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**CONVERSION OF ARJ CORP.
HOT CHAMBER**

FINAL REPORT

Contract no. 96/051

UNIDO's PROJECT NO. MP/IRA/94/403

March 1997

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TABLE OF CONTENTS

- 1 - SYNOPSIS
- 2 - INTRODUCTION
- 3 - ICRC HOT CHAMBER CHARACTERISTICS
- 4 - HOT CHAMBER, TECHNICAL CHARACTERISTICS
- 5 - ACTIVITIES
- 6 - SUPPLY PARTS AND MATERIAL
- 7 - ATTACHMENTS

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SYNOPSIS

Under supreme supervision of UNIDO the CFC phase project has been implemented in Iran to phase out 100 % ODS in five major Iranian White Industries.

The project No. MP/IRA/94/403 has been nominated to Islamic Republic of Iran for the Multilateral Fund for the implementation of The Montreal Protocol Financing.

The project was approved by Montreal Protocol Multilateral Fund executive committee. The project was actually started in November 1994, but the implementation of the project has been already started from January 1994, by recommendation of Montreal Protocol and request of Government of Islamic Republic of Iran, the refrigerant R134a was finally approved and selected by UNIDO as an alternative for refrigerant R12.

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INTRODUCTION

According to UNIDO contract No. 96/051 with Industrial Research Center Co. (ICRC) the existing Arj Corp. hot chambers facilities in Tehran will be converted and modified to phase out CFC-12 and suitable for R134a refrigerant to perform functionality and performance test of converted refrigerators and complying with ISO standards 7173, 8187, and 5155.

- 1 This contract has been executed according the requirements of Islamic Republic of Iran indicated in the country programme no UNEP/OZL. PRO/EX COM/10/24 dated 27 May 1993 prepared by UNDP.
- 2 The CFC phase out project in Arj Corp. Co. enables this company to convert the existing production line facilities and existing hot chambers into Non CFC production line, using R134a refrigerant.
- 3 The converted Hot Chamber Installations will provide more than sixteen data points in the refrigeration circuit this means more information and the ability of analyzing refrigeration system and new refrigerant effect.
- 4 The reconstructed Hot Chambers will be able to check and test two refrigerator and/or ref.-freezers units at the same time. The same equipment and data processing system, as will be used at Marvdasht plant test room will be installed in this chamber.
- 5 The immediate effect of this project at Arj Corp. is to perform all required check and tests, suitable for Ozone friendly Refrigerator & Freezers.

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ICRC Hot Chamber Characteristics

In order to convert Arj Corp. hot room facilities in Tehran, ICRC has provided following services:

- Supply of new equipment.
- Redesign of old equipment
- Delivery of technical drawings and software.
- Installation and commissioning.
- Start-up of the equipment and the technology.
- On-the-job training of the plant personnel.

With respect to ISO standards test requirements, and for the purpose of functionality and performance tests of the new redesigned Refrigerator and Ref.-Freezers using R134a refrigerants. The existing hot room in Arj Corp. has been converted and equipped in such a way to enable Arj Corp. to check and test at least two different models of refrigerators and freezers at ambient temperature 15 to 50 degree centigrade.

Following services have been provided to the project.

- a) Procurement of new test measurement and data processing equipment.
- b) Redesign and rebuilding of presently used equipments and installation.
- c) Installation, commissioning, trial operation, start-up and on-the-job training

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Arj Corp. HOT CHAMBER TECHNICAL SPECIFICATION

As previously mentioned, Arj Corp.'s main plant is located in Tehran and is producing 800 refrigerator daily, subsequently the hot chamber should be able to cover plant daily test requirement as well as other activities. Therefore, the converted hot chamber should respond to all test requirements and be able to meet ISO standards numbers 7371, 5155, 8187 as set forth in the contract and IJISI, Iranian standards numbers 254, 2482, 2818. The plant hot chamber technical specifications are as follows:

- Hot Chamber Dimension 4 mt. by 4.5 mt.
- Refrigerator test ability simultaneously, 4 units
- Ability to perform following operational tests and report:
 - 1 - Pull down test.
 - 2 - Continuous run test.
 - 3 - Cyclic run test.
 - 4 - Ice Freeze test.
 - 5 - Energy consumption test
- 16 Measuring points, including.
 - 1 - Humidity, one point.
 - 2 - Compressor Power, four points for each refrigerator.
 - 3 - Motor energy consumption, four points for each refrigerator.
 - 4 - Pressure measurement, two points.

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- 5 - Hot chamber air temperature reading, one point.
- 6 - Hot chamber relative humidity, one point.
- 7 - Supply Voltage, one point.

- Computerized graphical diagram of the refrigerator performance data sheet.
- Test measurement tolerance for temperature reading 0.3 degree centigrade.
- Computerized data processing system.
- Full color test sheet system reporting.

