respectively 3 or 5. If the successive vote or votes, after a 3 or 5-vote, stayed the same, only the temperatures recorded 1 and 3½ minutes before the first vote were used in the computation of the threshold levels.

The corresponding minimum and maximum of the forehead and cheek local skin temperatures due to the varying draft temperatures, were calculated in the same way using the observed local skin temperature approximately 1¼ min before each vote allowing approximately 1 minute response time relative to recorded draft temperature.

Table 5.3. Sources of variation in statistical model including Degrees of Freedom and Associate Degrees of Freedom due to "Individual within Sex" being a random variable.

	Degrees of Freedom	Associated Degrees of Freedom
Sex	1	14
Individual within sex	14	14
Temperature Level	1	14
Velocity Level	1	14
Sex * Temp. Level	1	14
(Ind. w. Sex) * Temp. Level	14	14
Sex * Velocity	1	14
(Ind. w. Sex) * Velocity	14	14
Temp. Level * Velocity	1	14
Sex * Temp. Level * Velocity	1	14
Error	14	
Total	63	

Table 5.4. Mean values and std. dev. of results from comfort tests, and mean values and analysis of variance of results from draft exposure tests for sixteen subjects (8 females and 8 males), sedentary (50 kcal/m^2h), clothing (0.6 clo). Observations were obtained between ½ hour and 2½ hours exposure.

Exposure Cond.	Adjusted Room Temp	Vapor Pressure in. Hg.	Draft Temp. at Location of Forehead min. °F	mean °F	max °F	range °F	Rectal Temp. °F	Skin Temp °F	Forehead Temp °F	Cheek Temp. °F	Weight Loss g/m^2h	Room Vote (scale, see Table 3.3)	Draft Temp Vote (scale, see Table 3.3)
Comfort 1 test	74.3 ± 3.3	0.431 ± 0.041					98.8 ± 0.6	91.5 ± 1.5	94.3 ± 1.4	91.7 ± 2.2	20.6 ± 4.9	4.00 ± 0.12	
Comfort 2 test	74.9 ± 3.9	0.447 ± 0.039					98.6 ± 0.5	91.3 ± 1.9	94.1 ± 1.4	92.0 ± 2.4	21.3 ± 4.7	4.00 ± 0.16	
Mean for Comfort Tests	74.6 ± 3.6	0.439 ± 0.040					98.7 ± 0.6	91.4 ± 1.7	94.2 ± 1.4	91.9 ± 2.3	21.0 ± 4.9	4.00 ± 0.14	
tc +3.3 °F Low Vel.	77.9	0.476	71.0	74.0	77.3	6.3	98.8	92.1	92.7	91.6	21.4	4.38	3.96
tc +3.3 °F High Vel.	77.8	0.481	72.2	74.4	77.2	5.0	98.8	91.2	90.6	88.5	22.6	4.32	3.96
tc -3.3 °F Low Vel.	71.5	0.398	73.7	77.1	80.8	7.2	98.4	89.9	92.7	90.7	20.0	3.57	3.99
tc -3.3 °F High Vel.	71.5	0.396	73.8	76.3	79.1	5.3	98.5	89.7	91.0	88.4	18.6	3.75	3.99
Source of Variance		F-Tests Values											
Sex	1.90	1.98	1.41	1.05	1.23	0.00	4.51	2.36	1.84	0.36	5.19*	0.22	2.14
Ind. within Sex†	295.93***	43.18***	14.20***	12.58***	13.24***	7.62***	2.91*	32.61***	8.94***	5.14***	5.65***	2.10	1.27
Temp. Level	>10^4***	161.32***	5.62*	10.38**	10.45***	1.23	4.01	120.99***	0.45	1.49	5.72*	32.27***	2.97
Velocity	0.73	0.28	0.65	0.08	1.34	7.21*	0.13	27.17***	14.81***	33.67***	0.01	0.90	0.03
Sex * Temp	1.18	1.03	0.19	0.06	0.06	1.16	0.23	2.01	1.46	9.81**	0.80	0.14	1.32
(Ind. w Sex)*Temp	0.25	2.56*	2.53*	1.65	1.83	2.04	1.70	1.37	1.59	0.82	1.57	2.89*	0.92
Sex & Velocity	0.09	0.04	0.03	0.00	0.01	0.01	0.00	1.12	2.63	0.02	0.78	0.76	5.90*
(Ind. w. Sex)*Vel	0.61	1.03	2.18	1.50	1.67	2.41	1.38	0.90	2.60*	1.31	0.50	0.77	0.46
Temp & Velocity	0.10	0.78	0.84	1.11	1.65	0.56	0.22	5.50*	0.13	1.07	2.26	2.76	0.00
Sex & Temp & Vel	0.06	0.01	2.35	0.28	2.05	6.67*	0.17	0.43	2.65	0.22	0.11	3.30	0.38

†Individual within sex is a random variable
*significant at 5% level
**significant at 1% level
***significant at 0.5% level.

Table 5.5. Threshold levels of comfort for draft temperature. The result for the mean draft temperature are giving the mean and std. dev. of the draft temperature for each subject relative to his comfort temperature while the lower and upper threshold level results are calculated as mean and std. dev. relative to the mean draft temperature for each subject. (all in °F)

Ambient Temp.	T_{co} + 3.3 °F		T_{co} - 3.3 °F	
Draft Velocity	0.5 m/s	1.0 m/s	0.5 m/s	1.0 m/s
Mean draft temp. differs from mean comfort temp.	-0.6 ± 3.3†	-0.2 ± 3.3	2.5 ± 4.9	1.7 ± 4.1
Lower level (below mean)	3.0 ± 1.4	2.2 ± 1.3	3.4 ± 1.7	2.5 ± 1.0
Upper level (above mean)	3.3 ± 1.6	2.8 ± 1.2	3.7 ± 1.8	2.8 ± 1.2
Range upper/lower levels	6.3 ± 2.9	5.0 ± 2.4	7.1 ± 3.4	5.3 ± 2.1

†standard deviation.

An analysis of variance including possible interactions and with individuals within sex as a random variable was performed on the results from the four types of draft exposure and the sources of variation in the statistical model (14) with associate degrees of freedom is shown in Table 5.3. The results of the statistical analyses together with the mean values for both the comfort tests and draft exposure tests and the standard deviations for comfort test results are shown in Table 5.4.

A plot of the observed mean draft temperatures at the location of the forehead as a function of the adjusted ambient temperature with lines connecting observations for equal velocity exposures for each subject at the two temperature levels is shown in Fig. 5.1. Low velocity, 0.5 m/s (100 fpm), is indicated with a dotted line and high velocity, 1.0 m/s (200 fpm) with a full line.

A regression model to predict the desired mean draft temperature as a function of the subject's comfort temperature and an interaction between the comfort temperature and the difference between the latter and the actual exposure temperature was found to be best fit by a model excluding skin temperature, temperature drop, or other dependent variables.

$$t_{draft} = \underset{}{16.5} + \underset{(0.14)}{0.79}\, t_{co} + \underset{(0.0021)}{0.0043}\, t_{co}\,(t_{co} - t_{amb}) \quad (°F) \qquad [5.11]$$

$$R^2 = 0.35 \qquad S_{y \cdot x} = 3.995$$

where t_{draft} is the desired temperature (°F) of the air jet at location of the forehead

t_{co} is the adjusted comfort temperature, °F

t_{amb} is the adjusted ambient temperature, °F

the numbers in parenthesis are the standard errors of estimates of coefficients

The velocity was found not to be significant in predicting t_{draft}. This can also be observed both from Fig. 5.1 and from the analysis of variance with neither velocity nor any velocity interactions being significant.

Fig. 5.2 and Fig. 5.3 show the mean of desired draft temperature for the two velocity levels for each subject as a function of the adjusted ambient temperature for ambient temperature levels respectively below and above comfort temperature with the regression lines predicted with [5.11] together with respectively [5.12] and [5.13].

$$t_{amb} = t_{co} - 3.3 \quad (°F) \qquad [5.12]$$

$$t_{amb} = t_{co} + 3.3 \quad (°F) \qquad [5.13]$$

The test subject was exposed to an ambient temperature higher or lower than his comfort temperature and was required to compensate for his feeling of discomfort by selecting a draft temperature which increased his overall feeling of comfort. For all tests the selected draft temperature was higher than ambient temperature if the ambient temperature was below the comfort temperature and vice versa. Recognizing this, a regression analysis related the temperature difference between draft and ambient and between comfort and ambient temperature as follows:

$$t_{draft} - t_{amb} = \underset{(0.16)}{0.9 - 1.32}(t_{co} - t_{amb}) \qquad [5.14]$$

$$R^2 = 0.53 \qquad S_{y \cdot x} = 4.07$$

where t_{draft} is the desired temperature (°F) of the air jet at location of the forehead

t_{co} is the adjusted comfort temperature, °F

t_{amb} is the adjusted ambient temperature, °F

the number in parenthesis is the standard error of estimate of coefficients

The draft velocity was also indicated in the analysis but the effect was shown to be unsignificant.

A plot like Fig. 5.1 but including the lower and upper limits of comfort for the jet temperature and connecting lines between these for each exposure is shown in Fig. 5.4. Low velocity, 0.5 m/s (100 fpm), is indicated with a dotted line and high velocity, 1.0 m/s (200 fpm), with a full line. Also shown in Fig. 5.4 are the two regression lines predicted with Eqn. [5.11] and respectively [5.12] and [5.13].

Fig. 5.5 shows the mean draft temperature as a function of time of exposure for all 16 subjects pooled for each type of exposure. Results of all environmental, physiological measurements and subjective votes as a function of time of exposure for all 16 subjects pooled for each type of exposure is given in Appendix C. In all four types of exposures the subjects appear to desire warmer draft temperature with time. This is in agreement with the result of the study performed by Rohles and Nevins (13) in which desired room temperature was a function of time of exposure. Their correlation showed an increase of room temperature with time, but since the room temperature in this study was kept constant during each exposure the only way the subjects could adjust for this desired room temperature increase would be by increasing the draft temperature.

Fig. 5.6 shows the draft temperature (mean value together with upper and lower comfort limits) for the two exposed draft velocities as a function of the ambient temperature. Both axes are relative to the comfort temperature.

The temperature range for the draft exposure is defined to be the difference between the upper and lower temperature limits determined for each exposure condition.

As can be observed, the range of the draft temperature is larger for the low draft velocity than for high, which is in agreement with the increased heat transfer for the higher velocity so the subject would be able to detect smaller changes in the draft temperature for high velocity than for low.

The same tendency can also be observed from the standard deviation of the tabulated values of threshold levels of comfort for draft temperatures in Table 5.5.

The ratio between the mean of the range for low and high velocity is approximately equal to the square root of the inverse ratio between the respective draft velocities

$$\frac{\text{range (low Vel.)}}{\text{range (high Vel.)}} = \frac{(6.3 + 7.1)^{*1/2}}{(5.0 + 5.3)^{*1/2}} = 1.30 \simeq \sqrt{\frac{V_{high}}{V_{low}}} = \sqrt{\frac{1.0}{0.5}} = 1.41 \quad [5.14]$$

which is in agreement with results obtained by Winslow et al. (17) for convective heat transfer from the human body as a linear function of the square root of the velocity, which implies that the heat transfer within the two ranges is of the same magnitude.

From Fig. 5.6 can also be observed that the intersection between the mean draft temperature and the ordinate (the expected mean of the desired draft temperature when ambient temperature equals the comfort temperature) shows that a subject would prefer a draft temperature approximately 0.8 °F above the related comfort temperature, which is in agreement with the increased local heat transfer.

The mean values of comfort votes relating to room temperature (Table 5.3) show that the feeling of comfort cannot be satisfied by adjusting the draft temperature when exposed to an ambient temperature lying on the borders of their comfort temperature range $t_c \pm 3.3$ °F. Without the

localized draft, the expected room temperature vote for the lower and higher ambient temperature level would be respectively 3.5 and 4.5. The measured mean values of room temperature vote for both draft velocity levels pooled at the two temperature levels were respectively 3.66 and 4.35. While there was no significant differences in preferred mean draft temperature for the two velocity levels it can be observed that the subjects moved closer to comfort conditions under high draft velocity exposure producing respectively votes of 3.75 and 4.32 than with low draft velocity resulting in votes of 3.57 and 4.38. The statistical analyses showed that the interaction between temperature level and velocity had a significance level of approximately 10%.

A correlation was found between room temperature vote, the difference between comfort and adjusted ambient temperature and an interaction between the square-root of the velocity and the difference between draft and adjusted ambient temperature

$$Y = 4.02 - \underset{(0.0204)}{0.0677}\,(t_{co} - t_{amb}) - \underset{(0.0133)}{0.0335}\,\sqrt{V}\,(t_{draft} - t_{amb}) \qquad [5.15]$$

$R^2 = 0.50$

where

Y	Room temperature voting scale (Table 3.3)
V	Draft velocity (m/s)
t_{co}	is the adjusted comfort temperature, °F
t_{amb}	is the adjusted ambient temperature, °F
t_{draft}	is the desired temperature (°F) of the air jet at location of the forehead

the numbers in parenthesis are the standard errors of estimates of coefficients.

This equation shows, when used in the extent of the experimental plan, how the room temperature vote decreases with increased velocity and draft temperature relative to ambient temperature and increases with increased ambient temperature relative to comfort temperature. Without draft and for exposure to ambient temperature equal to comfort temperature the predicted room temperature vote with [5.15] will be 4.02.

Some of the subjects (approx. 1/3 of the 16 subjects) complained that the high draft velocity was "windy" while none complained at the low draft velocity.

While draft temperature was significant at 1% level for temperature levels, but not for velocity levels it can be observed that the resulting forehead temperatures show no significant difference for temperature levels but were significant at 0.5% level for draft velocity levels. Of course the influence of radiant heat transfer with the walls of the chamber must be taken into account since the radiant heat loss from the subject's forehead will reduce the expected effect of the draft temperature alone at the two ambient temperature levels.

ILLEGIBLE DOCUMENT

THE FOLLOWING DOCUMENT(S) IS OF POOR LEGIBILITY IN THE ORIGINAL

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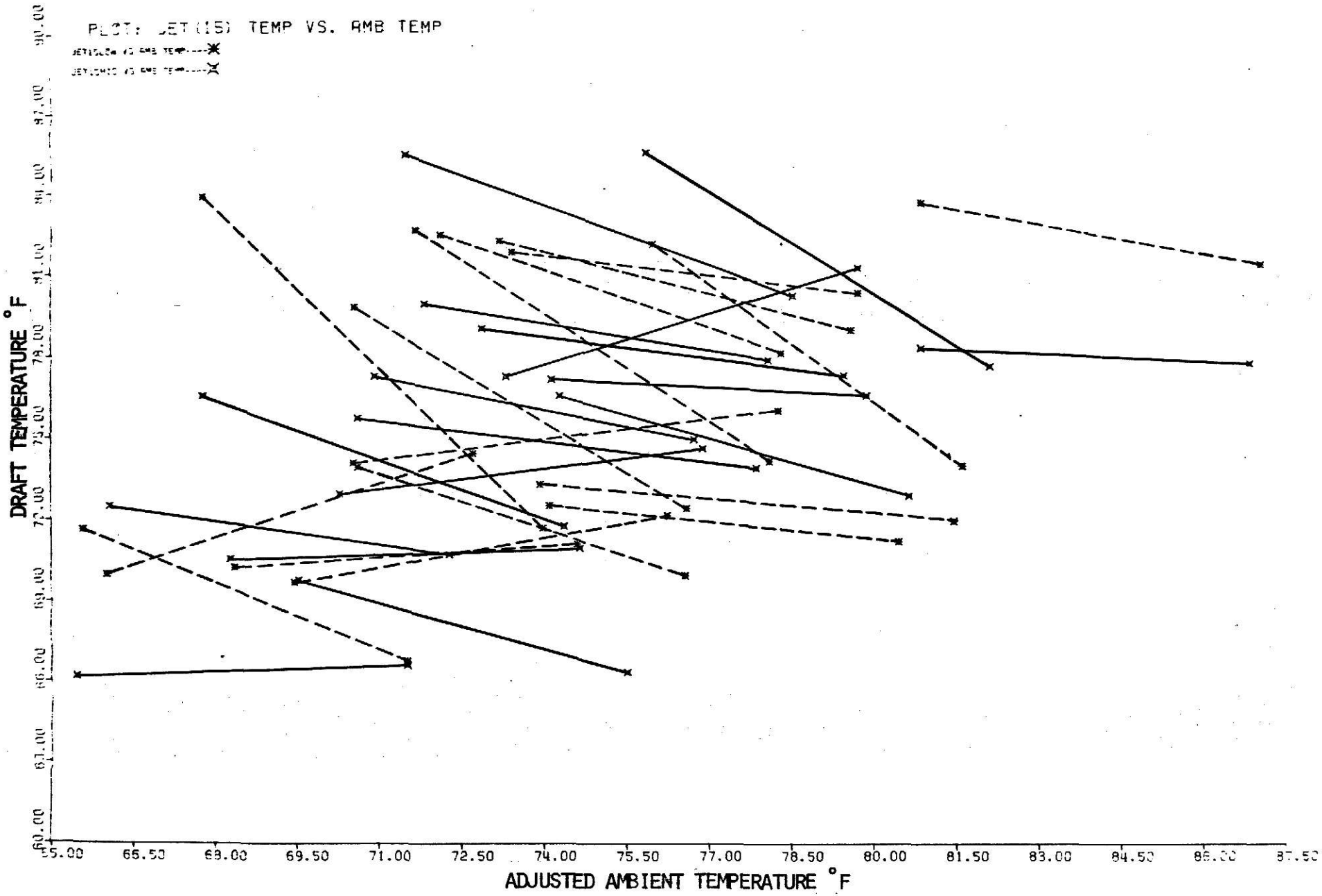


Fig. 5.1. Plot of mean draft temperature at the location of the subject's forehead as a function of the exposed adjusted ambient temperature with lines connecting observations with equal velocity exposures for each subject (low velocity, 0.5 m/s, is indicated with a dotted line and high velocity, 1.0 m/s, with a full line).

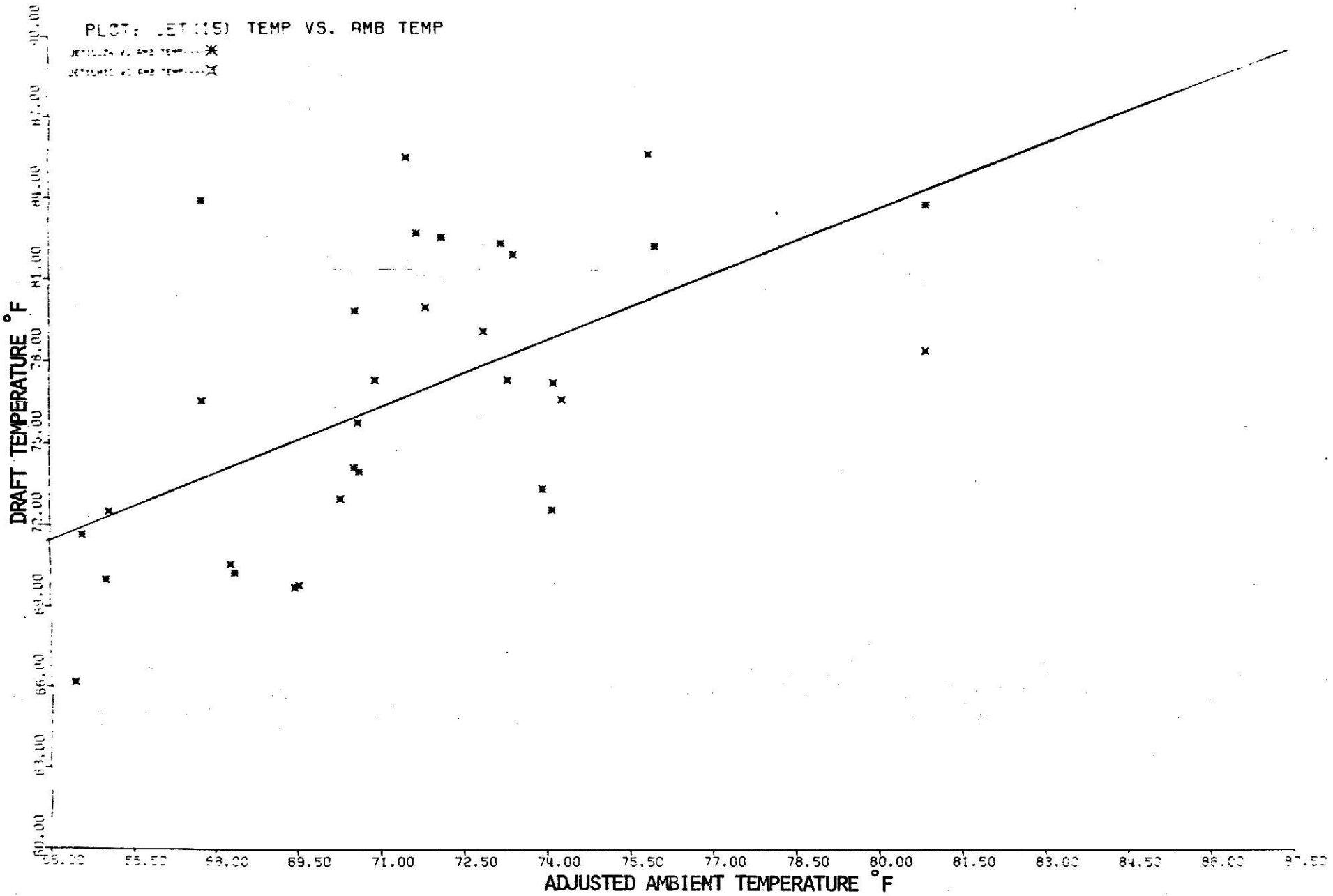


Fig. 5.2. Mean draft temperature as a function of adjusted ambient temperature for exposure to ambient temperatures 3.3 °F below each individual subject's comfort temperature including the regression line for these observations predicted with [5.11] and [5.12].

