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22689

SAHAND MINA ENGINEERING CO LTD.

UNIDO

Conversion and Development of Prototype from R12 to R134a Ozone Friendly Refrigerant System at

Arjah Broudat, Novin Enjema, Takran, Tehran Shirak, Zarifan Companies

PROJECT NUMBERS

MP/IRA/01/133, 134, 137, 138, 139

Contract Number 01/285

Final Report

April 2002

Sahandmina Engineering Company Ltd.

Final Report

PROJECTS NO.
MP/IRA/01/133, 134, 137, 138, 139

Contract Number 01/285

Novin Enjemad, Takran Mobared, Arjah Broudat, Zarifan and Tehran Shirak Companies

Introduction

We are delighted to submit to you herewith, our draft Final Report, concerning calculation and redesign of the prototypes that have been made the counterparts and they have been tested at counterparts hot chamber. These prototypes have been manufactured under our close engineering supervision and have been tested in accordance with appropriate ISO standard test procedure and relevant performance test characteristics for functionality and performance of the new Ozone friendly R134a refrigerant. Our preliminarily review of test results revealed that majorities of prototypes responded to the new R134a refrigerant functional behavior. The final assessment and evaluation of

prototypes test results together with original copies of prototypes performance sheets will be submitted to you together with our final reports after UNIDO's approval of our this report and we hope that this report could have satisfied the UNIDO in order to comply with our contract.

Synopsis

This report has been prepared based on the Contract between UNIDO and Sahandmina Engineering company.
This project will phase out the use of CFC-11 and CFC-12 in the production of Domestic/commercial refrigeration equipment at ***Novin Enjemad, Takran Mobared, Arjah Broudat, Zarifan and Tehran Shirak Companies***. CFC-11, which is used, as a foam-blowing agent in the production of polyurethane foam will be replaced by **HCFC-141b** and CFC-12, which is used as the refrigerant in the cooling circuit of appliances, will be replaced by **HFC-134a**. The project includes the modification of all cooling equipment produced and the conversion of the production facilities. The model redesign element of the project includes testing, trial manufacture and reliability tests. The cost of converting foaming machines to use HCFC-141b will be covered by the counterpart organizations.

General Background

The objective of this project is to eliminate the use of CFC-11 and CFC-12 in the production of commercial and domestic refrigeration equipment at the ***Novin Enjemad, Takran Mobared, Arjah Broudat, Zarifan and Tehran Shirak Companies***, through conversion to the use of HFC-134a refrigerant for the cooling system and HCFC-141b as blowing agent for the polyurethane insulation foam.

The same operating parameters and the same quality level is guaranteed on completion of the conversion process, but no increase in production capacity will be brought about by the project. The company involved is aware of the financial limitations of the funding process and is prepared to use its own funds to share some of the cost of the conversion process.

SECTOR BACKGROUND

The Islamic Republic of Iran ratified the Montreal Protocol in March 1990. Subsequently, Iran's Country Programme has outlined a plan for the reduction of the domestic use of ODS by 75% before 1999, and aims to be ODS free by 2005.

Based on the data provided by the Ozone Layer Protection Center/Department of Environment of Iran, the Refrigeration Sector in Iran is estimated to comprise of about 300 enterprises. The annual ODS consumption in the domestic and commercial refrigeration sectors is reported to be about 2,500 ODP MT as of 1998, representing the bulk of the overall ODS consumption in Iran. The domestic and commercial refrigeration sub-sector each contributes about 50% of the total ODS consumption in this sector. The average growth rate in this sector has been about 6.5% annually.

In the domestic refrigeration sub-sector, there are about 10 large manufacturers and about 15 medium-sized manufacturers, with a combined production of about 2 million units. In the commercial refrigeration sub-sector, there are about 30 relatively large-sized enterprises, and the remaining (estimated to be about 300) are small and medium sized. Due to the relatively unsophisticated technology and practices prevailing in the small and medium enterprises, and being unorganized, they will present a challenge to reach out to for purposes of participation in the Montreal Protocol programme for ODS phase-out.

There are two indigenous manufacturers of hermetic refrigeration compressors in Iran, which produce compressors suitable for domestic refrigeration appliances using CFC-12 technology. Their combined production is estimated to be about 800,000 units, which meets only a part of the domestic demand, the balance being imported. The hermetic and semi-hermetic compressors required by the commercial refrigeration sub-sector are predominantly imported.

The Ozone Layer Protection Center/Department of Environment is leading the efforts for ODS phase-out under the Montreal Protocol, in co-operation with the consuming and supplying industry and with the assistance of the implementing agencies. Complete ODS phase-out is targeted for 2005 except essential uses. The Refrigeration Sector has been identified as a priority sector for ODS phase-out.

In terms of technology and equipment employed the commercial refrigeration sector is very similar to the domestic appliance sector. The primary differences are in the scale of equipment is used, which is bigger in commercial applications, and the variety of products which are manufactured. Most companies manufacture several types of equipment from a wide ranges of applications, including the following:

- display and sales cabinets for supermarkets and individual suppliers of food,
- upright and chest freezers for commercial application,
- different sizes of drinking water coolers,
- blood cooling cabinets,
- milk coolers, water coolers,
- soft ice freezers,
- cooling chambers, cooling stores
- insulated panels for larger cold stores,
- window-type air conditioners and fan coil,

- refrigeration equipment for trucks

In common with the domestic refrigeration sub-sector ozone depleting substances are consumed in commercial applications for:

- Charging of new appliances with CFC-12, R-502 and R-22
- Refilling/topping up of appliances with CFC-12, R-502 and R-22 after repair work
- Insulation foam blowing using CFC-11

Counterpart Data

The baseline data for the company covered by this project contains:

- baseline production data
- baseline ODS consumption data
- baseline production equipment data

The ***Novin Enjemad, Takran Mobared, Arjah Broudat, Zarifan and Tehran Shirak Companies,*** are manufacturers of commercial and domestic refrigerators and freezers. These enterprises are 100% indigenously owned by the same group people and report no exports and being financially sound.

PROJECT SUMMARY

The companies have recognized the need to comply with the Montreal Protocol and have agreed to participate in Iran's ODS phase-out programme. The company is committed to phase out CFCs by converting their foaming equipment to HCFC-141b and adopting HFC-134a as refrigerant. This project document describes the activities needed to carry out the phase out process. The conversion technology and expertise will be acquired from equipment, component and chemical suppliers and external

foam and refrigeration experts. The impact on the plant/process due to the use of HCFC-141b as the blowing agent and HFC-134a as the refrigerant, would need to be addressed by implementing plant modifications and through the introduction of new equipment, components and processes, as below:

Refrigeration operation

The conversion to HFC-134a as the replacement for CFC-12 will involve the following changes:

- Compressors suitable for HFC-134a will be required. These will be available from existing suppliers.
- The chemical stability of HFC-134a and of the synthetic lubricants compatible with HFC-134a are highly sensitive to moisture and impurities in the system, as compared to CFC-12 system. The evacuation/charging process for HFC-134a and polyol-ester lubricant will need to ensure the required level of cleanliness and dryness in the system. To ensure this the following is proposed:
- The vacuum pumps will need to be suitable for use with HFC134a of the existing vacuum pumps, are replaced.
- The existing refrigerant charging units are not suitable for use with HFC - 134a and cannot be retrofitted, and will therefore be replaced with two charging units suitable for HFC-134a duty.

The design/sizing of the refrigeration system will need to be suitably changed, to ensure the viability of the process and to maintain the product standards for performance, such as:

1. Up sizing the condensers and re engineering evaporators and condensers, so as to ensure the levels of cleanliness and contamination that can be tolerated with HFC-134a

2. Lengthening of the capillary tubes.
3. Use of filter-dryers with finer pores, suitable for use with HFC-134a
4. The existing leak detectors are suitable for detecting CFC-12 only and will therefore need to be replaced with leak detectors suitable for detecting HFC-134a.
5. Provision for technical assistance from external international refrigeration experts and also from compressor suppliers will be required to be made to ensure smooth transition to the new technology and the successful implementation of the project.
6. In-house and field trials on prototypes of each model will be needed to be carried out, to establish performance and reliability with the HFC-134a based refrigeration systems.
7. The system dryness/cleanliness with the use of HFC-134a being of crucial nature, careful re-assessment of the production program, re-training/orientation of the staff for the new technology would be required.

Aim of the Project

The aim of the immediate project is to;

- Design, calculation for model redefinition.
- Testing prototypes for functionality and performance criteria.
- Redesign the cooling units of the all models so that they could run on the new Ozone friendly R134a instead of the ODP active CFC12.

Scope of the Contract

A study will be made for 8 models of commercial refrigerators made by ***Novin Enjemad, Takran Mobared, Arjah Broudat, Zarifan and Tehran Shirak Companies***.to specify;

- Dimensional specification;
- Type and thickness of insulation
- Refrigeration unit component details
- Working performance
- Energy consumption

Selection of HFC 134a compatible components
Redesign of the refrigeration circuit as necessary
Specifying necessary changes in the cooling system if required
Preparation of the trial equipment one prototype per model
Testing of two prototypes for functionality and performance
Evaluation of the test results

Supply of the Material

Following components and material have been used to make prototypes .

- R134a Compressors
- R134a Refrigerant
- Refrigerant Accumulators
- Specially designed filter drier
- Specially designed evaporator and condenser

Activities

The activities for implementation of this contract could be summarized as below.

- Site survey of the counterpart premises in order to be familiar with the counterpart facility and production line and also define the prototypes for conversion.
- Site survey of the counterpart premises in order to collect necessary data for calculation of prototype.
- Preparation of Technical data sheet in order to define detail technical specification
- Review the existing technical drawing for the purpose of assessment of possible changes in the design criteria.
- Review each prototype refrigeration circuit for determination of cooling circuit components
- Review and assessment of design criteria following cooling circuit component in order to minimize possible changes and design improvement.
    - Compressor technical specification
    - Condenser type, material and design criteria
    - Evaporator type, material and design criteria
    - Capillary tube design, dimensions and material
    - Filter drier, size and material
    - Determination of R12 refrigerant charge for each prototype in order to adjust R134a charge weight
- Coordination with the counterparts for performing, performance test after completion of making prototypes
- Calculation of prototypes in order to determine the size of R134a compressor and implement necessary changes to the cooling circuits
- Preparation of Performance Test Results Sheet, in order to record all data obtained during functional test.
- Testing Prototypes at Hot Chamber.
- Evaluation of Performance test results.
- Corrective action on defective parts and components.
- Replacement of defected parts.
- Adjustment of refrigerant charge for each prototype.
- Assembly line preparation of trial test and production to fulfill R134a cleanliness requirement.

- On the job training to counterpart technical staff to operate new R134a equipment such as new refrigerant charger machine, new vacuum pump, and new leak detector.
- Coordination with equipment supplier to conduct suitable training program to the counterpart technical staff.
- Final visit of the counterpart to assure trial production of R134a products as foreseen in the project investment documents in case of new equipment availability.

Preparation of prototypes for performance test as

The prototypes shall be tested under designated ambient temperature mostly at
+ 32 C, the test performance revealed that no significant changes is necessary for refrigeration system circuit, because the original size of evaporator and condensers are much bigger than cooling requirements.

The adjustment will be applied to the mainly to the amount of refrigerant charge and length of capillary tube.

Each prototypes should under go for performance test at the following test criteria.
Pull down test at + 32 C
Continues run Test at = 32 C ambient temperature
Cyclic run test at + 32 C ambient temperature.
The test condition was selected in accordance with appropriate ISO test standards.

The material as sample for making prototypes are supplied mainly from local market, due to the limitation for purchasing R134a compressor from local market we had to contact several manufacturers to find out the technical specification for appropriate compressor.

The prices for material specially R134a and R141b blended polyol are much higher than R12 and R11,

Training

Before making prototypes we conducted a training course to train the technical staffs to make their own prototypes and also make them familiar with the new technology.

The following topics were thought during the theatrical training course.

- An orientation to UNIDO CFC phases out project.
- Montreal Protocol
- Ozone Layer and CFC side effect to Ozone layer
- Familiarization with new R134a Refrigerant, application, safety precaution, use and maintenance.
- Familiarization with the new vacuum and charging equipment, vacuum pump and charging board.
- Recovery and recycling of R12 refrigerant, and also R134a.
- Alternative for R11 and R12.
- Some explanation about R141b blowing agent,
- Selection of refrigeration components to be replaced with R12 refrigeration system.
- Calculation and redesign of prototypes
- Performance test
- Test results Evaluation.
- Refrigeration system adjustment
- Selecting Prototype Model
- Refrigeration System components Familiarization
- Refrigeration Load Calculation
- Thermostat Selection and Adjustment
- Refrigerant Charging Methods
- Testing Prototypes
- Analyzing Prototype Test Results

Making Prototypes

- Prototype Model Selection
- Refrigeration System Components Selection

1- Defrost Type
2- No-Frost Type

- Familiarization with Refrigeration System Components
  1- Condenser
     a. Wire on Tube
     b. Tube welded on Plate
     c. Tune on Plate
     d. Tube in the Body
     e. Tube on the fins
  2- Capillary Tube
     a. Tube Length
     b. Tube Diameter
     c. Tube Material
  3- Expansion Valve
     a. Size
     b. Capacity
     c. Material
  4- Filter Direr
     a. Weight
     b. Material
     c. Model
  5- Evaporator
     a. Roll Bond
     b. Wire on Tube
     c. Tube welded on Plate
     d. Tune on Plate
     e. Tube in the Body
     f. Tube on the fins
- Refrigeration Load Calculation
  1- Aim of Calculation
     a. Model Re-Definition
     b. Model Improvement
     c. Model Modification
     d. Conversion of Prototype
     e. Model New Design
  2- Methods of Refrigeration Load Calculation
     a. ASHREA
     b. Manufacturer
     c. Institutes and Universities

3- Different Elements Required for Calculation
   a. Heat Transfer
      Dimension, Insulation, Ambient, Working Condition
      Gasket, etc.
   b. Product Load
      Food, Material, Ice, Etc.
   c. Infiltration
      Door Opening, Air Replacement
   d. Miscellaneous devices and apparatus
      Light, Fan, Etc.