- On screen and data reporting system ability with following characteristics;

- 1 - Test number.
- 2 - Product name.
- 3 - Product model
- 4 - Product internal volume
- 5 - Compressor name
- 6 - Compressor model
- 7 - Compressor cooling capacity
- 8 - Compressor current
- 9 - Thermostat setting
- 10 - Thermostat type.
- 11 - Total test running time.
- 12 - Ambient temperature.
- 13 - Voltage rating
- 14 - Working percentage
- 15 - Evaporator mean air temperature
- 16 - Cabin mean temperature
- 17 - Evaporator bulb temperature

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- 18 - Crisper temperature.
- 19 - Actual compressor running time
- 20 - Energy consumption
- 21 - Compressor motor winding temperature
- 22 - Compressor shell temperature.
- 23 - Compressor discharge temperature.
- 24 - Condenser inlet temperature.
- 25 - Condenser out let temperature.
- 26 - Condenser mid temperature
- 27 - Evaporator inlet temperature
- 28 - Evaporator outlet temperature.
- 29 - Freezing temperature.
- 30 - Refrigeration system condition display.

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ACTIVITIES

The following activities were generally accomplished toward achievement of the contract requirement as set forth by UNIDO and the counterpart.

- 1 - .Planning for;
 - a) Hot chambers system management.
 - b) Hot chambers graphic display management.
 - c) Hot chambers calibration setting parameters.
 - d) Hot chambers test standards management
- 2 - Preparing material requirement list.
- 3 - Component and material supply source evaluation.
- 4 - Technical data collecting.
- 5 - Engineering drawing for electronic and electrical system
- 6 - Hot chamber design review.
- 7 - Data processing software planning.
- 8 - Data processing hardware planning.

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- 9 - Thermal amplification electronic cart design
- 10 - Pressure sensor amplification electronic cart design.
- 11 - Initial test of data loggers electronic cart.
- 12 - Initial connection of data loggers to the computers.
- 13 - Interface electronic cart design for PC and operating system.
- 14 - RTX3 electronic diagram design.
- 15 - RTX electronic diagram design.
- 16 - UNIDO, CRC - 386 design.
- 17 - UNIDO, TC- 100 design.
- 18 - UNIDO, in-out CRC design.
- 19 - Preparation of operating system display flow chart.
- 20 - Preparation of timer 1 flow chart.
- 21- Activities at home office and project area:
 - Visiting plant.
 - Visiting and coordinating with UNDP office in Tehran four times.

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- Technical negotiation with Arj Corp. engineers in Tehran headquarter in order to coordinate activities in Tehran
- Visiting Tehran hot chamber several times in order to coordinate activities.

21 -1 - Reviewing and evaluating the existing hot chamber for the purpose of:

- a) Hot Chamber Heat Control Design;
- b) Hot Chamber Heat Capacity;
- c) Hot Chamber Heat leaks;
- d) System Control Placement;
- e) Refrigerator Unit Placement;

21 - 2 - Following steps were taken to manufacture hot chamber hoods:

- a) Designing;
- b) Fabricating;
- c) Preparation;
- d) Hood Installation;
- e) Sensor Preparation;
- f) Sensor Check and Test;
- g) Sensor Installation;
- h) Wiring;
- l) Wiring Control;
- k) Selecting Blower and Fans;
- l) Blower Check and test;
- m) Blower Installation;

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21 - 3 - Following Components and parts were designed and manufactured:

- a) Complete Data Logger System;
- b) Thermal Amplifier;
- c) Electrical Control Panel;
- d) Electronic Control Panel;
- e) Complete Heat Control System;
- f) Hot Air Circulating System;
- g) Voltage Regulator for 220 Volts and 50 Htz;
- h) Refrigerator Unit Power Supply;

21 - 4 - Following Components were installed in hot chambers at Tehran Service Center:

- a) Data Programme Logger in CPU;
- b) Data Logger Check and Test;
- c) Power Supply Installation;
- d) Refrigerator Power Supply Installation;
- e) Hot air circulation hoods;
- f) Electrical Control Panel;
- g) Main Control Panel;

21 - 5 - Initial Check and test of thermal measurement system and relevant sensors.

21 - 6 - Man Hours spent at home office:

- | | | |
|----------------|-----|-----------|
| a) Engineer: | 100 | Man Hours |
| b) Technician: | 250 | Man Hours |

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- c) Technical Assistance: 800 Man Hours
 (Direct Labor, by helpers)
- d) Management: 120 Man Hours

21 - 7 - Project Area.

- a) Two engineers for the execution of the contract and converting of existing hot chamber facilities at plant for two man months;
- b) Two technicians for the execution of the contract and converting of existing hot chamber facilities at plant for two man months;

21 - 8 - Evaluating operating condition of the hot chamber to insure proper performance, and giving corrective action to correct discrepancies.

21 - 9 - Installation of the new refrigeration system in the hot chamber and regulate air flow system, in order to get desired ambient temperature.

