SEPTEMBER 25, 1991

TEST REPORT #91427

VERIFICATION TEST

PART NUMBER: SNM-100-BK-T (SHUNT)

SAMTEC CORPORATION

APPROVED BY: MAX PEEL
PRESIDENT AND DIRECTOR OF ADVANCED RESEARCH
CONTECH RESEARCH, INC.

Contech Research

CERTIFICATION

This is to certify that the evaluation described herein was designed and executed by personnel of Contech Research, Inc. It was performed with the concurrence of Samtec Corporation of New Albany, IN, who was the test sponsor.

All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to MIL-STD-45662, as applicable.

All data, raw and summarized, analysis and conclusions presented herein are the property of the test sponsor. No copy of this report, in part or in full, shall be forwarded to any agency, customer, etc., by Contech Research without the written approval of the sponsor.

Max Peel
President

MP/lo

SCOPE

To perform verification testing on shunts as manufactured and submitted by the test sponsor, Samtec Corporation.

TEST SAMPLES AND PREPARATION

1. The following test samples were submitted by the test sponsor, Samtec Corporation, for the evaluation to be performed by Contech Research, Inc.

   a) Shunt, Part Number SNM-100-BK-T
   b) Header, Part Number TMS-150

2. Unless otherwise indicated, all materials were certified by the manufacturer to be in accordance with the applicable product specification.

3. The test samples as submitted were certified by the manufacturer as being fabricated and assembled utilizing normal production techniques common for this type of product and inspected in accordance with the quality criteria as established for the product involved.

4. The test samples were tested not mounted to printed circuit boards.

5. All test samples were coded and identified to maintain continuity throughout the test sequences.

6. The test samples were not cleaned prior to testing.

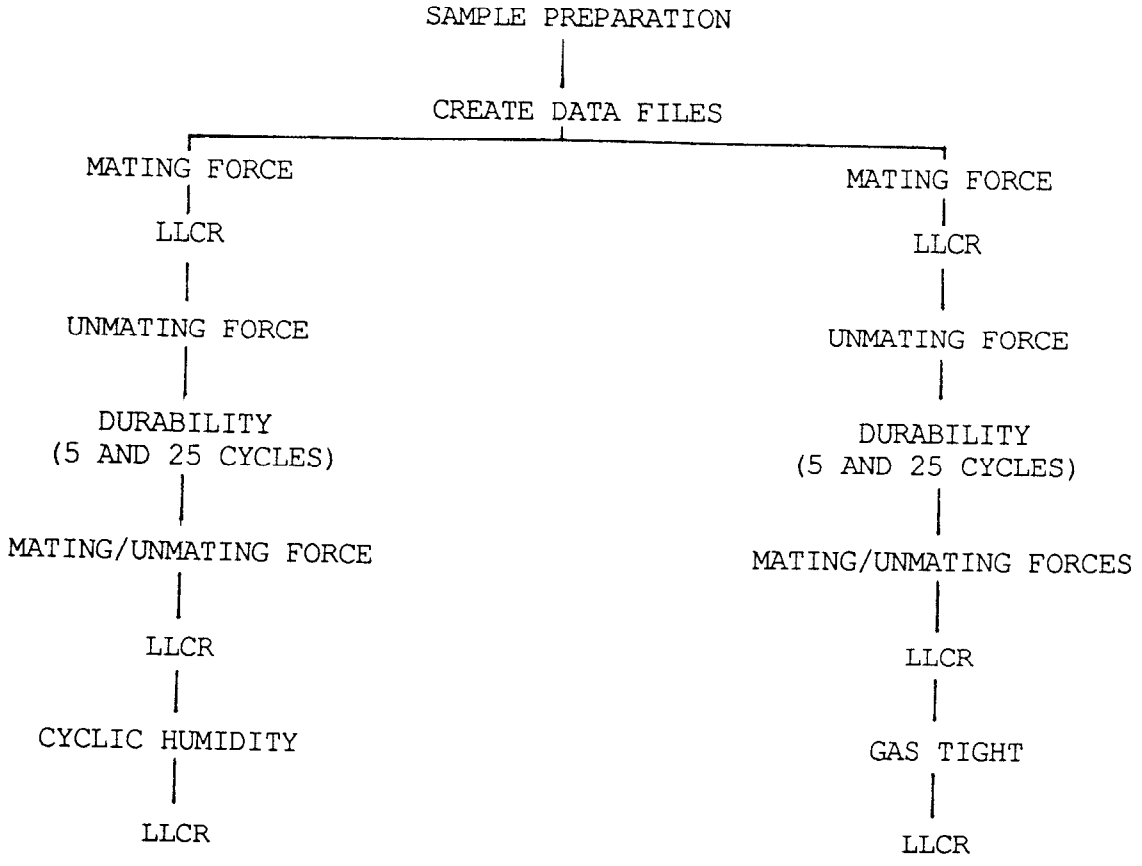
7. Unless otherwise specified in the test procedures used, no further preparation was used.

8. All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to MIL-STD-45662, as applicable.

TEST SELECTION

See Test Plan Flow Diagram, Figure #1, for test sequences used.

FIGURE #1



LLCR = Low Level Circuit Resistance

Contech Research

PRECONDITIONING AND MONITORING TESTS

DURABILITY

This is a preconditioning sequence which is used to induce the type of wear on the contacting surfaces which may occur under normal service conditions. The connectors are mated and unmated a predetermined number of cycles. Upon completion, the units being evaluated are exposed to the environments as specified to assess any impact on electrical stability resulting from wear or other wear dependent phenomenon.

This type of preconditioning sequence is also used to mechanically stress the connector system as would normally occur in actual service. This sequence in conjunction with other tests is used to determine if a significant loss of pressure occurs from said stresses, which in turn, may result in an unstable electrical condition to exist.

LOW LEVEL CIRCUIT RESISTANCE

To evaluate contact resistance characteristics of the contact systems under conditions where applied voltages and currents do not alter the physical contact interface and will detect oxides and films which degrade electrical stability.