- Compressor

  Cooling System (Static, Oil, Air)

1- Pressure
   a. LBP (Low Back Pressure)
   b. HBP (High Back Pressure)
   c. MBP (Medium Back Pressure)
2- Model
   a. Hermetic
   b. Semi-Hermetic
   c. Open
3- Type of Refrigerant
   a. R12
   b. R134a
   c. Isobutene
   d. Blend
4- Accessories
   a. Capacitor Type
   b. Starting Relay
   c. Voltage, Frequency and Current
   d. Electrical Circuit
5- Mounting Compressor
   a. Refrigerant Fellow Direction
   b. Top on the Roof
   c. Bottom on Base
   d. Double Compressor Mounted
6- Compressor Capacity

a. Watt
b. Horse Power
c. B.T.U/Hr
d. Kcal/Hr

7- Compressor Test Condition

CECOMAF

Evaporating Temp.	-25° C
Condensing Temp.	55° C
Ambiant Temp.	32° C
Suction Gas Temp.	32° C
Liquid Temp.	55° C
Volatage/Hertz	220V/50 Hz

Heat out Put= Capacity+Watt Consumption

ASHRAE

Evaporating Temp.	-23.3° C
Condensing Temp.	55° C
Ambiant Temp.	32° C
Suction Gas Temp.	32° C
Liquid Temp.	32° C
Volatage/Hertz	220V/50 Hz

Heat out Put= Capacity+Watt Consumption

ASHRAE to CECOMAF

Conversion of Capacity From CECOMAF into ASHRAE

R134a Multiply by 1.231
R22 Multiply by 1.097
R404 Multiply by 1.183
1 Watt = 0.86 Kcal/h
1 Watt = 3.41 BTU/h
1 Kcal/h = 1.0162 Watt
1 BTU/h = 0.293 Watt

8- Evaporating Temp. and Selection of Compressor

9- Thermostat

Thermostat Adjustment

a. Cut-in Time - 5 to -15 Compressor Connected

b. Cut-out time -15 to -25 Compressor Dis-Connected
c. Thermostat Setting, Max. Med, Min
d. Thermostat Temperature Difference

- Refrigerant Type

1- CFC- 12
2- HFC-134a
3- Isobutene, R-600
4- Blend, (Isobutene+ Propane)

- Methods of Refrigerant Charging
  1- Bottle, 13.5 Kg. Cylinder
  2- Portable Charger
  3- Production, Evacuation and Charging Equipment
- Refrigerant Charge Weight
  1- Experimental, trial and error
  2- Calculation
  3- Comparison with other Refrigerants
- Refrigeration Leak Detection Procedure
  1- Conventional Method, (water and Soap)
  2- Portable Electronic Leak Detector
  3- Production Electronic Leak Detector
  4- Nitrogen, and Helium Leak Detection Procedure

- Accuracy and Precision of Leak Detection Procedure
  5- Conventional Method, (water and Soap)
  6- Portable Electronic Leak Detector
  7- Production Electronic Leak Detector
  8- Nitrogen, and Helium Leak Detection Procedure
- Recovery
- Recycling
- Reclaiming

Testing Prototypes

- Test Prototypes with R12 Refrigerant to get desired test results.
- Hot Chamber Specification
- Placing Prototypes at Hot Chamber
- Mounting Sensors and their Place and Location
- Testing Condition

1- Tropical "T" 43 °C
2- Sub-Tropical 38 °C
3- Normal 32 °C
4- Sub-Normal 28 °C
5- Cold 18 °C
6- Relative Humidity

- Test Package
- « M » Package
- Meat
- Ice
- Different Tests
    1- Operational
    2- Performance
    3- Energy Consumption
    4- Ice Making
    5- Humidity
- Testing Procedure
    1- Pull Down
    2- Continuous Run
    3- Cyclic Run
- Duration of Test
- Reading Test Result
- Test Results Analysis

Conclusion

All prototypes were tested successfully at the counterparts premises. The test results have been evaluated for proper functioning of refrigeration system components specially R134a compressor. The main difficulties and problems during implementation of the contract were hot chamber design and performance. The hot chambers are being constructed locally and improper insulation and air distribution inside the hot room and soft ware affected the test performance quality.

Recommendation
An up to dated and user-friendly Testing system for the enterprises is recommended to be supplied to the counterparts, to improve quality of model redesign and performance test.

Sahandmina Engineering Company Limited

Novin Enjemad

Setting

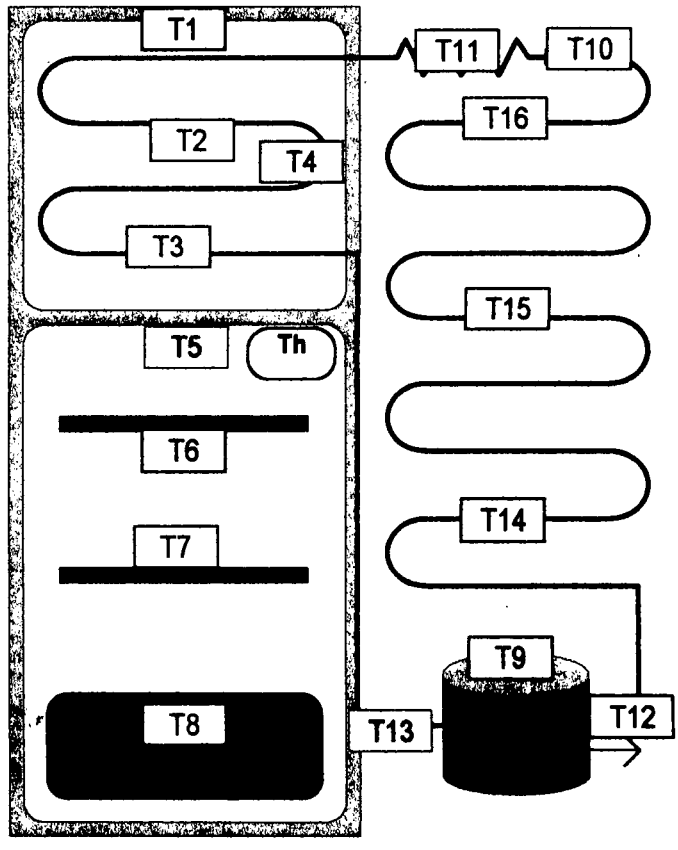
Test Date	Thu Jan 26-07
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	:\NOVIN\160-19

Product Specification

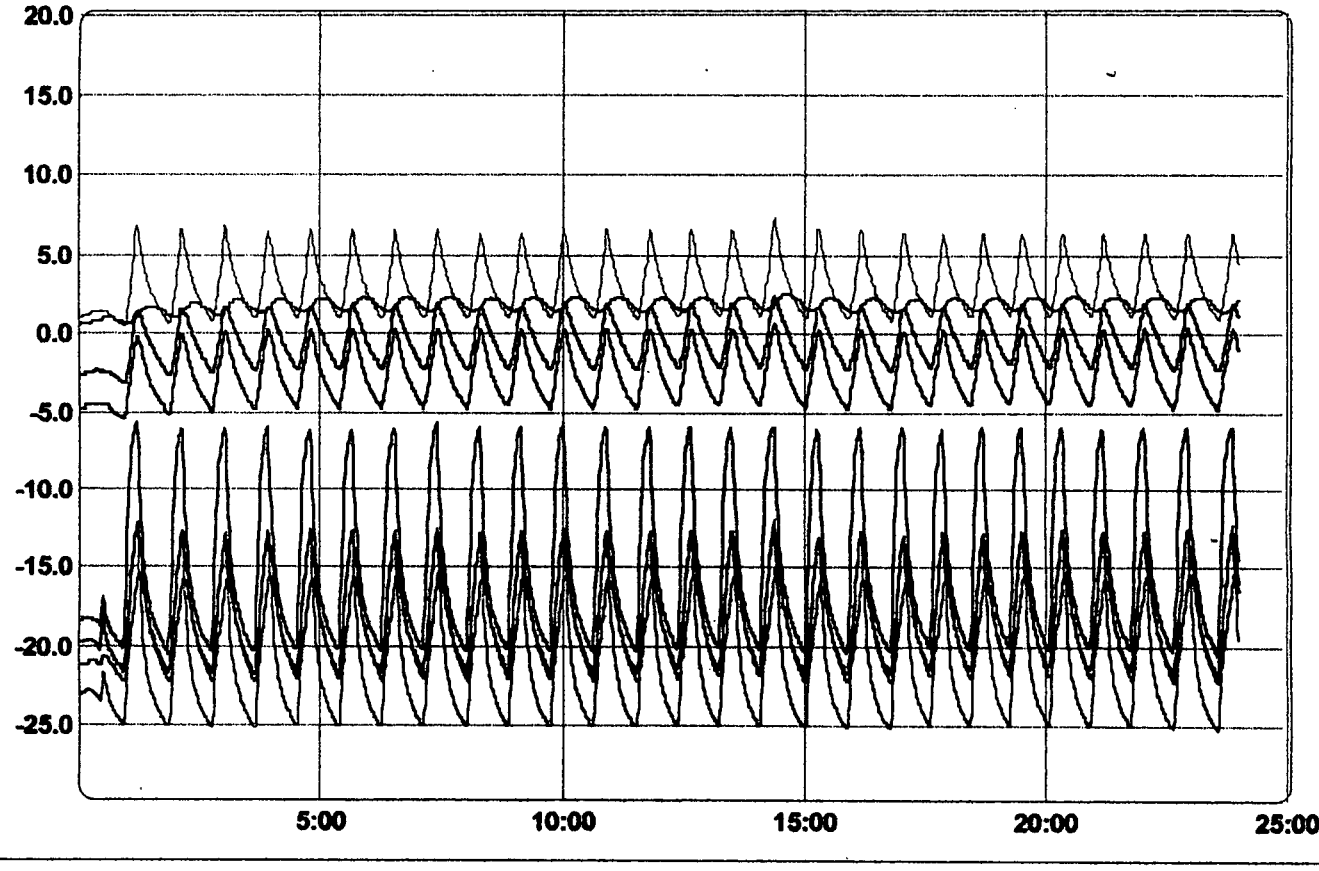
Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	23:59
Working Time(h:m)	16:53
Working Percentage	70.4%
Energy Cons.(KWh)	3.510
Av. En. Cons.(KWh/Day)	3.512
No. of Thermostat	27
No. of Over Load	0



Thu Jan 25 -07



Novin Enjemad

Setting

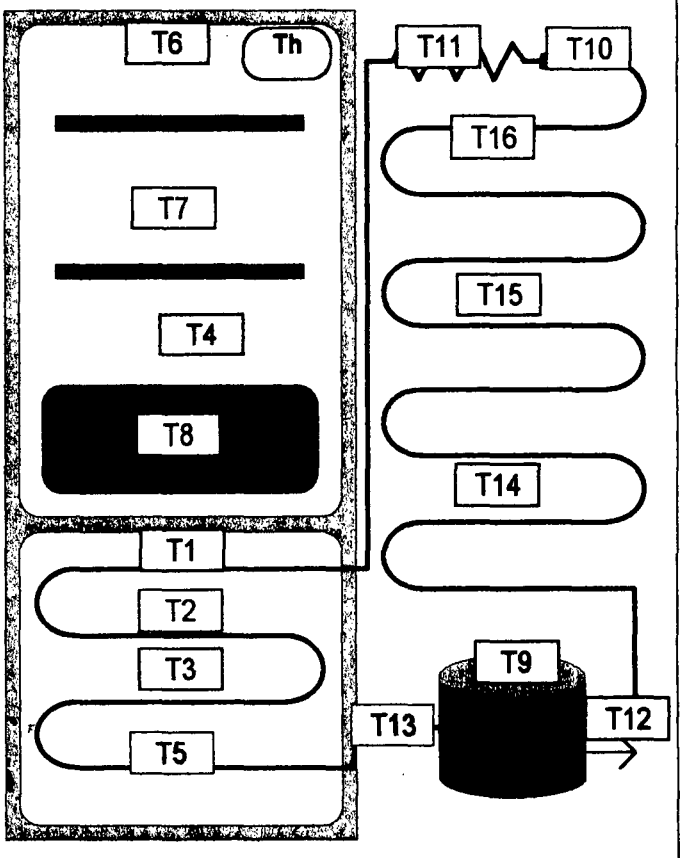
Test Date	Thu Jan 25-07
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	:\NOVIN\200-18

Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	23:59
Working Time(h:m)	12:49
Working Percentage	53.5%
Energy Cons.(KWh)	3.449
Av. En. Cons.(KWh/Day)	3.451
No. of Thermostat	57
No. of Over Load	0



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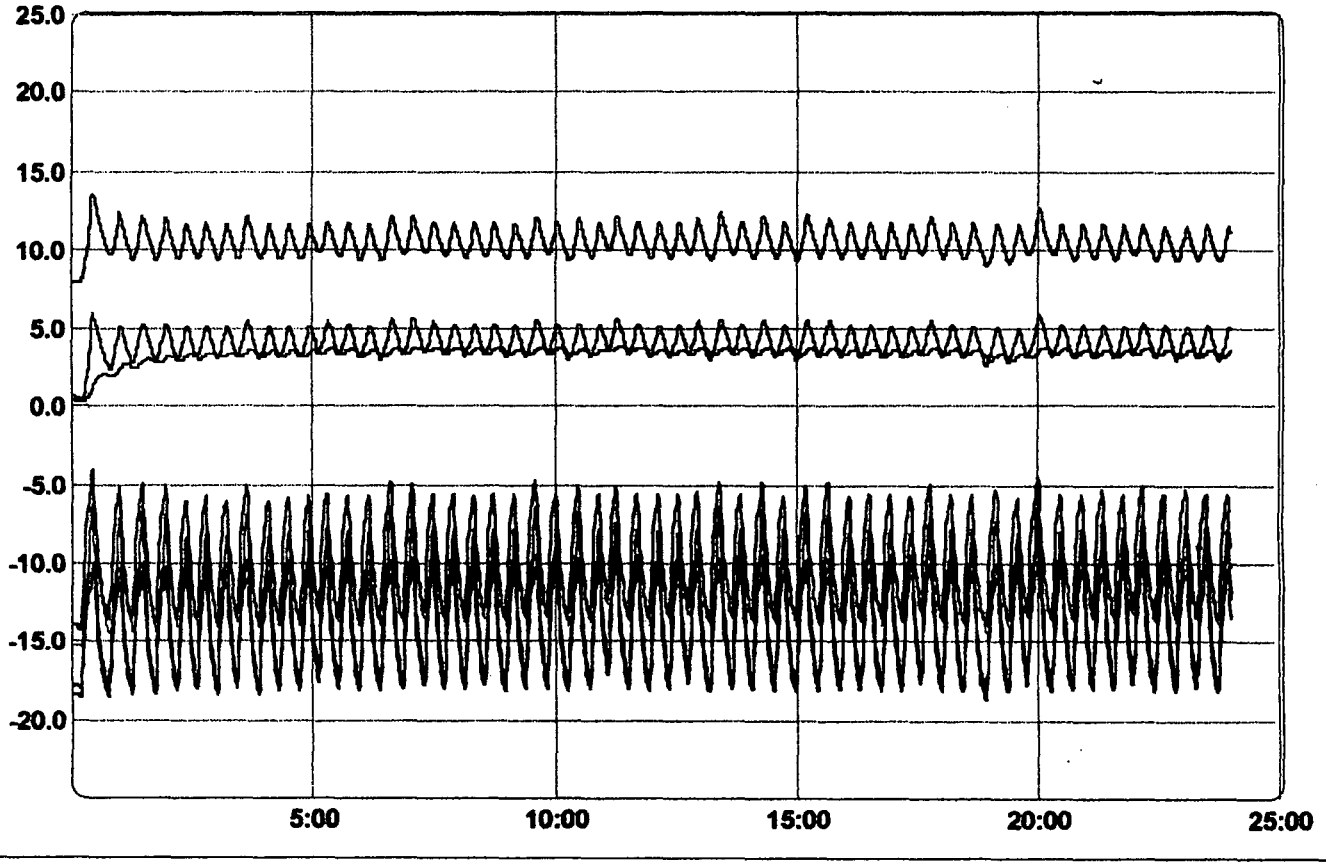