21 -10 - Design, manufacturing and installing new logical evaluating system, this new system will improve the efficiency of the hot chamber and will enable the operator to determine automatically all the possible discrepancies, that may occur during the operation of the system.

21 - 11 - Redesign and replacement of previously installed hood and installing the hood in the new position.

21 - 12 - System optimizing, in order to prolong system retirement life.

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- 21 - 13 - System calibration in order to ensure the accuracy of the reading data and improve management information system.
- 21 - 14 - Performing necessary modification to the air flow circulation in order to ensure a stable and steady air temperature in the all hot chamber space.

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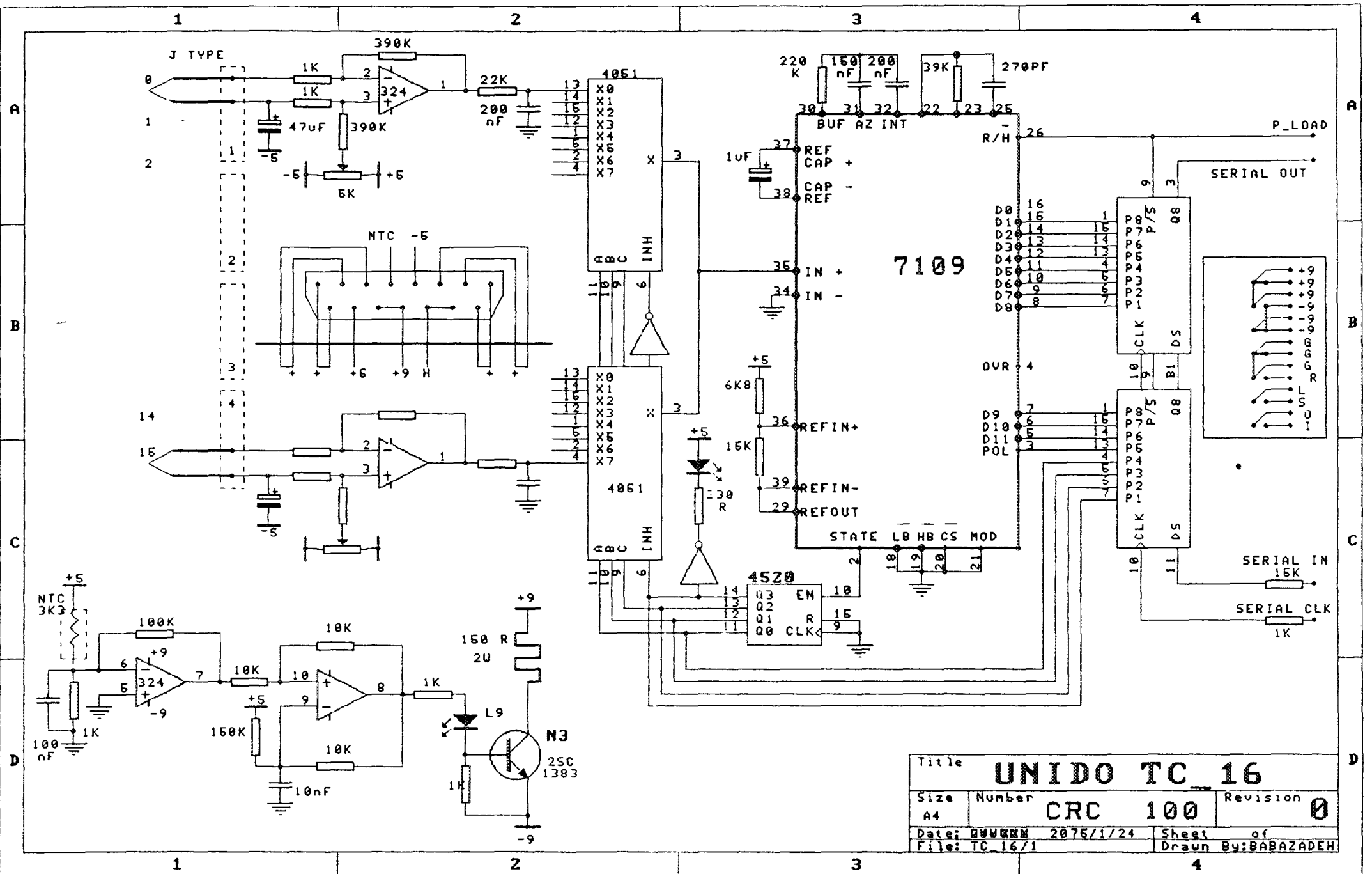
SUPPLY PARTS AND MATERIALS

In order to fabricate components and electronic kits following material and parts have been purchased so far.