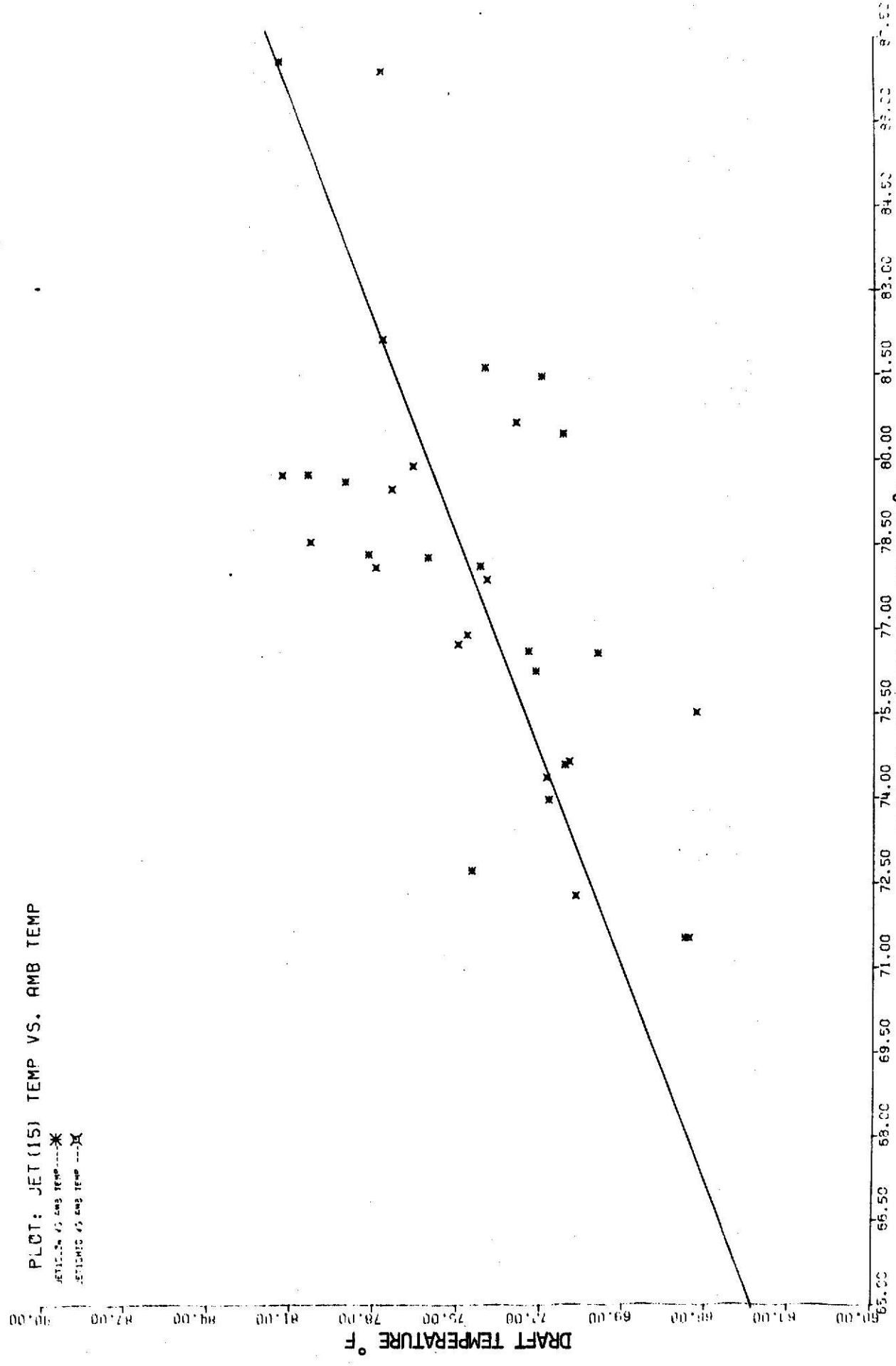


Fig. 5.3. Mean draft temperature as a function of adjusted ambient temperature for exposure to ambient temperatures 3.3 °F above each individual subject's comfort temperature including the regression line for these observations predicted with [5.11] and [5.13].

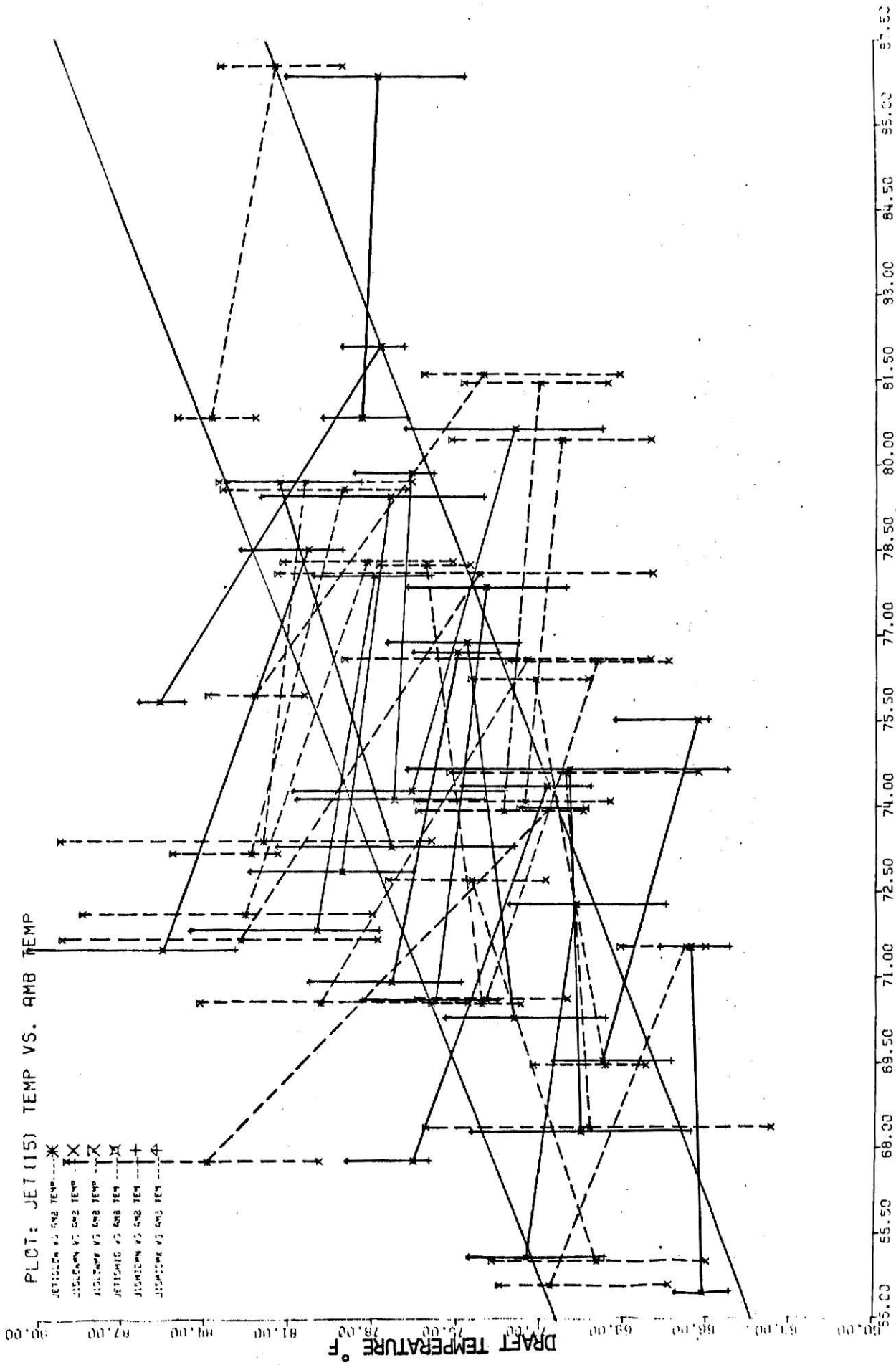


Fig. 5.4. Plot of mean draft temperature at the location of the forehead as a function of the adjusted ambient temperature with lines connecting observations of equal velocity for each subject including lines connecting lower and upper comfort levels of draft temperature for each adjusted ambient temperature (low velocity, 0.5 m/s, is indicated with a dotted line and high velocity, 1.0 m/s, with a full line). The two regression lines predicted with [5.11] together with [5.12] and [5.13], respectively are shown.

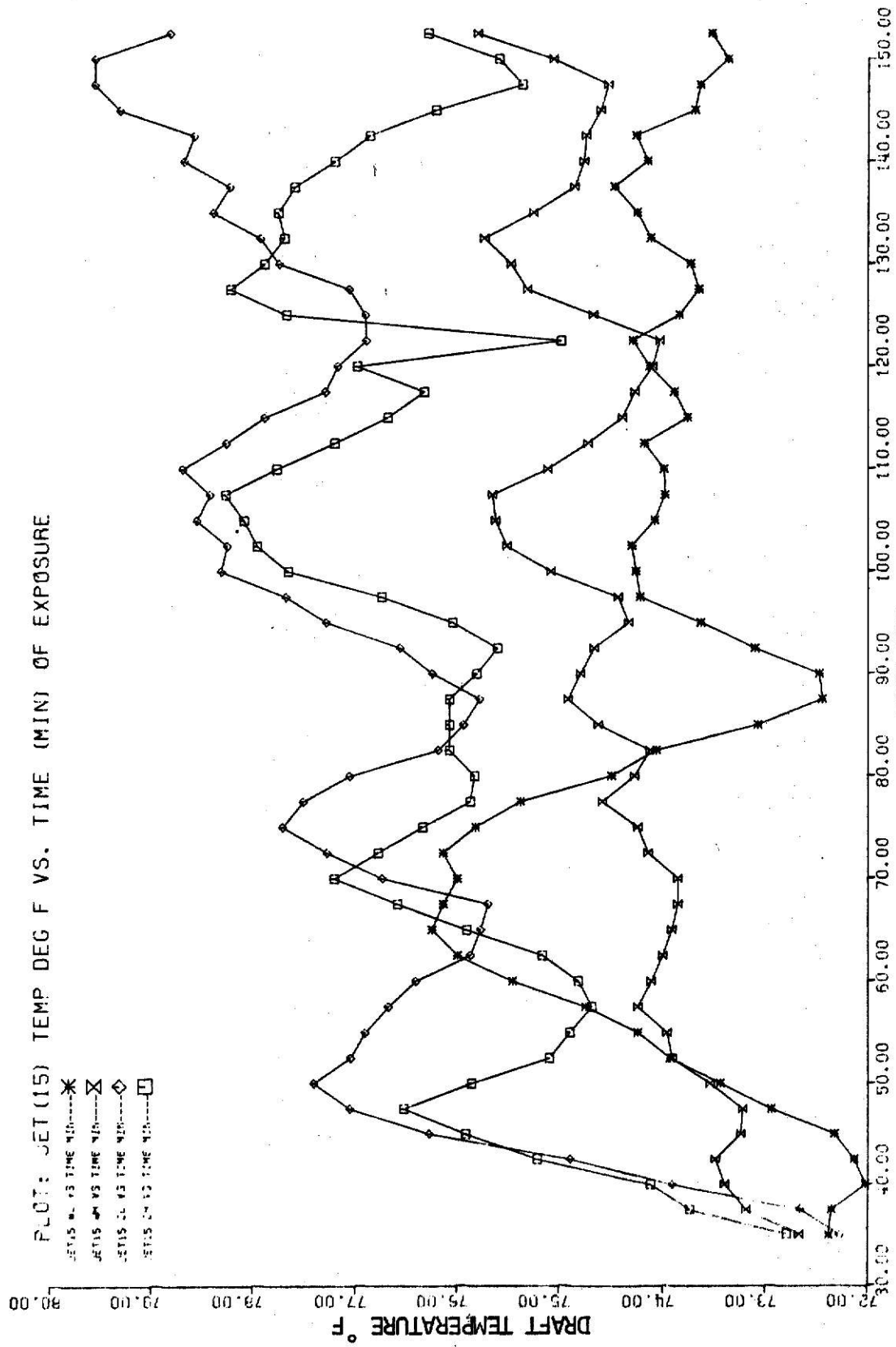


Fig. 5.5. Mean of draft temperature impinging on the subject's forehead for 16 subjects (8 female and 8 male) as a function of time for the four different combinations of draft velocity (0.5 and 1.0 m/s) and ambient temperature 3.3 °F below and above comfort temperature.

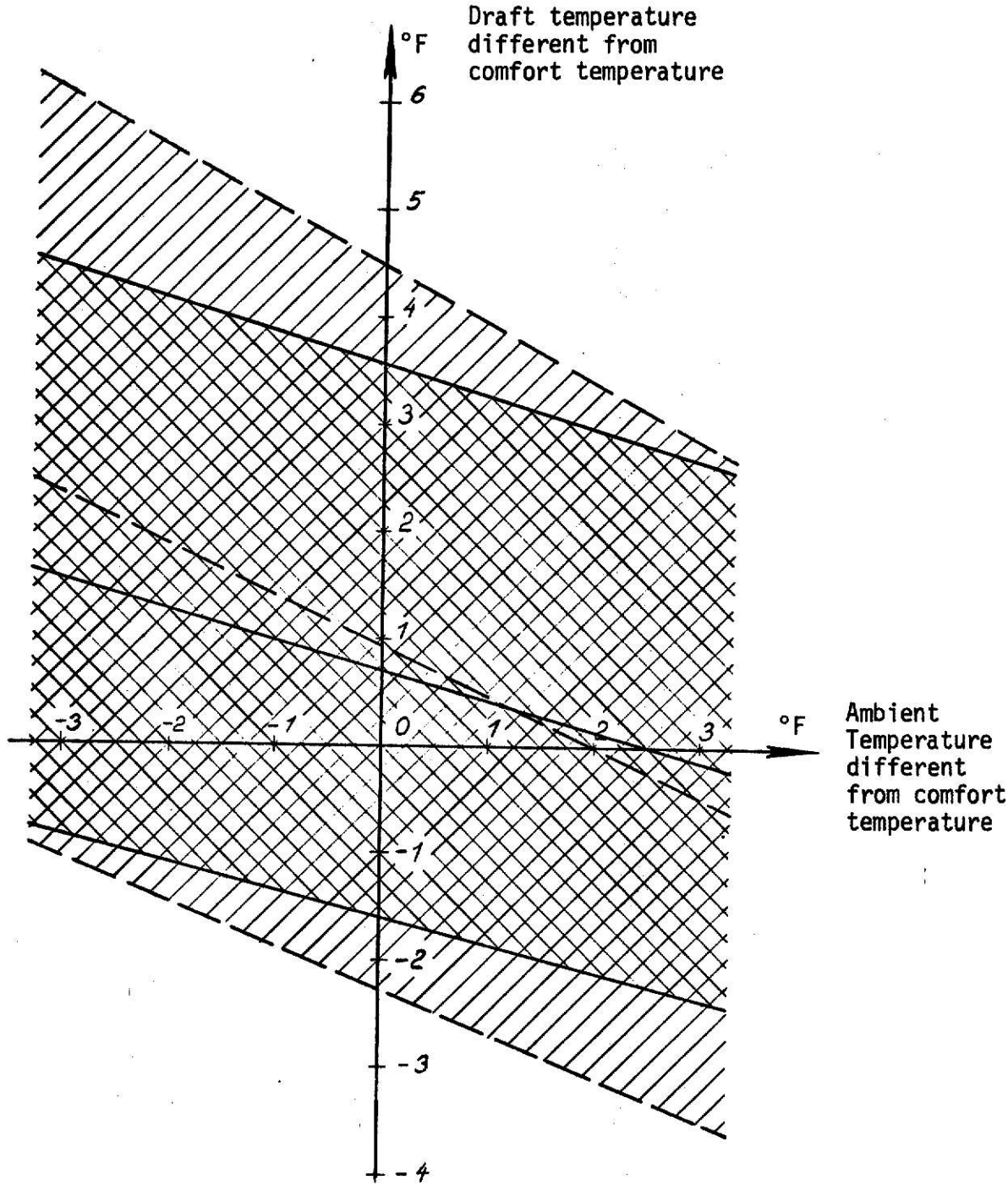


Fig. 5.6. Graph showing draft temperature (mean and upper and lower comfort limits) for the two exposed draft velocities as a function of ambient temperature, both axis relative to comfort temperature (low draft velocity (0.5 m/s) indicated with dotted lines and high (1.0 m/s) with full lines).

CHAPTER VI

CONCLUSIONS

From these experiments it appears that a person's feeling of comfort cannot be satisfied by adjusting the temperature of an airstream impinging on his forehead when he is exposed to an ambient temperature differing slightly to either side of his optimal comfort temperature.

The desired jet mean temperature for two levels of jet velocity (0.5 m/s and 1.0 m/s at location of forehead) was not a function of the air velocity but only of the temperature level with respect to the persons comfort temperature. Local skin temperatures at the location of the impinging air jet was a function of the velocity.

The desired jet temperature when exposed to an ambient temperature differing from a persons comfort temperature was found to be a function of the person's comfort temperature, and an interaction between this comfort temperature and the difference between the latter and the actual exposure temperature.

The desired temperature of an airstream impinging a person's forehead will increase with time of exposure for constant ambient temperature.

The threshold levels for desired draft temperature relative to comfort temperature were found to be:

	Mean of Desired Draft Temp.		Mean of Range around Mean Draft temperature
Draft Velocity	T_{co} + 3.3 °F	T_{co} - 3.3 °F	
0.5 m/s	-0.6 °F	2.5 °F	6.7
1.0 m/s	-0.2 °F	1.7 °F	5.1

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Appendix A

Computer output of test results of the six different exposures with each subject (only mean values of the results from two comfort tests). All data from each subject is listed on one output page.

EXPERIMENTAL RESULTS FOR SUBJECT NO: 11 SEX: FEMALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	73.06	76.48	77.71	70.03	69.79
WALL TEMPERATURE	74.46	76.56	78.07	70.52	70.56
BOBBIN PROBE TEMP (11% RH TEMP)	127.40	129.65	130.41	125.21	128.02
VAPOR PRESSURE (INCH HG)	0.445	0.471	0.480	0.420	0.452
RELATIVE HUMIDITY	54.2%	51.2%	50.1%	56.8%	61.5%
ADJUSTED ROOM TEMPERATURE	73.88	76.57	77.88	70.57	70.68
ADJ ROOM TEMP DIFF FROM COMFORT		2.69	4.00	-3.31	-3.21
JET OUTLET TEMP LOWER LEVEL		52.04	61.95	77.11	78.48
JET OUTLET TEMP MEAN/RANGE		58.83/15.31	68.67/13.25	80.80/ 8.44	83.74/11.34
JET OUTLET TEMP UPPER LEVEL		67.35	75.20	85.55	89.82
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-17.74	-9.21	10.23	13.06
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		67.36/-2.53	71.03/-2.85	72.67/-1.38	73.47/-2.23
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		69.89	73.88	74.05	75.70
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		73.07/ 3.18	76.65/ 2.77	75.82/ 1.77	78.28/ 2.58
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-3.99/ 5.71	0.00/ 5.61	0.17/ 3.15	1.82/ 4.81
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.69	-0.25	-0.69	-0.25
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		18.73	13.96	17.97	13.84
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.05	98.51/-0.54	99.13/ 0.08	98.73/-0.32	98.78/-0.27
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	91.26	91.06/-0.20	91.23/-0.03	89.50/-1.76	89.51/-1.75
FOREHEAD TEMP MIN/DIFF FROM MEAN		88.21/-0.41	86.65/-1.19	91.59/-0.43	88.63/-0.91
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	92.52	88.62/-3.90	87.84/-4.68	92.02/-0.50	89.54/-2.98
FOREHEAD TEMP MAX/DIFF FROM MEAN		89.39/ 0.77	88.81/ 0.97	92.47/ 0.45	90.64/ 1.10
CHEEK TEMP MIN/DIFF FROM MEAN		86.63/-0.38	86.29/-0.62	93.78/-0.49	88.37/-0.19
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	90.84	87.01/-3.83	86.91/-3.93	94.27/ 3.43	88.56/-2.28
CHEEK TEMP MAX/DIFF FROM MEAN		87.51/ 0.50	87.23/ 0.32	94.51/ 0.24	89.00/ 0.44
WEIGHT LOSS (GRAMS/M**2/HOUR)	19.20	14.31	16.14	16.07	9.13
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-4.89	-3.06	-3.13	-10.07
ROOM TEMP SENSATION VOTE	4.10	4.54	4.17	3.71	3.75
JET TEMP SENSATION VOTE		3.83	3.92	3.96	3.88
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		4 / 3	5 / 5	5 / 5	4 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 12	SEX: FEMALE	ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	75.93	79.38	79.48	72.58	72.61
WALL TEMPERATURE	76.20	79.78	79.61	73.87	73.40
BOBBIN PROBE TEMP (11% RH TEMP)	126.85	133.34	131.26	124.77	122.34
VAPOR PRESSURE (INCH HG)	0.438	0.516	0.490	0.415	0.390
RELATIVE HUMIDITY	48.6%	51.0%	48.3%	51.5%	48.3%
ADJUSTED ROOM TEMPERATURE	75.98	79.61	79.46	73.23	72.88
ADJ ROOM TEMP DIFF FROM COMFORT		3.62	3.47	-2.76	-3.10
JET OUTLET TEMP LOWER LEVEL		72.14	66.47	95.97	81.75
JET OUTLET TEMP MEAN/RANGE		78.21/17.63	74.30/18.68	98.47/10.06	87.71/13.63
JET OUTLET TEMP UPPER LEVEL		89.77	85.15	106.03	95.38
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-1.40	-5.16	25.24	14.83
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		76.68/-2.26	73.97/-3.32	81.31/-0.93	76.49/-2.53
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		78.95	77.29	82.24	79.01
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		83.26/ 4.31	81.88/ 4.60	85.06/ 2.82	82.26/ 3.25
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		2.96/ 6.58	1.30/ 7.92	6.26/ 3.75	3.03/ 5.78
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.52	-0.26	-0.52	-0.26
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		13.86	10.50	12.67	14.24
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.07	99.30/ 0.23	99.06/-0.01	98.81/-0.26	98.84/-0.23
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	92.71	93.50/ 0.79	92.01/-0.70	91.81/-0.90	91.69/-1.02
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.54/-0.27	85.09/-2.70	95.03/ 0.12	92.54/-0.71
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	93.47	92.81/-0.66	87.79/-5.68	94.91/ 1.44	93.25/-0.22
FOREHEAD TEMP MAX/DIFF FROM MEAN		94.02/ 1.21	90.78/ 2.99	95.43/ 0.52	94.00/ 0.75
CHEEK TEMP MIN/DIFF FROM MEAN		92.29/ 0.04	91.49/-0.32	91.33/ 0.33	90.47/-0.53
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	92.38	92.25/-0.13	91.81/-0.57	91.00/-1.38	91.00/-1.38
CHEEK TEMP MAX/DIFF FROM MEAN		93.23/ 0.98	93.51/ 1.70	91.26/ 0.26	91.54/ 0.54
WEIGHT LOSS (GRAMS/M**2/HOUR)	22.13	19.78	30.32	20.70	20.74
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-2.35	8.19	-1.43	-1.39
ROOM TEMP SENSATION VOTE	3.96	4.46	4.92	3.63	3.92
JET TEMP SENSATION VOTE		3.92	4.00	4.00	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		4 / 4	3 / 3	4 / 5	4 / 4

