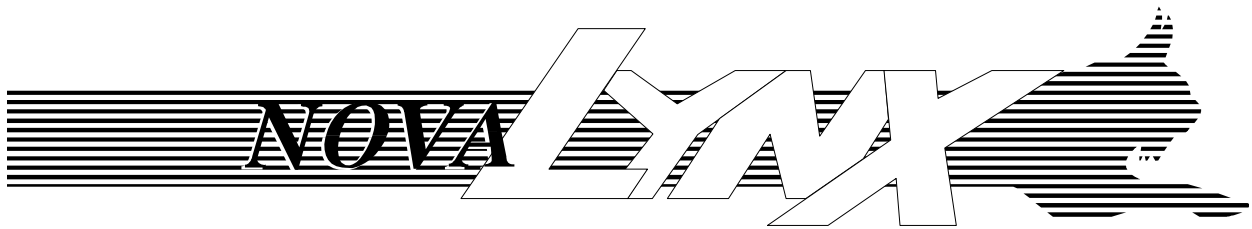


# NOVALYNX CORPORATION

MODEL 225-5230 225-5231  
ASSMANN PSYCHROMETER

INSTRUCTION MANUAL



## Receiving and Unpacking

Carefully unpack all components and compare to the packing list. Notify NovaLynx Corporation immediately concerning any discrepancy. Inspect equipment to detect any damage that may have occurred during shipment. In the event of damage, any claim for loss must be filed immediately with the carrier by the consignee. Damages to equipment sent via Parcel Post or UPS require the consignee to contact NovaLynx Corporation for instructions.

## Returns

If equipment is to be returned to the factory for any reason, call NovaLynx between 8:00 a.m. and 4:00 p.m. Pacific Time to request a Return Authorization Number (RA#). Include with the returned equipment a description of the problem and the name, address, and daytime phone number of the sender. Carefully pack the equipment to prevent damage or additional damage during the return shipment. Call NovaLynx for packing instructions in the case of delicate or sensitive items. If packing facilities are not available take the equipment to the nearest Post Office, UPS, or other freight service and obtain assistance with the packaging. Please write the RA# on the outside of the box.

## Warranty

NovaLynx Corporation warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment from the factory. NovaLynx Corporation's obligations under this warranty are limited to, at NovaLynx's option: (i) replacing; or (ii) repairing; any product determined to be defective. In no case shall NovaLynx Corporation's liability exceed product's original purchase price. This warranty does not apply to any equipment that has been repaired or altered, except by NovaLynx Corporation, or that has been subjected to misuse, negligence, or accident. It is expressly agreed that this warranty will be in lieu of all warranties of fitness and in lieu of the warranty of merchantability.

## Address

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# NovaLynx Corporation

## Model 225-5230 225-5231 Assmann Psychrometer Instruction Manual

### 1.0 INTRODUCTION

- 1.1 The Assmann Psychrometers are designed to give precision wet and dry bulb measurements in a convenient yet durable housing. The psychrometer includes a spring-driven fan for forced aspiration, and the measuring thermometers. Accessories include a carrying case to protect the instrument during transport, a permanent mount support arm, a carrying handle, a syringe, and a psychrometric chart.
- 1.2 The psychrometer gives accurate readings due to the construction of the housing, the precision of the thermometers, and the constant ventilation of the fan. Because the fan is driven by a spring motor, no power source is required.
- 1.3 The measuring portion of the instrument is constructed of ventilating tubes and protective covers. The psychrometer uses two thermometers, one for wet bulb measurements and one for dry bulb measurements. Ambient temperature measurements can be made by reading only the dry bulb thermometer.
- 1.4 The Model 225-5230 Psychrometer provides measurements from  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  with a precision of 0.2 degrees. The Model 225-5231 Psychrometer provides measurements from  $-20^{\circ}\text{F}$  to  $+130^{\circ}\text{F}$  with a precision of 0.5 degrees.