Product Technical Specification

Description	Specification
Company Name	NOVIN ENJEMAD CO.LTD
Product Name	REFRIGERATOR and FREEZER
Product Model	NRF 200
Product Application	Home Appliance
Operating Temperature	Rfc. 8C°
Climatic Condition	Humid
Product Overall Dimension WxLxH mm	65x190x5[illegible]
Freezer Compartment Overall Dimension and Wall Thickness	180 lit - 65mm
Refrigerator Compartment Overall Dimension and Wall Thickness	65mm
Product Shape, Double Doors, Upright, Chest, etc	Double Doors
Freezer Internal Net Volume	
Refrigerator Net Volume	
Product Net Volume	
Product Inside Temperature C	8C°
Water Storage Tank Capacity, Water Cooler	—
Type of Water Storage Tank Cylinder, Cubic, etc.	—
Water Follow per hour for water cooler	—
Water Storage Tank Dimension	—
Water Outlet Temperature	—
Water Inlet Temperature	—
Freezer Inside Temperature	-22C°
Refrigerator Inside Temperature	8C°
Evaporating Temperature	-22C°
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	65mm, 50mm, 50mm, 35mm, 50mm
Type of PU Foam	
Foam Density, Kg/Cu Mt.	
Foam Mixture, Percentage Pol% + R11% + Isocyanate%	36.5% + 13.5% + 50%
Total amount of Foam Injection, Kg	8.200 kg
Refrigerant Type	
Refrigerant Charge Weight Gr.	320Gr

Takran Mobared [redacted]

Setting

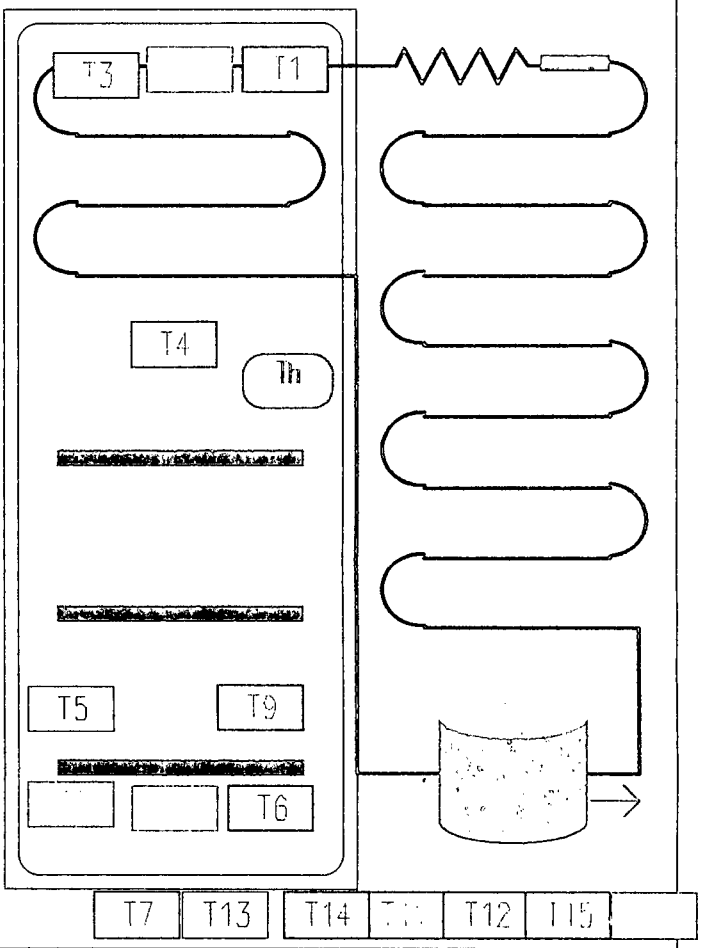
Test Date	Mon Feb 18-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	[redacted]

Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	1:22
Working Time(h:m)	19:35
Working Percentage	20.0%
Energy Cons.(KWh)	1.407
Av. En. Cons.(KWh/Day)	2.346
No. of Thermostat	24
No. of Over Load	0



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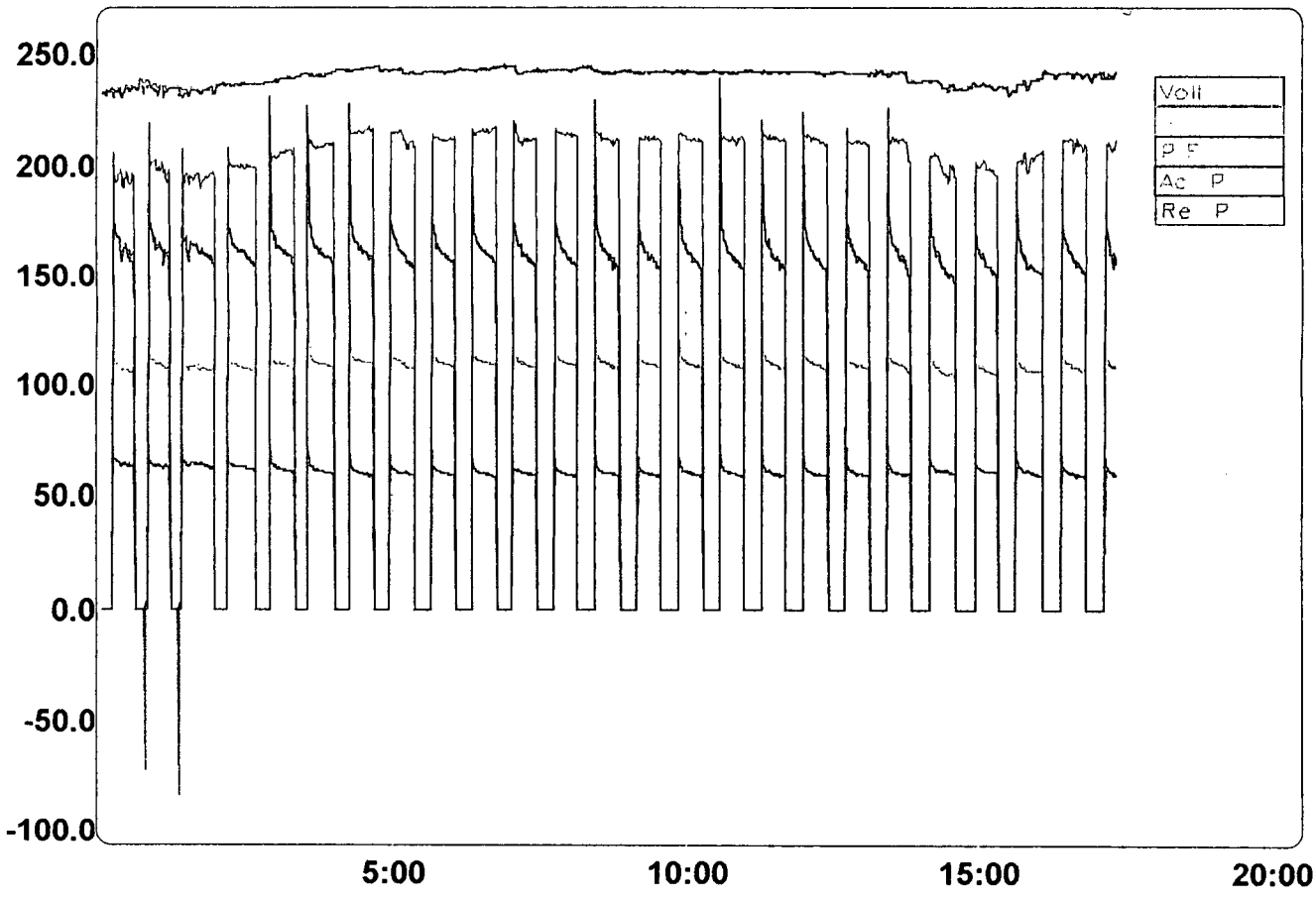


Takran Mobared

Setting

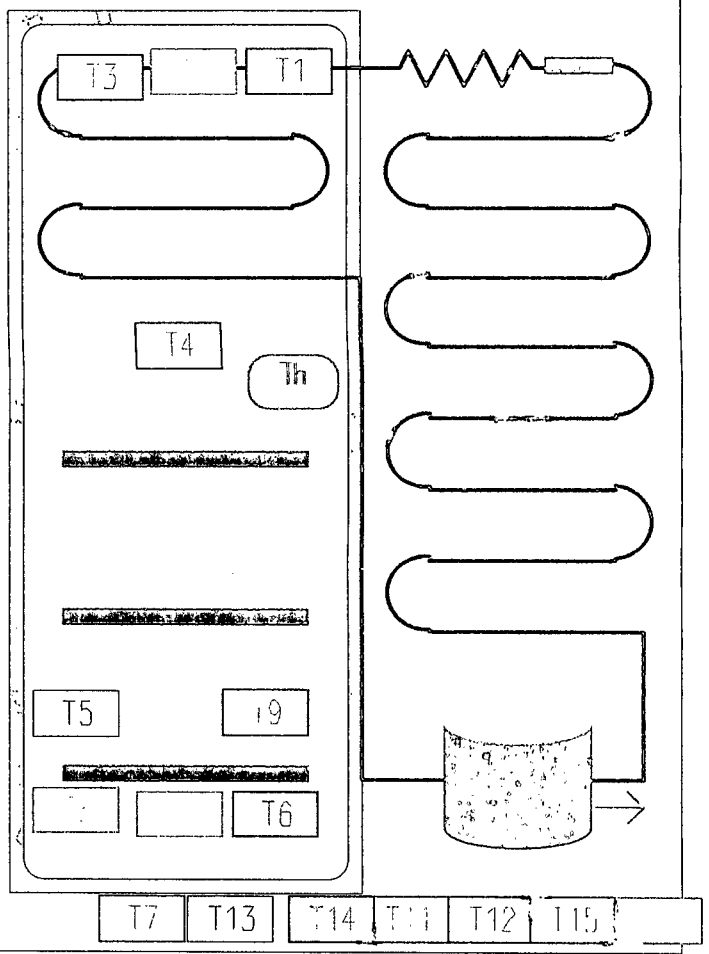
Test Date	Mon Feb 18-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	20
File Name	TAKRAN-R134A-F

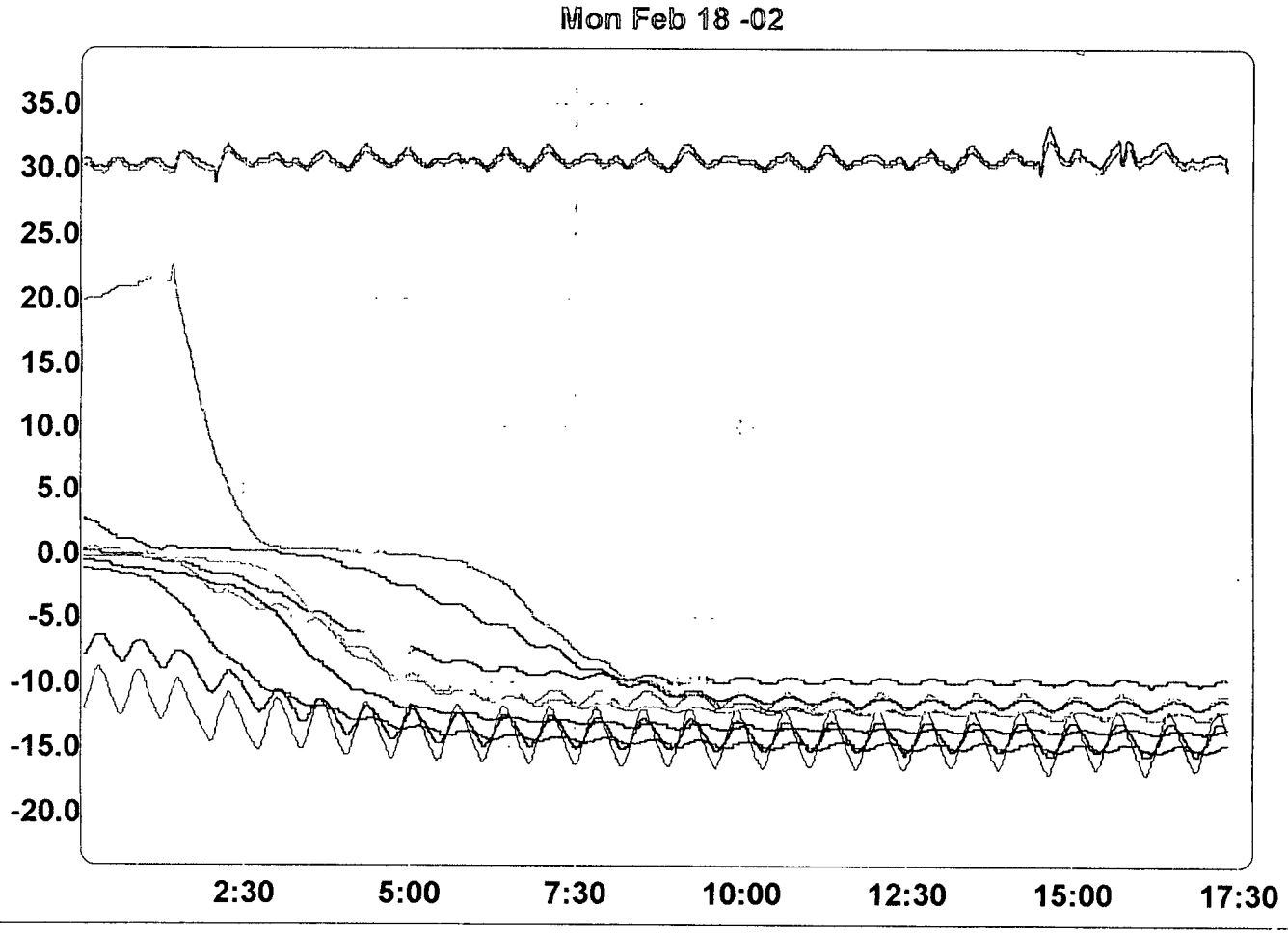
Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	17:22
Working Time(h:m)	10:25
Working Percentage	60.0%
Energy Cons.(KWh)	1.797
Av. En. Cons.(KWh/Day)	2.599
No. of Thermostat	2
No. of Over Load	0