This attribute was monitored after each preconditioning and/or test exposure in order to determine said stability of the connector material systems as they progress through the applicable test sequences.

The electrical stability of the system is determined by comparing the resistance value after a given test exposure to its initial value (prior to any exposure). The difference is the change in resistance occurring whose magnitude establishes the stability of the interface being evaluated.

The test is performed with a four wire system. The test is performed in accordance with MIL-STD-1344, Method 3002 with a 100 milliamp maximum test current and an open circuit voltage of 20 millivolts. Measurements are taken in the forward and reverse direction and averaged. Voltage probes were placed on the header pins approximately 0.075 inches from the housing.

TEST RESULTS

Cyclic Humidity

PROJECT NO.:	91427	SPECIFICATION:	N/A
PART NO.:	SNM-100-BK-T	PART DESCRIPTION:	Shunt
SAMPLE SIZE:	20 Shunts	TECHNICIAN:	SR
START DATE:	9/11/91	COMPLETE DATE:	9/23/91
ROOM AMBIENT:	22°C	RELATIVE HUMIDITY:	65%
EQUIPMENT ID#:	27, 52, 114, 206, 233, 251, 266		

HUMIDITY (THERMAL CYCLING)

PURPOSE:

To evaluate the impact on electrical stability of the contact system when exposed to any environment which may generate thermal/moisture type failure mechanisms such as:

a) Fretting corrosion due to wear resulting from micromotion, thermal cycling induces micromotion between contacting surfaces and humidity accelerates the oxidation process.

b) Oxidation of wear debris resulting from induced micromotion which may have become entrapped between the contacting surfaces

c) Failure mechanisms resulting from a wet oxidation process.

d) This test obtains added effectiveness in employment of temperature cycling that provides a breathing action, inducing corrosion processes, and the introduction of moisture into partially sealed test samples. This condition imposes a vapor pressure on the samples which constitutes the major force behind the moisture migration and penetration.

PROCEDURE:

1. Initial mating force was performed at a mating rate of 1.0 inch per minute.

2. Initial low level circuit resistance was performed.

3. Initial unmating force was performed.

4. The test samples were mated and unmated five times on half of the sample group and 25 times on the balance of the samples. Cycle rate was one cycle/eight seconds.

5. The mating and unmating forces were measured on the final cycle of durability.

6. Low level circuit resistance was performed in accordance with MIL-STD-1344, Method 1002, Procedure II with the following conditions.

7. Test Conditions:

a)	Relative Humidity	:	90% to 95%
b)	Temperature Conditions	:	25°C to 65°C
c)	Mating Conditions	:	Mated
d)	Mounting Conditions	:	Unmounted
e)	Duration	:	240 hours
f)	Cycle Duration	:	24 hours

8. Final low level circuit resistance was performed.

REQUIREMENTS:

1. There shall be no evidence of physical deterioration of the test samples as tested.

2. The low level circuit resistance shall be measured and recorded.

3. Mating and unmating forces shall be measured and recorded.

RESULTS:

1. The test samples as tested showed no evidence of physical deterioration.

2. The following is a summary of the data observed:

LOW LEVEL CIRCUIT RESISTANCE
(Milliohms)

Durability: 5 Cycles	Avg.	Max	Min.	Avg. Change	Max Change	Std. Dev.
Initial	11.0	11.6	10.6	---	---	---
After Durability	10.6	11.4	10.2	- 0.4	+ 0.1	0.3
After Humidity	12.7	16.3	10.8	+ 1.7	+ 5.2	1.8
Durability: 25 Cycles						
Initial	11.4	12.1	10.7	---	---	---
After Durability	11.4	12.0	10.6	0.0	+ 0.8	0.6
After Humidity	15.4	18.3	11.9	+ 4.0	+ 7.5	2.2

3. See pages 9a thru 9b for individual data points.

RESULTS -- Continued:

4. The following is a summary of the data observed:

	MAX MATING FORCE (Kg)	MIN. UNMATING FORCE (Kg)
Initial	0.261 (9.2 oz)	0.139 (4.9 oz)
After 5 Cycles	0.280 (9.9 oz)	0.187 (6.6 oz)
Initial	0.266 (9.4 oz)	0.130 (4.6 oz)
After 25 Cycles	0.262 (9.2 oz)	0.187 (6.6 oz)

5. See page 9c for individual data points.

Project #: 91427
Customer: SAMTEC
Product: SHU.SNM-100-BK-T/HEAD.TMS-150
Description: 10 POS.DUR.5X/HUMIDITY CYCL.

Spec: MIL-SDT-1344-3002
SubGroup: #1
File #: 142701
Print Date: 23Sep91

Open circuit voltage: 20 millivolts

Test current: 100 milliamps

Units: milliohms
Delta values

Temp °C	+22	+22	+20
R.H.%	65	57	60
Date	11Sep91	12Sep91	23Sep91
Pos ID	INITIAL	DUR.5X	HUMIDITY
1-1	11.1	-0.6	+0.2
1-2	11.0	-0.6	-0.2
1-3	11.1	-0.5	-0.2
1-4	11.5	-0.1	+2.5
1-5	10.6	+0.1	+0.6
1-6	11.1	-0.3	+5.2
1-7	10.6	-0.4	+1.2
1-8	10.8	-0.4	+4.2
1-9	10.7	-0.5	+1.4
1-10	11.6	-0.8	+2.5
HIGH	11.6	+0.1	+5.2
LOW	10.6	-0.8	-0.2
AVG	11.0	-0.4	+1.7
STD DEV	0.3	0.3	1.8
OPENS	0	0	0
INITIALS	S-R	S-R	S-R

NOTES:

1 - An asterisk (*) indicates an open circuit or a value greater than 2 ohms.