### 2.0 SPECIFICATIONS

	<b>Model 225-5230</b>	<b>Model 225-5231</b>
<b>Measuring range</b>	$-30^{\circ}\text{C}$ to $+50^{\circ}\text{C}$	$-20^{\circ}\text{F}$ to $+130^{\circ}\text{F}$
<b>Accuracy</b>	0.2 $^{\circ}\text{C}$ typical	0.3 $^{\circ}\text{F}$ typical
<b>Resolution</b>	0.2 $^{\circ}\text{C}$	0.5 $^{\circ}\text{F}$
<b>Fan aspiration</b>	8 minutes per winding 3.5 to 6 m/s	same
<b>Size</b>	16-1/2" x 4" dia	same
<b>Weight</b>	3 lbs	same
<b>Case size</b>	17-1/2" x 5" x 4-1/2"	same
<b>Case weight</b>	3 lbs	same
<b>Shipping weight</b>	8 lbs	same

## 3.0 INSTALLATION

- 3.1 This instrument is thoroughly tested and fully calibrated at the factory and is ready for installation.
- 3.2 To use the psychrometer, care must be taken to select a location for the measurement that is representative of the area of interest. Avoid sources of heat and cold. Especially avoid direct solar radiation.
- 3.3 Measurements can be made both indoor and outdoor. To prevent thermal conduction from the hands, use the hanger provided or hang the instrument from a stable support.
- 3.4 Prior to making any measurements, inspect the psychrometer for broken thermometers, stained or soiled wicks, and free rotation of the fan. Both thermometers should provide the same temperature measurement prior to wetting the wick.
- 3.5 Upon completion of the preliminary inspection, moisten the wick. Use only clean distilled water or soft water. Use only the syringe to moisten the wick. **Never touch the wick with fingers or hands.** Human body oils will soil the wick and cause inaccuracies in the data.

Insert the syringe into the air intake cylinder and moisten the wick completely. Avoid excessive moistening which causes water droplets to appear at the end of the wick. Prevent water from standing inside the wet bulb cylinder. In extremely dry climates, moistening of the wick may require several repetitions.

If the wick is stained or old, replace it with a new clean wick. NovaLynx carries replacement wick material, Model 225-568.

- 3.6 To take the actual measurement, wind the motor using the key provided. Release the fan key and hold or support the psychrometer in a perfectly vertical position. Watch the tops of the mercury columns. When there is no further drop in the wet bulb column the reading can be made. Read the mercury column at an angle of 90 degrees from the thermometer tube. A quick reading of the thermometer is necessary because of the variable nature of the humidity. It is suggested that the user read the tenths of degrees first and then degree units.
- 3.7 When taking readings with the wet bulb frozen, try to use water that is 75°F (25°C). Melt any accumulated ice on the bulb before moistening with the warmed water and wait 15 minutes before operating the fan. The reading will appear to be near 32°F (0°C) and a thin thoroughly cooled coating will be seen. Due to surface evaporation, the wet bulb temperature will gradually read below 32°F. Read the thermometer at this point.

- 3.8 For temperatures below 32°F (0°C) but without freezing, take the reading and note that the temperature is without freezing for use with the psychrometric tables. If the temperature is near 32°F (0°C), inspect the wick for frozen water.
- 3.9 In dense fog (100% RH), the wet bulb reading should be the same as the dry bulb reading.
- 3.10 Calibration certificates are provided with each thermometer set. Use the correction values supplied on the certificate to correct the actual readings. Avoid incorrect use of the correction factors.

**EXAMPLE**

Positive correction +0.1, +.02, +0.3  
 for a reading of +15.2  
 and a correction of +0.1  
 the corrected reading is +15.3

Negative correction -0.1, -0.2, +0.3  
 reading +15.2  
 correction -0.1  
 corrected reading +15.1

Zero correction readings are the same as the corrected value

- 3.11 To compute relative humidity, align the wet bulb temperature and the dry bulb temperature on a psychrometric slide rule and read the humidity directly or use the tables provided in the back of this document.

**4.0 THEORY OF OPERATION**

- 4.1 The Assmann Psychrometer is designed to measure relative humidity and dew point temperature by using wet bulb and dry bulb thermometers. The depression of the wet bulb reading is compared to the dry bulb reading and the result is looked up on psychrometric tables.
- 4.2 The psychrometer consists of two thermometers, one used as a wet bulb thermometer with a cotton wick and one as a dry bulb thermometer without a wick. The wick is made of cotton fiber and is moistened with distilled water.