TAKRAN

NO : شماره : ۸۰۰۲۹۲
DATE / تاریخ :

تولید کننده سیستمهای سرد کننده صنعتی ، تجاری
Refrigeration Co. Ltd

Description	specification
Company name	TAKRAN MOBARRED
Product Name	Water Cooler
Product Model	50 litr
Product Application	Producing cool water
Operating Temperature	+10 C
Climatic Condition	Wet & Dry, Hot
Product Over Dimension WxLxH mm	120×59×120cm
Freezer Compartment Overall Dimension and Wall Thickness	
Refrigerator Compartment Overall Dimension and wall Thickness	
Product Shape, Double Doors,Upright,Chest,etc	
Freezer Internal Net Volume	
Refrigerator Net Volume	
Product Net Volume	
Product Inside Temperature C	+10 C
Water Storage Tank Capacity, Water Cooler	200 litr
Type of Water Storage Tank Cylinder,Cubic,etc	Cubic
Water Fellow Per hour for water cooler	50 litr/h
Water Storage Tank Dimension	100×39×54cm
Water Outlet Temperature	+10 C
Water Inlet Temperature	+35 C
Freezer Inside Temperature	
Refrigerator Inside Temperature	
Evaporating Temperature	-5 C
Foam Insulation Thickness mm Side Walls,Top,Bottom,Door,Back Panel	S:100, W:100, T:50, B:100, BP:100

آدرس دفترمرکزی تهران - خیابان انقلاب - ایستگاه دوم خیابان شهید - شماره ۱۹
تلفن کارخانه دم : ۴۵۱ ۴۱۹۰ دورنگار ۴۵۷۴ ۷۶۹۹۰۱
دفترمرکزی تهران ۷۶۶۰۲۸ - ۷۶۶۸۸۰۱ دورنگار ۷۶۹۹۰۱
Tel No. : 98-21-766028
Fax No. : +98-21-769901
Address : No.19,Hamta Building,Istgah Derakhti
Enghelab Ave.TEHRAN-IRAN

$Q_1 + Q_2 = 330 +$

$(200 \times 1 \times 14/24) \times 1.163 \approx 135$

$\dot{M} = 0.2 \times 60 \times 16 = 192$

$Q = (192 \times 1 \times 14)/16 \times 1.163 = 195$

NO. /شماره : ۸۰/۷۹۴
DATE / تاریخ :

تولید سیستمهای سرد کننده صنعتی ، تجاری
Refrigeration Co. Ltd.

Description	specification
Company name	TAKRAN MOBARRED
Producer Name	Freezer
Product Model	6Doors
Product Application	Cool Preservation Aria for Icecream
Operating Temperature	-18 C .... +4 C
Climatic Condition	Wet & Dry, Hot
Product Over Dimension W×L×H mm	188×70×83cm
Freezer Compartment Overall Dimension and Wall Thickness	185×70×80cm
Refrigerator Compartment Overall Dimension and wall Thickness	10cm
Product Shape, Double Doors,Upright,Chest,etc	Chest
Freezer Internal Net Volume	550 litr
Refrigerator Net Volume	
Product Net Volume	
Product Inside Temperature C	-20 C
Water Storage Tank Capacity, Water Cooler	
Type of Water Storage Tank Cylinder,Cubic,etc	Cubic
Water Fellow Per hour for water cooler	
Water Storage Tank Dimension	100×39×54cm
Water Outlet Temperature	
Water Inlet Temperature	
Freezer Inside Temperature	-20 C
Refrigerator Inside Temperature	
Evaporating Temperature	-25 C
Foam Insulation Thickness mm Side Walls. Top,Bottom,Door,Back Panel	S:100, W:100, T:70, B:100, D:-, BP:100

آدرس دفترمرکزی تهران - خیابان انقلاب - ایستگاه درختی
ساختمان حمید - شماره ۱۹
تلفن کارخانه قم ۰۲۵۱-۴۱۹۱۰ دورنگار : ۰۲۵۱-۶۶۵۲۴
دفترمرکزی تهران : ۷۶۶۰۲۸ - ۷۶۹۹۰۱ دورنگار : ۷۶۹۹۰۱
Tel No. : +98-21-766028
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Address : No.19,Hamid Building,Istgah Derakhti
Enghelab Ave.TEHRAN-IRAN

1.4
1.6
3.2

NO. شماره : ۸۰۱۷۹۴
DATE / تاریخ :

تولید سیستمهای سرد کننده صنعتی ، تجاری
Refrigeration Co. Ltd

	Type of PU Foam	
	Foam Density, Kg/Cu.Mr	25 Kg/Cu m
	Foam Mixture, Percentage	
X	Pol%+R11%+Isocyanate%	———
X	Toral amount of Foam Injection, Kg	———
	Refrigerant Type	R12
۶	Refrigerant Charage Weight Gr	1000 gr
	Type of Compressor, Hermetic, Semi Hermetic, Open	Hermetic
	Compressor Cooling System Static, Oil Cooled, Fan Cooled	Fan Cooled
۶	Compressor Cooling Capacity Watt	500 Watt
۶	Compressor input Power, Watt	1100 Watt
	Compressor Model Number	SC 21 B
	Compressor Manufacturer	Danfuss
	Compressor Mounting Place Top, Bottom, Front,Back	Bottom
	Condenser Type. Static, Fan Cooled	Fan Cooled
	Condenser Dimension,Lenght, Inside Tube Diameter	Lenght:150cm -Inside: 3/8 inch
	Condenser Material Aluminium, Copper, Copper Coated,etc	Aluminum -Copper
	Condenser mounting Place Back Wall,Top, Bottom	Bottom
	Evaporator Type,Fin and Tub, Roll Bond,Wire and Tube, etc	Roll Bond
	Evaporator Dimension,Length,Surface Area,Inside Tube Diameter	200 cm 3/8 inch
	Evaporator Material. Aluminum, Copper,Copper Coated,etc	Copper
	Dryer Type	Screw Dryer
	Dryer Material. weight and Size	Silica gel weight:40Gr - size: 3/8
	Capillary Tube Diameter and Lenght	inside:0/05 in - Length:250cm

آدرس دفترمرکزی تهران - خیابان انقلاب - ایستگاه درختی
ساختمان حمید - طبقه ۱۹
تلفن کارخانه قم : ۰۲۵۱-۲۱۹۱۰ دورنگار : ۰۲۵۱-۲۲۵۳۴
دفترمرکزی تهران : ۷۶۶۰۲۸ ۷۶۹۹۰۱ دورنگار : ۷۶۹۹۰۱
Tel No. : +98-21-766028
Fax No : +98-21 769901
Address : No.19,Hamid Building,Isfgah Derakhti
Enghelab Ave,TEHRAN-IRAN

TAKRAN

NO. شماره : ۸۰۲۹۲
DATE / تاریخ :

تولید سیستمهای سرد کننده صنعتی ، تجاری

Refrigeration Co. Ltd.

Type of PU Foam	Rigid
Foam Density, Kg/Cu.Mt	25 Kg/Cu m
Foam Mixture, Percentage Pol%+R11%+Isocyanate%	—
Toral amount of Foam Injection, Kg	—
Refrigerant Type	R12
Refrigerant Charage Weight Gr	1200 gr
Type of Compressor, Hermetic, Semi Hermetic, Open	Hermetic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Fan Cooled
Compressor Cooling Capacity Watt	700 Watt
Compressor input Power, Watt	1320 Watt
Compressor Model Number	511a
Compressor Manufaeturer	Tecomceh
Compressor Mounting Place Top, Bottom, Front,Back	Back,Bottom
Condenser Type. Static, Fan Cooled	Fan Cooled
Condenser Dimension,Lenght, Inside Tube Diameter	Lenght:170cm -Inside: $\frac{3}{8}$ inch
Condenser Material Aluminum, Copper, Copper Coated,etc	Aluminum -Copper
Condenser mounting Place Back Wall,Top, Bottom	Back, Bottom
Evaporator Type,Fin and Tub, Roll Bond,Wire and Tube, etc	Roll Bond
Evaporator Dimension,Length,Surface Area,Inside Tube Diameter	300 cm - $\frac{1}{2}$ inch
Evaporator Material. Aluminum, Copper,Copper Coated,etc	Copper
Dryer Type	Screw Dryer
Dryer Material, weight and Size	Silica gel weight:40Gr - size: $\frac{3}{8}$
Capillary Tube Diameter and Lenght	inside:0/05 in - Length:350 cm

آدرس دفترمرکزی : تهران - خیابان انقلاب - ایستگاه درختی
ساختمان حمید - شماره ۱۹
تلفن کارخانه قم : ۰۲۵۱ ۶۱۹۱۰ دورنگار : ۰۲۵۱-۴۲۵۴۰
دفترمرکزی تهران : ۷۶۶۰۳۸ - ۷۶۹۹۰۱ دورنگار : ۷۶۹۹۰۱
Tel No. : +98-21-766028
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Address : No.19,Hamid Building,Istgah Derakhti
Enghelab Ave,TEHRAN-IRAN

ARJAH

Setting

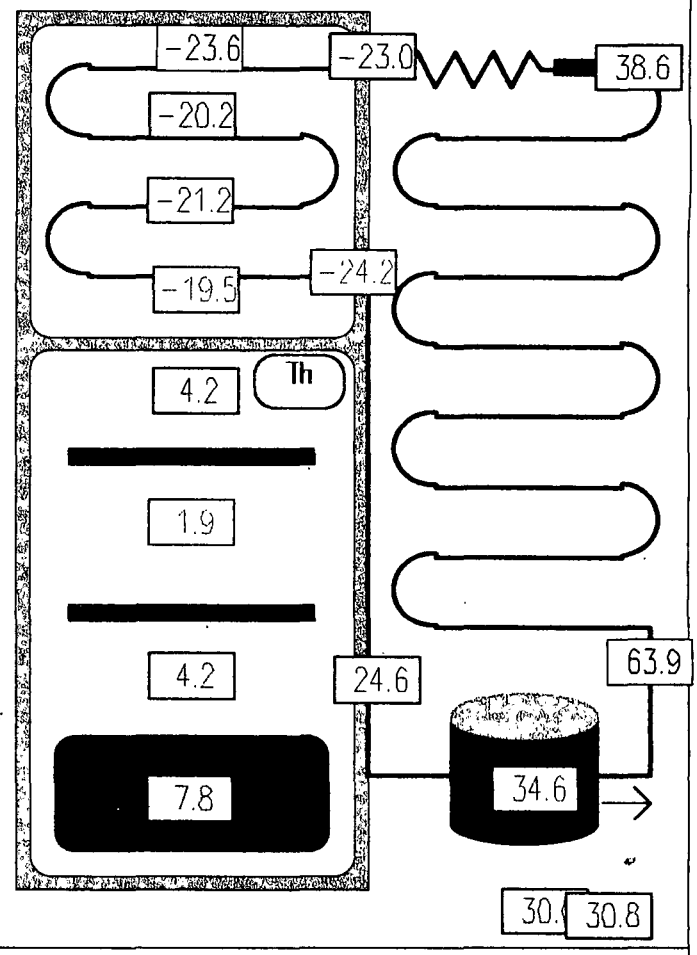
Test Date	Mon Jan 28-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	ASET1\801013S1

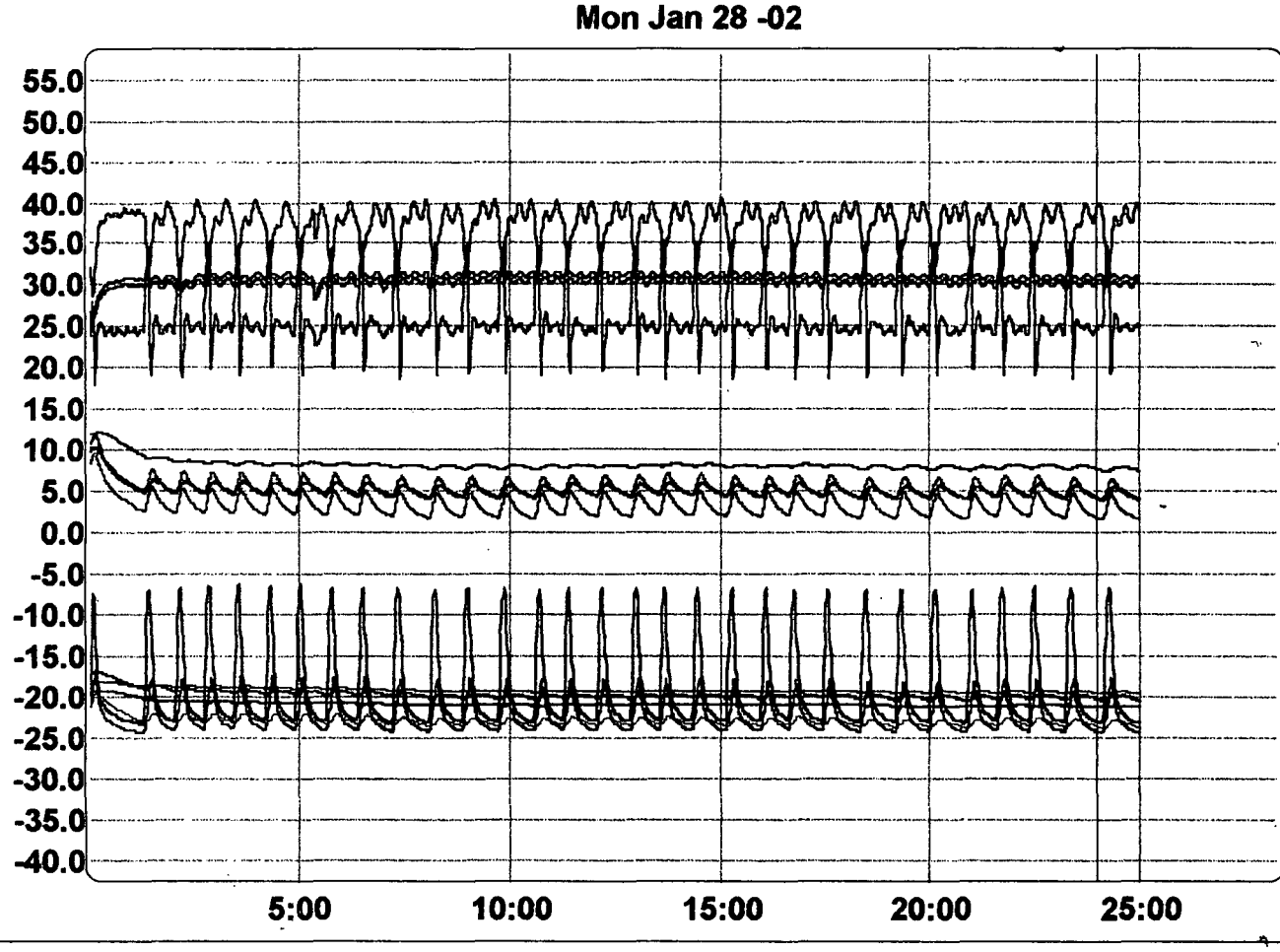
Product Specification

Product Type	18ft
Compressor Type	R134a
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	25:00
Working Time(h:m)	20:27
Working Percentage	81.9%
Energy Cons.(KWh)	3.701
Av. En. Cons.(KWh/Day)	3.553
No. of Thermostat	32
No. of Over Load	0