LOW-LEVEL CONTACT RESISTANCE

Project #: 91427
Customer: SAMTEC
Product: SHU.SNM-100-BK-T/HEAD.TMS-150
Description: 10 POS.DUR.25X HUMIDITY CYCL.

Spec: MIL-SDT-1344-3002
SubGroup: #1
File #: 142702
Print Date: 23Sep91

Open circuit voltage: 20 millivolts

Test current: 100 milliamps

Units: milliohms
Delta values

Temp °C	+22	+22	+20
R.H.%	65	57	60
Date	11Sep91	12Sep91	23Sep91
Pos ID	INITIAL	DUR.25X	HUMIDITY
2-1	11.0	+0.8	+4.8
2-2	11.5	-0.1	+3.1
2-3	10.7	+0.2	+3.5
2-4	11.5	-0.8	+0.4
2-5	11.2	+0.2	+6.6
2-6	12.1	-0.6	+1.3
2-7	11.4	+0.4	+3.1
2-8	11.5	-0.9	+5.0
2-9	10.8	+0.5	+7.5
2-10	11.9	+0.1	+4.4
HIGH	12.1	+0.8	+7.5
LOW	10.7	-0.9	+0.4
AVG	11.4	-0.0	+4.0
STD DEV	0.4	0.6	2.2
OPENS	0	0	0
INITIALS	S-R	S-R	S-R

NOTES:
1 - An asterisk (*) indicates an open circuit or a value greater than 2 ohms.

MATING AND UNMATING FORCE
(MIL-STD-1344, METHOD 2013)