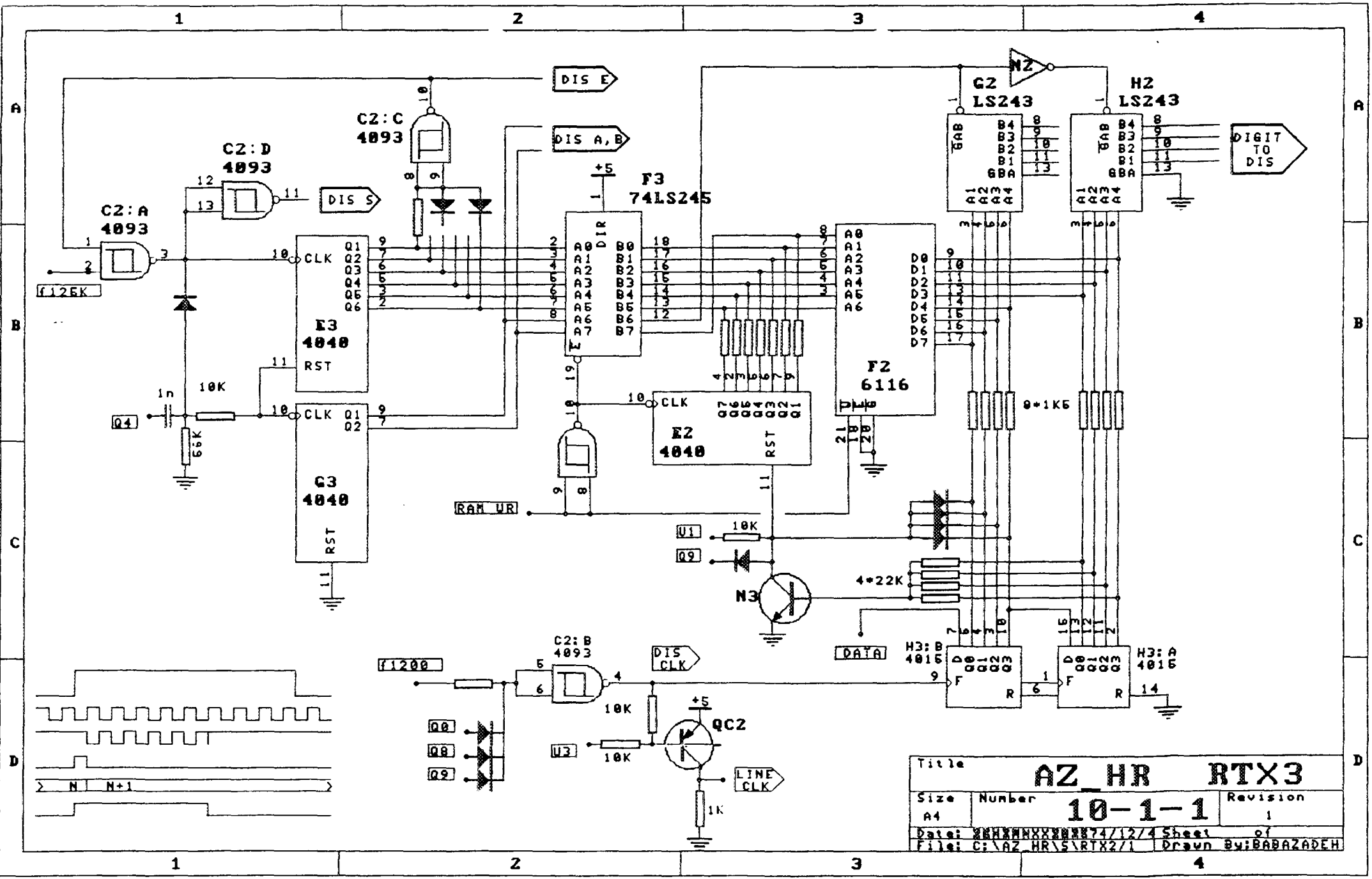
- 1 - Thermocouple type "J " for measuring temperature from - 30 to + 200 degree centigrade. 20 each
- 2 - Electronic pressure measurement sensor 1 each
- 3 - Electronic data logger cart for temperature measurement 6 each
- 4 - Electronic data logger cart for humidity measurement 6 each
- 5 - Z80 micro processor IC for system integral management.
- 6 - Electronic parts consist of resistor, IC, capacitor, and diode, 2760 each.
- 7 - Following Components and Parts were installed and procured for each hot chamber:
 - a) Heat generator;
 - b) Air Blower;
 - c) Three Phase Thermal Control System(10 KW) with relevant integrated analog control (0 to 100 % rated);

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- d) Refrigerator Compressor Motor Current Measuring System Data Logger;
- e) Sensor Socket Support Bracket;
- f) Socket Channels;
- g) One room air conditioner units for maintaining hot chamber ambient temperature at 18 and 32 degree C;
- h) One Humidifier unit for hot chamber;
- I) Control panel consist of 16 thermal sensors with +90 to -25 C accuracy.
- J) Three electrical sensors for measurment of electrical current, Cos. ϕ , power and energy.
- K) Two thermal and humidity contrl panel for control of hot chamber condition.
- L) 16 additional data loger.
- M) Data loger for collecting 128 thermal data and 16 electrical data and 16 humidity data.
- N) 16 out put control line with additional divice for insulation meaurment and compressor test.
- O) 4 supply transformers.
- P) 32 sensor cabls with 2 mt. Length with 4 sockets.
- Q) Data loger channel.
- R) A complete soft ware programme to be used with windows 3.11.