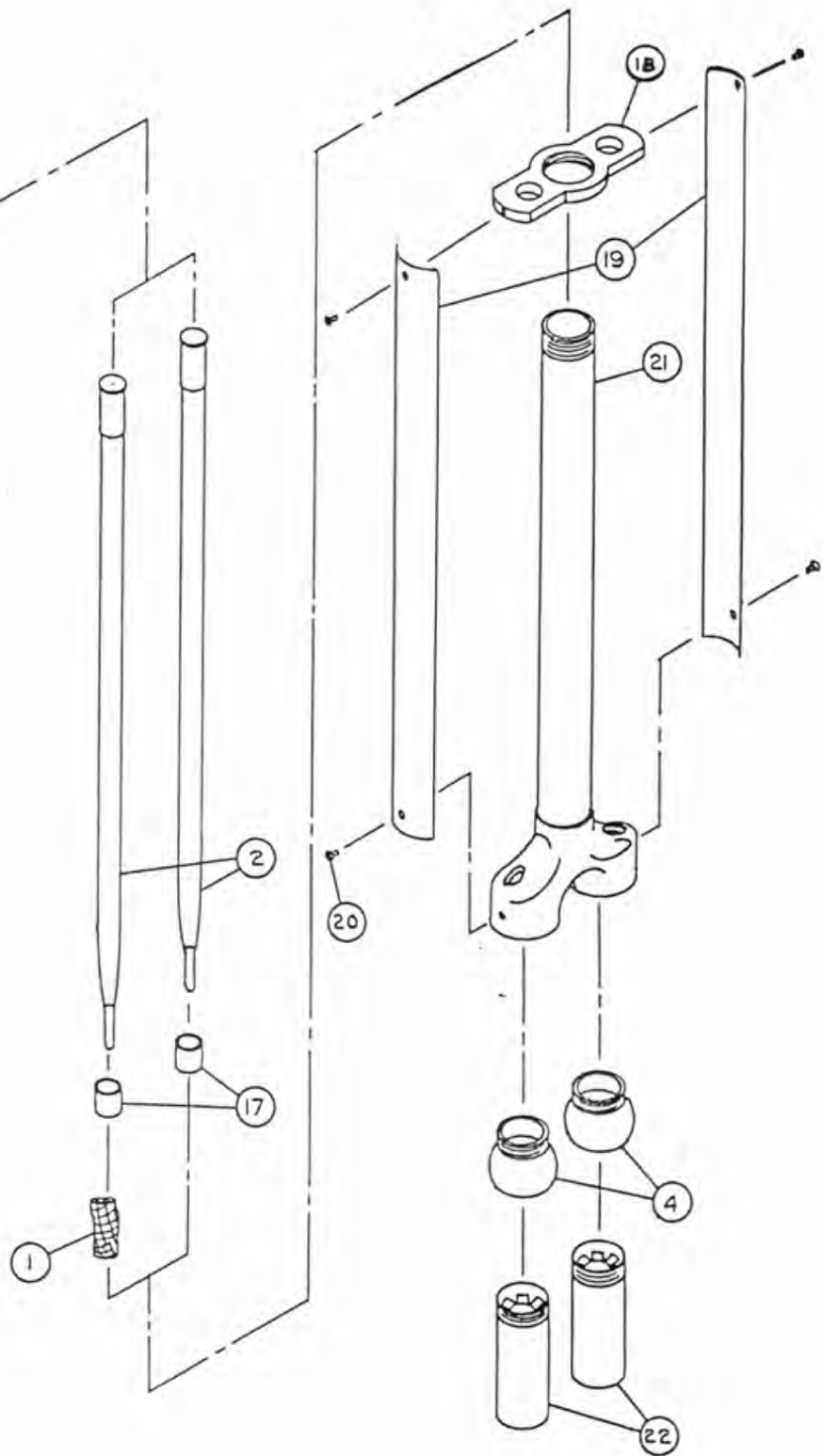
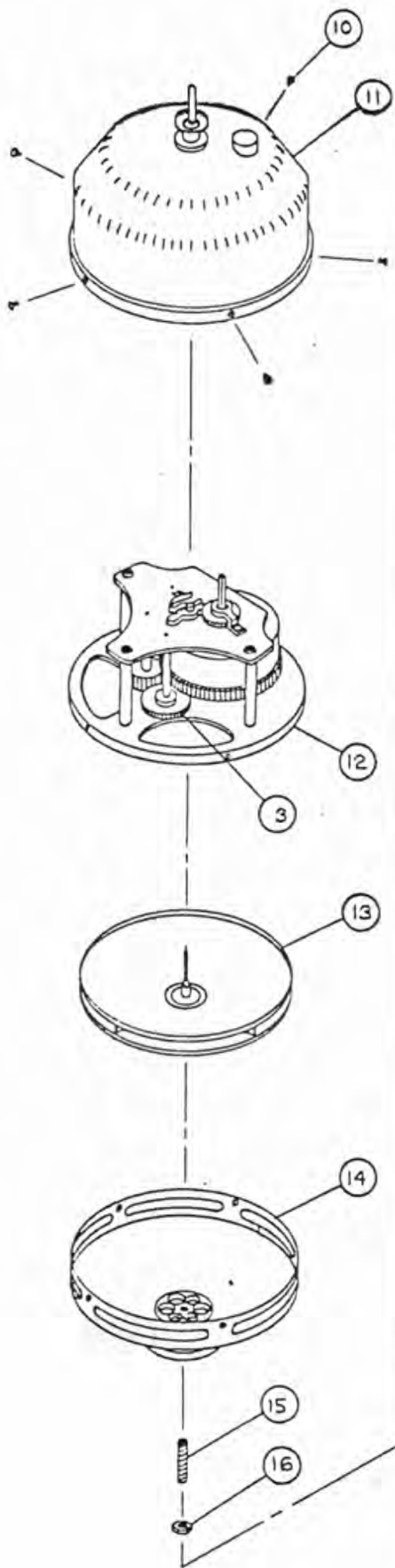
- 4.3 The psychrometer operates on the principle of forced aspiration to give a good sample of ambient air around the thermometer bulbs. The thermometers are supported by metal shields which form ventilation tubes around the bulb ends of the thermometers. A spring-driven fan pulls air through a central tube which connects to the two ventilation tubes. The air intake ports have no sharp edges or obstructions.
- 4.4 The thermometer bulbs enter the ventilation tubes through special insulated fittings. A double cylinder design increases accuracy by decreasing errors from external radiation.