ARJAH

Setting

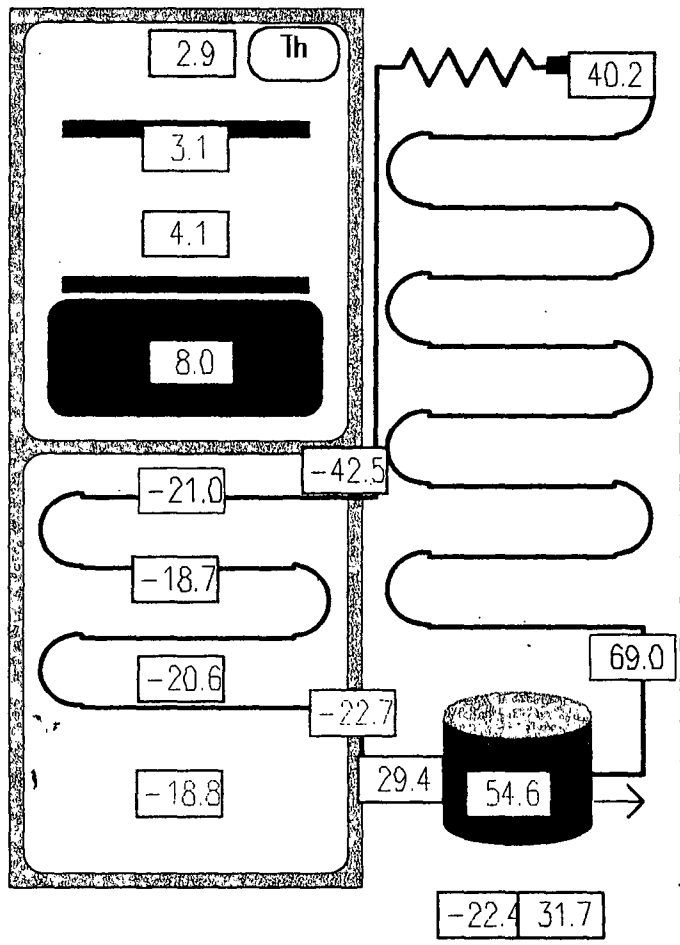
Test Date	Mon Jan 28-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	ASET1\801013S2

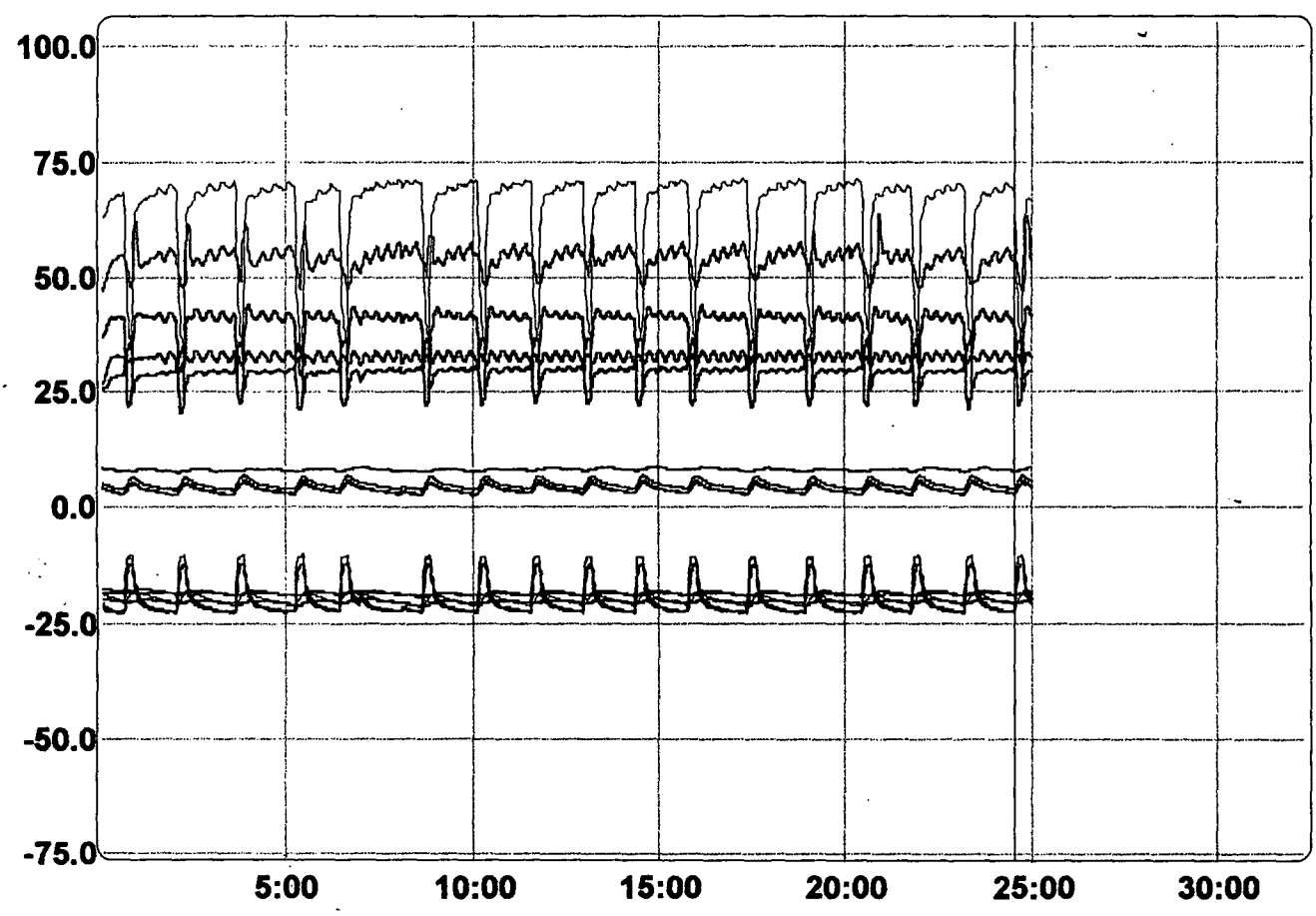
Product Specification

Product Type	20ft
Compressor Type	R134a
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	24:59
Working Time(h:m)	21:23
Working Percentage	85.6%
Energy Cons.(KWh)	4.048
Av. En. Cons.(KWh/Day)	3.889
No. of Thermostat	17
No. of Over Load	0





ARJAH

Setting

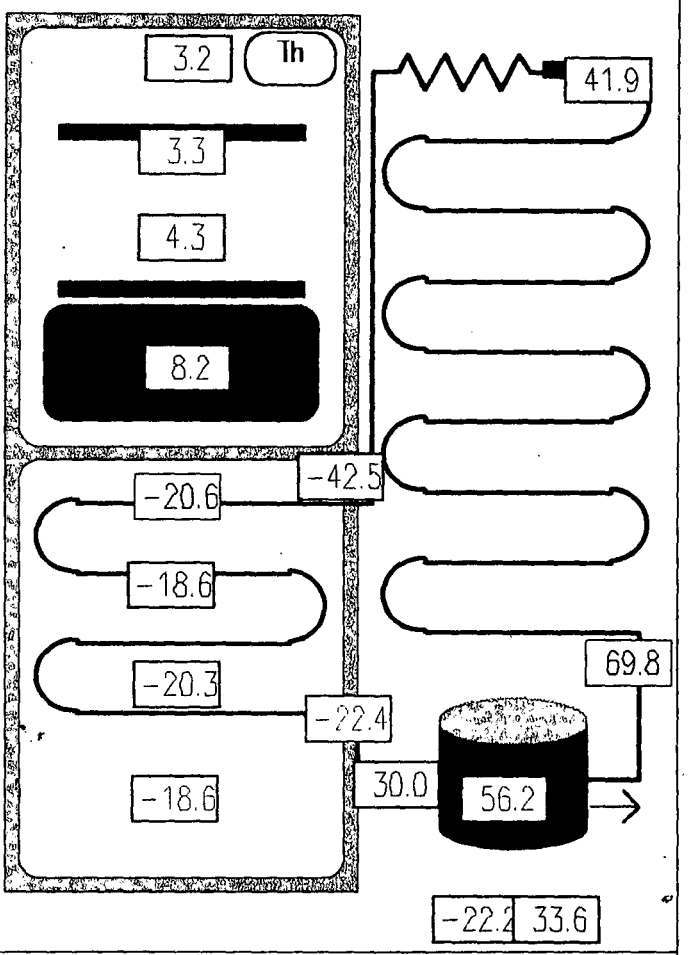
Test Date	Mon Jan 28-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	ASET1\801013S2

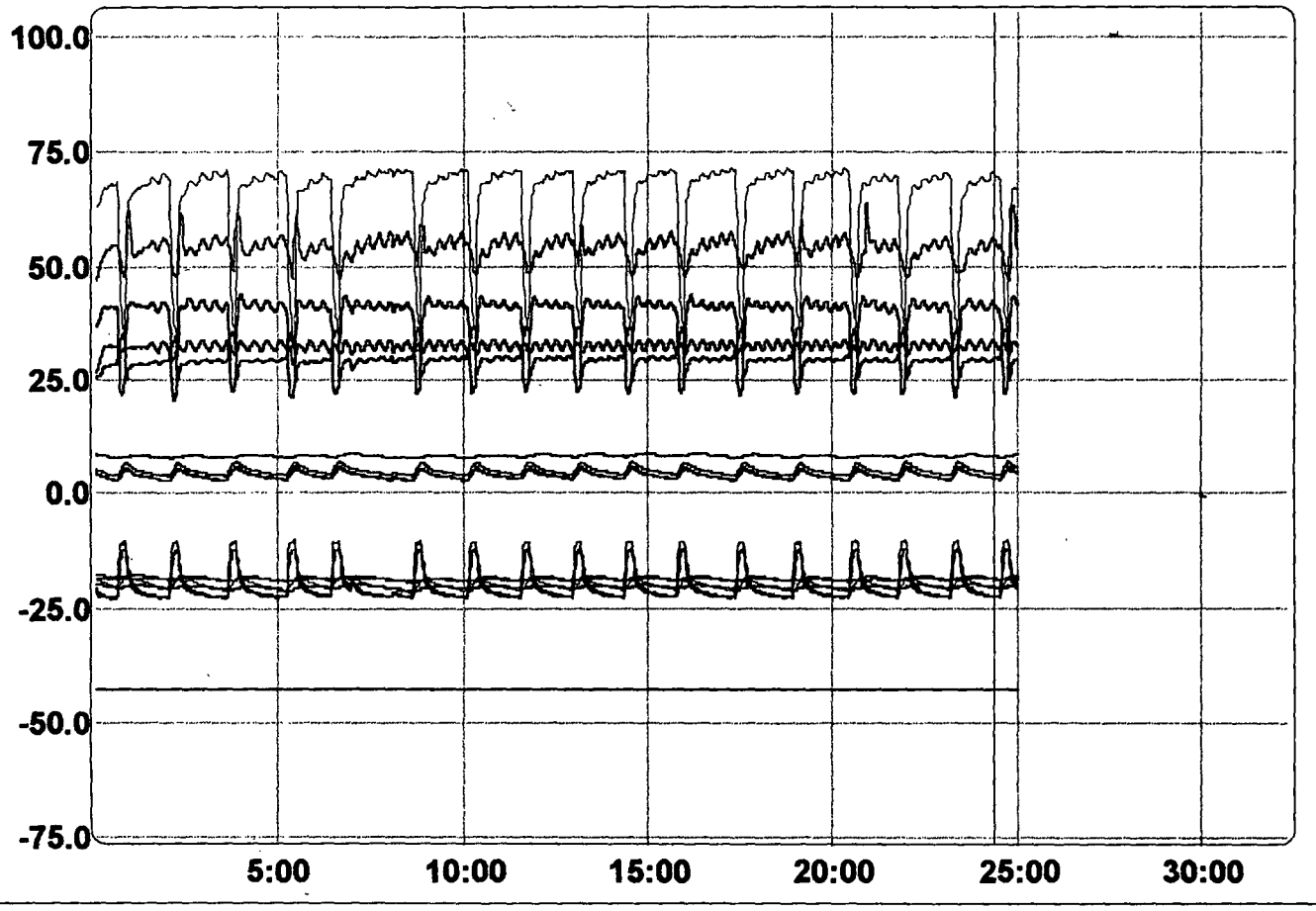
Product Specification

Product Type	20ft
Compressor Type	R134a
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	24:59
Working Time(h:m)	21:23
Working Percentage	85.6%
Energy Cons.(KWh)	4.048
Av. En. Cons.(KWh/Day)	3.889
No. of Thermostat	17
No. of Over Load	0





ARJAH

Setting

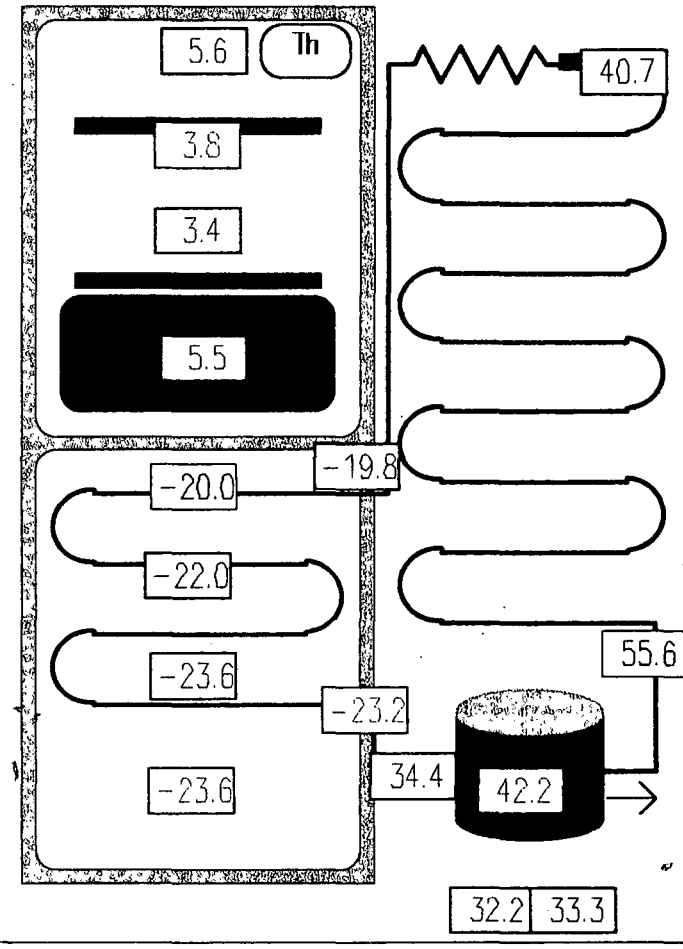
Test Date	Tue Jan 08-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	ASET1\801003S2