PROJECT NO. 91427 SPEC — PAR. NO. —

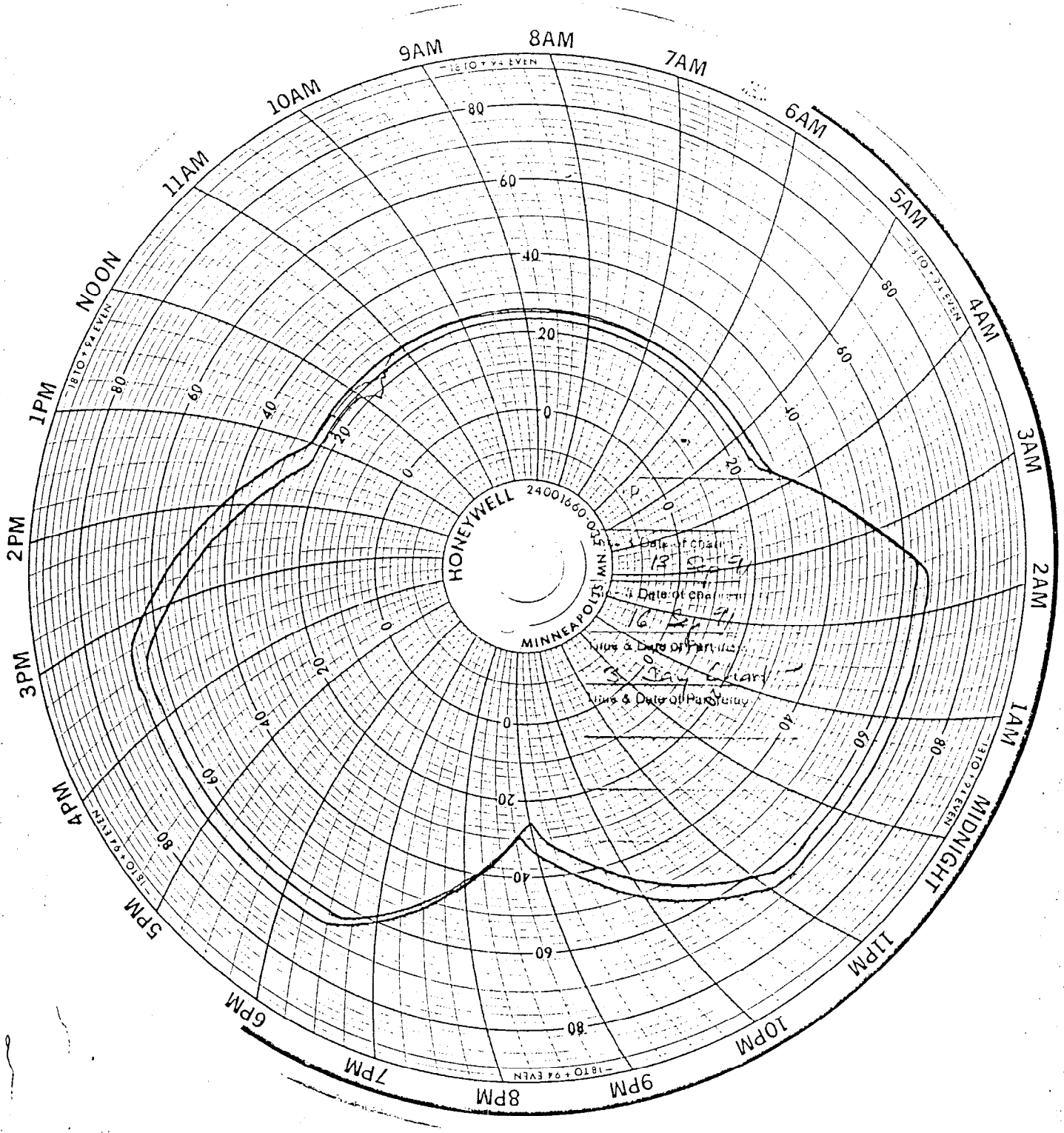
CUSTOMER SAMTEC CR T.P. — TECH S-R

EQUIP. ID. 52-114-206 SAMPLE SIZE 2

REQUIREMENT RECORD UNIT= KGRAMS

START	11	SEP	91								
FINISH	12	SEP	91								
TEMP	22 C										
R.H.	65%										
SUB GP	1										
SAMPLE ID	MATING INITIAL	UNMATING INITIAL	MATING 5X	UNMATING 5X		SAMPLE ID-#	MATING INITIAL	UNMATING INITIAL	MATING 25X	UNMATING 25X	
CONN. # 1 POS. # 1	.252	.168	.251	.234		CONN. 2 POS. # 1	.265	.143	.259	.245	
2	.246	.155	.263	.225		2	.266	.157	.216	.244	
3	.250	.182	.208	.238		3	.232	.134	.251	.270	
4	.224	.142	.221	.209		4	.247	.144	.262	.291	
5	.261	.165	.280	.215		5	.238	.158	.234	.205	
6	.228	.153	.203	.187		6	.200	.137	.201	.189	
7	.225	.147	.251	.230		7	.232	.151	.212	.198	
8	.234	.139	.242	.202		8	.224	.130	.228	.234	
9	.217	.157	.267	.221		9	.223	.145	.243	.205	
10	.223	.158	.248	.205		10	.236	.156	.204	.187	