## **5.0 CALIBRATION**

- 5.1 Calibration of the thermometers is accomplished at the time of manufacture. A certificate is issued to each psychrometer with the correction factors listed for each thermometer. Should the thermometer change from the indicated values on the certificate then the thermometer should be replaced.

## **6.0 MAINTENANCE**

- 6.1 To ensure accurate data, routine maintenance and care must be performed on the psychrometer. The thermometer bulbs and scales must be cleaned to prevent accumulation of dust. Use a soft moist cloth to remove dust and moisture.
- 6.2 The wet bulb thermometer accuracy depends upon the correct functioning of the wick on the bulb. The wick will not perform well when it is soiled or aged. Replace the wick with new material at least twice monthly or more often in dirty environments. Never place a new wick over an old wick. Always remove and discard the old wick. Do not touch the wick material with bare hands. The oils in the human skin will contaminate the wick.
- 6.3 To clean the ventilation cylinders, covers, and aspiration tube, wipe with a silicone cloth to prevent rust. Rust and corrosion on any of the metal surfaces will cause errors due to heat from radiation.
- 6.4 Store the psychrometer in a polyethylene bag when the instrument is not in use.



ITEM	PART NO.	SUFFIX	QTY	LIMIT	DESCRIPTION	REVISED NO.
BILL OF MATERIALS						
TITLE ASSEMBLY DWG						
ASSMAN PSYCHRO-						
METER, MODELS 5230, 31						
NONE						
12-3-79						