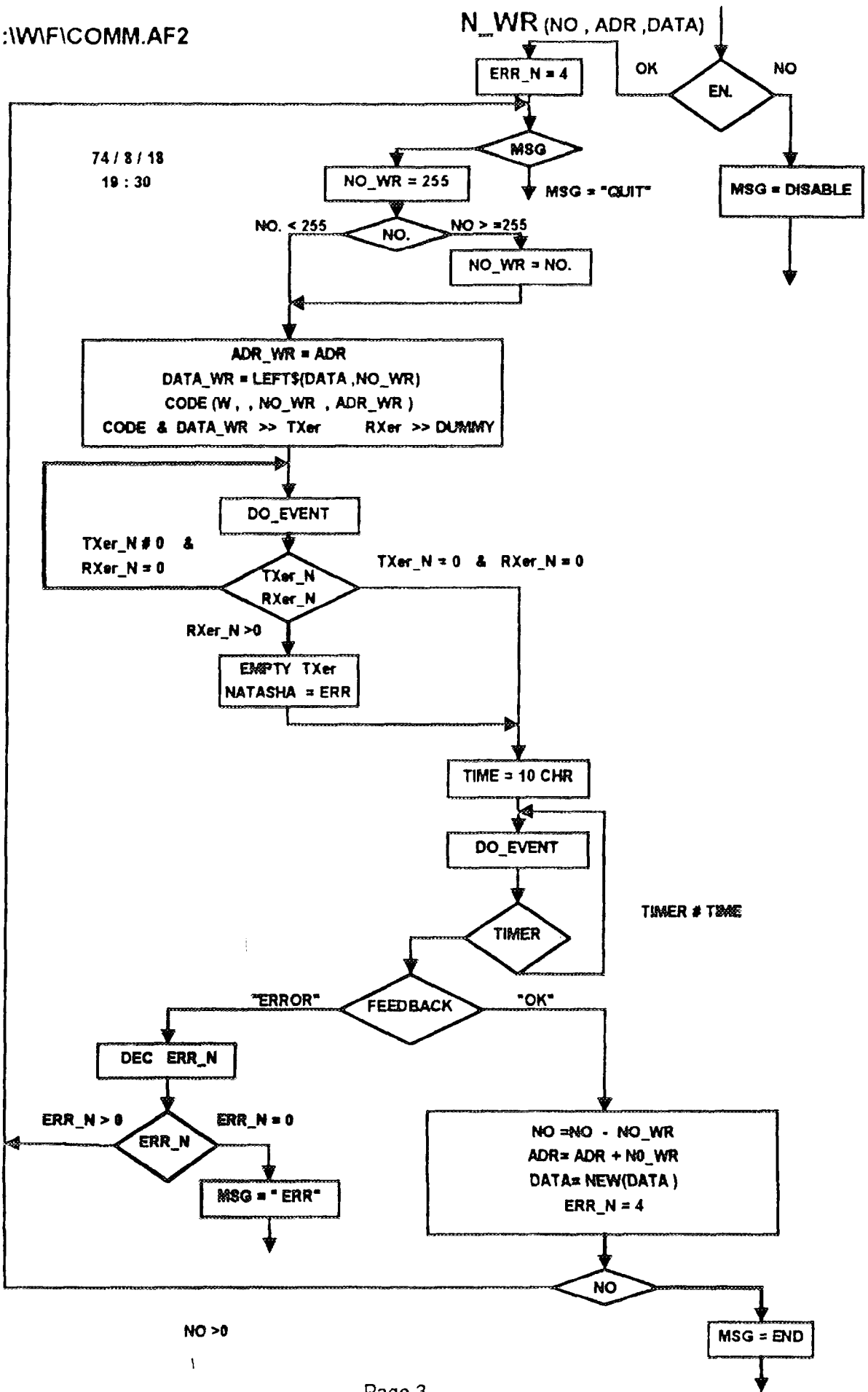


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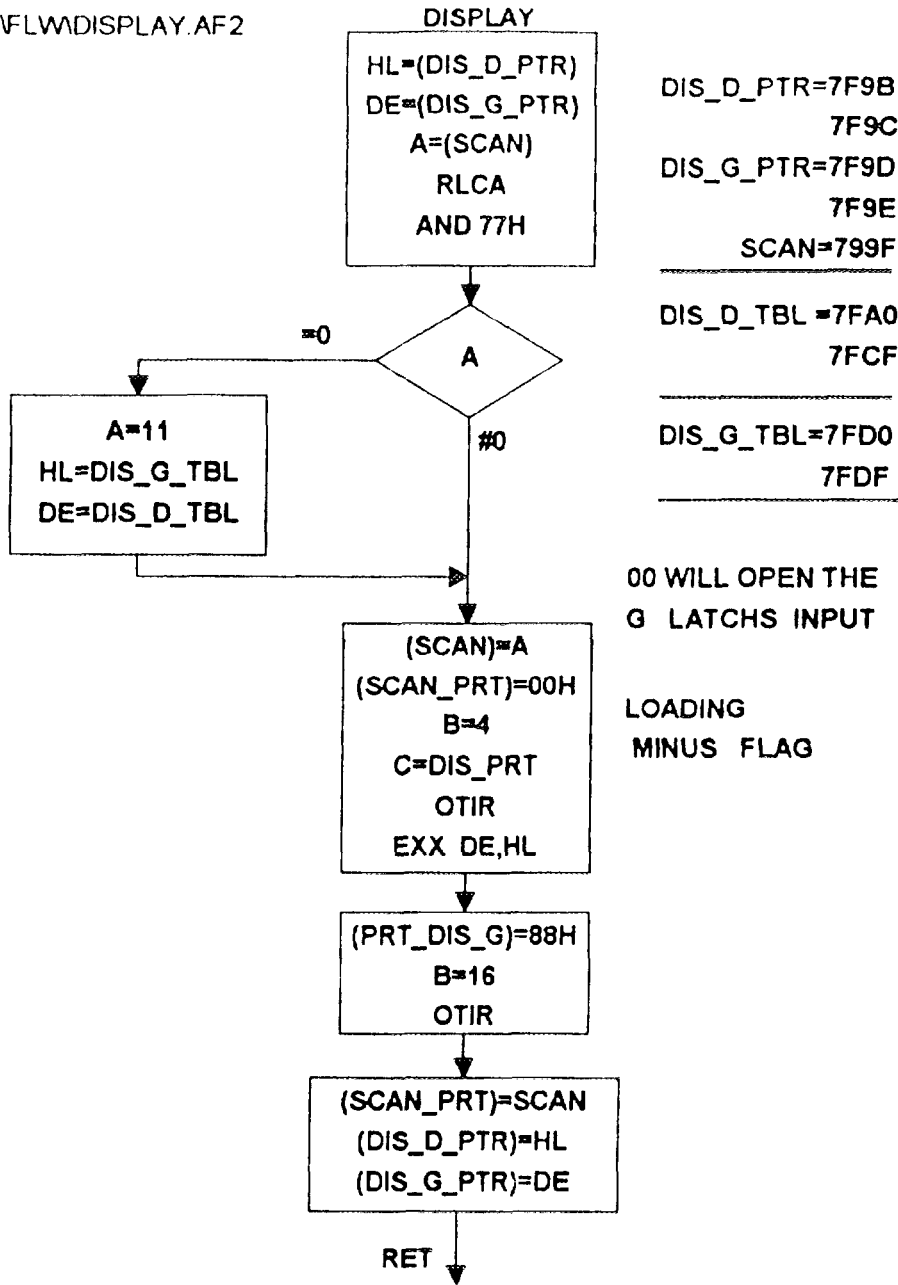