EXPERIMENTAL RESULTS FOR SUBJECT NO: 13 SEX: FEMALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	77.60	81.52	80.41	73.69	73.93
WALL TEMPERATURE	78.06	82.04	79.14	73.85	74.37
BOBBIN PROBE TEMP (11% RH TEMP)	128.05	129.95	133.66	127.99	125.48
VAPOR PRESSURE (INCH HG)	0.452	0.474	0.520	0.451	0.423
RELATIVE HUMIDITY	47.4%	43.7%	49.7%	53.9%	50.1%
ADJUSTED ROOM TEMPERATURE	77.69	81.46	79.83	73.94	74.13
ADJ ROOM TEMP DIFF FROM COMFORT		3.77	2.15	-3.74	-3.55
JET OUTLET TEMP LOWER LEVEL		49.38	69.41	64.92	73.99
JET OUTLET TEMP MEAN/RANGE		55.82/13.81	71.27/ 6.56	72.52/15.72	81.49/15.69
JET OUTLET TEMP UPPER LEVEL		63.19	75.97	80.64	89.68
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-25.64	-9.56	-1.42	7.36
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		69.53/-2.40	75.75/-0.79	70.42/-2.84	73.96/-3.18
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		71.93	76.54	73.25	77.14
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		74.68/ 2.75	78.53/ 1.99	76.28/ 3.03	80.61/ 3.47
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-5.75/ 5.15	-1.15/ 2.78	-4.43/ 5.87	-0.55/ 6.65
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.18	-0.10	-0.18	-0.10
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		21.03	14.88	18.96	15.41
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.59	99.51/-0.08	99.50/-0.09	99.46/-0.13	99.49/-0.10
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	91.87	92.55/ 0.68	90.88/-0.99	89.83/-2.04	90.36/-1.51
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.77/-0.19	91.52/ 0.10	92.13/-0.08	92.69/ 0.14
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	94.69	92.96/-1.73	91.42/-3.27	92.21/-2.48	92.55/-2.14
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.42/ 0.46	91.74/ 0.32	92.15/-0.06	92.68/ 0.13
CHEEK TEMP MIN/DIFF FROM MEAN		92.86/-0.49	88.58/-0.02	91.36/-0.26	91.11/ 0.43
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	93.00	93.35/ 0.35	88.60/-4.40	91.62/-1.38	90.68/-2.32
CHEEK TEMP MAX/DIFF FROM MEAN		94.08/ 0.73	88.74/ 0.14	91.82/ 0.20	90.73/ 0.05
WEIGHT LOSS (GRAMS/M**2/HOUR)	15.08	20.02	14.46	12.42	17.58
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		4.94	-0.62	-2.66	2.50
ROOM TEMP SENSATION VOTE	3.94	4.58	4.17	3.29	3.33
JET TEMP SENSATION VOTE		3.92	3.92	3.96	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		5 / 4	5 / 6	5 / 5	3 / 3

EXPERIMENTAL RESULTS FOR SUBJECT NO: 14 SEX: FEMALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	84.65	87.93	87.84	81.18	81.32
WALL TEMPERATURE	82.68	86.34	86.18	80.34	80.14
BOBBIN PROBE TEMP (11% RH TEMP)	134.30	139.65	138.21	135.63	135.62
VAPOR PRESSURE (INCH HG)	0.529	0.602	0.581	0.546	0.546
RELATIVE HUMIDITY	44.1%	45.2%	43.8%	50.9%	50.7%
ADJUSTED ROOM TEMPERATURE	83.50	86.99	86.81	80.85	80.83
ADJ ROOM TEMP DIFF FROM COMFORT		3.50	3.31	-2.65	-2.67
JET OUTLET TEMP LOWER LEVEL		64.17	56.87	83.63	70.43
JET OUTLET TEMP MEAN/RANGE		70.59/11.59	64.12/14.91	87.82/ 7.43	74.22/ 6.98
JET OUTLET TEMP UPPER LEVEL		75.76	71.78	91.06	77.41
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-16.40	-22.69	6.97	-6.61
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		79.06/-2.40	74.72/-3.07	82.10/-1.56	76.71/-1.61
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		81.46	77.79	83.66	78.31
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		83.39/ 1.93	81.04/ 3.25	84.87/ 1.21	79.67/ 1.35
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-2.04/ 4.32	-5.70/ 6.32	0.16/ 2.77	-5.18/ 2.96
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.36	-0.09	-0.36	-0.09
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		11.78	14.04	9.57	10.62
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.00	98.87/-0.13	99.00/ 0.00	97.54/-1.46	98.58/-0.42
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	94.88	95.63/ 0.75	93.56/-1.32	94.29/-0.59	93.06/-1.82
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.89/-0.35	90.93/-0.90	92.71/-0.52	88.46/-0.47
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	96.65	93.24/-3.41	91.83/-4.82	93.23/-3.42	88.93/-7.72
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.70/ 0.46	92.44/ 0.61	93.39/ 0.16	89.77/ 0.84
CHEEK TEMP MIN/DIFF FROM MEAN		92.12/-0.22	87.74/-0.39	91.91/-0.34	87.39/-0.06
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	95.45	92.34/-3.11	88.13/-7.32	92.25/-3.20	87.45/-8.00
CHEEK TEMP MAX/DIFF FROM MEAN		92.59/ 0.25	88.69/ 0.56	92.31/ 0.06	88.01/ 0.56
WEIGHT LOSS (GRAMS/M**2/HOUR)	21.68	29.13	25.32	19.29	17.26
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		7.45	3.64	-2.39	-4.42
ROOM TEMP SENSATION VOTE	3.77	4.67	3.63	3.04	3.75
JET TEMP SENSATION VOTE		4.00	3.92	3.92	4.08
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		5 / 5	4 / 4	6 / 5	6 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 15 SEX: FEMALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	72.73	76.33	75.63	68.91	68.96
WALL TEMPERATURE	72.95	76.20	75.54	69.79	69.75
BOBBIN PROBE TEMP (11% RH TEMP)	129.97	127.96	126.39	121.77	122.94
VAPOR PRESSURE (INCH HG)	0.475	0.451	0.433	0.384	0.396
RELATIVE HUMIDITY	58.7%	49.3%	48.5%	53.9%	55.5%
ADJUSTED ROOM TEMPERATURE	73.24	76.24	75.52	69.49	69.57
ADJ ROOM TEMP DIFF FROM COMFORT		3.00	2.28	-3.75	-3.67
JET OUTLET TEMP LOWER LEVEL		60.00	52.78	66.96	65.03
JET OUTLET TEMP MEAN/RANGE		65.04/11.26	53.65/ 7.76	70.85/10.81	70.79/ 9.83
JET OUTLET TEMP UPPER LEVEL		71.26	60.54	77.77	74.86
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-11.20	-21.87	1.36	1.22
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		70.24/-1.88	65.95/-0.37	68.19/-1.45	67.29/-2.44
JET TEMP 15" FROM OUTL (FORFH LOC) MEAN		72.12	66.32	69.64	69.73
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		74.44/ 2.32	69.24/ 2.92	72.22/ 2.58	71.46/ 1.72
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-1.12/ 4.20	-6.92/ 3.29	-3.60/ 4.03	-3.51/ 4.17
JET(15) TEMP INCR PR DEG ROOM T INCR		0.37	-0.57	0.37	-0.57
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		19.11	14.15	20.07	15.89
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.69	99.11/-0.58	98.71/-0.98	98.50/-1.19	98.63/-1.06
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	91.67	91.26/-0.41	89.92/-1.75	89.53/-2.14	88.64/-3.03
FOREHEAD TEMP MIN/DIFF FROM MEAN		91.16/-0.07	80.59/ 0.12	89.59/-0.12	84.46/-1.16
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	94.10	91.23/-2.87	80.47/-13.63	89.71/-4.39	85.62/-8.46
FOREHEAD TEMP MAX/DIFF FROM MEAN		91.42/ 0.19	82.38/ 1.91	90.14/ 0.43	86.17/ 0.55
CHEEK TEMP MIN/DIFF FROM MEAN		89.00/-0.07	80.87/-0.84	88.57/ 0.02	83.08/-0.49
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	92.56	89.07/-3.49	81.71/-10.85	88.55/-4.01	83.57/-8.99
CHEEK TEMP MAX/DIFF FROM MEAN		89.14/ 0.07	82.33/ 0.62	88.86/ 0.31	83.82/ 0.25
WEIGHT LOSS (GRAMS/M**2/HOUR)	17.64	11.71	12.15	15.74	12.66
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-5.93	-5.49	-1.90	-4.98
ROOM TEMP SENSATION VOTE	4.04	5.00	5.00	3.25	4.00
JET TEMP SENSATION VOTE		3.83	4.00	3.88	3.96
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		6 / 5	3 / 3	6 / 5	5 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 16 SEX: FEMALE A TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	74.43	78.21	77.93	71.38	71.13
WALL TEMPERATURE	74.51	78.20	78.38	72.15	72.60
BOBBIN PROBE TEMP (11% RH TEMP)	124.22	129.34	130.06	121.37	123.03
VAPOR PRESSURE (INCH HG)	0.410	0.467	0.476	0.380	0.397
RELATIVE HUMIDITY	47.7%	48.0%	49.3%	49.1%	51.7%
ADJUSTED ROOM TEMPERATURE	74.36	78.11	78.10	71.68	71.87
ADJ ROOM TEMP DIFF FROM COMFORT		3.75	3.74	-2.68	-2.49
JET OUTLET TEMP LOWER LEVEL		50.65	72.99	88.43	86.64
JET OUTLET TEMP MEAN/RANGE		67.25/35.89	77.76/ 9.85	101.48/30.22	91.84/15.80
JET OUTLET TEMP UPPER LEVEL		86.54	82.84	118.65	102.44
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-10.86	-0.34	29.80	19.97
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		67.93/-6.19	75.84/-2.02	77.74/-4.87	77.70/-2.20
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		74.12	77.86	82.61	79.91
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		81.32/ 7.20	80.01/ 2.15	89.02/ 6.41	84.40/ 4.49
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-0.24/13.39	3.50/ 4.17	8.25/11.28	5.55/ 6.69
JET(15) TEMP INCR PR DEG ROOM T INCR		-1.32	-0.33	-1.32	-0.33
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		19.34	14.22	9.29	9.19
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.34	98.54/-0.80	98.12/-1.22	99.22/-0.12	97.34/-2.00
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	92.40	93.02/ 0.62	92.94/ 0.54	90.40/-2.00	90.67/-1.73
FOREHEAD TEMP MIN/DIFF FROM MEAN		93.52/ 0.06	91.56/-0.52	90.76/-1.14	87.83/-1.27
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	93.89	93.46/-0.43	92.08/-1.81	91.90/-1.99	89.10/-4.79
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.35/-0.11	92.47/ 0.39	93.49/ 1.59	90.24/ 1.14
CHEEK TEMP MIN/DIFF FROM MEAN		91.46/-0.74	90.93/-0.43	90.92/-0.39	91.02/-0.30
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	92.67	92.20/-0.47	91.36/-1.31	91.31/-1.36	91.32/-1.35
CHEEK TEMP MAX/DIFF FROM MEAN		92.75/ 0.55	91.57/ 0.21	91.69/ 0.38	91.53/ 0.21
WEIGHT LOSS (GRAMS/M**2/HOUR)	20.18	15.89	18.69	20.43	21.31
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-4.29	-1.49	0.25	1.13
ROOM TEMP SENSATION VOTE	3.96	3.96	4.00	3.00	3.88
JET TEMP SENSATION VOTE		3.92	4.00	3.96	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		3 / 2	5 / 5	3 / 3	4 / 4

EXPERIMENTAL RESULTS FOR SUBJECT NO: 17 SEX: FEMALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	73.27	76.52	76.55	70.09	69.87
WALL TEMPERATURE	73.40	76.84	77.11	71.12	70.66
BOBBIN PROBE TEMP (11% RH TEMP)	127.04	127.75	130.64	121.02	121.54
VAPOR PRESSURE (INCH HG)	0.441	0.448	0.483	0.377	0.382
RELATIVE HUMIDITY	53.4%	48.7%	52.4%	50.8%	51.9%
ADJUSTED ROOM TEMPERATURE	73.48	76.60	76.91	70.59	70.31
ADJ ROOM TEMP DIFF FROM COMFORT		3.12	3.43	-2.90	-3.17
JET OUTLET TEMP LOWER LEVEL		53.69	67.53	82.08	69.29
JET OUTLET TEMP MEAN/RANGE		65.42/29.23	71.89/10.96	96.05/25.54	77.01/13.44
JET OUTLET TEMP UPPER LEVEL		82.92	78.49	107.62	82.73
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-11.18	-5.02	25.46	6.70
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		68.00/-4.38	72.73/-1.85	74.56/-5.21	69.62/-3.27
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		72.38	74.58	79.78	72.90
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		78.91/ 6.53	77.37/ 2.80	84.09/ 4.32	75.32/ 2.42
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-1.11/10.91	1.09/ 4.64	6.29/ 9.53	-0.59/ 5.69
JET(15) TEMP INCR PR DEG ROOM T INCR		-1.23	0.25	-1.23	0.25
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		20.72	14.52	12.67	17.22
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.12	98.93/-0.19	99.43/ 0.31	98.71/-0.41	99.27/ 0.15
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	89.68	91.53/ 1.85	90.10/ 0.42	89.39/-0.29	89.08/-0.60
FOREHEAD TEMP MIN/DIFF FROM MEAN		93.34/ 0.24	88.54/-0.56	91.66/-0.79	89.08/-1.04
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	94.54	93.10/-1.44	89.10/-5.44	92.45/-2.09	90.12/-4.42
FOREHEAD TEMP MAX/DIFF FROM MEAN		92.80/-0.30	90.35/ 1.25	93.00/ 0.55	90.57/ 0.45
CHEEK TEMP MIN/DIFF FROM MEAN		91.91/-0.67	86.66/-0.53	91.75/-0.26	88.89/-1.10
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	91.29	92.58/ 1.29	87.19/-4.10	92.01/ 0.72	89.99/-1.30
CHEEK TEMP MAX/DIFF FROM MEAN		92.85/ 0.27	88.28/ 1.09	92.13/ 0.12	89.86/-0.13
WEIGHT LOSS (GRAMS/M**2/HOUR)	19.20	20.64	21.52	21.19	21.84
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		1.44	2.32	1.99	2.64
ROOM TEMP SENSATION VOTE	3.96	3.92	4.29	3.92	3.96
JET TEMP SENSATION VOTE		4.08	3.96	3.96	4.04
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		4 / 3	4 / 4	3 / 4	4 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 18	SEX: FEMALE	ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	74.62	78.23	78.36	71.68	71.32
WALL TEMPERATURE	74.77	78.37	78.50	72.84	72.22
BOBBIN PROBE TEMP (11% RH TEMP)	126.16	131.53	133.30	121.50	119.42
VAPOR PRESSURE (INCH HG)	0.431	0.493	0.516	0.381	0.361
RELATIVE HUMIDITY	50.0%	50.7%	52.7%	48.7%	46.7%
ADJUSTED ROOM TEMPERATURE	74.69	78.32	78.55	72.14	71.57
ADJ ROOM TEMP DIFF FROM COMFORT		3.63	3.86	-2.55	-3.12
JET OUTLET TEMP LOWER LEVEL		69.79	79.88	88.45	98.45
JET OUTLET TEMP MEAN/RANGE		77.93/16.22	82.72/ 8.45	100.57/27.76	104.59/17.46
JET OUTLET TEMP UPPER LEVEL		86.01	88.33	116.21	115.91
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-0.39	4.17	28.43	33.02
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		75.08/-3.04	79.00/-1.20	77.94/-4.52	82.82/-2.60
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		78.11	80.21	82.46	85.42
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		81.13/ 3.01	82.58/ 2.38	88.30/ 5.84	90.22/ 4.80
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		3.43/ 6.05	5.52/ 3.58	7.77/10.36	10.73/ 7.40
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.70	-0.75	-0.70	-0.75
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		15.41	12.11	10.96	8.85
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.36	98.77/ 0.41	98.90/ 0.54	98.68/ 0.32	99.13/ 0.77
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	90.89	92.85/ 1.96	91.99/ 1.10	90.50/-0.39	90.28/-0.61
FOREHEAD TEMP MIN/DIFF FROM MEAN		93.19/-0.33	92.01/-0.31	93.08/-0.34	93.96/-0.31
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	95.13	93.52/-1.61	92.32/-2.81	93.42/-1.71	94.27/-0.86
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.90/ 0.38	92.80/ 0.48	94.06/ 0.64	95.44/ 1.17
CHEEK TEMP MIN/DIFF FROM MEAN		92.12/ 1.39	90.92/ 0.21	92.26/-0.08	91.35/-0.03
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	92.91	90.73/-2.18	90.71/-2.20	92.34/-0.57	91.38/-1.53
CHEEK TEMP MAX/DIFF FROM MEAN		84.21/-6.52	91.37/ 0.66	92.61/ 0.27	92.21/ 0.83
WEIGHT LOSS (GRAMS/M**2/HOUR)	17.69	14.86	20.05	15.36	16.21
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-2.83	2.36	-2.33	-1.48
ROOM TEMP SENSATION VOTE	3.87	4.21	4.08	3.58	3.75
JET TEMP SENSATION VOTE		4.04	4.00	3.88	3.96
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		5 / 5	4 / 5	4 / 3	4 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 31 SEX: MALE		ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	73.50	77.93	76.60	70.03	70.21
WALL TEMPERATURE	74.76	78.79	76.60	70.69	71.27
BOBBIN PROBE TEMP (11% RH TEMP)	127.19	131.13	131.04	125.44	124.83
VAPOR PRESSURE (INCH HG)	0.442	0.488	0.487	0.423	0.416
RELATIVE HUMIDITY	53.1%	50.6%	52.8%	57.1%	55.9%
ADJUSTED ROOM TEMPERATURE	74.21	78.34	76.73	70.66	70.96
ADJ ROOM TEMP DIFF FROM COMFORT		4.13	2.52	-3.55	-3.26
JET OUTLET TEMP LOWER LEVEL		68.65	69.14	72.61	81.04
JET OUTLET TEMP MEAN/RANGE		72.70/ 8.65	72.63/ 7.12	80.41/14.32	86.80/12.68
JET OUTLET TEMP UPPER LEVEL		77.30	76.26	86.93	93.72
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-5.64	-4.10	9.75	15.84
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		74.47/-1.51	73.44/-1.48	70.99/-2.91	74.80/-2.44
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		75.98	74.91	73.90	77.24
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		77.69/ 1.72	76.45/ 1.54	76.34/ 2.43	80.17/ 2.93
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		1.77/ 3.23	0.70/ 3.02	-0.31/ 5.34	3.02/ 5.37
JET(15) TEMP INCR PR DEG ROOM T INCR		0.27	-0.40	0.27	-0.40
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		15.77	18.63	19.22	16.70
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.56	98.19/-0.37	98.78/ 0.22	98.76/ 0.20	97.45/-1.11
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	91.78	92.59/ 0.81	90.68/-1.10	87.52/-4.26	87.96/-3.82
FOREHEAD TEMP MIN/DIFF FROM MEAN		91.66/-0.09	92.92/-0.62	92.66/-0.46	93.84/-0.10
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	95.15	91.75/-3.40	93.54/-1.61	93.12/-2.03	93.94/-1.21
FOREHEAD TEMP MAX/DIFF FROM MEAN		91.83/ 0.08	93.87/ 0.33	93.72/ 0.60	94.44/ 0.50
CHEEK TEMP MIN/DIFF FROM MEAN		95.84/ 0.22	84.07/-0.84	86.88/-0.71	86.14/-0.36
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	91.26	95.62/ 4.36	84.91/-6.35	87.59/-3.67	86.50/-4.76
CHEEK TEMP MAX/DIFF FROM MEAN		95.58/-0.04	85.14/ 0.23	88.14/ 0.55	86.82/ 0.32
WEIGHT LOSS (GRAMS/M**2/HOUR)	15.47	20.60	21.11	19.12	14.05
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		5.13	5.64	3.65	-1.42
ROOM TEMP SENSATION VOTE	4.04	4.21	4.13	3.92	3.58
JET TEMP SENSATION VOTE		3.88	3.92	4.04	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		6 / 5	5 / 5	4 / 4	4 / 4