# BILL OF MATERIALS

MODEL/PART NUMBER 5230, 5231

DESCRIPTION Assman Psychrometer

DATE \_\_\_\_\_



Item No.	Part No.	Suffix	Qty.	Unit	Description	Reference No.		
1	52105		1		Wick			
2	52301		2		Thermometer-30to+50°C	5230		
	52311				Thermometer-20 to +120°F	5231		
3	951620		1		Gear, drive nylon			
4	951621		2		Bushing, plastic			
5	951622		1		Syringe	Not shown		
6	951623		1		Case, wood	Not shown		
7	951624		1		Hook, mounting	Not shown		
8	951625		1		Deflector, Air discharge	Not shown		
9	951626		1		Key, motor	Not shown		
10	951627		5		Screw, cover			
11	951628		1		Cover, motor			
12	951629		1		Motor spring			
13	951630		1		Fan rotor assembly			
14	951631		1		Base, fan			
15	951632		1		Bearing, lower fan			
16	951633		1		Nut			
17	951634		2		Bushing, Rubber			
18	951635		1		Support			
19	951636		2		Guard, thermometer			
A	5230	01	MANUAL			Rev.	Date	Orig. RDH
B	5230	03	ASSY. DWG.					Engr. WSH
C		04	SCHEMATIC					APPV.
D								Doc. No.
							5230 -02	
							Sheet of	
							1 2	

# BILL OF MATERIALS

MODEL/PART NUMBER 5230, 5231

DESCRIPTION Assman Psychrometer

DATE \_\_\_\_\_

Item No.	Part No.	Suffix	Qty.	Unit	Description	Reference No.
20	951637		4		Screw, guard	
21	951638		1		Duct, air	
22	951639		2		Shield, radiation	
A	5230	01	MANUAL			Orig. RDH
B	5230	03	ASSY. DWG.			Engr. WSH
C		04	SCHEMATIC			Appv.
D						Doc. No.
 						5230 -02
						Sheet of 2 2



PSYCHROMETRIC TABLES - CELSIUS (CENTIGRADE) TEMPERATURES

TABLE 1. - Relative humidity, percent - Celsius (centigrade) temperatures [Pressure = 29.24 in.]

Air Temp t °C	Depression of wet-bulb thermometer (t-t')																								
	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	
0	81	73	64	55	46	38	29	21	13	5															
1	82	74	65	56	47	39	30	22	14	6															
2	83	75	66	57	48	40	32	24	16	8															
3	84	76	67	58	49	41	33	25	17	9															
4	85	77	68	59	50	42	34	26	18	10															
5	86	78	69	60	51	43	35	27	19	11															
6	87	79	70	61	52	44	36	28	20	12															
7	88	80	71	62	53	45	37	29	21	13															
8	89	81	72	63	54	46	38	30	22	14															
9	90	82	73	64	55	47	39	31	23	15															
10	91	83	74	65	56	48	40	32	24	16															
11	92	84	75	66	57	49	41	33	25	17															
12	93	85	76	67	58	50	42	34	26	18															
13	94	86	77	68	59	51	43	35	27	19															
14	95	87	78	69	60	52	44	36	28	20															
15	96	88	79	70	61	53	45	37	29	21															
16	97	89	80	71	62	54	46	38	30	22															
17	98	90	81	72	63	55	47	39	31	23															
18	99	91	82	73	64	56	48	40	32	24															
19	100	92	83	74	65	57	49	41	33	25															
20	101	93	84	75	66	58	50	42	34	26															
21	102	94	85	76	67	59	51	43	35	27															
22	103	95	86	77	68	60	52	44	36	28															
23	104	96	87	78	69	61	53	45	37	29															
24	105	97	88	79	70	62	54	46	38	30															
25	106	98	89	80	71	63	55	47	39	31															
26	107	99	90	81	72	64	56	48	40	32															
27	108	100	91	82	73	65	57	49	41	33															
28	109	101	92	83	74	66	58	50	42	34															
29	110	102	93	84	75	67	59	51	43	35															
30	111	103	94	85	76	68	60	52	44	36															
31	112	104	95	86	77	69	61	53	45	37															
32	113	105	96	87	78	70	62	54	46	38															
33	114	106	97	88	79	71	63	55	47	39															
34	115	107	98	89	80	72	64	56	48	40															
35	116	108	99	90	81	73	65	57	49	41															
36	117	109	100	91	82	74	66	58	50	42															
37	118	110	101	92	83	75	67	59	51	43															
38	119	111	102	93	84	76	68	60	52	44															
39	120	112	103	94	85	77	69	61	53	45															
40	121	113	104	95	86	78	70	62	54	46															
41	122	114	105	96	87	79	71	63	55	47															
42	123	115	106	97	88	80	72	64	56	48															
43	124	116	107	98	89	81	73	65	57	49															
44	125	117	108	99	90	82	74	66	58	50															

With the dry bulb temperature and the wet bulb depression known, the relative humidity can be determined from the accompanying table. For example, if the dry bulb thermometer reads 55° C, and the wet bulb thermometer reads 49° C, the wet bulb depression is 5°. Locate the dry bulb temperature, 55°, in the left hand vertical column and the wet bulb depression, 5°, in the horizontal heading of the table and at the intersection of the columns read the relative humidity, 69%.