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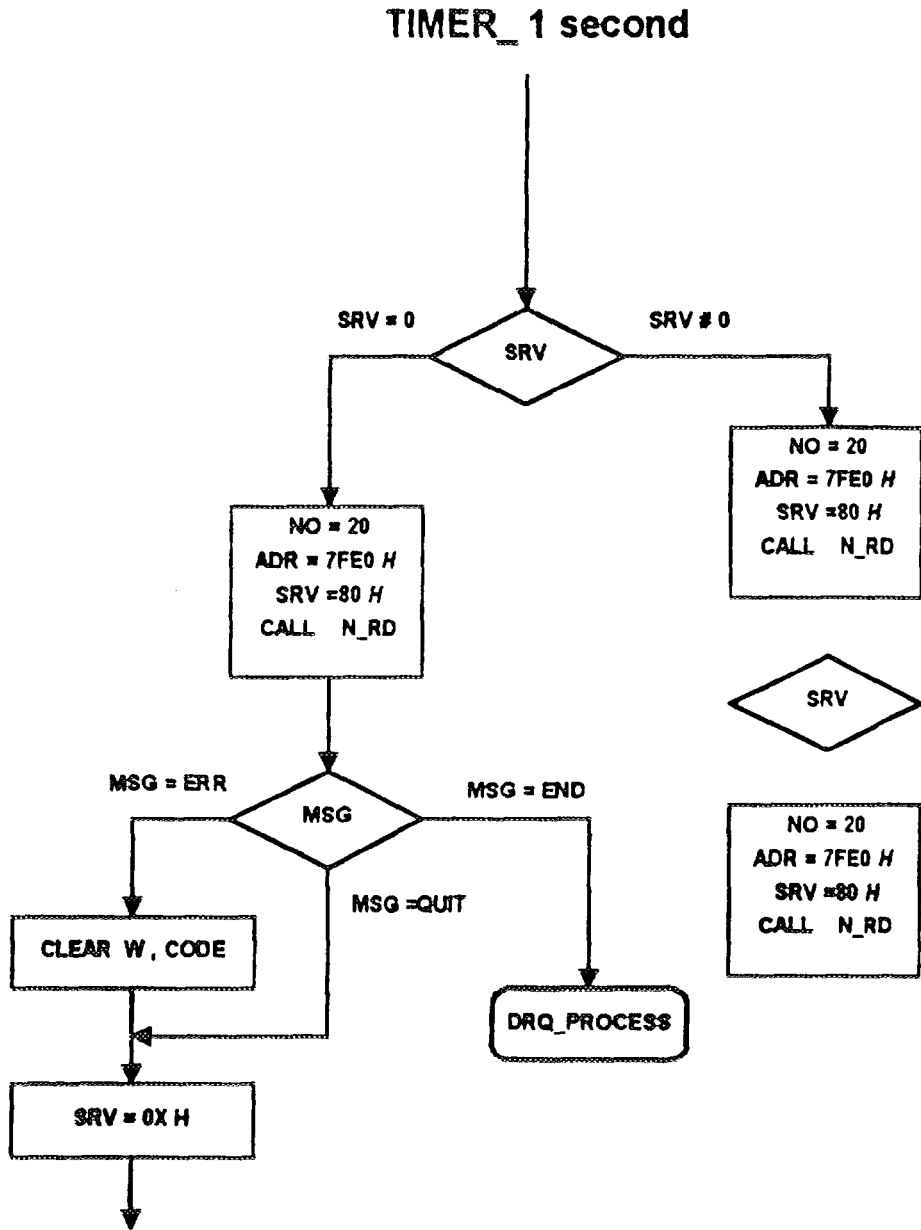