Product Specification

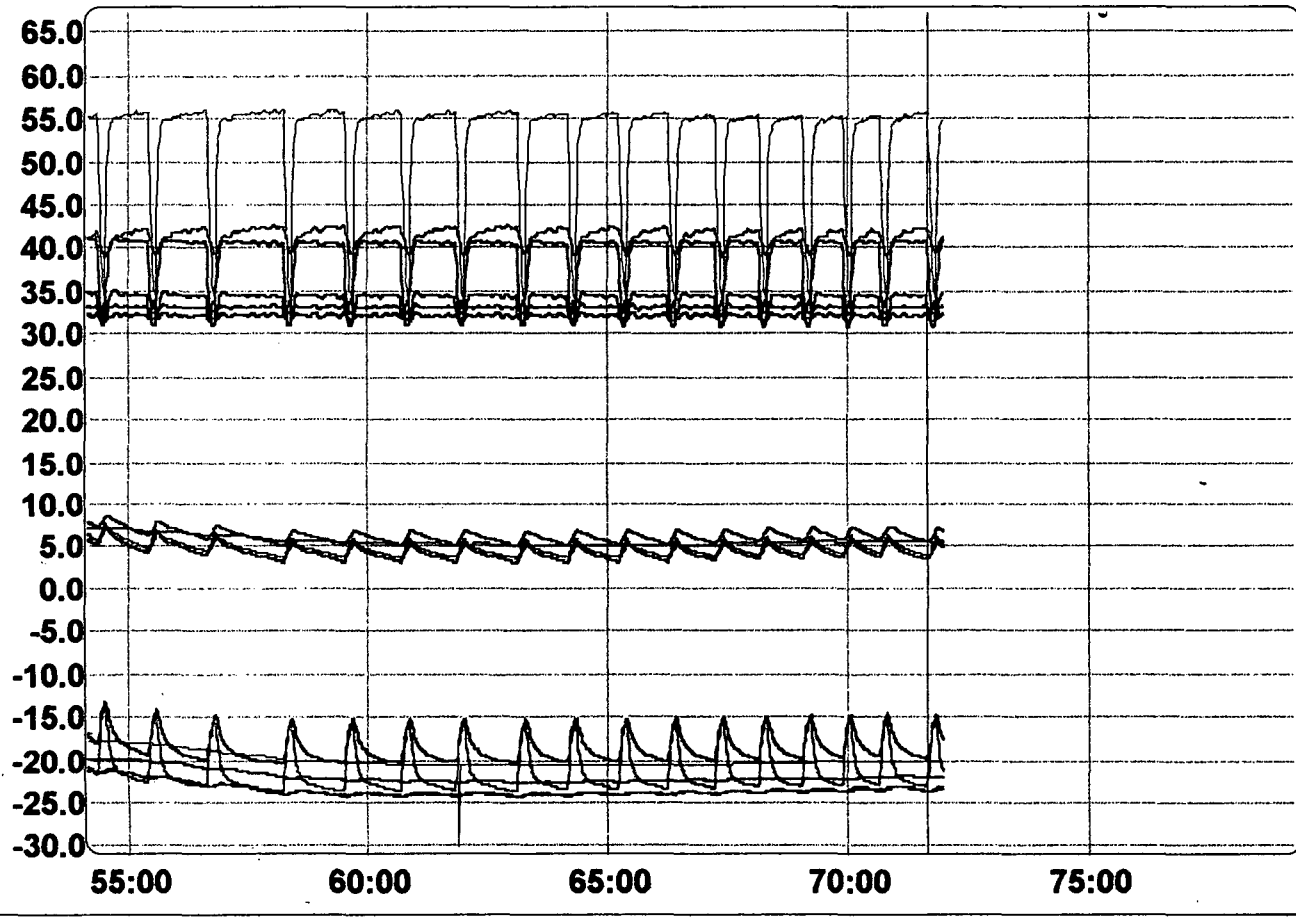
Product Type	20ft
Compressor Type	R12
Refrigerant	-
Coppil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	71:59
Working Time(h:m)	57:09
Working Percentage	79.4%
Energy Cons.(KWh)	9.811
Av. En. Cons.(KWh/Day)	3.271
No. of Thermostat	91
No. of Over Load	0



Tue Jan 08 -02



ARJAH

Setting

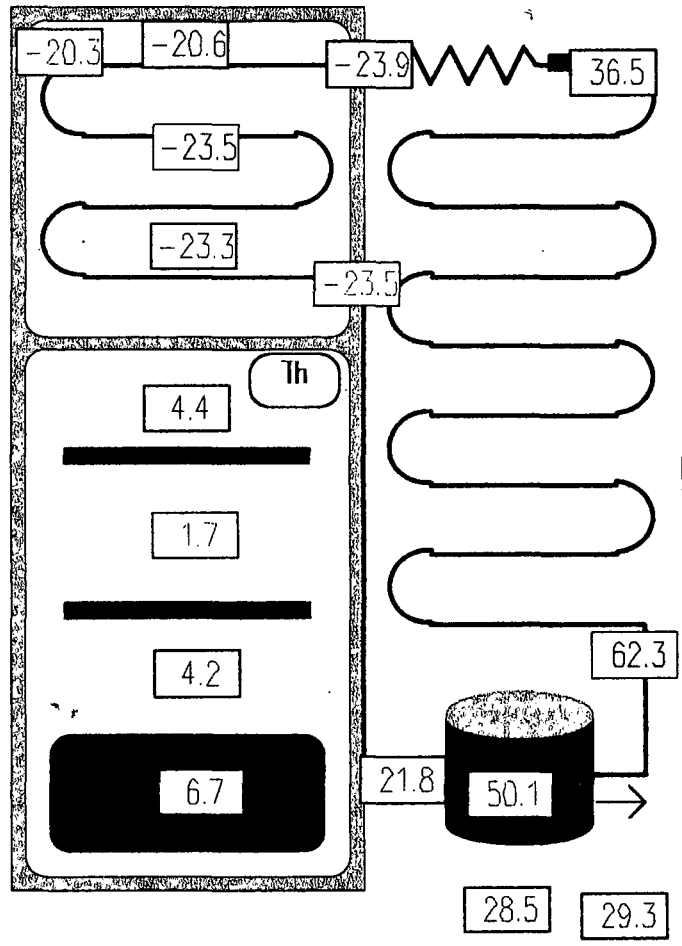
Test Date	Thu Jan 17-02
Test Type	–
Hot Room Temp.	32.5
Hot Room Hum.	50
File Name	ASET1\801007S2

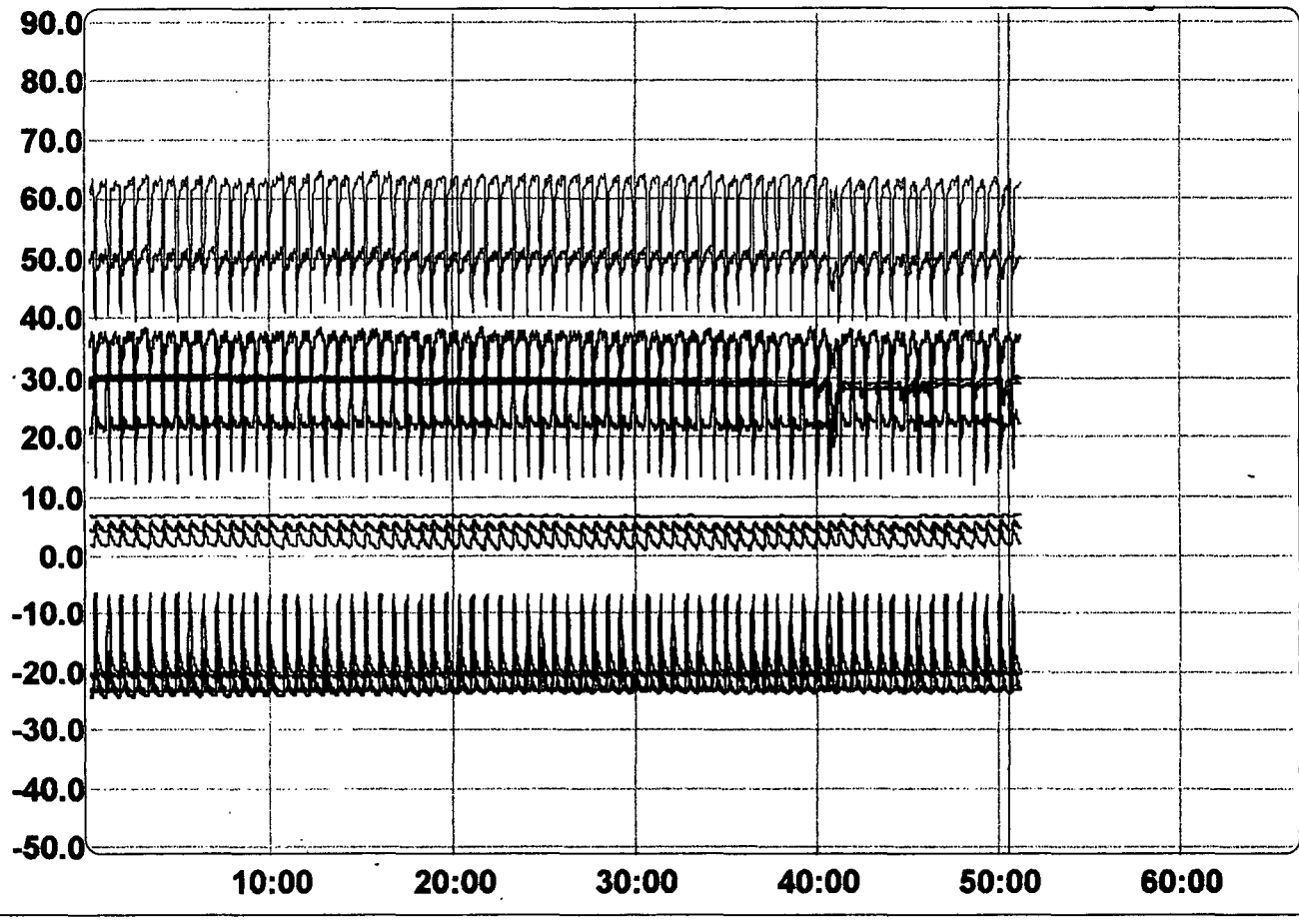
Product Specification

Product Type	18ft
Compressor Type	R12
Refrigerant	–
Cappil. Length	–
Evap. Volume	–
Condensor Length	–
Thermostat Type	–

Test Result

Total Test Time(h:m)	51:10
Working Time(h:m)	41:56
Working Percentage	82.0%
Energy Cons.(KWh)	7.871
Av. En. Cons.(KWh/Day)	3.692
No. of Thermostat	70
No. of Over Load	0

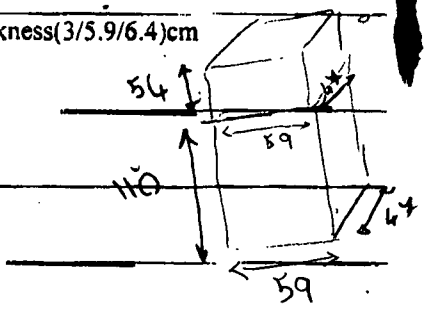




A RJAH BOROUDAT CO., LTD.

Manufacturer of Houshold Refrigerator & Freezer

Company name	Arjah boroudat
Product name	Refrigerator&freezer
Product model	18ft
Product application	Home use
Operating temperature	Middle
Climatic temperature	Moderate
Product overall dimension w.l.h mm	66.52.184
Freezer compartment overall dimension&wall thickness	(59.54./5.47)cm thickness(4./1.3/6.6)cm
Refrigerator compartment overall dimension &wall thickness	59 .110.74/.5) cm thickness(3/5.9/6.4)cm
Product shape	Double door
Freezer internal net volume	(143572)cm^3
Refrigerator net volume	(250 340) cm^3
Product net volume	(360700.5)cm^3
Product inside temprature	Refrigerator(0-5)C FREEZER(-17 to -23)C
Freezer inside temprature	maximum T. will -18
Refrigerator inside temperature	0-5 C
Evaporating temperature	-27 C°
Foam insulation thickness mm side walls. Top.bottom.door back.panel	Refrigerator wall 4.1 freezer wall 4.8 top 6.3 bottom 7.5 back freezer 8 refigerator 6
Type of pu foam	JCJ - IPC
Foam density kg/cu/mt	32 kg/m^3
Foam mixture.percentage Pol% R11%+isocyanate%	ISO25 poli 25.7
	6.960 kg



Refrigerant type	R12
Refrigerant charge weight gr	310gr
Type of compressor	Hermetic
Compressor cooling system	Static
Compressor cooling capacity	1 ph
Compressor model number	20G
Compressor manufacturer	National japan
Compressor mounting place	Back bottom
Condenser type	Static
Condenser material	
Condenser dimention	Length 16.20 inside tube diametr 6.36 mm
Evaporator type	Fin and tube
Evaporator dimention	Length 14.5 s.a (3.63.57) inside tube 8mm
Evaporator material	
Dryer type	Inter dryer
Dryer material .weight and size	Copper 15 gr
Capillary tube diametr and length	Diameter 0.36 length 3.30cm

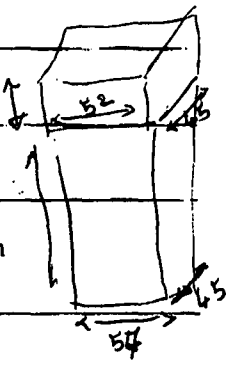
Manager director
A.zarafshan

شرکت صنایع ارجح برودت
سازنده یخچال و فریزر طرح
SUPER STAR

A RJAH BOROUDAT CO., LTD.