COMMENT: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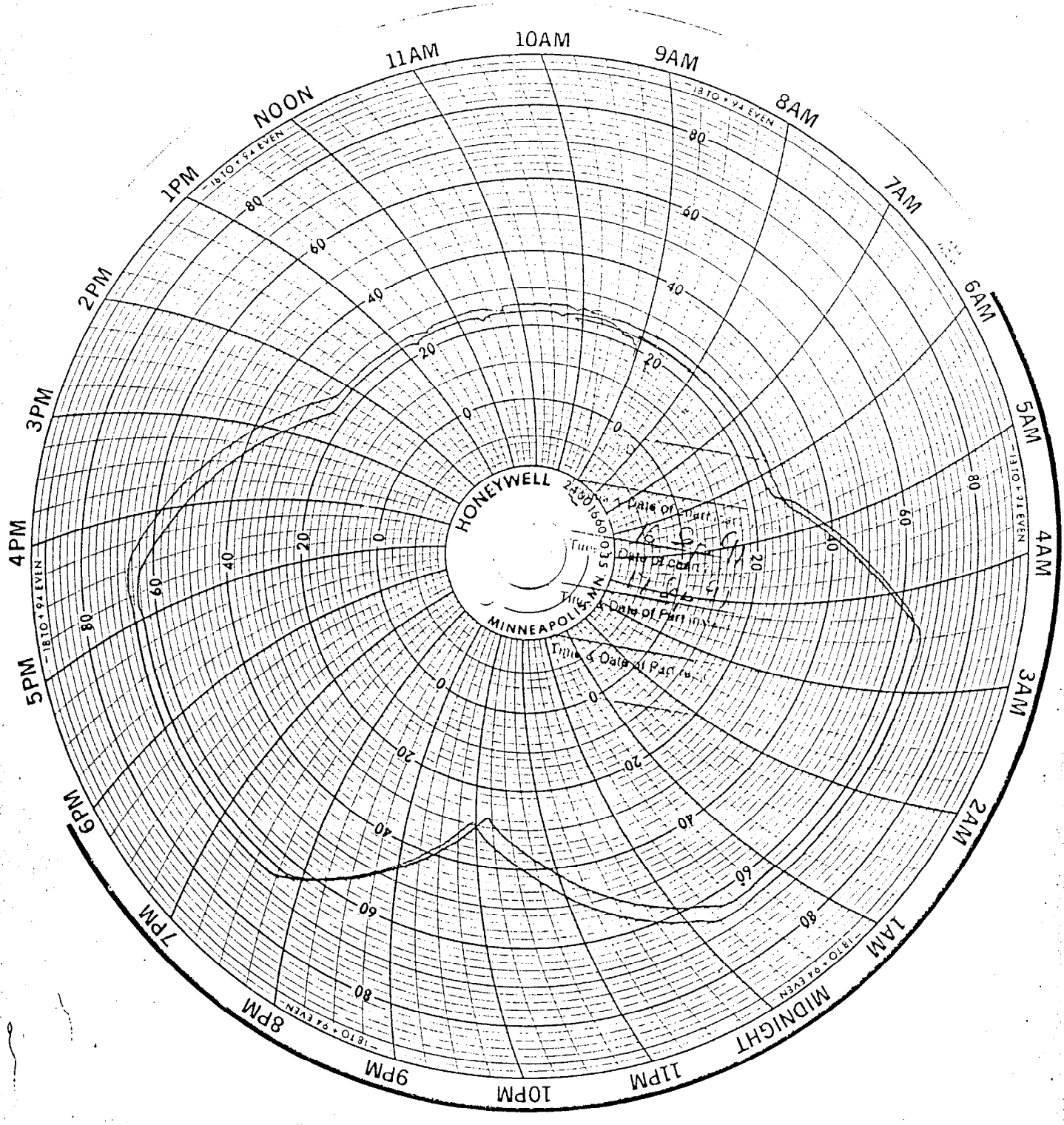
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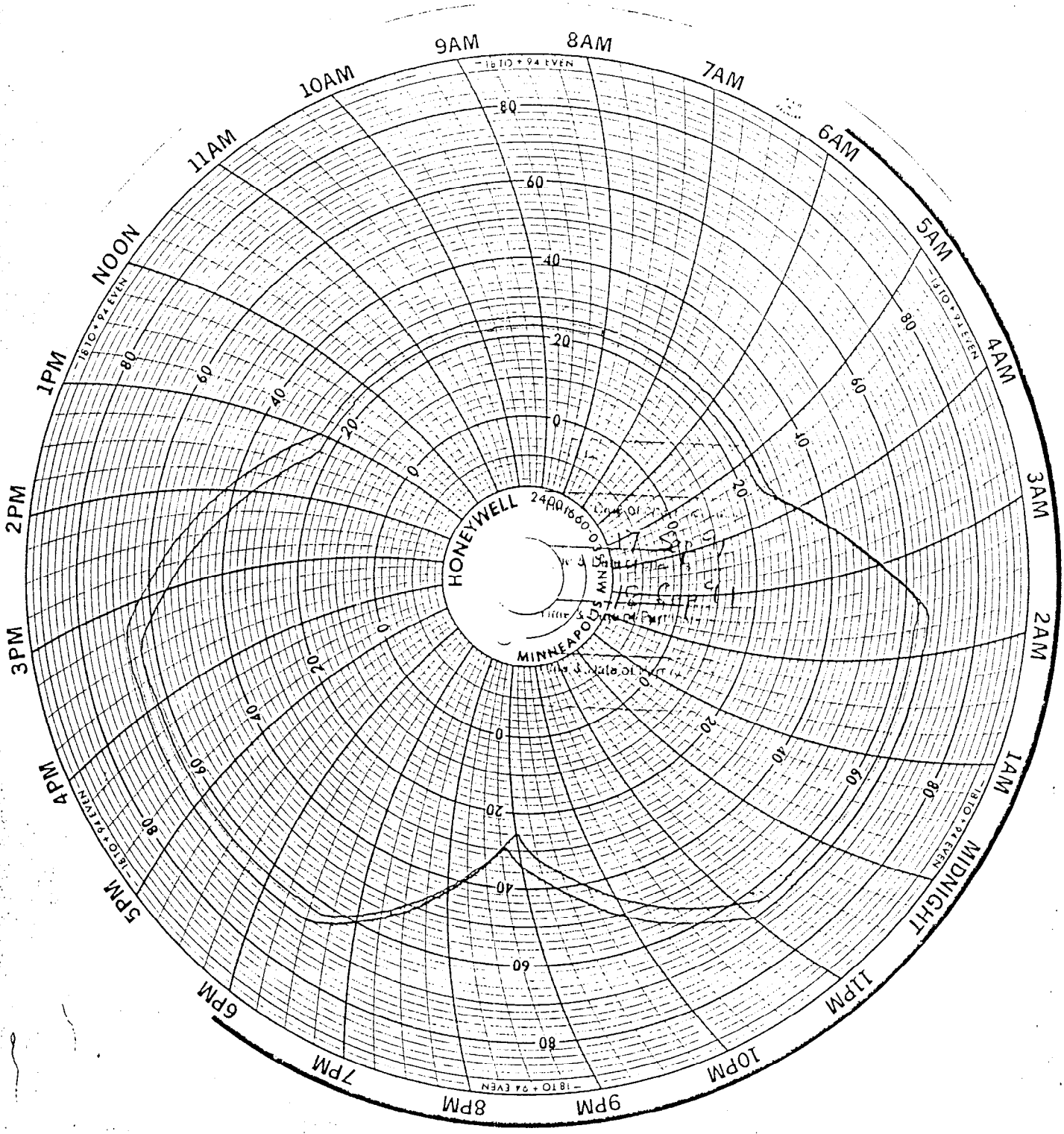
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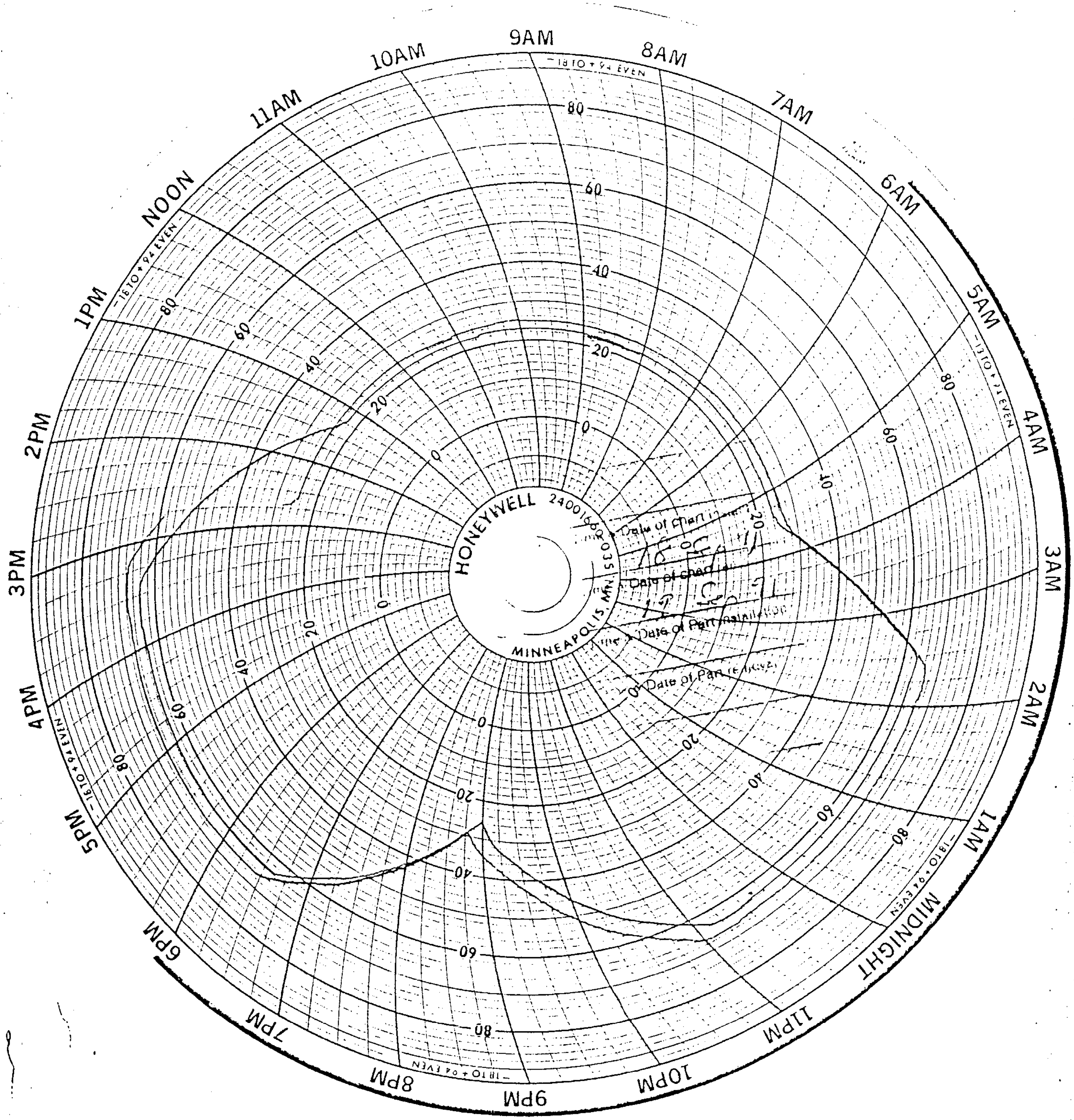