It is essential to the accuracy of this method of measuring relative humidity that the psychrometer work be kept clean and wet. In the absence of forced circulation of the air around the bulbs, it is recommended that the observer fan the wet bulb until there is no further drop in the wet bulb temperature before taking a reading.

Depression of wet-bulb thermometer (t-t')

TABLE 1a. Factors (F) to be used in obtaining corrections to values of relative humidity as given in table 1, in cases when barometric pressure (P) differs from 29.24 inches.

Air Temperature t	Correction factor F	Air Temperature t	Correction factor F	Air Temperature t	Correction factor F
-40	11.3	-10	0.771	0	0.0973
-38	9.19	-8	0.661	+20	0.0862
-36	7.53	-6	0.568	+22	0.0766
-34	6.19	-4	0.489	+24	0.0681
-32	5.11	-2	0.422	+26	0.0607
-30	4.24	0	0.366	+28	0.0539
-28	3.52	+2	0.317	+30	0.0482
-26	2.94	+4	0.276	+32	0.0432
-24	2.46	+6	0.240	+34	0.0385
-22	2.07	+8	0.210	+36	0.0346
-20	1.74	+10	0.184	+38	0.0312
-18	1.47	+12	0.161	+40	0.0279
-16	1.25	+14	0.142	+42	0.0252
-14	1.06	+16	0.125	+44	0.0229
-12	0.902	+18	0.110		

Application of the foregoing factors is indicated by the following equation:

$$R_p = R_1 + F(t - t') \quad (29.24 - P) \text{ in percent}$$

where  
 $R_p$  = actual relative humidity (%) at dry bulb temperature t, wet bulb temperature t' and barometric pressure P (inches of mercury).  
 $R_1$  = relative humidity (%) as given in Table 1, corresponding to observed values of t and (t - t').  
 F = factor from Table 1a corresponding to observed dry bulb temperature t on assumption barometric pressure is 29.24 inches of mercury.

Note that when P is greater than 29.24 inches, the correction will be negative, and when P is less than 29.24 inches, the correction will be positive.

- Examples:
1.  $t = 28.0^\circ$ ,  $(t - t') = 0.5^\circ$ ,  $P = 25.60$  inches  
 From Table 1,  $R_1 = 4.5\%$ ; from Table 1a,  $F = 3.52$   
 $R_p = 4.5\% + 3.52(0.5) = 29.24 - 25.60\% = 4.3\% + 4.3\% = 4.7\%$
  2.  $t = 30.0^\circ$ ,  $(t - t') = 6.5^\circ$ ,  $P = 30.70$  inches  
 From Table 1,  $R_1 = 5.8\%$ ; from Table 1a,  $F = 0.0519$   
 $R_p = 5.8\% + 0.0519(6.5) = 29.24 - 30.70\% = 5.8\% - 1\% = 5.7\%$
  3.  $t = 40.0^\circ$ ,  $(t - t') = 17.8^\circ$ ,  $P = 27.50$  inches  
 From Table 1,  $R_1 = 20\%$ ; from Table 1a,  $F = 0.0312$   
 $R_p = 20\% + 0.0312(17.8) = 29.24 - 25.50\% = 20\% + 3\% = 23\%$