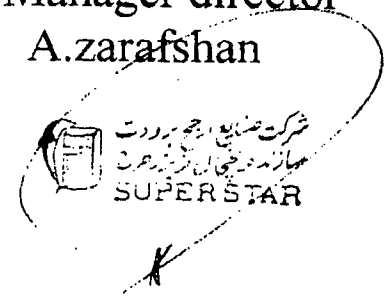
Manufacturer of Houshold Refrigerator & Freezer

Company name	Arjah boroudat
Product name	Refrigerator&freezer
Product model	20 fot
Product application	Home use
Operating temperature	Middle
Climatic temperature	moderate
Product overall dimension w.l.h mm	66 .52 .196
Freezer compartment overall dimension&wall thickness	(3/5 .9/6 .6)cm thickness(52 . 96.45)cm
Refrigerator compartment overall dimension &wall thickness	(4,3 .7/8 .4)cm thickness(57.96.4)cm
Product shape	Double door
Freezer internal net volume	(120408)cm^3
Refrigerator net volume	(240374) cm^3
Product net volume	(336928)cm^3
Product inside temprature	Refrigerator(0-5)C FREEZER(-17 to -23)C
Freezer inside temprature	MAXIMUM T. until -18
Refrigerator inside temperature	0-5 C
Evaporating temperature	-23 C
Foam insulation thickness mm side walls. Top.bottom.door back.panel	Refrigerator wall 4.1 freezer wall 7.8 top 2.8 bottom 7.5 back freezer 8 refigerator 6
Type of pu foam	ICI - IPC
Foam density kg/cu/mt	32 kg /m^3
Foam mixture.percentage Pol% R11%+isocyanate%	ISO25 poli 25.7
Totall amount of foam injection,kg	9.360 kg



Refrigerant type	R12
Refrigerant charge weight gr	320gr
Type of compressor	Hermetic
Compressor cooling system	Static
Compressor cooling capacity	1 ph
Compressor model number	20G
Compressor manufacturer	National japan
Compressor mounting place	Back bottom
Condenser type	Static
Condenser material	
Condenser dimention	Length 16.20 inside tube diametr 6.36 mm
Evaporator type	Fin and tube
Evaporator dimention	Length 19.5 s.a (4.35.50/5) inside tube 8mm
Evaporator material	
Dryer type	Inter dryer
Dryer material .weight and size	Copper 15 gr
Capillary tube diametr and length	Diameter 0.36 length 3.30cm

Manager director
A.zarafshan



Zarifan Co.

BASET P.N.

Setting

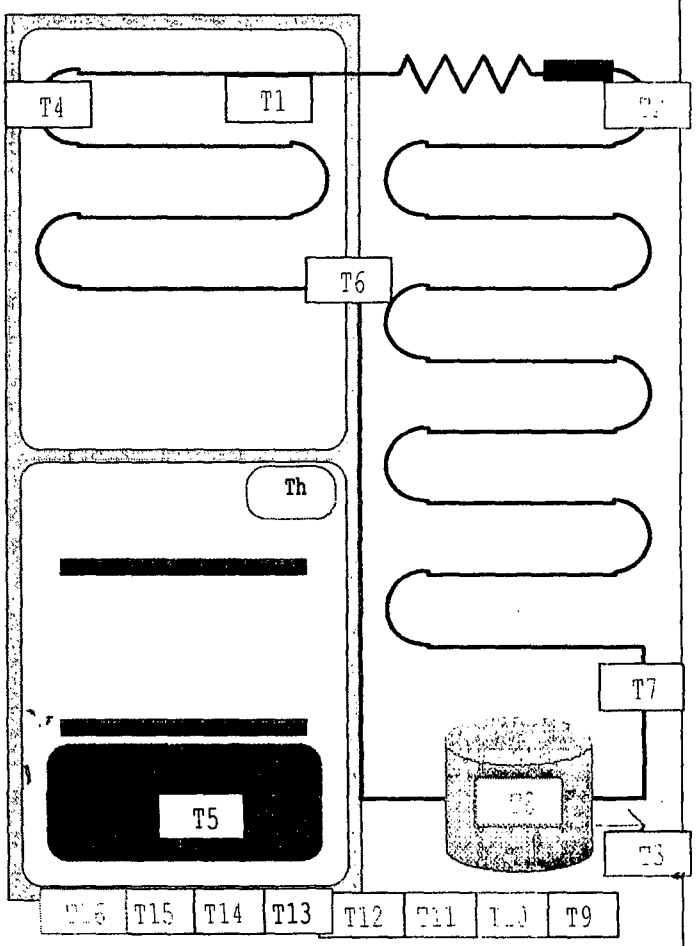
Test Date	Mon Apr 15-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	:\UNIDO\ZARIF4

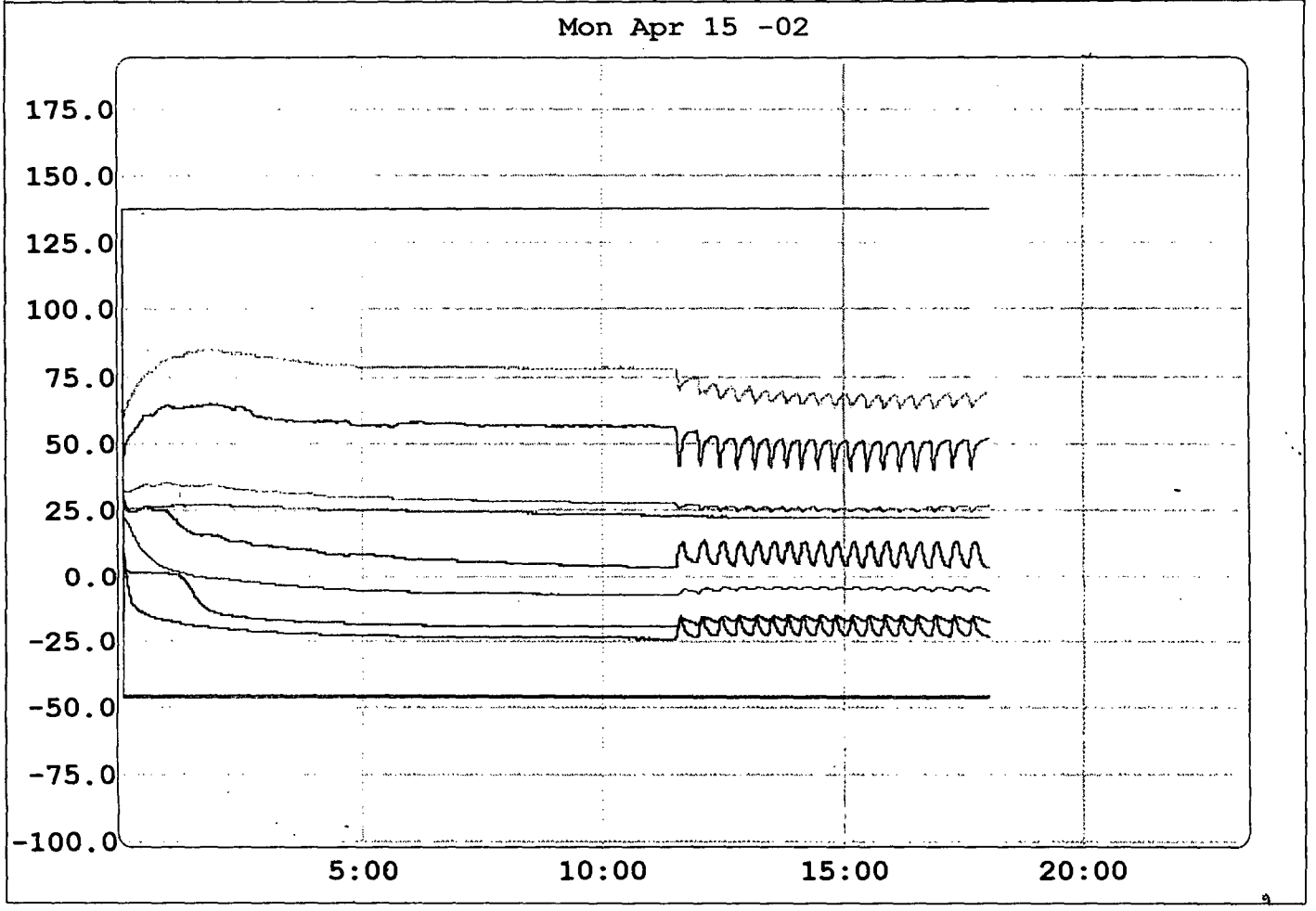
Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	17:59
Working Time(h:m)	15:36
Working Percentage	86.78
Energy Cons.(KWh)	0.0001
Av. En. Cons.(KWh/Day)	0.000
No. of Thermostat	1635
No. of Over Load	0





Zarifar Co.

BASET P.N.

Setting

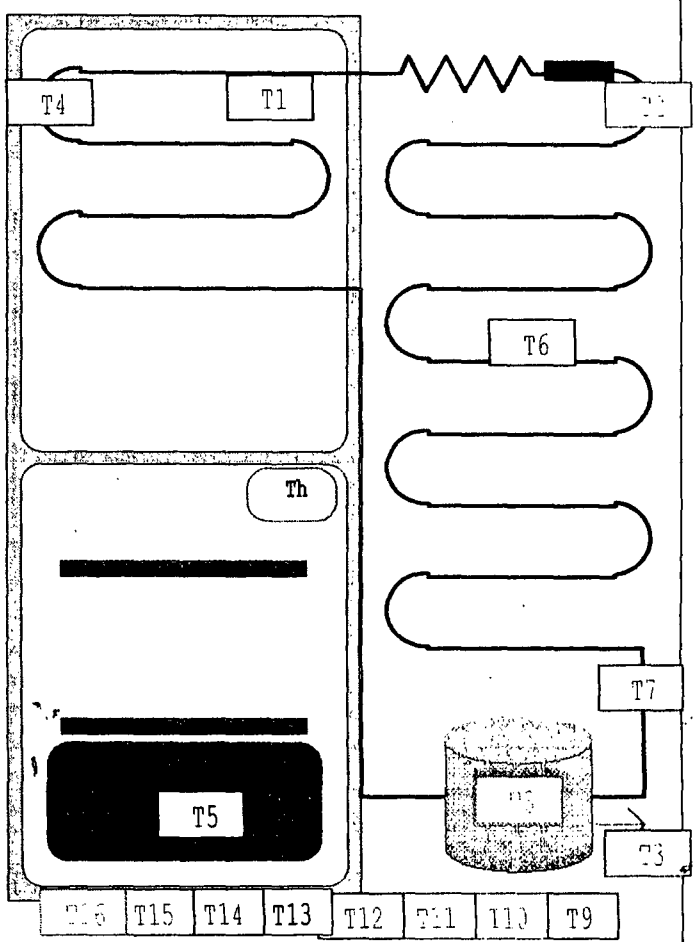
Test Date	Tue Apr 16-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	:\UNIDO\ZARIF1

Product Specification

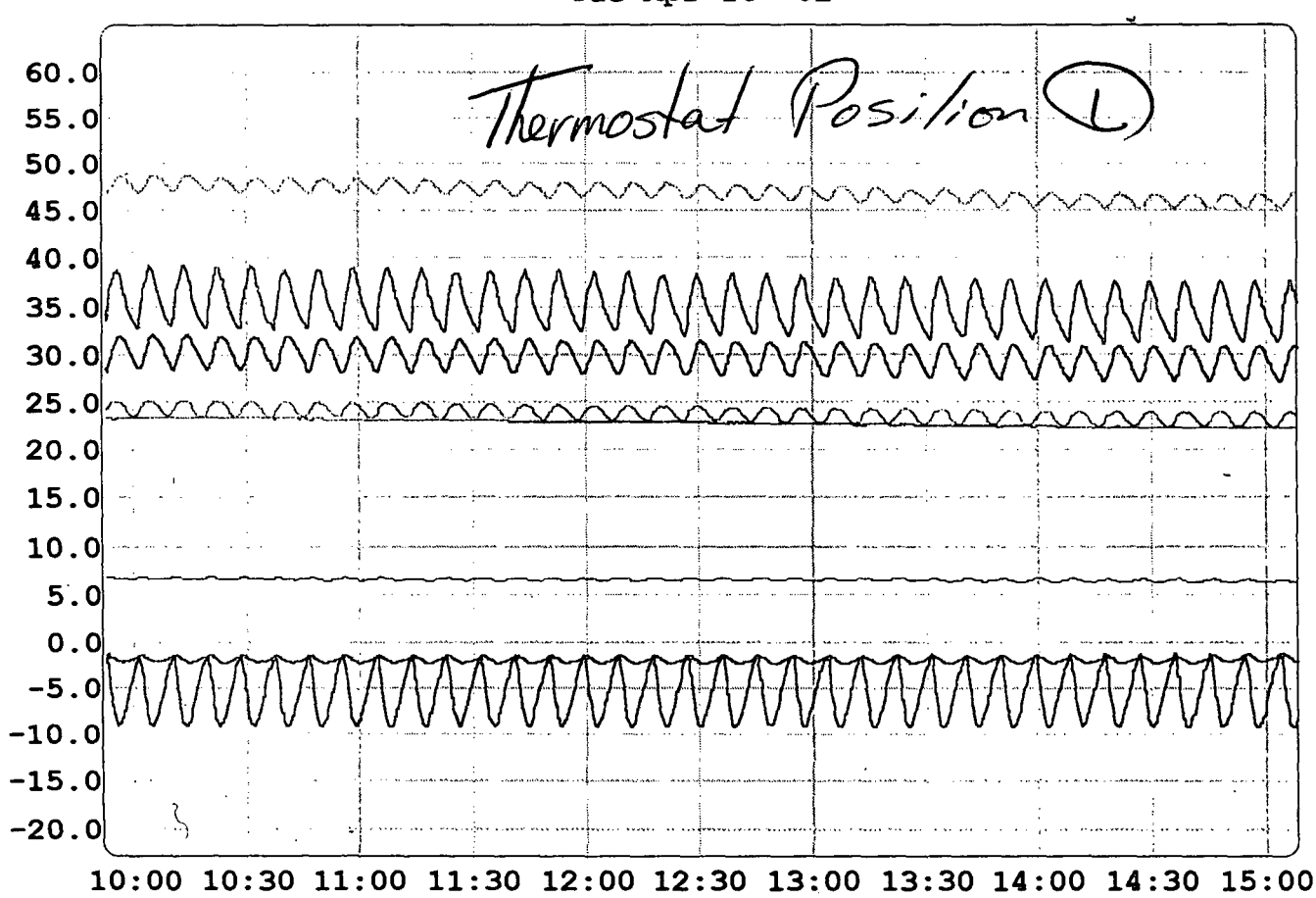
Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	17:59
Working Time(h:m)	15:34
Working Percentage	86.68
Energy Cons.(KWh)	0.0000
Av. En. Cons.(KWh/Day)	0.000
No. of Thermostat	1688
No. of Over Load	0