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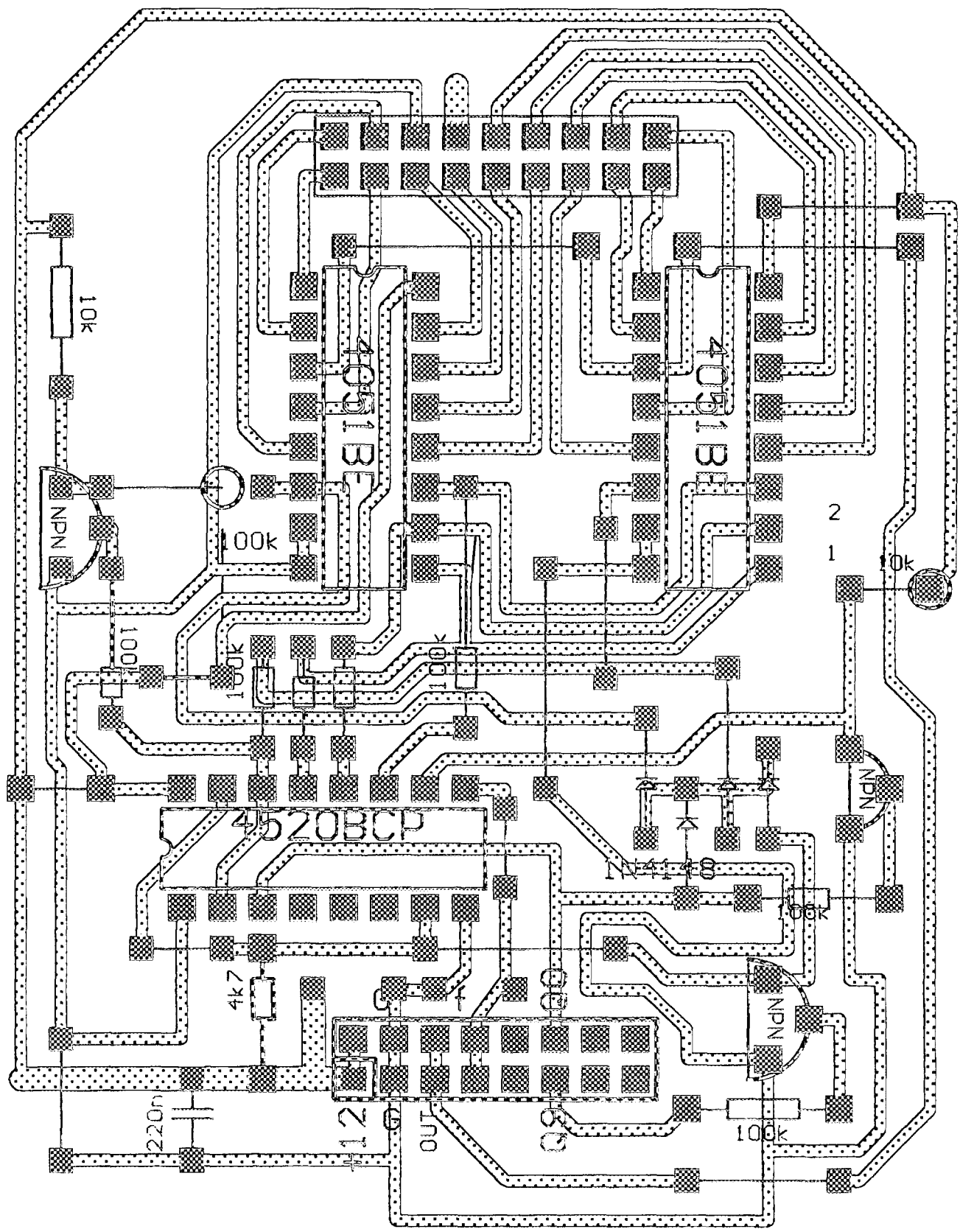
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