EXPERIMENTAL RESULTS FOR SUBJECT NO: 32	SEX: MALE	ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	68.58	72.13	71.92	65.46	65.55
WALL TEMPERATURE	69.94	73.09	72.73	66.98	67.11
BOBBIN PROBE TEMP (11% RH TEMP)	122.98	126.24	123.28	113.02	112.77
VAPOR PRESSURE (INCH HG)	0.398	0.431	0.400	0.304	0.302
RELATIVE HUMIDITY	56.5%	54.3%	50.7%	48.0%	47.6%
ADJUSTED ROOM TEMPERATURE	69.50	72.76	72.31	66.05	66.13
ADJ ROOM TEMP DIFF FROM COMFORT		3.26	2.82	-3.45	-3.37
JET OUTLET TEMP LOWER LEVEL		71.14	61.40	66.94	75.30
JET OUTLET TEMP MEAN/RANGE		78.23/15.00	68.97/13.14	77.54/20.62	81.94/11.44
JET OUTLET TEMP UPPER LEVEL		86.14	74.54	87.56	86.74
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		5.47	-3.34	11.49	15.81
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		71.76/-2.65	67.46/-3.21	66.01/-3.96	69.68/-2.81
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		74.40	70.67	69.97	72.49
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		77.35/ 2.95	73.03/ 2.36	73.71/ 3.74	74.53/ 2.03
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		4.91/ 5.60	1.17/ 5.57	0.47/ 7.69	3.00/ 4.85
JET(15) TEMP INCR PR DEG ROOM T INCR		0.66	-0.30	0.66	-0.30
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		18.54	21.45	22.38	19.58
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.30	99.01/ 0.71	99.02/ 0.72	98.95/ 0.65	99.09/ 0.79
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	89.44	88.97/-0.47	89.24/-0.20	88.17/-1.27	86.74/-2.70
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.60/-0.34	91.62/-0.50	92.01/-0.34	91.37/-0.70
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	93.49	92.94/-0.55	92.12/-1.37	92.35/-1.14	92.07/-1.42
FOREHEAD TEMP MAX/DIFF FROM MEAN		92.99/ 0.05	92.53/ 0.41	92.58/ 0.23	92.24/ 0.17
CHEEK TEMP MIN/DIFF FROM MEAN		88.12/-0.33	85.61/-0.14	87.47/ 0.19	84.26/-0.37
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	86.62	88.45/ 1.83	85.75/-0.87	87.28/ 0.66	84.63/-1.99
CHEEK TEMP MAX/DIFF FROM MEAN		88.44/-0.01	85.98/ 0.23	87.40/ 0.12	84.75/ 0.12
WEIGHT LOSS (GRAMS/M**2/HOUR)	24.49	21.80	22.65	23.02	24.19
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-2.69	-1.84	-1.47	-0.30
ROOM TEMP SENSATION VOTE	4.17	4.08	4.46	4.29	4.00
JET TEMP SENSATION VOTE		3.83	4.04	4.17	4.13
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		6 / 5	4 / 5	3 / 4	4 / 5

EXPERIMENTAL RESULTS FOR SUBJECT NO: 33 SEX: MALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	78.87	81.74	82.06	75.66	75.54
WALL TEMPERATURE	77.90	81.51	82.31	76.44	76.26
BOBBIN PROBE TEMP (11% RH TEMP)	129.60	135.48	135.23	127.29	127.82
VAPOR PRESSURE (INCH HG)	0.470	0.544	0.541	0.443	0.449
RELATIVE HUMIDITY	47.3%	49.8%	49.0%	49.6%	50.4%
ADJUSTED ROOM TEMPERATURE	78.31	81.63	82.13	75.99	75.88
ADJ ROOM TEMP DIFF FROM COMFORT		3.32	3.82	-2.32	-2.42
JET OUTLET TEMP LOWER LEVEL		47.88	69.69	88.25	97.03
JET OUTLET TEMP MEAN/RANGE		60.92/18.68	71.63/ 5.12	92.98/ 9.16	99.07/ 3.73
JET OUTLET TEMP UPPER LEVEL		66.56	74.81	97.41	100.76
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-20.71	-10.50	16.99	23.19
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		69.11/-4.87	76.82/-0.82	80.36/-1.76	84.65/-0.86
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		73.97	77.64	82.12	85.51
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		76.08/ 2.10	78.99/ 1.35	83.78/ 1.65	86.23/ 0.72
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-4.34/ 6.97	-0.67/ 2.17	3.81/ 3.42	7.20/ 1.58
JET(15) TEMP INCR PR DEG ROOM T INCR		-1.44	-1.26	-1.44	-1.26
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		18.48	13.85	11.70	6.94
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.59	99.07/ 0.48	98.64/ 0.05	98.97/ 0.38	98.17/-0.42
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	93.15	94.00/ 0.85	93.81/ 0.66	92.93/-0.22	91.95/-1.20
FOREHEAD TEMP MIN/DIFF FROM MEAN		91.45/-1.00	90.93/-0.56	93.58/-0.24	92.14/-0.31
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	94.61	92.45/-2.16	91.49/-3.12	93.82/-0.79	92.45/-2.16
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.61/ 1.16	91.68/ 0.19	94.16/ 0.34	92.74/ 0.29
CHEEK TEMP MIN/DIFF FROM MEAN		92.77/-0.32	89.78/-0.49	92.98/-0.21	91.29/-0.12
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	93.52	93.09/-0.43	90.27/-3.25	93.19/-0.33	91.41/-2.11
CHEEK TEMP MAX/DIFF FROM MEAN		93.44/ 0.35	90.36/ 0.09	93.22/ 0.03	91.51/ 0.10
WEIGHT LOSS (GRAMS/M**2/HOUR)	23.15	32.96	26.18	41.70	19.89
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		9.81	3.03	18.55	-3.26
ROOM TEMP SENSATION VOTE	3.81	4.63	4.63	4.00	3.63
JET TEMP SENSATION VOTE		4.17	3.92	3.96	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		3 / 3	6 / 7	6 / 5	7 / 7

EXPERIMENTAL RESULTS FOR SUBJECT NO: 34 SEX: MALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	68.06	71.19	71.38	64.95	64.94
WALL TEMPERATURE	69.23	71.91	71.67	65.95	66.53
BOBBIN PROBE TEMP (11% RH TEMP)	121.80	122.57	122.50	117.10	111.40
VAPOR PRESSURE (INCH HG)	0.385	0.392	0.392	0.339	0.290
RELATIVE HUMIDITY	55.6%	51.0%	50.5%	54.6%	46.8%
ADJUSTED ROOM TEMPERATURE	68.84	71.56	71.54	65.61	65.50
ADJ ROOM TEMP DIFF FROM COMFORT		2.72	2.69	-3.23	-3.35
JET OUTLET TEMP LOWER LEVEL		57.39	56.75	71.49	65.54
JET OUTLET TEMP MEAN/RANGE		59.22/ 8.14	60.04/ 5.84	82.87/16.25	67.84/ 4.49
JET OUTLET TEMP UPPER LEVEL		65.53	62.59	87.74	70.03
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-12.34	-11.50	17.26	2.34
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		66.04/-0.68	65.18/-1.39	67.39/-4.25	65.19/-0.97
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		66.73	66.58	71.64	66.17
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		69.08/ 2.35	67.66/ 1.08	73.45/ 1.82	67.10/ 0.93
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-2.12/ 3.04	-2.27/ 2.47	2.79/ 6.06	-2.67/ 1.90
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.83	0.07	-0.83	0.07
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		23.73	21.05	19.77	19.35
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.61	99.02/ 0.41	98.30/-0.31	98.30/-0.31	99.37/ 0.76
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	89.01	89.47/ 0.46	88.02/-0.99	86.55/-2.46	86.47/-2.54
FOREHEAD TEMP MIN/DIFF FROM MEAN		90.64/ 0.18	87.17/-0.46	90.69/-0.72	85.34/-0.18
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	92.81	90.46/-2.35	87.63/-5.18	91.41/-1.40	85.52/-7.29
FOREHEAD TEMP MAX/DIFF FROM MEAN		90.82/ 0.36	87.47/-0.16	91.70/ 0.29	85.73/ 0.21
CHEEK TEMP MIN/DIFF FROM MEAN		92.78/ 0.05	89.34/-0.09	90.68/-0.10	87.13/ 0.15
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	91.49	92.73/ 1.24	89.43/-2.06	90.78/-0.71	86.98/-4.51
CHEEK TEMP MAX/DIFF FROM MEAN		92.93/ 0.20	89.30/-0.13	90.90/ 0.12	86.82/-0.16
WEIGHT LOSS (GRAMS/M**2/HOUR)	28.38	22.13	29.68	24.22	20.34
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		-6.25	1.30	-4.16	-8.04
ROOM TEMP SENSATION VOTE	4.21	4.13	4.38	3.58	4.33
JET TEMP SENSATION VOTE		3.96	3.92	4.13	4.08
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		5 / 5	6 / 5	4 / 4	6 / 6

EXPERIMENTAL RESULTS FOR SUBJECT NO: 35 SEX: MALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	76.24	79.76	79.59	73.10	72.99
WALL TEMPERATURE	76.19	79.79	80.01	73.75	73.59
BOBBIN PROBE TEMP (11% RH TEMP)	127.63	132.07	131.91	124.99	125.20
VAPOR PRESSURE (INCH HG)	0.448	0.500	0.498	0.418	0.420
RELATIVE HUMIDITY	49.0%	48.8%	48.9%	50.9%	51.3%
ADJUSTED ROOM TEMPERATURE	76.17	79.72	79.73	73.43	73.32
ADJ ROOM TEMP DIFF FROM COMFORT		3.55	3.55	-2.74	-2.85
JET OUTLET TEMP LOWER LEVEL		71.12	76.62	80.43	72.72
JET OUTLET TEMP MEAN/RANGE		81.23/18.38	83.46/11.32	96.46/35.51	83.01/19.85
JET OUTLET TEMP UPPER LEVEL		89.50	87.94	115.94	92.57
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		1.51	3.73	23.03	9.69
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		76.54/-3.77	78.33/-2.90	75.84/-5.98	72.88/-4.36
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		80.31	81.23	81.82	77.24
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		83.40/ 3.09	83.13/ 1.90	89.09/ 7.27	81.29/ 4.05
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		4.14/ 6.86	5.06/ 4.80	5.64/13.25	1.07/ 8.41
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.24	0.62	-0.24	0.62
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		13.61	11.77	10.89	15.81
RECTAL TEMPERATURE/DIFF FROM COMF TEST	97.93	98.08/ 0.15	98.00/ 0.07	97.87/-0.06	98.18/ 0.25
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	90.89	92.46/ 1.57	92.38/ 1.49	90.29/-0.60	90.67/-0.22
FOREHEAD TEMP MIN/DIFF FROM MEAN		94.07/ 0.15	92.68/-0.32	92.29/-0.42	92.72/-0.33
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	92.55	93.92/ 1.37	93.00/ 0.45	92.71/ 0.16	93.05/ 0.50
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.88/-0.04	92.85/-0.15	93.33/ 0.62	93.49/ 0.44
CHEEK TEMP MIN/DIFF FROM MEAN		90.59/-0.74	90.96/-0.22	91.19/-0.20	88.60/-0.71
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	91.01	91.33/ 0.32	91.18/ 0.17	91.39/ 0.38	89.31/-1.70
CHEEK TEMP MAX/DIFF FROM MEAN		92.03/ 0.70	91.34/ 0.16	91.68/ 0.29	89.48/ 0.17
WEIGHT LOSS (GRAMS/M**2/HOUR)	23.32	23.38	18.88	17.23	14.71
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		0.06	-4.44	-6.09	-8.61
ROOM TEMP SENSATION VOTE	4.00	3.88	3.79	3.42	3.33
JET TEMP SENSATION VOTE		4.04	3.96	4.00	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		4 / 5	4 / 4	3 / 3	3 / 4

EXPERIMENTAL RESULTS FOR SUBJECT NO: 36	SEX: MALE	ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	70.53	73.89	74.13	67.13	67.19
WALL TEMPERATURE	71.33	74.40	74.53	68.51	68.43
BOBBIN PROBE TEMP (11% RH TEMP)	122.01	122.89	126.83	117.62	117.60
VAPOR PRESSURE (INCH HG)	0.387	0.396	0.438	0.344	0.344
RELATIVE HUMIDITY	51.4%	46.9%	51.5%	51.4%	51.2%
ADJUSTED ROOM TEMPERATURE	70.96	73.97	74.38	67.81	67.80
ADJ ROOM TEMP DIFF FROM COMFORT		3.01	3.42	-3.15	-3.15
JET OUTLET TEMP LOWER LEVEL		64.36	64.74	101.25	87.86
JET OUTLET TEMP MEAN/RANGE		67.89/ 6.30	68.46/10.78	111.94/24.22	89.19/ 6.81
JET OUTLET TEMP UPPER LEVEL		70.66	75.52	125.47	94.67
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-6.08	-5.92	44.13	21.39
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		70.33/-1.32	70.15/-1.58	79.86/-3.99	75.95/-0.56
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		71.65	71.72	83.85	76.51
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		72.68/ 1.03	74.72/ 2.99	88.90/ 5.05	78.84/ 2.32
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		0.69/ 2.35	0.77/ 4.57	12.90/ 9.04	5.56/ 2.89
JET(15) TEMP INCR PR DEG ROOM T INCR		-1.98	-0.73	-1.98	-0.73
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		22.32	21.85	10.22	15.70
RECTAL TEMPERATURE/DIFF FROM COMF TEST	99.06	98.36/-0.70	98.88/-0.18	97.46/-1.60	99.19/ 0.13
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	88.59	89.81/ 1.22	90.63/ 2.04	88.75/ 0.16	88.74/ 0.15
FOREHEAD TEMP MIN/DIFF FROM MEAN		94.03/ 0.06	93.43/-0.14	93.72/-0.35	91.94/-0.27
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	92.00	93.97/ 1.97	93.57/ 1.57	94.07/ 2.07	92.21/ 0.21
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.89/-0.08	94.10/ 0.53	94.76/ 0.69	92.52/ 0.31
CHEEK TEMP MIN/DIFF FROM MEAN		91.58/-0.04	87.43/-0.56	90.37/ 0.10	87.02/-0.23
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	89.43	91.62/ 2.19	87.99/-1.44	90.27/ 0.84	87.25/-2.18
CHEEK TEMP MAX/DIFF FROM MEAN		91.61/-0.01	87.94/-0.05	90.37/ 0.10	87.49/ 0.24
WEIGHT LOSS (GRAMS/M**2/HOUR)	21.19	25.41	22.79	18.34	23.86
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		4.22	1.60	-2.85	2.67
ROOM TEMP SENSATION VOTE	4.14	4.79	4.50	3.00	3.58
JET TEMP SENSATION VOTE		3.88	3.88	4.00	3.75
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		5 / 5	5 / 4	2 / 3	6 / 6

EXPERIMENTAL RESULTS FOR SUBJECT NO: 37 SEX: MALE ALL TEMPERATURES IN DEG F

ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	77.23	80.45	80.50	73.96	73.92
WALL TEMPERATURE	76.07	80.54	80.73	74.50	74.70
BOBBIN PROBE TEMP (11% RH TEMP)	127.65	133.54	135.13	123.88	125.91
VAPOR PRESSURE (INCH HG)	0.448	0.519	0.539	0.406	0.428
RELATIVE HUMIDITY	47.6%	49.5%	51.4%	48.0%	50.7%
ADJUSTED ROOM TEMPERATURE	76.60	80.47	80.67	74.11	74.30
ADJ ROOM TEMP DIFF FROM COMFORT		3.87	4.08	-2.49	-2.29
JET OUTLET TEMP LOWER LEVEL		47.04	55.05	61.92	72.32
JET OUTLET TEMP MEAN/RANGE		55.54/19.15	62.41/16.55	69.99/18.47	80.08/17.63
JET OUTLET TEMP UPPER LEVEL		66.19	71.60	80.39	89.95
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-24.93	-18.26	-4.12	5.78
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		67.99/-3.17	69.72/-3.12	69.46/-3.01	73.24/-3.29
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		71.16	72.84	72.48	76.53
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		75.13/ 3.97	76.73/ 3.89	76.36/ 3.88	80.72/ 4.18
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-5.44/ 7.15	-3.76/ 7.01	-4.12/ 6.89	-0.06/ 7.47
JET(15) TEMP INCR PR DEG ROOM T INCR		-0.21	-0.58	-0.21	-0.58
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		22.09	19.59	19.98	15.03
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.70	98.30/-0.40	98.52/-0.18	98.32/-0.38	98.67/-0.03
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	92.53	92.53/ 0.00	91.70/-0.83	90.10/-2.43	90.83/-1.70
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.96/-0.29	92.07/-0.36	91.61/-0.85	90.61/-0.95
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	95.66	93.25/-2.41	92.43/-3.23	92.46/-3.20	91.56/-4.10
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.50/ 0.25	92.87/ 0.44	93.15/ 0.69	92.53/ 0.97
CHEEK TEMP MIN/DIFF FROM MEAN		93.64/ 0.00	90.38/-0.48	90.41/-0.19	87.85/-0.93
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	93.50	93.64/ 0.14	90.86/-2.64	90.60/-2.90	88.78/-4.72
CHEEK TEMP MAX/DIFF FROM MEAN		93.66/ 0.02	91.57/ 0.71	90.73/ 0.13	89.38/ 0.60
WEIGHT LOSS (GRAMS/M**2/HOUR)	30.04	32.02	29.26	28.29	27.41
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		1.98	-0.78	-1.75	-2.63
ROOM TEMP SENSATION VOTE	3.96	5.00	5.00	3.46	3.25
JET TEMP SENSATION VOTE		4.00	3.96	4.00	4.00
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		3 / 3	4 / 3	3 / 4	3 / 3

EXPERIMENTAL RESULTS FOR SUBJECT NO: 38	SEX: MALE	ALL TEMPERATURES IN DEG F			
ROOM TEMPERATURE CONDITION	COMFORT	T(CO)+3.3	T(CO)+3.3	T(CO)-3.3	T(CO)-3.3
JET VEL (M/S), AT LOC OF FOREHEAD		0.50	1.00	0.50	1.00
JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA		1.34	2.36	1.34	2.36
AIR TEMPERATURE	71.14	74.38	74.38	67.99	67.91
WALL TEMPERATURE	72.44	75.07	75.04	69.06	68.75
BOBBIN PROBE TEMP (11% RH TEMP)	125.72	124.97	126.03	116.44	117.92
VAPOR PRESSURE (INCH HG)	0.426	0.418	0.429	0.333	0.347
RELATIVE HUMIDITY	55.4%	48.7%	50.1%	48.3%	50.4%
ADJUSTED ROOM TEMPERATURE	71.98	74.63	74.68	68.39	68.30
ADJ ROOM TEMP DIFF FROM COMFORT		2.65	2.70	-3.59	-3.67
JET OUTLET TEMP LOWER LEVEL		52.70	52.86	56.49	64.79
JET OUTLET TEMP MEAN/RANGE		65.49/23.82	66.19/26.91	73.88/33.06	74.04/18.47
JET OUTLET TEMP UPPER LEVEL		76.52	79.77	89.55	83.26
DIFF BETWEEN JET OUTL & ADJ ROOM TEMP		-9.14	-8.49	5.49	5.74
JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN		66.29/-4.77	65.26/-5.65	63.70/-6.49	66.59/-3.92
JET TEMP 15" FROM OUTL (FOREH LOC) MEAN		71.06	70.91	70.19	70.51
JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN		75.18/ 4.12	76.67/ 5.75	76.03/ 5.85	74.41/ 3.91
JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)		-0.91/ 8.89	-1.06/11.40	-1.79/12.34	-1.47/ 7.83
JET(15) TEMP INCR PR DEG ROOM T INCR		0.14	0.06	0.14	0.06
DIFF BETWEEN JET T(15) & FOREHEAD TEMP		22.37	21.87	23.47	20.58
RECTAL TEMPERATURE/DIFF FROM COMF TEST	98.63	99.08/ 0.45	98.57/-0.06	96.65/-1.98	96.41/-2.22
MEAN SKIN TEMP/DIFF FROM COMFORT TEST	91.12	91.61/ 0.49	89.97/-1.15	88.69/-2.43	88.48/-2.64
FOREHEAD TEMP MIN/DIFF FROM MEAN		92.90/-0.53	91.79/-0.99	93.76/ 0.10	89.91/-1.18
FOREHEAD TEMP MEAN/DIFF FROM COMF TEST	95.46	93.43/-2.03	92.78/-2.68	93.66/-1.80	91.09/-4.37
FOREHEAD TEMP MAX/DIFF FROM MEAN		93.67/ 0.24	93.67/ 0.89	94.03/ 0.37	91.73/ 0.64
CHEEK TEMP MIN/DIFF FROM MEAN		89.13/-0.81	87.32/-1.51	87.03/-0.44	85.89/-0.46
CHEEK TEMP MEAN/DIFF FROM COMFORT TEST	91.61	89.94/-1.67	88.83/-2.78	87.47/-4.14	86.35/-5.26
CHEEK TEMP MAX/DIFF FROM MEAN		90.38/ 0.44	89.74/ 0.91	87.33/-0.14	86.91/ 0.56
WEIGHT LOSS (GRAMS/M**2/HOUR)	16.92	17.14	17.50	22.64	16.27
WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T		0.22	0.58	5.72	-0.65
ROOM TEMP SENSATION VOTE	4.02	4.04	4.00	4.00	3.92
JET TEMP SENSATION VOTE		4.04	4.04	4.04	4.04
NO OF MIN/MAX PEAKS OF JET TEMPERATURE		3 / 4	3 / 3	3 / 3	3 / 3