## RELATIVE HUMIDITY TABLE (In Percent) + 30 + 120° F.

Dry Bulb Temp. °F.	Difference Between Wet and Dry Thermometers																									
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
30	100	89	78	67	56	46	36	26	16	6																
32	100	89	79	69	59	49	39	30	20	11	2															
34	100	90	81	71	62	52	43	34	25	16	8															
36	100	91	82	73	64	55	46	38	29	21	13	5														
38	100	91	83	75	66	58	50	42	33	25	17	10	2													
40	100	92	83	75	68	60	52	45	37	29	22	15	7	0												
42	100	92	85	77	69	62	55	47	40	33	26	19	12	5												
44	100	93	85	78	71	63	56	49	43	36	30	23	16	10	4											
46	100	93	86	79	72	65	58	52	45	39	32	26	20	14	8	2										
48	100	93	86	79	73	66	60	54	47	41	35	29	23	18	12	7	1									
50	100	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5	0								
52	100	94	87	81	75	69	63	57	51	46	40	35	29	24	19	14	9	4								
54	100	94	88	82	76	70	64	59	53	48	42	37	32	27	22	17	12	8	3							
56	100	94	88	82	76	71	65	60	55	50	44	39	34	30	25	20	16	11	7	2						
58	100	94	88	83	77	72	66	61	56	51	46	41	37	32	27	23	18	14	10	6	1					
60	100	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1				
62	100	94	89	84	79	74	69	64	59	54	50	45	41	36	32	28	24	20	16	12	8	4	1			
64	100	95	90	84	79	74	70	65	60	56	51	47	43	38	34	30	26	22	18	15	11	7	4	0		
66	100	95	90	85	80	75	71	66	61	57	53	48	44	40	36	32	29	25	21	17	14	10	7	3	0	
68	100	95	90	85	80	76	71	67	62	58	54	50	46	42	38	34	31	27	23	20	16	13	10	6	3	
70	100	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3
72	100	95	91	86	82	77	73	69	65	61	57	53	49	45	42	38	34	31	28	24	21	18	15	12	9	6
74	100	95	91	86	82	78	74	69	65	61	58	54	50	47	43	39	36	33	29	26	23	20	17	14	11	8
76	100	96	91	87	82	78	74	70	66	62	59	55	51	48	44	41	38	34	31	28	25	22	19	16	13	11
78	100	96	91	87	83	79	75	71	67	63	60	56	53	49	46	43	39	36	33	30	27	24	21	18	16	13
80	100	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15
82	100	96	92	88	84	80	76	72	69	65	61	58	55	51	48	45	42	39	36	33	30	28	25	22	20	17
84	100	96	92	88	84	80	76	73	69	66	62	59	56	52	49	46	43	40	37	35	32	29	26	24	21	19
86	100	96	92	88	84	81	77	73	70	66	63	60	57	53	50	47	44	42	39	36	33	31	28	26	23	21
88	100	96	92	88	85	81	77	74	70	67	64	61	57	54	51	48	46	43	40	37	35	32	30	27	25	22
90	100	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24
92	100	96	92	89	85	82	78	75	72	68	65	62	59	56	53	50	48	45	42	40	37	35	32	30	28	25
94	100	96	93	89	85	82	79	75	72	69	66	63	60	57	54	51	49	46	43	41	38	36	33	31	29	27
96	100	96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	47	44	42	39	37	35	32	30	28
98	100	96	93	89	86	83	79	76	73	70	67	64	61	58	56	53	50	48	45	43	40	38	36	34	32	29
100	100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30
102	100	96	93	90	86	83	80	77	74	71	68	65	62	60	57	55	52	49	47	45	42	40	38	36	34	32
104	100	97	93	90	87	83	80	77	74	71	69	66	63	60	58	55	53	50	48	46	43	41	39	37	35	33
106	100	97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	36	34
108	100	97	93	90	87	84	81	78	75	72	70	67	64	62	59	57	54	52	49	47	45	43	41	39	37	35
110	100	97	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	52	50	48	46	44	42	40	38	36
112	100	97	94	90	87	84	81	79	76	73	70	68	65	63	60	58	55	53	51	49	47	44	42	40	38	36
114	100	97	94	91	88	85	82	79	76	74	71	68	66	63	61	58	56	54	52	49	47	45	43	41	39	37
116	100	97	94	91	88	85	82	79	76	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38
118	100	97	94	91	88	85	82	79	77	74	72	69	67	64	62	59	57	55	53	51	49	47	45	43	41	39
120	100	97	94	91	88	85	82	80	77	74	72	69	67	65	62	60	58	55	53	51	49	47	45	43	41	40

### HOW TO USE THE HYGROMETER TABLE

Suppose the dry bulb temperature reads 72° and the wet bulb temperature is 62°. The difference between the wet and dry thermometers is therefore 10°. Under the column head "Air Temperature" locate the "72" line; then follow over to the right until you reach the vertical column headed "10". This gives the figure "57", indicating a relative humidity of 57%.