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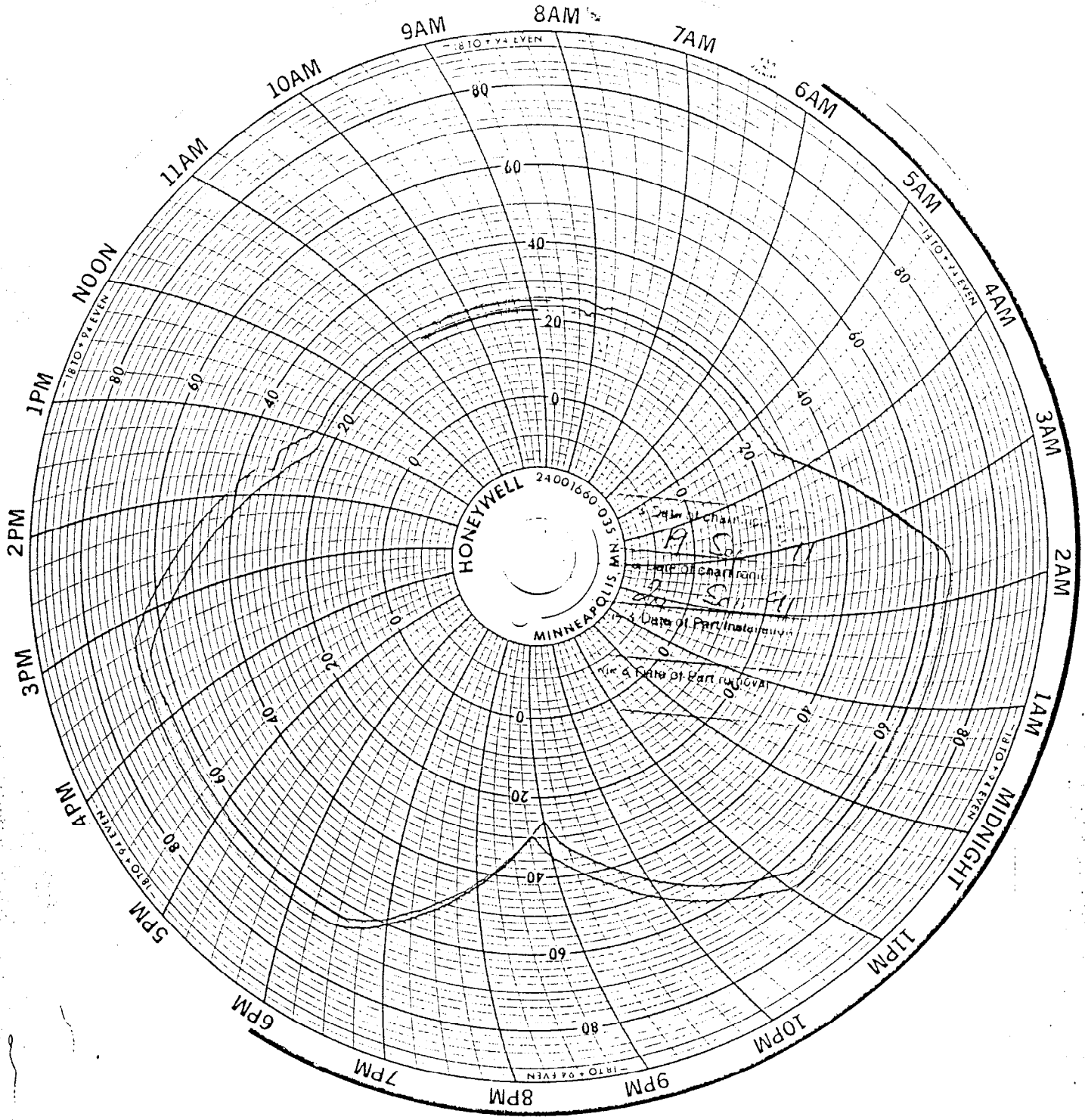
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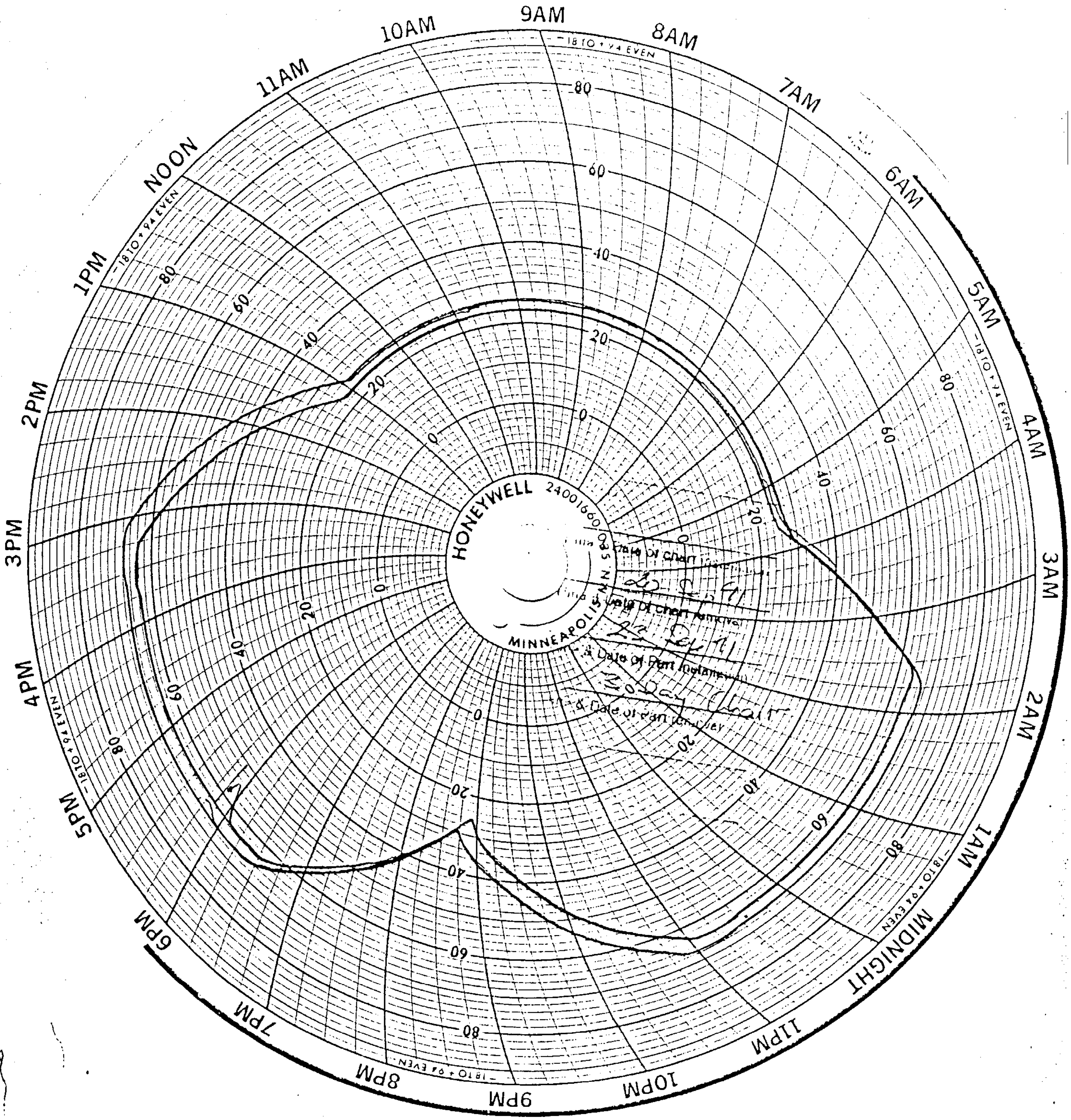
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TEST RESULTS