Appendix B

Computer output of test results from
the two comfort tests with each subject

RESULTS FROM COMFORT TESTS, FEMALE SUBJECTS

SUBJ/ TEST	NO	ROOM 1	ROOM 2	ROOM 1	WALL	11% RH	SKIN	FOREHEAD	CHEEK	RECTAL	ROOMAIR	VP " HG	% RH	ADJROOM	VOTE
11	1	73.28	73.13	73.20	74.97	127.08	91.12	92.24	89.93	99.04	73.18	0.441	53.5	74.15	4.25
11	2	73.12	72.81	72.97	73.95	127.72	91.40	92.79	91.74	99.06	72.93	0.448	54.9	73.61	3.96
12	1	76.29	75.48	76.19	76.11	128.13	93.02	95.70	94.06	99.39	75.86	0.453	50.3	75.99	4.00
12	2	76.35	75.74	76.18	76.29	125.57	92.41	91.25	90.71	98.74	76.00	0.424	46.9	75.98	3.92
13	1	77.04	77.78	77.04	77.62	127.85	91.68	94.41	91.53	99.52	77.41	0.450	47.4	77.38	3.96
13	2	77.21	78.38	77.21	78.51	128.26	92.05	94.96	94.47	99.65	77.79	0.454	47.3	77.99	3.92
14	1	83.41	83.42	83.43	81.36	134.15	94.59	96.69	95.53	99.42	83.42	0.527	45.6	82.30	3.75
14	2	86.00	85.89	85.77	84.01	134.46	95.16	96.51	95.37	98.57	85.89	0.531	42.5	84.70	3.79
15	1	73.16	73.29	72.98	72.95	127.31	92.03	94.42	92.99	97.44	73.18	0.443	53.9	73.26	4.04
15	2	72.15	72.25	72.49	72.95	132.64	91.31	93.79	92.13	97.93	72.28	0.507	63.5	73.22	4.04
16	1	73.51	72.33	73.66	73.51	123.17	92.72	93.67	93.25	99.45	72.96	0.399	48.8	73.15	3.96
16	2	76.48	75.29	76.59	75.51	125.28	92.09	94.10	92.08	99.23	75.91	0.421	46.7	75.58	3.96
17	1	73.70	73.47	73.67	73.54	128.46	89.92	94.90	88.43	99.51	73.58	0.457	54.7	73.78	4.30
17	2	73.43	72.44	73.51	73.26	125.63	89.43	94.19	94.15	98.73	72.95	0.425	52.0	73.19	3.92
18	1	74.78	73.64	74.57	74.57	128.64	91.34	95.18	91.71	98.80	74.16	0.459	53.9	74.53	3.96
18	2	75.36	74.82	75.34	74.97	123.69	90.44	95.07	94.10	97.93	75.08	0.404	46.0	74.95	3.79

RESULTS FROM COMFORT TESTS, MALE SUBJECTS

SUBJ/ TEST	NO	ROOM 1	ROOM 2	ROOM 1	HALL	11% RH	SKIN	FOREHEAD	CHEEK	RECTAL	ROOMAIR	VP " HG	% RH	ADJROOM	VOTE
31	1	73.64	73.61	73.62	74.71	126.12	91.44	95.50	91.14	98.42	73.62	0.430	51.5	74.18	3.83
31	2	73.49	73.33	73.41	74.81	128.26	92.12	94.80	91.38	98.70	73.39	0.454	54.8	74.25	4.25
32	1	69.32	68.27	69.40	70.01	120.01	89.54	93.90	87.51	98.30	68.82	0.367	51.7	69.43	4.13
32	2	68.79	67.98	68.67	69.88	125.95	89.35	93.08	85.74	98.30	68.35	0.428	61.3	69.57	4.21
33	1	78.86	78.30	78.27	77.47	128.82	92.73	94.82	93.87	98.54	78.43	0.461	47.0	77.86	3.92
33	2	79.67	78.88	79.77	78.34	130.38	93.57	94.40	93.17	98.64	79.30	0.479	47.5	78.75	3.71
34	1	68.14	67.41	68.22	68.85	120.27	88.89	92.87	90.58	98.68	67.79	0.369	53.9	68.45	4.13
34	2	68.67	67.97	68.66	69.61	123.33	89.13	92.75	92.40	98.54	68.32	0.400	57.4	69.24	4.29
35	1	75.23	74.86	75.27	74.84	125.39	90.48	92.69	89.61	97.89	75.05	0.422	48.2	74.87	3.92
35	2	77.71	77.12	77.73	77.55	129.87	91.30	94.28	92.41	97.98	77.42	0.473	49.9	77.47	4.08
36	1	72.00	71.11	72.06	72.47	121.50	90.03	91.79	90.86	98.95	71.57	0.381	48.9	71.92	4.08
36	2	69.94	69.04	69.96	70.20	122.53	87.16	92.21	88.00	99.16	69.49	0.392	53.9	69.99	4.21
37	1	77.76	77.10	77.71	74.41	125.31	92.51	95.35	94.49	98.58	77.42	0.421	44.4	75.81	3.96
37	2	77.44	76.69	77.36	77.72	129.99	92.55	95.97	92.51	98.81	77.04	0.475	50.7	77.38	3.96
38	1	70.54	69.62	70.59	71.78	124.50	91.37	95.32	91.38	99.62	70.09	0.413	55.6	71.11	4.04
38	2	72.54	71.78	72.64	73.11	126.95	90.87	95.60	91.85	97.64	72.18	0.439	55.2	72.84	4.00

Appendix C

Computer output of results of all environmental and physiological measurements and subjective votes as a function of time of exposure for all 16 subjects pooled for each type of exposure condition (four combinations of draft velocity and ambient temperature levels)

MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOSURE TO AMB TEMP = T(CO)+3.3 F AND DRAFT VELOCITY = 0.5 M/S

ALL TEMPERATURE OBSERVATIONS IN DEG F, AND VAPOR PRESSURE IN INCHES HG, VOTES AFTER 1-7 COMFORT VOTE SCALE (COMFORT = 4)

TIME OF OBSERVATION /			ENVIRONMENTAL OBSERVATINS								PHYSIOLOGICAL OBSERVATIONS /				VOTES	
ID	HOURS	MINUTES	AIR T	WALL	11% RH	VAPOR	%R H	ADJ AIR	JET	JET15	SKIN	FOREH	CHEEK	BODY	ROOM	JET
1	0.350	35.0	78.01	78.06	129.72	0.471	48.8	77.97	62.91	72.38	92.07	92.26	91.68	99.15	4.37	3.93
2	0.375	37.5	77.96	78.06	129.72	0.471	48.8	77.95	62.93	72.35	92.07	92.26	91.68	99.15	4.37	3.93
3	0.400	40.0	77.92	78.07	128.56	0.458	47.5	77.87	62.10	72.02	92.10	92.23	91.52	99.08	4.31	3.81
4	0.425	42.5	77.90	78.07	128.56	0.458	47.5	77.86	62.43	72.13	92.10	92.23	91.52	99.08	4.31	3.81
5	0.450	45.0	77.90	78.07	130.16	0.477	49.5	77.95	62.94	72.32	92.12	92.35	91.68	99.03	4.43	3.87
6	0.475	47.5	77.91	78.07	130.16	0.477	49.5	77.96	64.60	72.94	92.12	92.35	91.68	99.03	4.43	3.87
7	0.500	50.0	77.93	78.06	130.14	0.476	49.4	77.96	65.89	73.44	92.19	92.53	91.66	98.97	4.56	4.00
8	0.525	52.5	77.92	78.06	130.14	0.476	49.4	77.96	67.24	73.93	92.19	92.53	91.66	98.97	4.56	4.00
9	0.550	55.0	77.91	78.08	129.88	0.473	49.1	77.94	68.08	74.24	92.24	92.47	91.70	98.89	4.56	3.81
10	0.575	57.5	77.93	78.08	129.88	0.473	49.1	77.95	69.38	74.74	92.24	92.47	91.70	98.89	4.56	3.81
11	1.000	60.0	77.89	78.11	130.64	0.483	50.1	78.00	71.35	75.45	92.35	92.75	91.95	98.89	4.31	4.31
12	1.025	62.5	77.90	78.11	130.64	0.483	50.1	78.00	72.76	75.99	92.35	92.75	91.95	98.89	4.31	4.31
13	1.050	65.0	77.96	78.13	129.99	0.475	49.2	77.99	73.36	76.24	92.35	92.64	92.00	98.87	4.43	3.87
14	1.075	67.5	77.90	78.13	129.99	0.475	49.3	77.97	73.15	76.13	92.35	92.64	92.00	98.87	4.43	3.87
15	1.100	70.0	77.89	78.14	131.00	0.487	50.6	78.03	72.79	75.99	92.25	92.91	92.04	98.84	4.50	4.12
16	1.125	72.5	77.85	78.14	131.00	0.487	50.6	78.01	73.24	76.13	92.25	92.91	92.04	98.84	4.50	4.12
17	1.150	75.0	77.93	78.14	129.03	0.463	48.0	77.93	72.27	75.81	92.29	92.99	92.23	98.81	4.43	4.12
18	1.175	77.5	77.91	78.14	129.03	0.463	48.1	77.92	71.10	75.37	92.29	92.99	92.23	98.81	4.43	4.12
19	1.200	80.0	77.92	78.15	130.76	0.484	50.2	78.03	68.72	74.49	92.17	92.71	92.07	98.77	4.25	4.06
20	1.225	82.5	77.93	78.15	130.76	0.484	50.2	78.04	67.56	74.06	92.17	92.71	92.07	98.77	4.25	4.06
21	1.250	85.0	77.85	78.07	129.88	0.473	49.2	77.91	65.03	73.07	92.11	92.62	91.88	98.76	4.31	3.50
22	1.275	87.5	77.85	78.07	129.88	0.473	49.2	77.91	63.37	72.44	92.11	92.62	91.88	98.76	4.31	3.50
23	1.300	90.0	77.91	78.07	129.65	0.471	48.8	77.93	63.33	72.47	92.05	92.73	91.85	98.74	4.37	4.06
24	1.325	92.5	77.90	78.07	129.65	0.471	48.9	77.92	65.05	73.10	92.05	92.73	91.85	98.74	4.37	4.06
25	1.350	95.0	77.82	78.06	130.95	0.486	50.6	77.96	66.58	73.63	92.01	92.70	91.72	98.74	4.43	4.06
26	1.375	97.5	77.82	78.06	130.95	0.486	50.6	77.96	68.18	74.22	92.01	92.70	91.72	98.74	4.43	4.06
27	1.400	100.0	77.89	78.10	130.15	0.477	49.5	77.96	68.17	74.26	91.99	92.39	91.70	98.72	4.43	4.18
28	1.425	102.5	77.88	78.10	130.15	0.477	49.5	77.95	68.29	74.30	91.99	92.39	91.70	98.72	4.43	4.18
29	1.450	105.0	77.82	78.08	129.75	0.472	49.1	77.89	67.81	74.08	92.02	92.58	91.81	98.72	4.43	4.00
30	1.475	107.5	77.79	78.08	129.75	0.472	49.1	77.88	67.59	73.98	92.02	92.58	91.81	98.72	4.43	4.00
31	1.500	110.0	77.85	78.07	129.78	0.472	49.1	77.91	67.51	73.99	92.00	92.49	91.79	98.70	4.50	4.06
32	1.525	112.5	77.85	78.07	129.78	0.472	49.1	77.91	68.02	74.18	92.00	92.49	91.79	98.70	4.50	4.06
33	1.550	115.0	77.83	78.07	129.97	0.474	49.4	77.91	66.92	73.76	92.00	92.55	91.61	98.70	4.43	3.81
34	1.575	117.5	77.84	78.07	129.97	0.474	49.3	77.91	67.25	73.89	92.00	92.55	91.61	98.70	4.43	3.81
35	2.000	120.0	77.85	78.06	128.90	0.462	48.0	77.85	67.87	74.13	91.97	92.57	86.43	98.67	4.43	4.12
36	2.025	122.5	77.85	78.06	128.90	0.462	48.0	77.85	68.30	74.29	91.97	92.57	91.68	98.67	4.43	4.12
37	2.050	125.0	77.88	78.10	130.21	0.477	49.6	77.96	67.06	73.84	91.91	92.38	91.72	98.66	4.37	3.81
38	2.075	127.5	77.87	78.10	130.21	0.477	49.6	77.95	66.56	73.65	91.91	92.38	91.72	98.66	4.37	3.81
39	2.100	130.0	77.79	78.05	128.30	0.455	47.4	77.78	66.91	73.73	91.86	92.52	91.59	98.66	4.18	3.87
40	2.125	132.5	77.79	78.05	128.30	0.455	47.4	77.78	67.95	74.12	91.86	92.52	91.59	98.66	4.18	3.87
41	2.150	135.0	77.87	78.08	130.67	0.483	50.2	77.97	68.17	74.25	91.86	92.64	91.53	98.65	4.43	4.00
42	2.175	137.5	77.87	78.08	130.67	0.483	50.2	77.97	68.77	74.47	91.86	92.64	91.53	98.65	4.43	4.00
43	2.200	140.0	77.82	78.08	129.39	0.468	48.7	77.87	67.98	74.15	91.83	92.81	91.56	98.66	4.37	4.06
44	2.225	142.5	77.82	78.08	129.39	0.468	48.6	77.88	68.26	74.26	91.83	92.81	91.56	98.66	4.37	4.06
45	2.250	145.0	77.96	78.12	130.63	0.482	50.0	78.03	66.53	73.69	91.77	92.43	91.33	98.65	4.12	3.87
46	2.275	147.5	77.92	78.12	130.63	0.482	50.0	78.01	66.45	73.64	91.77	92.43	91.33	98.65	4.12	3.87
47	2.300	150.0	77.86	78.09	129.00	0.463	48.1	77.87	65.84	73.37	91.76	92.46	91.24	98.64	4.06	3.62
48	2.325	152.5	77.81	78.09	129.00	0.463	48.2	77.85	66.35	73.53	91.76	92.46	91.24	98.64	4.06	3.62

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MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOSURE TO AMB TEMP = T(CO)+3.3 F AND DRAFT VELOCITY = 1.0 M/S

ALL TEMPERATURE OBSERVATIONS IN DEG F, AND VAPOR PRESSURE IN INCHES WG, VOTES AFTER 1-7 COMFORT VOTE SCALE (COMFORT = 4)

TIME OF OBSERVATION			ENVIRONMENTAL OBSERVATINS								PHYSIOLOGICAL OBSERVATIONS				VOTES	
ID	HOURS	MINUTES	AIR T	WALL	11% RH	VAPOR	%R H	ADJ AIR	JET	JET15	SKIN	FOREH	CHEEK	BODY	ROOM	JET
1	0.350	35.0	77.67	77.71	130.26	0.478	50.0	77.69	65.87	72.67	91.34	90.47	87.72	99.15	4.25	3.87
2	0.375	37.5	77.71	77.71	130.26	0.478	49.9	77.70	67.06	73.19	91.34	90.47	87.72	99.15	4.25	3.87
3	0.400	40.0	77.93	77.92	131.02	0.487	50.5	77.90	67.24	73.40	91.37	90.53	88.08	99.09	4.31	3.93
4	0.425	42.5	77.91	77.82	131.02	0.487	50.5	77.90	67.47	73.49	91.37	90.53	88.08	99.09	4.31	3.93
5	0.450	45.0	77.75	77.76	129.40	0.468	48.8	77.70	67.10	73.24	91.29	90.37	88.32	99.05	4.50	3.75
6	0.475	47.5	77.71	77.76	129.40	0.468	48.8	77.68	67.11	73.22	91.29	90.37	88.32	99.05	4.50	3.75
7	0.500	50.0	77.83	77.88	131.35	0.491	51.1	77.91	67.71	73.54	91.33	90.35	88.62	99.01	4.31	4.00
8	0.525	52.5	77.82	77.88	131.35	0.491	51.1	77.90	68.59	73.91	91.33	90.35	88.62	99.01	4.31	4.00
9	0.550	55.0	77.70	77.81	129.40	0.468	48.9	77.70	68.87	73.96	91.31	90.59	88.52	98.95	4.31	4.06
10	0.575	57.5	77.70	77.81	129.40	0.468	48.9	77.70	69.54	74.24	91.31	90.59	88.52	98.95	4.31	4.06
11	1.000	60.0	77.79	77.87	130.56	0.482	50.2	77.84	69.09	74.11	91.31	90.41	88.21	98.90	4.31	4.00
12	1.025	62.5	77.77	77.87	130.56	0.482	50.2	77.82	68.88	74.00	91.31	90.41	88.21	98.90	4.31	4.00
13	1.050	65.0	77.83	77.88	130.39	0.479	49.9	77.85	68.57	73.91	91.31	90.30	88.34	98.87	4.37	4.06
14	1.075	67.5	77.77	77.88	130.39	0.479	50.0	77.82	68.52	73.85	91.31	90.30	88.34	98.87	4.37	4.06
15	1.100	70.0	77.77	77.84	129.31	0.467	48.6	77.74	68.51	73.85	91.34	90.74	88.47	98.84	4.43	3.81
16	1.125	72.5	77.75	77.84	129.31	0.467	48.7	77.73	69.24	74.14	91.34	90.74	88.47	98.84	4.43	3.81
17	1.150	75.0	77.71	77.84	130.90	0.486	50.7	77.80	69.51	74.24	91.32	90.57	88.83	98.80	4.31	4.18
18	1.175	77.5	77.73	77.84	130.90	0.486	50.7	77.81	70.29	74.58	91.32	90.57	88.83	98.80	4.31	4.18
19	1.200	80.0	77.71	77.85	129.75	0.472	49.3	77.74	69.58	74.27	91.25	90.76	88.65	98.78	4.18	3.81
20	1.225	82.5	77.71	77.85	129.75	0.472	49.3	77.74	69.24	74.12	91.25	90.76	88.65	98.78	4.18	3.81
21	1.250	85.0	77.79	77.89	130.10	0.476	49.6	77.82	70.31	74.62	91.28	90.87	88.63	98.76	4.50	4.06
22	1.275	87.5	77.77	77.89	130.10	0.476	49.6	77.81	71.02	74.91	91.28	90.87	88.63	98.76	4.50	4.06
23	1.300	90.0	77.77	77.88	130.94	0.486	50.7	77.85	70.74	74.79	91.25	90.68	88.39	98.75	4.37	3.87
24	1.325	92.5	77.76	77.88	130.94	0.486	50.7	77.85	70.44	74.66	91.25	90.68	88.39	98.75	4.37	3.87
25	1.350	95.0	77.73	77.87	129.53	0.469	49.0	77.74	69.70	74.33	91.19	90.64	88.32	98.73	4.37	3.87
26	1.375	97.5	77.72	77.87	129.53	0.469	49.0	77.74	69.96	74.43	91.19	90.64	88.32	98.73	4.37	3.87
27	1.400	100.0	77.76	77.88	130.43	0.480	50.0	77.82	71.44	75.08	91.18	90.77	88.57	98.73	4.31	4.00
28	1.425	102.5	77.76	77.88	130.43	0.480	50.0	77.82	72.44	75.51	91.18	90.77	88.57	98.73	4.31	4.00
29	1.450	105.0	77.81	77.93	131.00	0.487	50.7	77.90	72.63	75.62	91.24	90.91	88.66	98.71	4.43	4.12
30	1.475	107.5	77.79	77.93	131.00	0.487	50.7	77.89	72.73	75.65	91.24	90.91	88.66	98.71	4.43	4.12
31	1.500	110.0	77.80	77.93	129.67	0.471	49.0	77.81	71.45	75.11	91.12	90.57	88.72	98.69	4.37	3.81
32	1.525	112.5	77.80	77.93	129.67	0.471	49.0	77.81	70.52	74.72	91.12	90.57	88.72	98.63	4.37	3.81
33	1.550	115.0	77.79	77.92	130.35	0.479	49.9	77.85	69.76	74.39	91.05	90.09	88.83	98.61	4.37	4.00
34	1.575	117.5	77.78	77.92	130.35	0.479	49.9	77.84	69.48	74.27	91.05	90.09	88.83	98.67	4.37	4.00
35	2.000	120.0	77.82	77.93	131.05	0.487	50.7	77.90	69.05	74.10	90.91	89.95	88.20	98.65	4.18	3.68
36	2.025	122.5	77.80	77.93	131.05	0.487	50.8	77.90	68.90	74.03	90.91	89.95	88.20	98.65	4.18	3.68
37	2.050	125.0	77.86	77.91	129.26	0.466	48.4	77.81	70.33	74.67	91.02	90.57	88.53	98.65	4.18	4.12
38	2.075	127.5	77.85	77.91	129.26	0.466	48.4	77.81	71.84	75.31	91.02	90.57	88.53	98.65	4.18	4.12
39	2.100	130.0	77.88	77.98	131.49	0.493	51.2	77.98	72.20	75.47	91.10	90.59	88.60	98.64	4.31	4.12
40	2.125	132.5	77.86	77.98	131.49	0.493	51.2	77.97	72.82	75.73	91.10	90.59	88.60	98.64	4.31	4.12
41	2.150	135.0	77.81	77.98	130.72	0.483	50.3	77.90	71.76	75.25	91.12	90.94	88.36	98.62	4.18	3.87
42	2.175	137.5	77.80	77.98	130.72	0.483	50.3	77.90	70.82	74.85	91.12	90.94	88.36	98.62	4.18	3.87
43	2.200	140.0	77.81	77.95	129.95	0.474	49.4	77.84	70.62	74.76	91.03	90.90	88.51	98.62	4.25	4.12
44	2.225	142.5	77.82	77.95	129.95	0.474	49.4	77.84	70.55	74.74	91.03	90.90	88.51	98.62	4.25	4.12
45	2.250	145.0	77.80	77.98	131.97	0.499	51.9	77.97	70.25	74.60	90.98	90.71	88.31	98.64	4.18	3.75
46	2.275	147.5	77.77	77.98	131.97	0.499	52.0	77.96	70.11	74.53	90.98	90.71	88.31	98.64	4.18	3.75
47	2.300	150.0	77.72	77.92	129.98	0.475	49.5	77.79	71.44	75.06	90.93	90.80	89.08	98.63	4.31	4.06
48	2.325	152.5	77.74	77.92	129.98	0.475	49.5	77.80	73.16	75.80	90.93	90.80	89.08	98.63	4.31	4.06

MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOSURE TO AMB TEMP = T(CO)-3.3 F AND DRAFT VELOCITY = 0.5 M/S

ALL TEMPERATURE OBSERVATIONS IN DEG F, AND VAPOR PRESSURE IN INCHES WG, VOTES AFTER 1-7 COMFORT VOTE SCALE (COMFORT = 4)

TIME OF OBSERVATION /			ENVIRONMENTAL OBSERVATINS								/ PHYSIOLOGICAL OBSERVATIONS /				VOTES	
ID	HOURS	MINUTES	AIR T	WALL	11% RH	VAPOR	%R H	ADJ AIR	JET	JET15	SKIN	FOREH	CHEEK	BODY	ROOM	JET
1	0.350	35.0	71.21	71.84	122.78	0.394	51.2	71.55	74.05	72.27	90.39	92.21	90.18	98.94	3.43	3.43
2	0.375	37.5	71.16	71.84	122.78	0.394	51.3	71.53	75.16	72.66	90.39	92.21	90.18	98.94	3.43	3.43
3	0.400	40.0	71.22	71.86	123.05	0.397	51.6	71.58	78.42	73.91	90.31	92.27	90.31	98.87	3.75	3.87
4	0.425	42.5	71.21	71.86	123.05	0.397	51.6	71.57	81.07	74.89	90.31	92.27	90.31	98.87	3.75	3.87
5	0.450	45.0	71.29	71.91	122.43	0.391	50.6	71.60	84.64	76.27	90.39	92.51	90.42	98.82	3.81	4.31
6	0.475	47.5	71.32	71.91	122.43	0.391	50.6	71.61	86.68	77.05	90.39	92.51	90.42	98.82	3.81	4.31
7	0.500	50.0	71.31	71.98	122.99	0.397	51.3	71.67	87.62	77.40	90.41	92.60	90.58	98.75	3.68	4.25
8	0.525	52.5	71.24	71.98	122.99	0.397	51.5	71.64	86.80	77.04	90.41	92.60	90.58	98.75	3.68	4.25
9	0.550	55.0	71.21	71.97	122.59	0.393	51.0	71.60	86.46	76.90	90.38	92.74	90.76	98.68	3.50	4.12
10	0.575	57.5	71.19	71.97	122.59	0.393	51.0	71.59	85.86	76.67	90.38	92.74	90.76	98.68	3.50	4.12
11	1.000	60.0	71.19	71.94	123.02	0.397	51.6	71.60	85.14	76.40	90.28	92.57	90.91	98.63	3.43	3.93
12	1.025	62.5	71.19	71.94	123.02	0.397	51.6	71.60	83.70	75.86	90.28	92.57	90.91	98.63	3.43	3.93
13	1.050	65.0	71.09	71.90	122.47	0.391	51.0	71.50	83.60	75.76	90.12	92.58	90.92	98.59	3.56	3.68
14	1.075	67.5	71.12	71.90	122.47	0.391	51.0	71.51	83.37	75.69	90.12	92.58	90.92	98.59	3.56	3.68
15	1.100	70.0	71.11	71.86	122.43	0.391	50.9	71.49	86.16	76.73	90.16	92.75	91.02	98.57	3.56	4.25
16	1.125	72.5	71.09	71.86	122.43	0.391	51.0	71.48	87.64	77.27	90.16	92.75	91.02	98.57	3.56	4.25
17	1.150	75.0	71.19	71.88	123.15	0.398	51.7	71.58	88.63	77.70	90.17	92.85	90.91	98.53	3.56	4.25
18	1.175	77.5	71.08	71.88	123.15	0.398	51.9	71.53	88.28	77.50	90.17	92.85	90.91	98.53	3.56	4.25
19	1.200	80.0	71.05	71.90	122.97	0.396	51.7	71.51	87.12	77.05	90.10	92.69	90.93	98.50	3.62	3.75
20	1.225	82.5	71.05	71.90	122.97	0.396	51.8	71.51	84.81	76.18	90.10	92.69	90.93	98.50	3.62	3.75
21	1.250	85.0	71.08	71.86	121.90	0.385	50.3	71.44	84.06	75.93	89.98	92.50	90.85	98.47	3.50	3.93
22	1.275	87.5	71.05	71.86	121.90	0.385	50.3	71.43	83.70	75.77	89.98	92.50	90.85	98.47	3.50	3.93
23	1.300	90.0	71.08	71.87	122.80	0.395	51.5	71.50	84.91	76.24	89.88	92.43	90.74	98.44	3.62	3.81
24	1.325	92.5	71.08	71.87	122.80	0.395	51.5	71.50	85.75	76.56	89.88	92.43	90.74	98.44	3.62	3.81
25	1.350	95.0	71.13	71.90	123.29	0.400	52.0	71.57	87.61	77.28	89.85	92.68	90.86	98.43	3.62	4.06
26	1.375	97.5	71.11	71.90	123.29	0.400	52.1	71.56	88.70	77.67	89.85	92.68	90.86	98.43	3.62	4.06
27	1.400	100.0	71.18	71.93	121.40	0.380	49.4	71.49	90.26	78.30	89.78	92.63	91.05	98.43	3.56	4.06
28	1.425	102.5	71.13	71.93	121.40	0.380	49.5	71.46	90.18	78.24	89.78	92.63	91.05	98.43	3.56	4.06
29	1.450	105.0	71.13	71.94	123.49	0.402	52.3	71.60	91.00	78.54	89.75	92.67	90.87	96.52	3.43	4.06
30	1.475	107.5	71.10	71.94	123.49	0.402	52.4	71.59	90.67	78.41	89.75	92.67	90.87	96.52	3.43	4.06
31	1.500	110.0	71.01	71.79	123.51	0.402	52.5	71.48	91.57	78.68	89.67	92.78	90.75	98.38	3.50	4.18
32	1.525	112.5	70.96	71.79	123.51	0.402	52.6	71.46	90.49	78.25	89.67	92.78	90.75	98.38	3.50	4.18
33	1.550	115.0	70.97	71.86	121.76	0.384	50.3	71.38	89.50	77.88	89.64	92.94	90.85	98.40	3.43	3.93
34	1.575	117.5	70.96	71.86	121.76	0.384	50.3	71.38	87.91	77.29	89.64	92.94	90.85	98.40	3.43	3.93
35	2.000	120.0	71.02	71.87	123.80	0.405	52.9	71.54	87.50	77.17	89.53	92.80	90.54	98.37	3.68	3.81
36	2.025	122.5	71.01	71.87	123.80	0.405	52.9	71.53	86.75	76.89	89.53	92.80	90.54	98.37	3.68	3.81
37	2.050	125.0	71.06	71.87	122.91	0.396	51.7	71.50	86.72	76.90	89.50	92.87	90.70	98.36	3.56	3.93
38	2.075	127.5	71.07	71.87	122.91	0.396	51.6	71.50	87.12	77.06	89.50	92.87	90.70	98.36	3.56	3.93
39	2.100	130.0	71.18	71.90	122.59	0.393	51.0	71.55	88.76	77.74	89.45	92.93	90.73	98.36	3.56	4.06
40	2.125	132.5	71.18	71.90	122.59	0.393	51.0	71.55	89.25	77.92	89.45	92.93	90.73	98.36	3.56	4.06
41	2.150	135.0	71.18	71.93	123.28	0.400	52.0	71.60	90.48	78.38	89.44	92.91	90.85	98.36	3.50	3.81
42	2.175	137.5	71.17	71.93	123.28	0.400	52.0	71.60	90.06	78.22	89.44	92.91	90.85	98.36	3.50	3.81
43	2.200	140.0	71.04	71.90	123.21	0.399	52.1	71.52	91.50	78.67	89.37	93.05	90.71	98.34	3.50	3.87
44	2.225	142.5	71.01	71.90	123.21	0.399	52.1	71.51	91.27	78.57	89.37	93.05	90.71	98.34	3.50	3.87
45	2.250	145.0	71.05	71.91	122.51	0.392	51.1	71.49	93.15	79.30	89.42	93.22	90.85	98.32	3.56	4.18
46	2.275	147.5	71.01	71.91	122.51	0.392	51.2	71.47	93.88	79.55	89.42	93.22	90.85	98.32	3.56	4.18
47	2.300	150.0	70.98	71.98	123.23	0.399	52.2	71.53	93.96	79.55	89.41	93.00	90.60	98.31	3.62	4.12
48	2.325	152.5	70.97	71.98	123.23	0.399	52.2	71.53	91.98	78.81	89.41	93.00	90.60	98.31	3.62	4.12

MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOSURE TO AMB TEMP = T(CO)-3.3 F AND DRAFT VELOCITY = 1.0 M/S

ALL TEMPERATURE OBSERVATIONS IN DEG F, AND VAPOR PRESSURE IN INCHES WG, VOTES AFTER 1-7 COMFORT VOTE SCALE (COMFORT = 4)

TIME OF OBSERVATION /			ENVIRONMENTAL OBSERVATINS								/ PHYSIOLOGICAL OBSERVATIONS /				VOTES	
ID	HOURS	MINUTES	AIR T	WALL	11% RH	VAPOR	%R H	ADJ AIR	JET	JET15	SKIN	FOREH	CHEEK	BODY	ROOM	JET
1	0.350	35.0	71.10	71.83	122.31	0.390	50.8	71.46	75.08	72.79	90.23	90.12	87.79	98.94	4.25	4.00
2	0.375	37.5	71.10	71.83	122.31	0.390	50.8	71.46	77.33	73.74	90.23	90.12	87.79	98.94	4.25	4.00
3	0.400	40.0	71.01	71.84	122.66	0.393	51.4	71.45	78.34	74.12	90.24	90.45	87.85	98.87	3.87	4.00
4	0.425	42.5	71.04	71.84	122.66	0.393	51.4	71.46	80.88	75.21	90.24	90.45	87.85	98.87	3.87	4.00
5	0.450	45.0	71.18	71.91	122.22	0.389	50.5	71.53	82.34	75.91	90.18	90.71	88.22	98.80	4.18	4.43
6	0.475	47.5	71.16	71.91	122.22	0.389	50.5	71.52	83.80	76.52	90.18	90.71	88.22	98.80	4.18	4.43
7	0.500	50.0	71.07	71.91	122.49	0.391	51.1	71.50	82.34	75.85	90.10	90.59	88.20	98.71	3.81	3.81
8	0.525	52.5	71.04	71.91	122.49	0.391	51.1	71.48	80.60	75.09	90.10	90.59	88.20	98.71	3.81	3.81
9	0.550	55.0	71.08	71.89	123.14	0.398	51.9	71.53	80.07	74.89	90.07	90.33	88.11	98.65	3.81	3.62
10	0.575	57.5	71.05	71.89	123.14	0.398	52.0	71.52	79.62	74.68	90.07	90.33	88.11	98.65	3.81	3.62
11	1.000	60.0	71.07	71.86	121.92	0.386	50.3	71.44	79.89	74.81	90.03	90.48	88.69	98.62	3.75	3.87
12	1.025	62.5	71.07	71.86	121.92	0.386	50.3	71.44	80.71	75.16	90.03	90.48	88.69	98.62	3.75	3.87
13	1.050	65.0	71.09	71.88	122.29	0.389	50.8	71.48	82.43	75.90	89.98	90.89	88.41	98.58	4.00	4.31
14	1.075	67.5	71.10	71.88	122.29	0.389	50.8	71.48	84.03	76.58	89.98	90.89	88.41	98.58	4.00	4.31
15	1.100	70.0	71.13	71.95	123.67	0.404	52.6	71.62	85.45	77.20	90.01	91.22	88.61	98.56	3.75	4.12
16	1.125	72.5	71.11	71.95	123.67	0.404	52.6	71.61	84.47	76.77	90.01	91.22	88.61	98.56	3.75	4.12
17	1.150	75.0	71.13	71.93	122.57	0.392	51.1	71.53	83.40	76.33	89.81	90.78	88.46	98.52	3.68	3.87
18	1.175	77.5	71.11	71.93	122.57	0.392	51.1	71.53	82.32	75.86	89.81	90.78	88.46	98.52	3.68	3.87
19	1.200	80.0	71.22	71.94	122.12	0.388	50.3	71.56	82.07	75.82	89.86	90.84	88.39	98.49	3.93	4.00
20	1.225	82.5	71.17	71.94	122.12	0.388	50.4	71.53	82.73	76.07	89.96	90.84	88.39	98.49	3.93	4.00
21	1.250	85.0	71.16	71.91	122.39	0.390	50.8	71.53	82.74	76.07	89.76	90.87	88.52	98.47	3.81	4.00
22	1.275	87.5	71.21	71.91	122.39	0.390	50.7	71.56	82.67	76.07	89.76	90.87	88.52	98.47	3.81	4.00
23	1.300	90.0	71.13	71.92	122.86	0.395	51.5	71.55	82.16	75.80	89.68	90.83	88.40	98.47	3.62	3.81
24	1.325	92.5	71.13	71.92	122.86	0.395	51.5	71.55	81.67	75.60	89.68	90.83	88.40	98.47	3.62	3.81
25	1.350	95.0	71.18	71.91	121.79	0.384	50.0	71.50	82.64	76.04	89.62	90.85	88.38	98.46	3.50	4.00
26	1.375	97.5	71.15	71.91	121.79	0.384	50.0	71.49	84.34	76.74	89.62	90.85	88.38	98.46	3.50	4.00
27	1.400	100.0	71.18	71.92	122.32	0.390	50.7	71.54	86.46	77.65	89.63	91.11	88.44	98.44	3.68	4.12
28	1.425	102.5	71.18	71.92	122.32	0.390	50.6	71.54	87.16	77.95	89.63	91.11	88.44	98.44	3.68	4.12
29	1.450	105.0	71.13	71.94	123.62	0.403	52.5	71.61	87.53	78.08	89.62	91.38	88.59	98.45	3.68	4.25
30	1.475	107.5	71.11	71.94	123.62	0.403	52.5	71.60	87.98	78.26	89.62	91.38	88.59	98.45	3.68	4.25
31	1.500	110.0	71.10	71.92	121.87	0.385	50.2	71.48	86.80	77.76	89.52	91.24	88.61	98.45	3.62	3.87
32	1.525	112.5	71.13	71.92	121.87	0.385	50.1	71.49	85.44	77.20	89.52	91.24	88.61	98.45	3.62	3.87
33	1.550	115.0	71.17	71.92	122.89	0.396	51.4	71.57	84.16	76.68	89.47	91.02	88.55	98.44	3.68	3.81
34	1.575	117.5	71.09	71.92	122.89	0.396	51.6	71.53	83.44	76.32	89.47	91.02	88.55	98.44	3.68	3.81
35	2.000	120.0	71.13	71.90	122.80	0.395	51.4	71.54	84.94	76.98	89.41	91.32	88.66	98.43	3.68	4.00
36	2.025	122.5	71.10	71.90	122.80	0.395	51.4	71.52	80.26	74.98	89.41	91.32	88.66	98.43	3.68	4.00
37	2.050	125.0	71.21	71.93	122.79	0.395	51.2	71.59	86.45	77.67	89.37	91.50	88.80	98.44	3.62	4.12
38	2.075	127.5	71.21	71.93	122.79	0.395	51.2	71.59	87.73	78.21	89.37	91.50	88.80	98.44	3.62	4.12
39	2.100	130.0	71.13	71.95	123.43	0.401	52.2	71.60	87.06	77.88	89.40	91.30	88.63	98.42	3.56	3.87
40	2.125	132.5	71.07	71.95	123.43	0.401	52.3	71.57	86.69	77.69	89.40	91.30	88.63	98.42	3.56	3.87
41	2.150	135.0	71.07	71.89	122.34	0.390	50.9	71.48	86.84	77.75	89.28	91.22	88.73	98.40	3.50	4.12
42	2.175	137.5	71.04	71.89	122.34	0.390	50.9	71.46	86.48	77.59	89.28	91.22	88.73	98.40	3.50	4.12
43	2.200	140.0	71.00	71.82	122.17	0.388	50.8	71.40	85.63	77.20	89.18	91.21	88.49	98.44	3.56	4.18
44	2.225	142.5	71.00	71.82	122.17	0.388	50.8	71.40	84.82	76.86	89.18	91.21	88.49	98.44	3.56	4.18
45	2.250	145.0	70.99	71.83	123.10	0.398	52.0	71.46	83.30	76.21	89.10	91.24	88.58	98.40	3.62	3.68
46	2.275	147.5	70.94	71.83	123.10	0.398	52.1	71.44	81.37	75.36	89.10	91.24	88.58	98.40	3.62	3.68
47	2.300	150.0	70.95	71.80	123.04	0.397	52.0	71.42	81.89	75.59	89.15	91.38	88.64	98.43	3.68	3.93
48	2.325	152.5	70.93	71.80	123.04	0.397	52.1	71.41	83.58	76.29	89.15	91.38	88.64	98.43	3.68	3.93

Appendix D

Output data from computation of body area, evaporative weight loss, and the latter converted to heat loss using 95°F evaporation temperature

RESULTS OF EVAPORATIVE WEIGHT LOSS, FEMALE SUBJECTS. 1&2 COMFORT TEST, 3&4 WARM EXP LOW/HIGH VEL, 5&6 COOL EXP LOW/HIGH VEL

SUBJECT	TEST	IN WEIGHT LBS	OUT	MINUTES	MEAN WGT KG	HEIGHT M	AREA M**2	WG LOSS G/H	WG L G/H/M2	KCAL/H/M**2	WATT/M**2
11	1	117.330	117.150	153.	53.18	1.57	1.53	32.02	20.97	12.11	14.08
11	2	116.270	116.120	154.	52.71	1.57	1.52	26.51	17.42	10.06	11.70
11	3	116.720	116.595	156.	52.92	1.57	1.52	21.81	14.31	8.26	9.61
11	4	116.490	116.350	155.	52.81	1.57	1.52	24.58	16.14	9.32	10.84
11	5	117.690	117.550	155.	53.35	1.57	1.53	24.58	16.07	9.28	10.80
11	6	117.630	117.550	156.	53.34	1.57	1.53	13.96	9.13	5.27	6.13
12	1	134.040	133.830	155.	60.75	1.68	1.69	36.87	21.80	12.59	14.64
12	2	132.200	131.985	155.	59.92	1.68	1.68	37.75	22.45	12.97	15.08
12	3	133.200	133.010	155.	60.38	1.68	1.69	33.36	19.78	11.42	13.29
12	4	131.870	131.580	155.	59.75	1.68	1.68	50.92	30.32	17.51	20.37
12	5	133.030	132.830	156.	60.30	1.68	1.69	34.89	20.70	11.95	13.90
12	6	132.470	132.270	156.	60.04	1.68	1.68	34.89	20.74	11.98	13.93
13	1	133.860	133.730	154.	60.69	1.69	1.70	22.98	13.52	7.81	9.08
13	2	133.850	133.690	154.	60.68	1.69	1.70	28.28	16.64	9.61	11.18
13	3	133.850	133.655	156.	60.67	1.69	1.70	34.02	20.02	11.56	13.45
13	4	131.870	131.730	156.	59.78	1.69	1.69	24.42	14.46	8.35	9.71
13	5	133.380	133.260	155.	60.47	1.69	1.70	21.07	12.42	7.17	8.34
13	6	133.640	133.470	155.	60.58	1.69	1.70	29.85	17.58	10.15	11.81
14	1	103.340	103.220	155.	46.85	1.59	1.46	21.07	14.47	8.36	9.72
14	2	104.010	103.770	155.	47.12	1.59	1.46	42.14	28.88	16.68	19.40
14	3	105.395	105.150	156.	47.75	1.59	1.47	42.74	29.13	16.82	19.56
14	4	103.480	103.270	155.	46.89	1.59	1.46	36.87	25.32	14.62	17.01
14	5	103.430	103.270	155.	46.88	1.59	1.46	28.09	19.29	11.14	12.96
14	6	105.000	104.855	156.	47.59	1.59	1.47	25.30	17.26	9.97	11.60
15	1	140.345	140.160	155.	63.62	1.68	1.72	32.48	18.83	10.88	12.65
15	2	139.400	139.240	154.	63.20	1.68	1.72	28.27	16.44	9.50	11.04
15	3	140.260	140.145	155.	63.60	1.68	1.72	20.19	11.71	6.76	7.86
15	4	139.885	139.765	156.	63.42	1.68	1.72	20.93	12.15	7.02	8.16
15	5	138.990	138.835	156.	63.01	1.68	1.72	27.04	15.74	9.09	10.57
15	6	139.915	139.790	156.	63.44	1.68	1.72	21.81	12.66	7.31	8.50
16	1	111.260	111.085	155.	50.43	1.65	1.55	30.73	19.88	11.48	13.36
16	2	110.970	110.790	155.	50.29	1.65	1.54	31.61	20.48	11.83	13.75
16	3	111.590	111.450	155.	50.59	1.65	1.55	24.58	15.89	9.18	10.67
16	4	112.135	111.970	155.	50.83	1.65	1.55	28.97	18.69	10.79	12.55
16	5	111.520	111.340	155.	50.54	1.65	1.55	31.61	20.43	11.80	13.73
16	6	113.030	112.840	156.	51.23	1.65	1.56	33.15	21.31	12.31	14.31
17	1	157.260	157.070	155.	71.29	1.70	1.83	33.36	18.23	10.53	12.24
17	2	157.150	156.940	155.	71.24	1.70	1.83	36.87	20.16	11.64	13.54
17	3	157.085	156.870	155.	71.20	1.70	1.83	37.75	20.64	11.92	13.86
17	4	156.090	155.865	156.	70.75	1.70	1.82	39.25	21.52	12.43	14.45
17	5	155.875	155.655	155.	70.65	1.70	1.82	38.63	21.19	12.24	14.23
17	6	156.420	156.190	157.	70.90	1.70	1.83	39.87	21.84	12.61	14.67
18	1	157.230	157.010	155.	71.27	1.68	1.81	38.63	21.34	12.33	14.34
18	2	160.505	160.360	154.	72.77	1.68	1.83	25.63	14.03	8.11	9.43
18	3	161.520	161.365	155.	73.23	1.68	1.83	27.22	14.86	8.59	9.98
18	4	163.185	162.975	155.	73.97	1.68	1.84	36.87	20.05	11.58	13.47
18	5	161.130	160.970	155.	73.05	1.68	1.83	28.09	15.36	8.87	10.32
18	6	161.260	161.090	156.	73.11	1.68	1.83	29.66	16.21	9.36	10.89