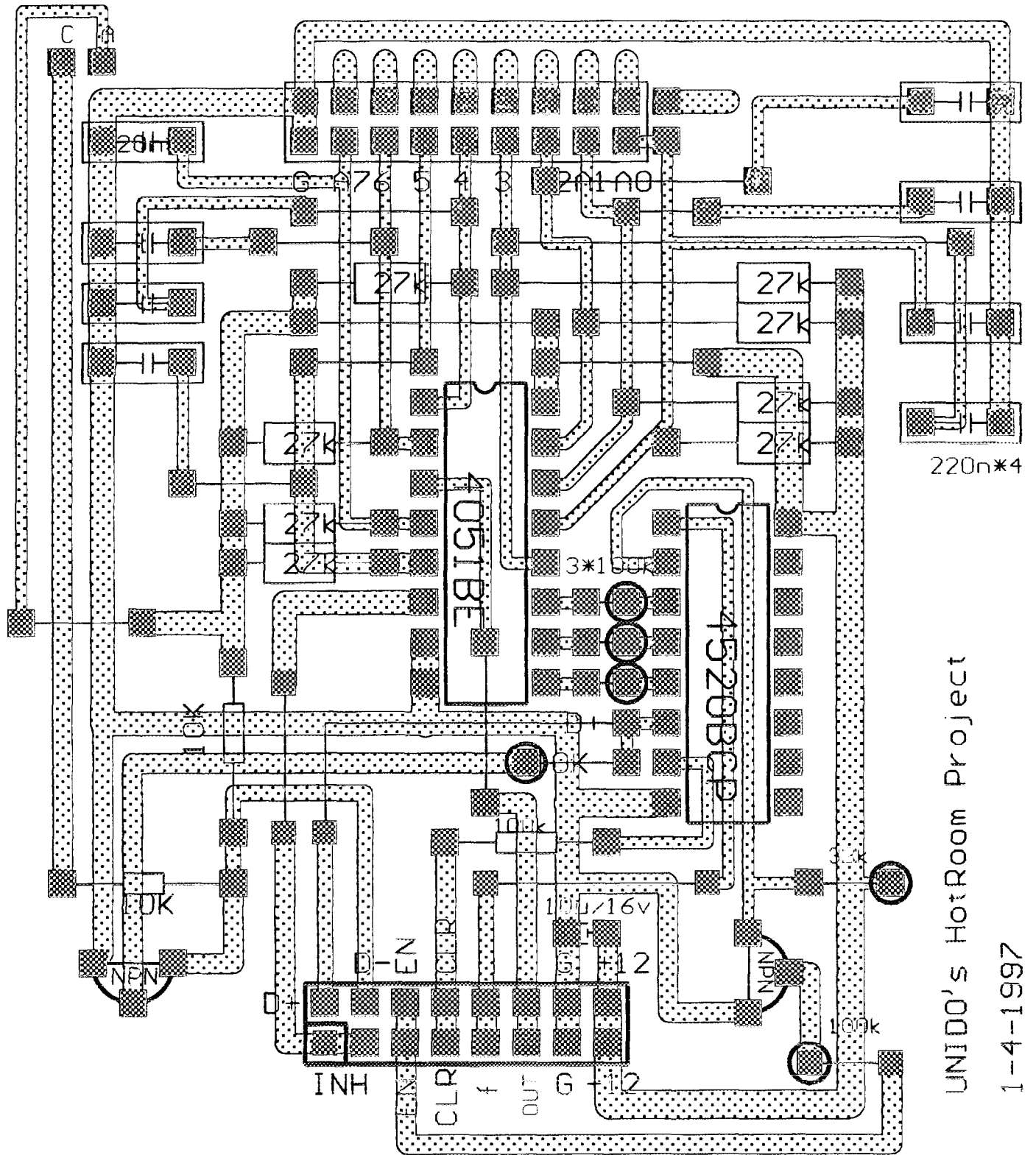


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