Gas Tight

PROJECT NO.:	91427	SPECIFICATION:	N/A
PART NO.:	SNM-100-BK-T	PART DESCRIPTION:	Shunt
SAMPLE SIZE:	20 Shunts	TECHNICIAN:	SR
START DATE:	9/13/91	COMPLETE DATE:	9/18/91
ROOM AMBIENT:	22°C	RELATIVE HUMIDITY:	56%
EQUIPMENT ID#:	52, 114, 233, 251, 280, Applicable Glassware		

GAS TIGHT

PURPOSE:

To evaluate the integrity of the contact interface by assessment of the gas tight characteristics of the contacting surfaces. The gas tight characteristic is the ability of contacting surfaces to prevent harsh environment from penetrating between them and forming oxides and/or films which will degrade electrical performance.

PROCEDURE:

1. Initial mating force was performed at a mating rate of 1.0 inch per minute.

2. Initial low level circuit resistance was performed.

3. Initial unmating force was performed.

4. The test samples were mated and unmated five times on half of the sample group and 25 times on the balance of the samples. Cycle rate was one cycle/eight seconds.

5. The mating and unmating forces were measured on the final cycle of durability.

6. Low level circuit resistance was performed in accordance with MIL-STD-1344, Method 1002, Procedure II with the following conditions.

7. The test was performed in accordance with EIA RS-364, TP-36, Method I.

8. Test Conditions:

   a) Concentration : Nitric acid vapors
   b) Duration : 1.0 hour

9. Nitric acid was placed in the test chamber of a sufficient volume to result in saturation of the test chamber. The conditions were room ambient.

10. The test samples were placed in such a manner as not to be closer than 1" (25mm) from the wall of the test chamber and not closer than 3" (76mm) from the solution surfaces.

11. After exposure, the samples were removed from the test chamber and oven dried at 50°C for a minimum of one hour.

12. Within 60 minutes of drying, the final low level circuit resistance was measured and recorded. Measurements were performed with the test sample at room ambient.

13. Final low level circuit resistance was performed.

REQUIREMENTS:

1. The low level circuit resistance shall be measured and recorded.

2. Mating and unmating forces shall be measured and recorded.

RESULTS:

1. The following is a summary of the data observed:

LOW LEVEL CIRCUIT RESISTANCE
(Milliohms)

Durability: 5 Cycles	Avg.	Max	Min.	Avg. Change	Max Change	Std. Dev.
Initial	11.1	12.5	10.0	---	---	---
After Durability	11.8	13.6	10.6	+ 0.7	+ 1.8	1.1
After Humidity	18.8	22.7	15.1	+ 7.7	+11.1	1.8
Durability: 25 Cycles						
Initial	10.5	11.2	10.0	---	---	---
After Durability	11.6	13.5	10.3	+ 1.1	+ 2.9	1.1
After Humidity	24.5	35.5	13.7	+14.0	+25.4	7.7

2. See pages 13a thru 13b for individual data points.

RESULTS -- Contined:

3. The following is a summary of the data observed:

	MAX MATING FORCE (Kg)	MIN. UNMATING FORCE (Kg)
Initial	0.254 (9.0 oz)	0.134 (5.0 oz)
After 5 Cycles	0.275 (9.7 oz)	0.150 (5.3 oz)
Initial	0.258 (9.1 oz)	0.142 (5.0 oz)
After 25 Cycles	0.241 (8.5 oz)	0.195 (6.9 oz)

4. See page 13c for individual data points.

LOW-LEVEL CONTACT RESISTANCE

Project #: 91427
Customer: SAMTEC
Product: SHU.SNM-100-BK-T/HEAD-TMS-150
Description: 10 POS.DUR.5X/GAS TIGHT

Spec: MIL-SDT-1344-3002
SubGroup: 2 CONN.#1
File #: 142703
Print Date: 18Sep91

Open circuit voltage: 20 millivolts

Test current: 100 milliamps

Units: milliohms
Delta values

Temp °C	+22	+22	+22
R.H.%	56	66	65
Date	13Sep91	17Sep91	18Sep91
Pos ID	INITIAL	DUR.5X	GAS TIGT
1-1	11.2	+1.4	+7.4
1-2	10.2	+0.8	+4.9
1-3	11.6	+0.0	+11.1
1-4	10.6	+1.8	+8.0
1-5	10.0	+1.7	+10.4
1-6	10.6	+1.2	+7.5
1-7	11.0	+1.0	+7.2
1-8	12.5	-1.8	+7.1
1-9	10.8	-0.2	+7.7
1-10	12.5	+1.1	+6.0
HIGH	12.5	+1.8	+11.1
LOW	10.0	-1.8	+4.9
AVG	11.1	+0.7	+7.7
STD DEV	0.9	1.1	1.8
OPENS	0	0	0
INITIALS	S-R	S-R	S-R

NOTES:
1 - An asterisk (*) indicates an open circuit or a value greater than 2 ohms.

LOW-LEVEL CONTACT RESISTANCE

Project #: 91427
Customer: SAMTEC
Product: SHU.SNM-100-BK-T/HEAD.TMS-150
Description: 10 POS.DUR.25X/GAS TIGHT

Spec: MIL-SDT-1344-3002
SubGroup: 2 CONN.#2
File #: 142704
Print Date: 18Sep91

Open circuit voltage: 20 millivolts

Test current: 100 milliamps

Units: milliohms
Delta values

Temp °C	+22	+22	+22
R.H.%	56	66	65
Date	13Sep91	17Sep91	18Sep91
Pos ID	INITIAL	DUR.25X	GAS TIGT
2-1	10.4	+2.3	+16.6
2-2	10.9	+1.6	+18.2
2-3	10.3	+0.4	+8.9
2-4	10.0	+1.1	+23.4
2-5	10.6	+1.9	+13.8
2-6	10.1	+1.3	+25.4
2-7	10.9	+0.6	+17.9
2-8	11.2	-0.9	+2.5
2-9	10.4	+0.1	+8.1
2-10	10.6	+2.9	+4.7
HIGH	11.2	+2.9	+25.4
LOW	10.0	-0.9	+2.5
AVG	10.5	+1.1	+14.0
STD DEV	0.4	1.1	7.7
OPENS	0	0	0
INITIALS	S-R	S-R	S-R

NOTES:
1 - An asterisk (*) indicates an open circuit or a value greater than 2 ohms.

MATING AND UNMATING FORCE
(MIL-STD-1344, METHOD 2013)

PROJECT NO. 91427 SPEC _____ PAR. NO. —

CUSTOMER SAMTEC CR T.P. — TECH S-R

EQUIP. ID. 52-114 SAMPLE SIZE MEASURE 20 POSITIONS

REQUIREMENT RECORD UNIT: KGRAMS

START	13	SEP	91									
FINISH	16	SEP	91									
TEMP	22°C											
R.H.	56%											
SUB GP	2											
SAMPLE ID	MATING INITIAL	UNMATING INITIAL	MATING ~~INITIAL~~ 5X	UNMATING 5X		SAMPLE ID #	MATING INITIAL	UNMATING INITIAL	MATING 25X	UNMATING 25X	
CONN. #1 Pos. # 1	.225	.146	.222	.173		CONN. #2 Pos. #1	.224	.155	.226	.224	
2	.254	.165	.273	.236		2	.200	.171	.204	.216	
3	.219	.134	.260	.157		3	.246	.146	.237	.250	
4	.204	.150	.275	.224		4	.258	.158	.224	.265	
5	.212	.168	.225	.204		5	.208	.163	.236	.239	
6	.252	.151	.243	.188		6	.197	.144	.213	.234	
7	.196	.161	.235	.217		7	.213	.167	.202	.195	
8	.248	.164	.268	.162		8	.215	.170	.241	.201	
9	.222	.155	.254	.178		9	.237	.153	.225	.257	
10	.205	.167	.213	.150		10	.206	.142	.196	.220	

COMMENT:

Equipment List

ID#	Last Cal	Next Cal	Equipment Name	Manufacturer	Accuracy	Model #	Serial #	Freq Cal
27	5/9/91	11/9/91	Temp/Hum Cycle	Blue M Company	±1% of span	FR-256PC-1	F2-249	6 months
52			Drill Press Stand	Craftsman	N/A	25921	4001-2	N/A
114	5/21/91	11/21/91	Digital Force Gage	Chatillon	±.1%	DFG-2	3985	6 months
206	9/13/91	3/13/92	Digital Force Gage	Chatillon Company	±.25% of full scale	DFGRS-10	2346	6 months
233	5/31/91	11/30/91	Temp. Hum. Gage	Cole Parmer	±3%	3310-40	04	6 months
251			Computer System	Packard Bell	N/A	286	105670	N/A
266	5/16/91	11/16/91	Micro ohm meter	Keithley Company	See manual	580-1	472438	6 months
280	7/23/91	1/23/92	Micro Ohm Meter	Keithley Company	See manual	580	477845	6 months