**NOTE:** To prevent clogging the wick only distilled water should be used in the water reservoir.



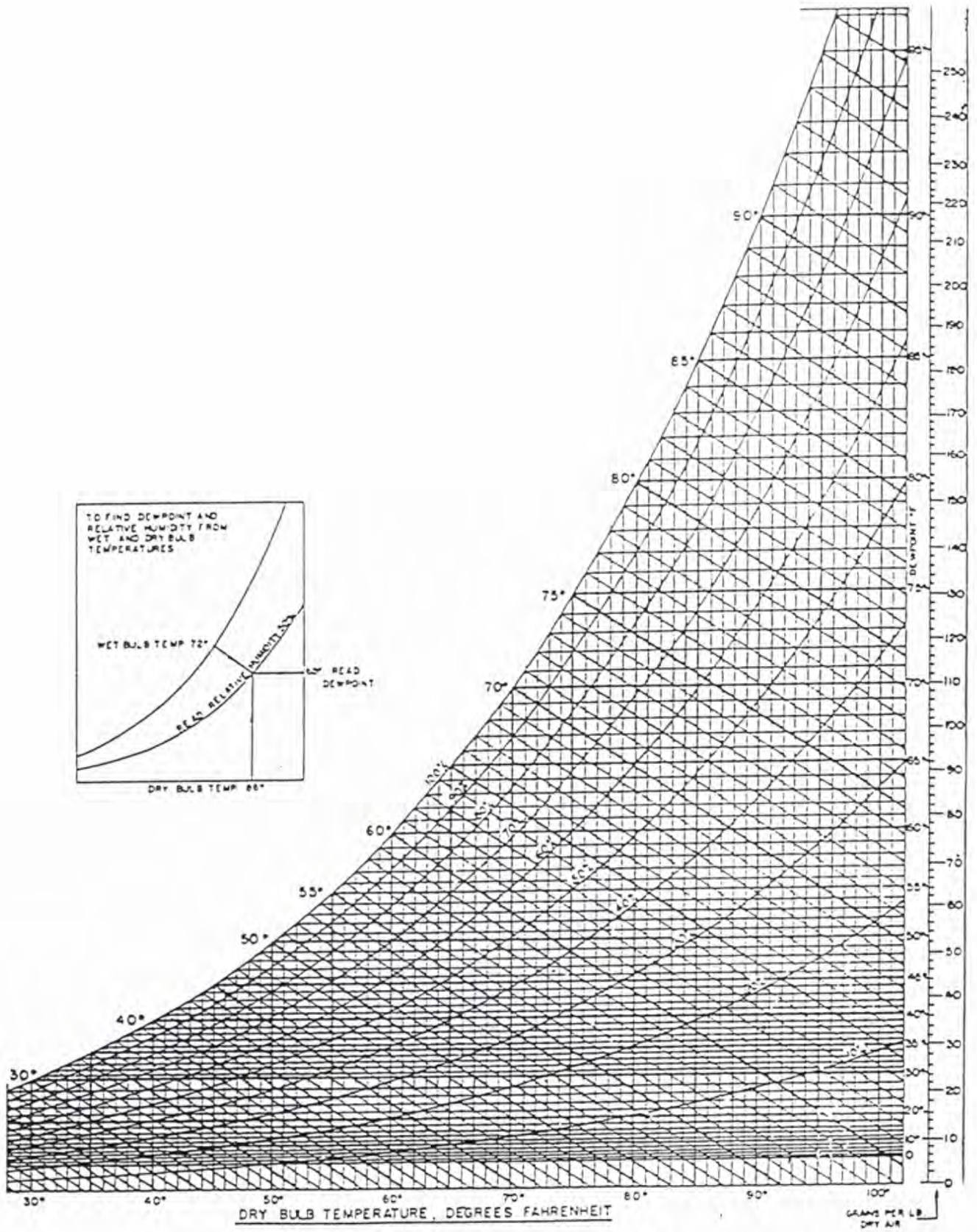


Figure Psychrometric Chart