RESULTS OF EVAPORATIVE WEIGHT LOSS, MALE SUBJECTS. 1&2 COMFORT TEST, 3&4 WARM EXP LOW/HIGH VEL, 5&6 COOL EXP LOW/HIGH VEL

SUBJECT	TEST	IN WEIGHT LBS	OUT	MINUTES	MEAN WGT KG	HEIGHT M	AREA M**2	WG LOSS G/H	WG L G/H/M2	KCAL/H/M**2	WATT/M**2
31	1	138.450	138.300	153.	62.77	1.73	1.75	26.68	15.23	8.79	10.23
31	2	139.090	138.935	153.	63.06	1.73	1.76	27.57	15.70	9.07	10.55
31	3	137.580	137.375	155.	62.36	1.73	1.75	36.00	20.60	11.90	13.84
31	4	139.510	139.300	154.	63.23	1.73	1.76	37.11	21.11	12.19	14.18
31	5	137.120	136.930	155.	62.15	1.73	1.74	33.36	19.12	11.04	12.84
31	6	138.030	137.890	155.	62.58	1.73	1.75	24.58	14.05	8.11	9.43
32	1	182.835	182.560	155.	82.87	1.90	2.12	48.29	22.81	13.17	15.32
32	2	182.115	181.800	155.	82.54	1.90	2.11	55.31	26.17	15.11	17.58
32	3	178.270	178.010	155.	80.80	1.90	2.09	45.65	21.80	12.59	14.64
32	4	180.670	180.400	154.	81.89	1.90	2.11	47.72	22.65	13.08	15.22
32	5	178.915	178.640	155.	81.09	1.90	2.10	48.29	23.02	13.29	15.46
32	6	177.670	177.380	156.	80.52	1.90	2.09	50.59	24.19	13.97	16.25
33	1	134.745	134.520	156.	61.07	1.69	1.70	39.25	23.03	13.30	15.47
33	2	135.105	134.880	155.	61.23	1.69	1.71	39.51	23.15	13.37	15.55
33	3	134.900	134.580	155.	61.12	1.69	1.70	56.19	32.96	19.03	22.14
33	5	135.870	135.615	155.	61.57	1.69	1.71	44.77	26.18	15.12	17.59
33	4	136.870	136.460	156.	61.99	1.69	1.72	71.53	41.70	24.09	28.01
33	6	135.845	135.650	156.	61.57	1.69	1.71	34.02	19.89	11.49	13.36
34	1	176.670	176.320	155.	80.06	1.88	2.07	61.45	29.74	17.18	19.98
34	2	176.870	176.550	156.	80.16	1.88	2.07	55.83	27.01	15.60	18.14
34	3	176.020	175.760	155.	79.78	1.88	2.06	45.65	22.13	12.78	14.86
34	4	177.510	177.160	155.	80.44	1.88	2.07	61.45	29.68	17.14	19.94
34	5	176.680	176.395	155.	80.08	1.88	2.07	50.04	24.22	13.99	16.27
34	6	177.810	177.570	155.	80.60	1.88	2.07	42.14	20.34	11.75	13.66
35	1	201.710	201.465	156.	91.44	1.82	2.13	42.74	20.05	11.58	13.46
35	2	201.950	201.625	156.	91.53	1.82	2.13	56.70	26.58	15.35	17.85
35	3	203.560	203.275	155.	92.27	1.82	2.14	50.04	23.38	13.50	15.70
35	4	203.090	202.860	155.	92.07	1.82	2.14	40.38	18.88	10.91	12.68
35	5	203.500	203.290	155.	92.26	1.82	2.14	36.87	17.23	9.95	11.57
35	6	202.260	202.080	156.	91.70	1.82	2.13	31.40	14.71	8.49	9.88
36	1	179.055	178.830	155.	81.17	1.80	2.02	39.51	19.59	11.31	13.16
36	2	176.320	176.060	155.	79.92	1.80	2.00	45.65	22.79	13.16	15.31
36	3	176.340	176.050	155.	79.92	1.80	2.00	50.92	25.41	14.68	17.07
36	4	176.350	176.090	155.	79.93	1.80	2.00	45.65	22.79	13.16	15.30
36	5	177.655	177.445	155.	80.54	1.80	2.01	36.87	18.34	10.59	12.32
36	6	177.905	177.630	156.	80.63	1.80	2.01	47.98	23.86	13.78	16.02
37	1	148.530	148.180	156.	67.29	1.80	1.86	61.06	32.79	18.94	22.02
37	2	149.280	148.990	155.	67.65	1.80	1.87	50.92	27.28	15.76	18.32
37	3	148.940	148.600	155.	67.48	1.80	1.86	59.70	32.02	18.49	21.51
37	4	148.080	147.770	155.	67.10	1.80	1.86	54.43	29.26	16.90	19.66
37	5	148.390	148.090	155.	67.24	1.80	1.86	52.68	28.29	16.34	19.01
37	6	147.690	147.400	155.	66.93	1.80	1.86	50.92	27.41	15.83	18.41
38	1	166.760	166.550	156.	75.59	1.90	2.04	36.64	17.99	10.39	12.09
38	2	169.555	169.370	155.	76.87	1.90	2.05	32.48	15.84	9.15	10.64
38	3	169.250	169.050	155.	76.73	1.90	2.05	35.12	17.14	9.90	11.51
38	4	168.260	168.055	156.	76.28	1.90	2.04	35.76	17.50	10.11	11.75
38	5	170.475	170.210	155.	77.27	1.90	2.06	46.53	22.64	13.08	15.21
38	6	169.580	169.390	155.	76.88	1.90	2.05	33.36	16.27	9.40	10.93

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Appendix E

Calibration charts from orifice calibration

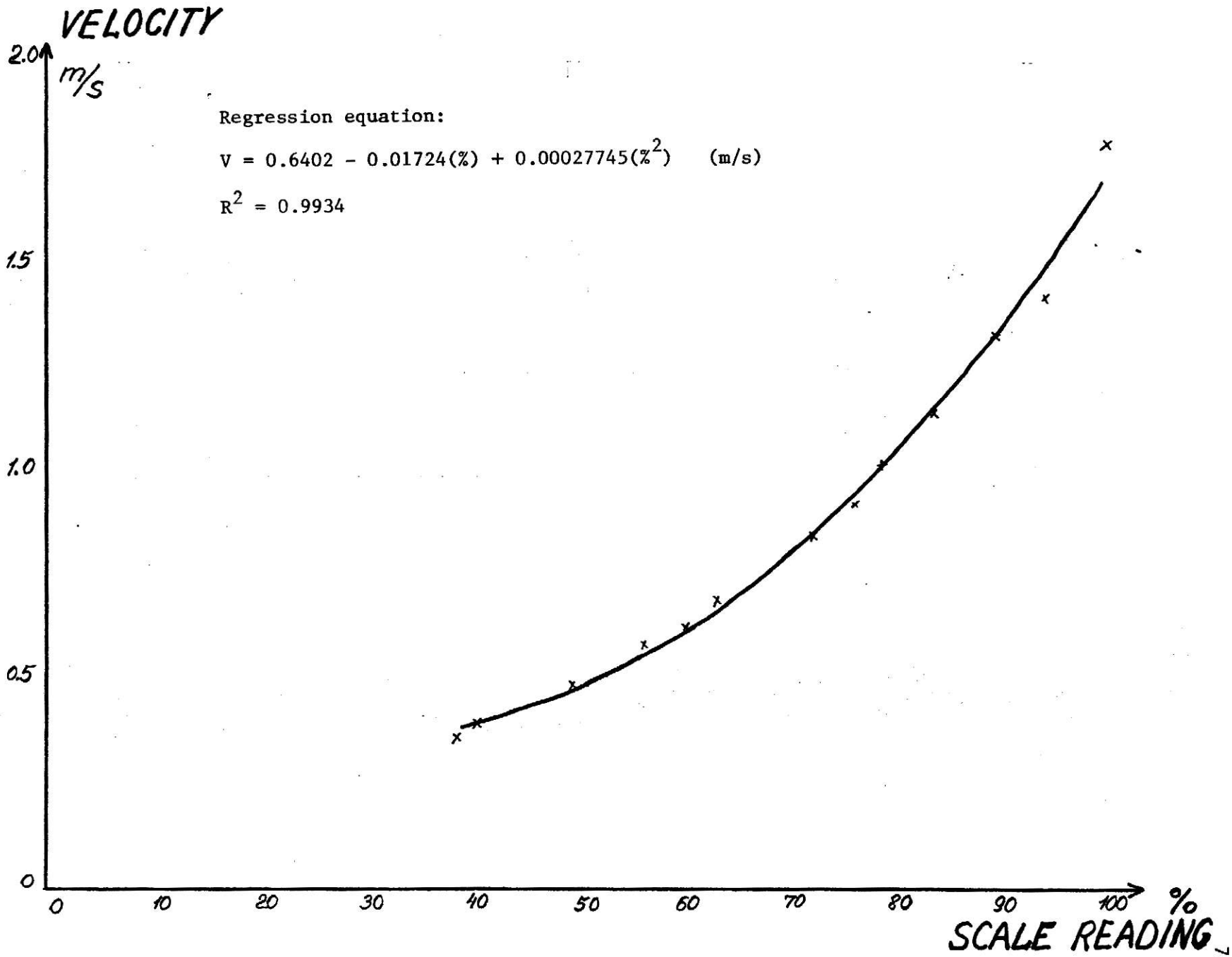


Fig. E.1 Calibration curve for DISA Low Velocity Anemometer (CCA Mode operation): Velocity as a function of % deflection on built-in scale measured at 6 inch dia. ASME nozzle against 2 inch dia. ASME nozzle. CCalibration temperature 75 °F.

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2 X 3 CYCLES MADE IN U.S.A.
KEUFFEL & ESSER CO.

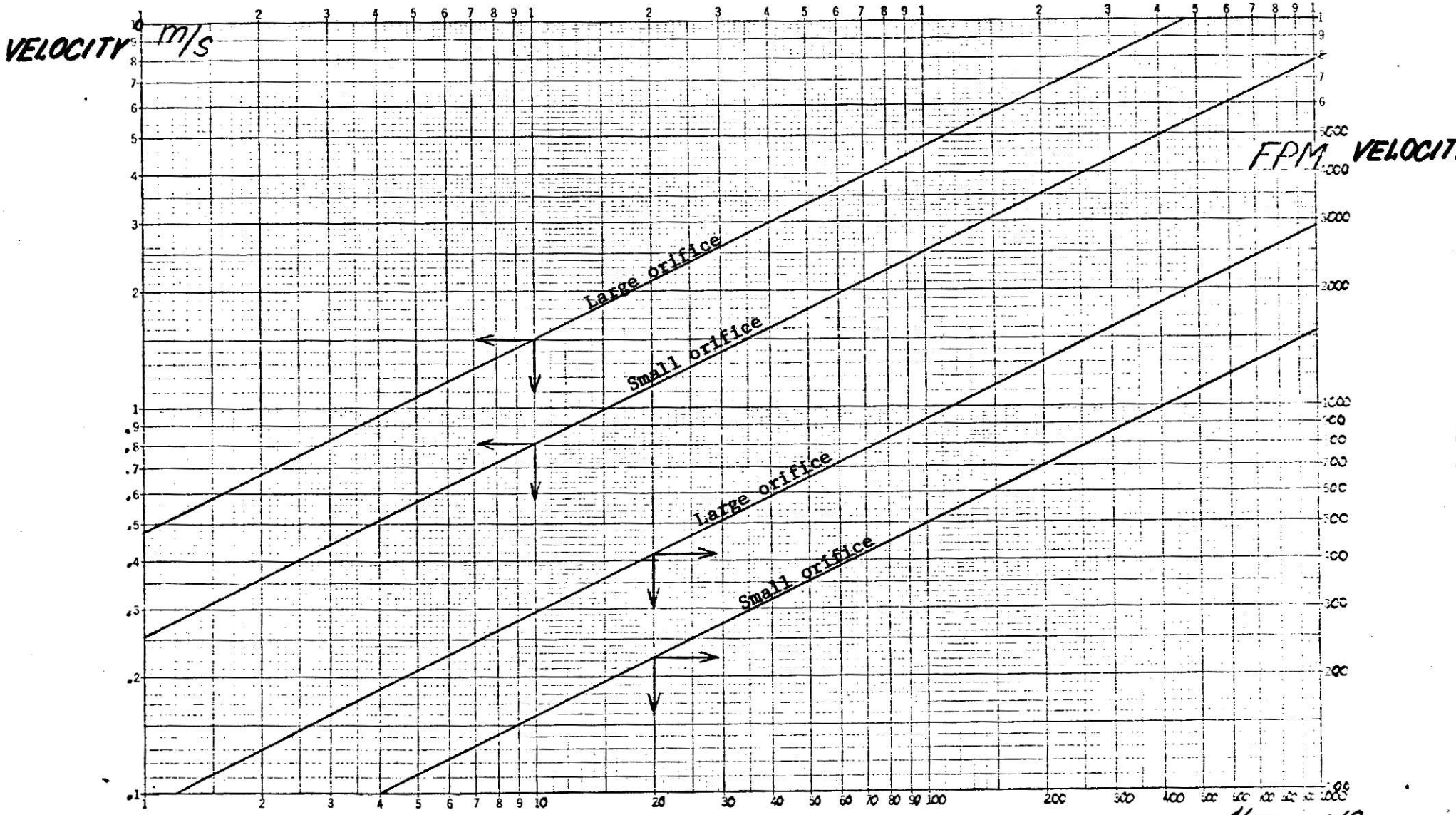


Fig. E.2 Outlet velocity in (m/s) and (fpm) from draft exposure nozzle as a function of pressure drop in (1/1000 in Hg) across the constructed small and large orifice.

Small orifice: $V = 1542.2*(\Delta p)^{0.49331}$ $R^2 = 0.9980$ where V Velocity is measured in (fpm)

Large orifice: $V = 2875.4*(\Delta p)^{0.49515}$ $R^2 = 0.9997$ and Δp pressure drop in (1/1000 in. Hg)

Appendix F

Computer programs used in computation of data presented in Appendices A-D

```
      $JOB            ,TIME=5,PAGES=30
      C
      C  THIS PROGRAM CALCULATE EXPERIMENTAL RESULTS OF 6 TESTS WITH EACH SUBJECT
      C
    1   107 PRC=0
    2       TBC=0
    3       SBC=0
    4       VPC=0
    5       RHC=0
    6       ADC=0
    7       VOTEC=0
    8   108 READ(5,125,END=100)I2,I4,PB,RB,SB,TB,UB,VB,XB,YB,ZB,VOTE
    9   125 FORMAT(I1,I2,2F4.2,F5.2,6F4.2,3X,F3.2)
   10       PR=(RB+(PB+ZB)/2.)/2.
   11       SBC=SBC+SB/2.
   12       DF = -45.525909 + 0.88378906*SB - 0.00070953369*(SB**2)
   13       VPB=VP(DF)
   14       VPA=VP(PR)
   15       RH=(VPB/VPA)*100.
   16       AD=PR+(TB-PR)*58./130.+(RH-50.)*0.047
   17       PRC=PRC+PR/2.
   18       TBC=TBC+TB/2.
   19       RHC=RHC+RH/2.
   20       VPC=VPC+VPB/2.
   21       ADC=ADC+AD/2.
   22       VOTEC=VOTEC+VOTE/2.
   23       IF(I2.EQ.1) GO TO 108
   24    80 READ(5,81,END=100)IV,MV,N,A,PV,RV,TV,SV,QV,Q5V,Q3V,F,GV,VK,VL
   25       READ(5,82)IV,7V,N,B,C,D,E,UV,VV,XV,YV,V3V,X3V,V5V,X5V,J3V,J5V
   26       READ(5,81,END=100)IX,MX,N,A,PX,RX,TX,SX,QX,Q5X,Q3X,F,GX,XK,XL
   27       READ(5,82)IX,ZX,N,B,C,D,E,UX,VX,XX,YX,V3X,X3X,V5X,X5X,J3X,J5X
   28       READ(5,81,END=100)IY,MY,N,A,PY,RY,TY,SY,QY,Q5Y,Q3Y,F,GY,YK,YL
   29       READ(5,82)IY,7Y,N,B,C,D,E,UY,VY,XY,YY,V3Y,X3Y,V5Y,X5Y,J3Y,J5Y
   30       READ(5,81,END=100)IZ,MZ,N,A,PZ,RZ,TZ,SZ,QZ,Q5Z,Q3Z,F,GZ,ZK,ZL
   31       READ(5,82)IZ,ZZ,N,B,C,D,E,UZ,VZ,XZ,YZ,V3Z,X3Z,V5Z,X5Z,J3Z,J5Z
   32    81 FORMAT(2I1,I2,F5.2,5X,9F6.2,2F4.2)
   33    82 FORMAT(I1,F1.0,I2,12F5.2,2I1)
   34       VELV=ZV/2
   35       VELX=ZX/2
   36       VOUTV=1.34
   37       VOUTY=2.36
   38       PRV=(PV+RV)/2
   39       PRX=(PX+RX)/2
   40       PRY=(PY+RY)/2
   41       PRZ=(PZ+RZ)/2
   42       DFV= -45.525909 + 0.88378906*SV - 0.00070953369*(SV**2)
   43       DFX= -45.525909 + 0.88378906*SX - 0.00070953369*(SX**2)
   44       DFY= -45.525909 + 0.88378906*SY - 0.00070953369*(SY**2)
   45       DFZ= -45.525909 + 0.88378906*SZ - 0.00070953369*(SZ**2)
   46       VPV=VP(DFV)
   47       VPX=VP(DFX)
   48       VPY=VP(DFY)
   49       VPZ=VP(DFZ)
   50       VPAV=VP(PRV)
   51       VPAX=VP(PRX)
   52       VPAY=VP(PRY)
   53       VPAZ=VP(PRZ)
   54       HV=(VPV/VPAV)*100
   55       HX=(VPX/VPAX)*100
   56       HY=(VPY/VPAY)*100
```

```
      HZ=(VPZ/VPAZ)*100
      ADTV=PRV+(TV-PRV)*58./130.+(HV-50.)*.047
      ADTX=PRX+(TX-PRX)*58./130.+(HX-50.)*.047
      ADTY=PRY+(TY-PRY)*58./130.+(HY-50.)*.047
      ADTZ=PRZ+(TZ-PRZ)*58./130.+(HZ-50.)*.047
      DADTV=ADTV-ADC
      DADTX=ADTX-ADC
      DADTY=ADTY-ADC
      DADTZ=ADTZ-ADC
      QRV=Q5V-Q3V
      QRX=Q5X-Q3X
      QRY=Q5Y-Q3Y
      QRZ=Q5Z-Q3Z
      QTDV=QV-ADTV
      QTDX=QX-ADTX
      QTDY=QY-ADTY
      QTDZ=QZ-ADTZ
      DTV=(QV-PRV)*.50/1.34
      DTX=(QX-PRX)/2.36
      DTY=(QY-PRY)*.50/1.34
      DTZ=(QZ-PRZ)/2.36
      DT3V=(Q3V-PRV)*.50/1.34
      DT5V=(Q5V-PRV)*.50/1.34
      DT3X=(Q3X-PRX)/2.36
      DT5X=(Q5X-PRX)/2.36
      DT3Y=(Q3Y-PRY)*.50/1.34
      DT5Y=(Q5Y-PRY)*.50/1.34
      DT3Z=(Q3Z-PRZ)/2.36
      DT5Z=(Q5Z-PRZ)/2.36
      Q15V=PRV+DTV
      Q315V=PRV+DT3V
      Q515V=PRV+DT5V
      Q15X=PRX+DTX
      Q315X=PRX+DT3X
      Q515X=PRX+DT5X
      Q15Y=PRY+DTY
      Q315Y=PRY+DT3Y
      Q515Y=PRY+DT5Y
      Q15Z=PRZ+DTZ
      Q315Z=PRZ+DT3Z
      Q515Z=PRZ+DT5Z
      Q30IFV=Q315V-Q15V
      Q30IFX=Q315X-Q15X
      Q30IFY=Q315Y-Q15Y
      Q30IFZ=Q315Z-Q15Z
      Q50IFV=Q515V-Q15V
      Q50IFX=Q515X-Q15X
      Q50IFY=Q515Y-Q15Y
      Q50IFZ=Q515Z-Q15Z
      Q15DCV=Q15V-ADC
      Q15DCX=Q15X-ADC
      Q15DCY=Q15Y-ADC
      Q15DCZ=Q15Z-ADC
      Q15L=(Q15V-Q15Y)/(ADTV-ADTY)
      Q15H=(Q15X-Q15Z)/(ADTX-ADTZ)
      RANV=Q515V-Q315V
      RANX=Q515X-Q315X
      RANY=Q515Y-Q315Y
      RANZ=Q515Z-Q315Z
      QVDV=VV-Q15V
```

```
      QVDX=VX-Q15X
      QVDY=VY-Q15Y
      QVDZ=VZ-Q15Z
      YDV=YV-E
      YDX=YX-E
      YDY=YY-E
      YDZ=YZ-E
      UDV=UV-B
      UDX=UX-B
      UDY=UY-B
      UDZ=UZ-B
      VDV=VV-C
      VDX=VX-C
      VDY=VY-C
      VDZ=VZ-C
      XDV=XV-D
      XDX=XX-D
      XDY=XY-D
      XDZ=XZ-D
      V3VDIF=V3V-VV
      V5VDIF=V5V-VV
      V3XDIF=V3X-VX
      V5XDIF=V5X-VX
      V3YDIF=V3Y-VY
      V5YDIF=V5Y-VY
      V3ZDIF=V3Z-VZ
      V5ZDIF=V5Z-VZ
      X3VDIF=X3V-XV
      X5VDIF=X5V-XV
      X3XDIF=X3X-XX
      X5XDIF=X5X-XX
      X3YDIF=X3Y-XY
      X5YDIF=X5Y-XY
      X3ZDIF=X3Z-XZ
      X5ZDIF=X5Z-XZ
      GDV=GV-F
      GDX=GX-F
      GDY=GY-F
      GDZ=GZ-F
      IF (N.GT.20) GO TO 52
      WRITE(6,1)N
      GO TO 50
   52 WRITE(6,51)N
   50 WRITE(6,4)
      WRITE(6,2)VELV,VELX,VELV,VELX
      WRITE(6,3)VOUTV,VOUTY,VOUTV,VOUTY
      WRITE(6,5)PRC,PRV,PRX,PRY,PRZ
      WRITE(6,6)TBC,TV,TX,TY,TZ
      WRITE(6,64)SBC,SV,SX,SY,SZ
      WRITE(6,63)VPC,VPV,VPX,VPY,VPZ
      WRITE(6,7)RHC,HV,HX,HY,HZ
      WRITE(6,8)ADC,ADTV,ADTX,ADTY,ADTZ
      WRITE(6,9)DADTV,DADTX,DADTY,DADTZ
      WRITE(6,12)Q3V,Q3X,Q3Y,Q3Z
      WRITE(6,11)QV,QRV,QX,QRX,QY,QRY,QZ,QRZ
      WRITE(6,10)Q5V,Q5X,Q5Y,Q5Z
      WRITE(6,14)QTDV,QTDX,QTDY,QTDZ
      WRITE(6,60)Q315V,Q3DIFV,Q315X,Q3DIFX,Q315Y,Q3DIFY,Q315Z,Q3DIFZ
      WRITE(6,18)Q15V,Q15X,Q15Y,Q15Z
      WRITE(6,61)Q515V,Q5DIFV,Q515X,Q5DIFX,Q515Y,Q5DIFY,Q515Z,Q5DIFZ
```

```
      WRITE(6,65)Q15DCV,RANV,Q15DCX,RANX,Q15DCY,RANY,Q15DCZ,RANZ
      WRITE(6,62)Q15L,Q15H,Q15L,Q15H
      WRITE(6,19)QVDV,QVDX,QVDY,QVDZ
      WRITE(6,20)F,YV,YDV,YX,YDX,YY,YDY,YZ,YDZ
      WRITE(6,22)B,UV,UDV,UX,UDX,UY,UDY,UZ,UDZ
      WRITE(6,24)V3V,V3VDIF,V3X,V3XDIF,V3Y,V3YDIF,V3Z,V3ZDIF
      WRITE(6,25)C,VV,VDV,VX,VDX,VY,VDY,VZ,VDZ
      WRITE(6,26)V5V,V5VDIF,V5X,V5XDIF,V5Y,V5YDIF,V5Z,V5ZDIF
      WRITE(6,27)X3V,X3VDIF,X3X,X3XDIF,X3Y,X3YDIF,X3Z,X3ZDIF
      WRITE(6,28)D,XV,XDV,XX,XDX,XY,XDY,XZ,XDZ
      WRITE(6,29)X5V,X5VDIF,X5X,X5XDIF,X5Y,X5YDIF,X5Z,X5ZDIF
      WRITE(6,30)F,GV,GX,GY,GZ
      WRITE(6,31)GDV,GDX,GDY,GDZ
      WRITE(6,32)VOTEC,VK,XK,YK,ZK
      WRITE(6,33)VL,XL,YL,ZL
      WRITE(6,34)J3V,J5V,J3X,J5X,J3Y,J5Y,J3Z,J5Z
    1 FORMAT(1H1,'EXPERIMENTAL RESULTS FOR SUBJECT NO:',I4,4X,'SEX: FEMA
     2LE',8X,'ALL TEMPERATURES IN DEG F')
   51 FORMAT(1H1,'EXPERIMENTAL RESULTS FOR SUBJECT NO:',I4,4X,'SEX: MALE
     2',10X,'ALL TEMPERATURES IN DEG F')
    2 FORMAT(1HO,'JET VEL (M/S), AT LOC OF FOREHEAD'          ,T54,4F17.2)
    3 FORMAT(1HO,'JET OUTL VEL (M/S), OUTL NOZZLE: 55 MM DIA',
     3T54,4F17.2)
    4 FORMAT(1HO,'ROOM TEMPERATURE CONDITION',20X,'COMFORT',9X,
     4'T(CO)+3.3         T(CO)+3.3         T(CO)-3.3         T(CO)-3.3')
    5 FORMAT(1HO,'AIR TEMPERATURE',                            T37,5F17.2)
    6 FORMAT(1HO,'WALL TEMPERATURE',T37,5F17.2)
    7 FORMAT(1HO,'RELATIVE HUMIDITY',T37,F16.1,'%',F16.1,'%',F16.1,'%',
     7F16.1,'%',F16.1,'%')
    8 FORMAT(1HO,'ADJUSTED ROOM TEMPERATURE',T37,5F17.2)
    9 FORMAT(1HO,'ADJ ROOM TEMP DIFF FROM COMFORT',T54,4F17.2)
   10 FORMAT(1H ,'JET OUTLET TEMP UPPER LEVEL ',T54,4F17.2)
   11 FORMAT(1H ,'JET OUTLET TEMP MEAN/RANGE',T54,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   12 FORMAT(1HO,'JET OUTLET TEMP LOWER LEVEL ',T54,4F17.2)
   14 FORMAT(1HO,'DIFF BETWEEN JET OUTL & ADJ ROOM TEMP' ,T54,4F17.2)
   18 FORMAT(1H ,'JET TEMP 15" FROM OUTL (FOREH LOC) MEAN',T54,4F17.2)
   19 FORMAT(1HO,'DIFF BETWEEN JET T(15) & FOREHEAD TEMP',T54,4F17.2)
   20 FORMAT(1HO,'RECTAL TEMPERATURE/DIFF FROM COMF TEST' T37, F17.2,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   22 FORMAT(1HO,'MEAN SKIN TEMP/DIFF FROM COMFORT TEST' ,T37, F17.2,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   24 FORMAT(1HO,'FOREHEAD TEMP MIN/DIFF FROM MEAN'       ,T54,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   25 FORMAT(1H ,'FOREHEAD TEMP MEAN/DIFF FROM COMF TEST',T37, F17.2,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   26 FORMAT(1H ,'FOREHEAD TEMP MAX/DIFF FROM MEAN'       ,T54,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   27 FORMAT(1HO,'CHEEK TEMP MIN/DIFF FROM MEAN'          ,T54,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   28 FORMAT(1H ,'CHEEK TEMP MEAN/DIFF FROM COMFORT TEST',T37, F17.2,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   29 FORMAT(1H ,'CHEEK TEMP MAX/DIFF FROM MEAN'          ,T54,
     83X,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
   30 FORMAT(1HO,'WEIGHT LOSS (GRAMS/M**2/HOUR)',          T37,5F17.2)
   31 FORMAT(1HO,'WEIGHT LOSS (GRAMS/M**2/HOUR) DIFF C-T',T54,4F17.2)
   32 FORMAT(1HO,'ROOM TEMP SENSATION VOTE'               ,T37,5F17.2)
   33 FORMAT(1HO,'JET TEMP SENSATION VOTE'                ,T54,4F17.2)
   34 FORMAT(1HO,'NO OF MIN/MAX PEAKS OF JET TEMPERATURE',T54,I13,
     4' / ',I1,I13,' / ',I1,I13,' / ',I1,I13,' / ',I1)
```

```
222      60 FORMAT(1HO,'JET TEMP 15" FROM OUTL LOWER LEVEL/DIFF FROM MEAN',T54
           8,F14.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
223      61 FORMAT(1H ,'JET TEMP 15" FROM OUTL UPPER LEVEL/DIFF FROM MEAN',T54
           8,F14.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
224      62 FORMAT(1HO,'JET(15) TEMP INCR PR DEG ROOM T INCR'   ,T54,4F17.2)
225      63 FORMAT(1HO,'VAPOR PRESSURE (INCH HG)'               ,T37,5F17.3)
226      64 FORMAT(1HO,'BOBBIN PROBE TEMP (11% RH TEMP)'        ,T37,5F17.2)
227      65 FORMAT(1HO,'JET(15) TEMP DIFF FROM T(CO)/RANGE(UPP-LOW LEVEL)',T54
           8,F14.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2,F11.2,'/',F5.2)
228         GO TO 107
229     100 STOP
230         END

231         FUNCTION VP(DF)
232         Y1 = (16.386396+(.00137804*DF))-(5656.0/(459.67+DF))
233         Y2 = ALOG((459.67+DF)/100.0)
234         Y3 = Y1-(3.560573*Y2)
235         VP = 10**Y3
236         RETURN
237         END

      $ENTRY
```

```
      $JOB
      C
      C
      C  THIS PROGRAM CALCULATES TEST RESULTS FROM THE TWO COMFORT TEST
      C  WITH EACH SUBJECT.
      C
      C
    1       8 READ(5,25,END=100)I2,I4,PB,RB,SB,TB,UB,VB,XB,YB,ZB,VOTE
    2      25 FORMAT(I1,I2,2F4.2,F5.2,5F4.2,3X,F3.2)
    3         PR=(RB+(PB+ZB)/2.)/2.
    4         DF = -45.525909 + 0.98378906*SB - 0.00070953369*(SB**2)
    5         Y1 = (16.386396+(.0013780*DF))-(5656.0/(459.67+DF))
    6         Y2 = ALOG((459.67+DF)/100.0)
    7         Y3 = Y1-(3.560573*Y2)
    8         VP = 10**Y3
    9         Y1A = (16.386396+(.0013780*PR))-(5656.0/(459.67+PR))
   10         Y2A = ALOG((459.67+PR)/100.0)
   11         Y3A = Y1A-(3.560573*Y2A)
   12         VPA = 10**Y3A
   13         RH=(VP/VPA)*100.
   14         AD=PR+(TB-PR)*58./130.+(RH-50.)*0.047
   15         IF(I2.EQ.2) GO TO 65
   16         IF(I4.EQ.11) GO TO 42
   17         IF(I4.EQ.31) GO TO 43
   18      65 WRITE(6,46)I4,I2,PB,RB,ZB,TB,SB,UB,VB,XB,YB,PR,VP,RH,AD,VOTE
   19      46 FORMAT(1H0,I3,I4,4F9.2,F10.2,5F9.2,F9.3,F8.1,F9.2,F8.2)
   20         IF(I2.EQ.2) GO TO 41
   21         GO TO 8
   22      41 WRITE(6,60)
   23      60 FORMAT(1H0,' ')
   24         GO TO 8
   25      42 WRITE(6,67)
   26         WRITE(6,61)
   27      61 FORMAT(1H ,10X,'RESULTS FROM COMFORT TESTS, FEMALE SUBJECTS'/)
   28         GO TO 66
   29      43 WRITE(6,67)
   30         WRITE(6,62)
   31      62 FORMAT(1H ,10X,'RESULTS FROM COMFORT TESTS, MALE SUBJECTS'/)
   32      66 WRITE(6,63)
   33      63 FORMAT(1H0,'SUBJ'/)
   34      67 FORMAT(1H1,' ')
   35         WRITE(6,64)
   36      64 FORMAT(1H ,'TEST NO   ROOM 1   ROOM 2   ROOM 1     WALL     11% RH'
             1,'     SKIN   FOREHEAD   CHEEK   RECTAL  ROOMAIR  VP " HG    % RH',
             2' ADJROOM   VOTE')
   37         WRITE(6,60)
   38         GO TO 65
   39     100 STOP
   40         END

      $ENTRY
```

```
      $JOB            ,TIME=5,PAGES=40
      C
      C
      C  THIS PROGRAMCALCULATES THE RESULTS OF ALL ENVIRONMENTAL, PHYSIOLOGICAL
      C  MEASUREMENTS AND SUBJECTIVE VOTES AS A FUNCTION OF TIME OF EXPOSURE
      C  FOR ALL 16 SUBJECTS POOLED FOR EACH OF THE FOUR EXPOSURE CONDITIONS.
      C
      C
            1       INTEGER H
            2     6 READ(5,1,END=100)I1,I2,H,Z,ZDEC,PB,OB,RB,TB,OB,VB,XB,YB,SB,BK,BL
            3    11 FORMAT(2I1,2X,I2,F5.3,F4.1,8F5.2,5X,F6.2,2F3.2)
            4       VEL=I2/2.
            5       PR=(PB+RB)/2.
            6       DF = -45.525909 + 0.88378906*SB - 0.00070953369*(SB**2)
            7       Y1 = (16.386396+(.00137804*DF))-(5656.0/(459.67+DF))
            8       Y2 = ALOG((459.67+DF)/100.0)
            9       Y3 = Y1-(3.560573*Y2)
           10       VP = 10**Y3
           11       Y1A = (16.386396+(.00137804*PR))-(5656.0/(459.67+PR))
           12       Y2A = ALOG((459.67+PR)/100.0)
           13       Y3A = Y1A-(3.560573*Y2A)
           14       VPA = 10**Y3A
           15       RH=(VP/VPA)*100.
           16       TAD=PR+(TB-PR)*58./130.+(RH-50.)*.047
           17       Q15=PR+(OB-PR)*.50/1.34
           18       IF(I2.EQ.2) Q15=PR+(QB-PR)/2.36
           19       I=I1+I2
           20       IF(H.EQ.1) GO TO 30
           21    33 WRITE(6,24)H,Z,ZDEC,PR,TB,SB,VP,RH,TAD,QB,Q15,UB,VB,XB,YB,BK,BL
           22    24 FORMAT(1H ,I3,F8.3,F8.1,F11.2,F7.2,F8.2,F7.3,F6.1,3F7.2,F11.2,
                    13F7.2,F10.2,F7.2)
           23       GO TO 6
           24    30 IF(I1.EQ.6) GO TO 31
           25       WRITE(6,20)VEL
           26    20 FORMAT(1H1,' MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOS
                    1URE TO AMB TEMP = T(CO)+3.3 F AND DRAFT VELOCITY =',F4.1,' M/S'/)
           27       GO TO 32
           28    31 WRITE(6,21)VEL
           29    21 FORMAT(1H1,' MEAN OF OBSERVATIONS FOR 16 SUBJECTS AT TIME OF EXPOS
                    1URE TO AMB TEMP = T(CO)-3.3 F AND DRAFT VELOCITY =',F4.1,' M/S'/)
           30    32 WRITE(6,35)
           31    35 FORMAT(1H ,' ALL TEMPERATURE OBSERVATIONS IN DEG F, AND VAPOR PRES
                    1SURE IN INCHES WG, VOTES AFTER 1-7 COMFORT VOTE SCALE (COMFORT = 4
                    2)'/)
           32       WRITE(6,22)
           33    22 FORMAT(1H0,' TIME OF OBSERVATION   /',16X,'ENVIRONMENTAL OBSERVATI
                    1NS',16X,'/   PHYSIOLOGICAL OBSERVATIONS   /     VOTES')
           34       WRITE(6,23)
           35    23 FORMAT(1H0,' ID   HOURS  MINUTES     AIR T   WALL  I1% RH  VAPOR
                    1%R H  ADJ AIR  JET  JET15       SKIN  FOREH  CHEEK   BODY      ROO
                    2M    JET')
           36       GO TO 33
           37   100 STOP
           38       END
      $ENTRY
```

```
      $JOB
      C
      C  THIS PROGRAM CALCULATE THE SUBJECT'S WEIGTH LOSS DUE TO EVAPORATION
      C  FOR ALL 6 DIFFERENT TYPES OF EXPOSURE
      C
      C
    1      2 READ(5,1,END=100) NOS, H1, H2, NOT, WLB1, WLB2, T1
    2      1 FORMAT(I2,F1.0,F3.1,I1,2F6.3,F2.0)
    3        T=T1+120.
    4        H=(H1*12.+H2)*.0254
    5        WG=(WLB1+WLB2)/2/2.2046
    6        A=(H**.725)*(WG**.425)*0.203
    7        WLH=(WLB1-WLB2)*60./(T*.0022046)
    8        WLHA=WLH/A
    9        CAL=WLHA*.57755
   10        WATT=CAL*1.163
   11        IF(NOT.GT.1) GO TO 3
   12        IF(NOS.EQ.11) GO TO 42
   13        IF(NOS.EQ.31) GO TO 43
   14      3 WRITE(6,4) NOS, NOT, WLB1, WLB2,T,WG,H,A,WLH,WLHA,CAL,WATT
   15      4 FORMAT(2I6,2F12.3,F8.0,3F11.2,4F13.2)
   16        IF (NOT.EQ.6.) GO TO 23
   17        GO TO 2
   18     23 WRITE(6,24)
   19     24 FORMAT(1H ,' ')
   20        GO TO 2
   21     42 WRITE(6,61)
   22     61 FORMAT(1H1,'RESULTS OF EVAPORATIVE WEIGHT LOSS, FEMALE SUBJECTS.
             3 1&2 COMFORT TEST, 3&4 WARM EXP LOW/HIGH VEL, 5&6 COOL EXP LOW/HIGH
             4 VEL')
   23        GO TO 66
   24     43 WRITE(6,62)
   25     62 FORMAT(1H1,'RESULTS OF EVAPORATIVE WEIGHT LOSS, MALE SUBJECTS. ',','
             3 1&2 COMFORT TEST, 3&4 WARM EXP LOW/HIGH VEL, 5&6 COOL EXP LOW/HIG
             4H VEL')
   26     66 WRITE(6,63)
   27     63 FORMAT(1H0,'SUBJECT  TEST   IN  WEIGHT LBS  OUT  MINUTES',
             1'  MEAN WGT KG  HEIGHT M  AREA M**2  WG LOSS G/H  WG L G/H/M2',
             2'  KCAL/H/M**2  WATT/M**2'/)
   28        GO TO 3
   29    100 STOP
   30        END

      $ENTRY
```

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THRESHOLD LEVELS FOR THERMAL COMFORT UNDER EXPOSURES TO A LOCALIZED, NON-AMBIENT TEMPERATURE AIR JET

by

Jorn Ostergaard

B.S. M.E., Denmark's Engineering Academy, 1970

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Mechanical Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1973

ABSTRACT

The object of this investigation was to obtain information on the human physiological and subjective response related to comfort under varying localized draft and ambient temperatures. This response resulted from exposure to a localized draft of two different velocities impinging on the forehead, each at two ambient temperature conditions.

The investigation was conducted at the Institute for Environmental Research, Kansas State University. Sixteen subjects (8 female and 8 male) were used and each participated in six tests, the first two of which were used to find each subject's "comfort temperature." In the last four tests the subjects were exposed to two localized drafts (velocities of 100 and 200 fpm) impinging on the subject's forehead, and two fixed ambient temperatures (3.3 °F above and below their comfort temperature).

Each exposure lasted 2½ hours, of which observations from the last two hours were used in the analysis. The subjects wore the standard KSU uniform (0.6 clo), and were tested at a sedentary activity level. The chamber ventilation rate was 125 changes per hour and the average air velocity in the chamber was less than 25 fpm. The room dry bulb temperature was maintained within ± 0.3 °F of set point and wall temperature was always equal to air temperature. Relative humidity was maintained at 50%.

It was found that the subjects' feelings of comfort cannot be satisfied by adjusting the temperature of an air stream impinging locally on their foreheads. There was found to be no significant difference in desired mean draft temperature for the two velocity levels at either of the two temperature levels. The draft threshold levels to maintain comfort was found to be a function of the draft velocity. A correlation was found between desired mean draft temperature as a function of the subject's comfort temperature and the actual ambient temperature.

VITA

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