Tue Apr 16 -02



Zarifan Co. **BASET P.N.**

Setting

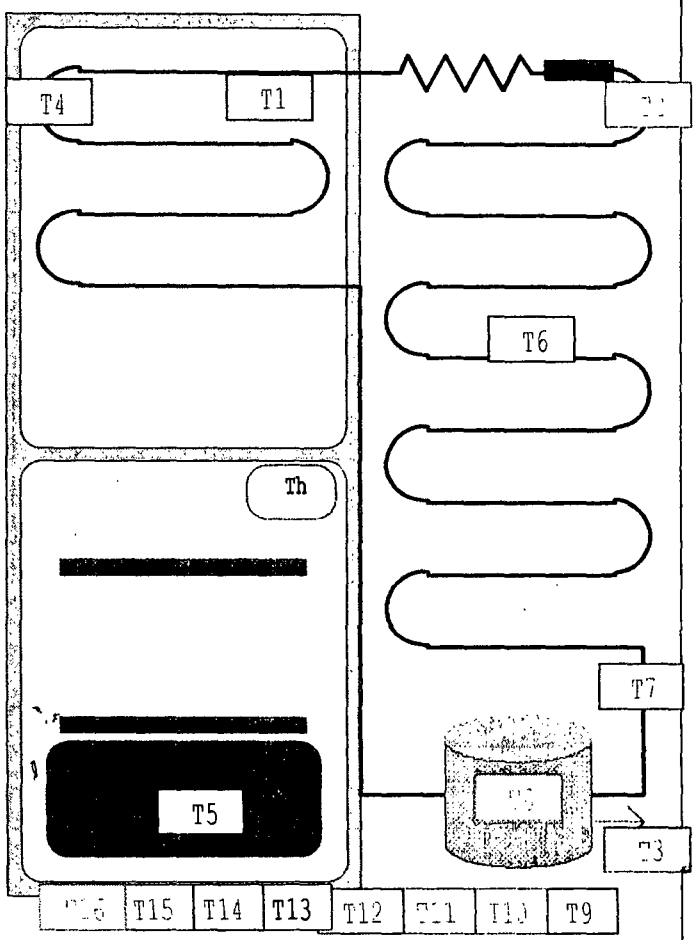
Test Date	Tue Apr 16-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	:\UNIDO\ZARIF1

Product Specification

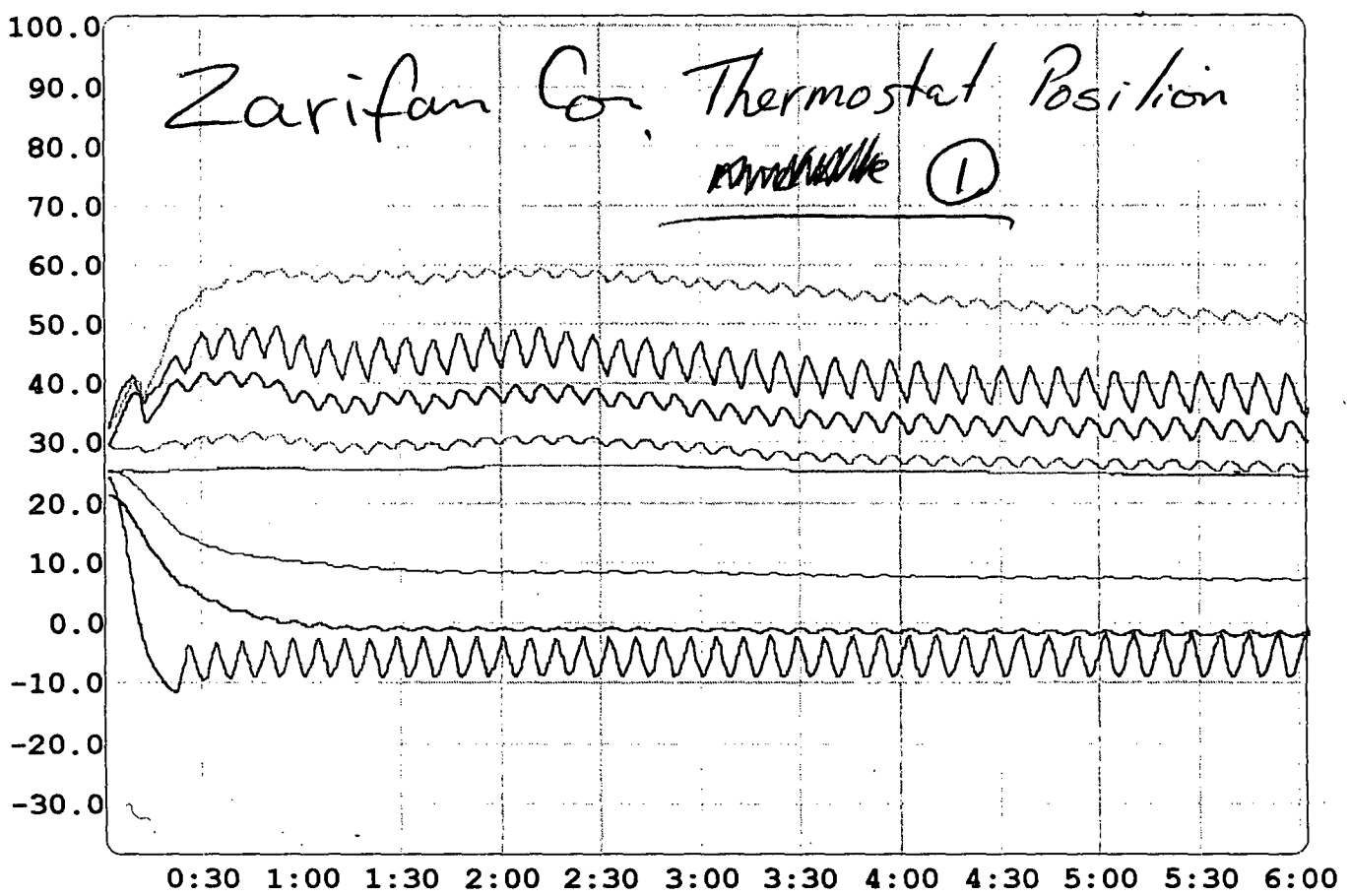
Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	17:59
Working Time(h:m)	15:34
Working Percentage	86.68
Energy Cons.(KWh)	0.0000
Av. En. Cons.(KWh/Day)	0.000
No. of Thermostat	1688
No. of Over Load	0



Tue Apr 16 -02



Tehran Shirak [redacted]

Setting

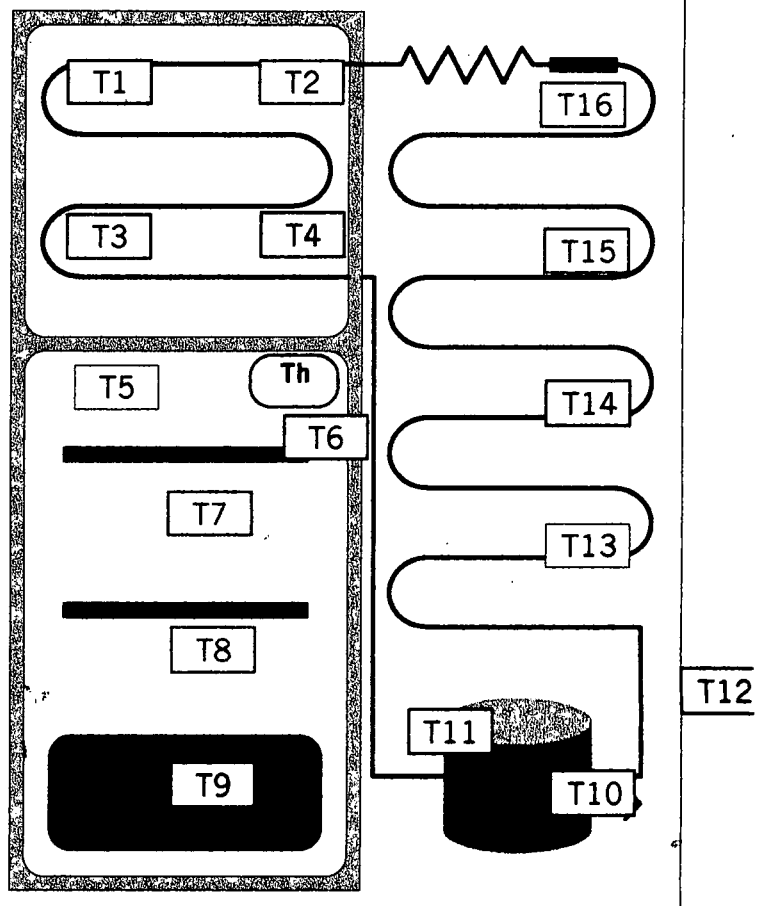
Test Date	Thu Feb 07-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	test1

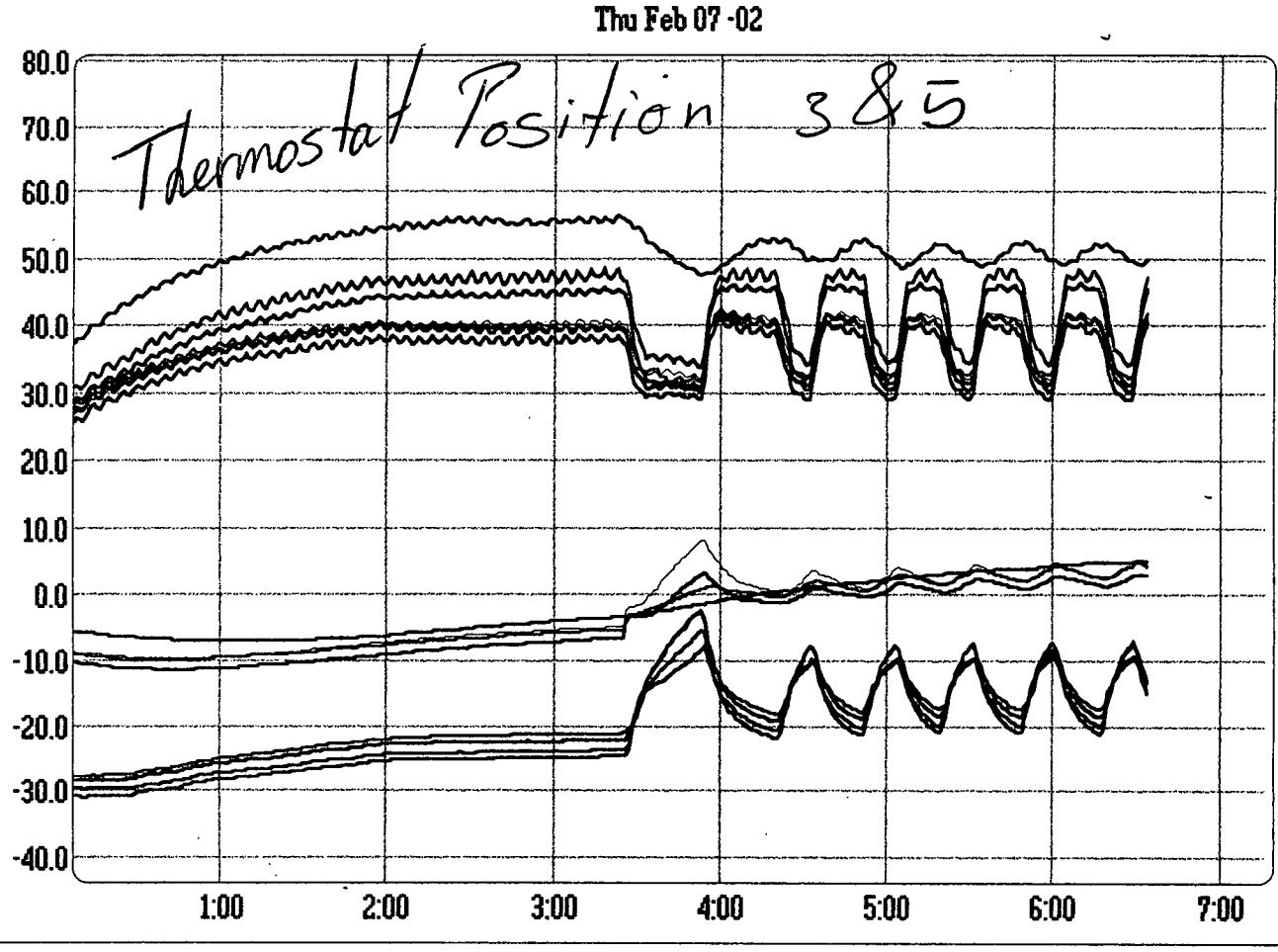
Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	06:34
Working Time(h:m)	05:07
Working Percentage	78.0%
Energy Cons.(KWh)	1.103
Av. En. Cons.(KWh/Day)	4.031
No. of Thermostat	6
No. of Over Load	0





Tehran Shirak

Setting

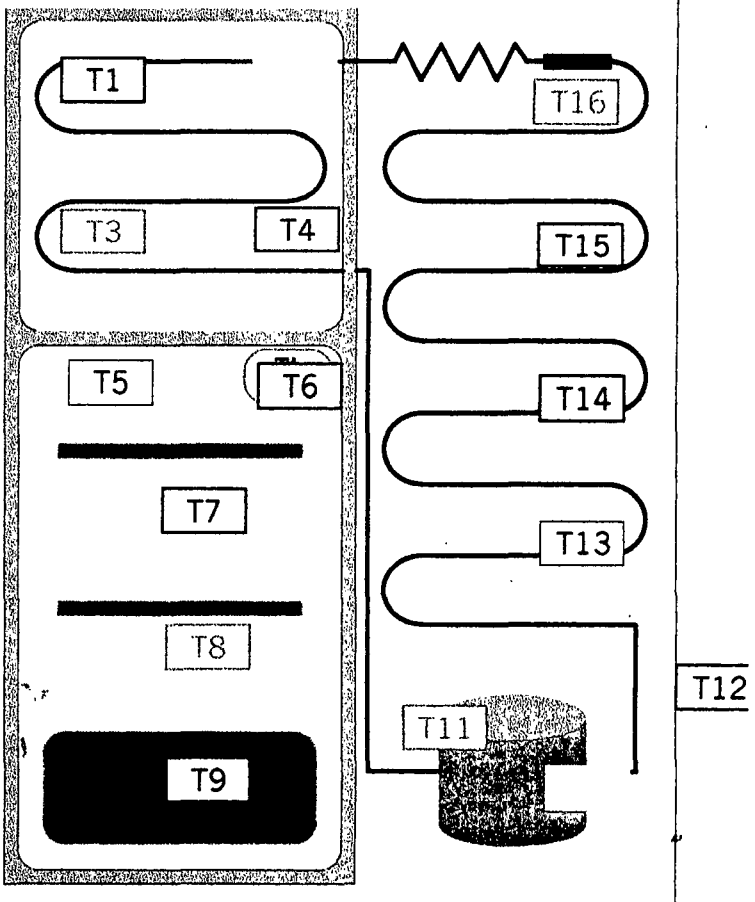
Test Date	Mon Feb 04-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	test2

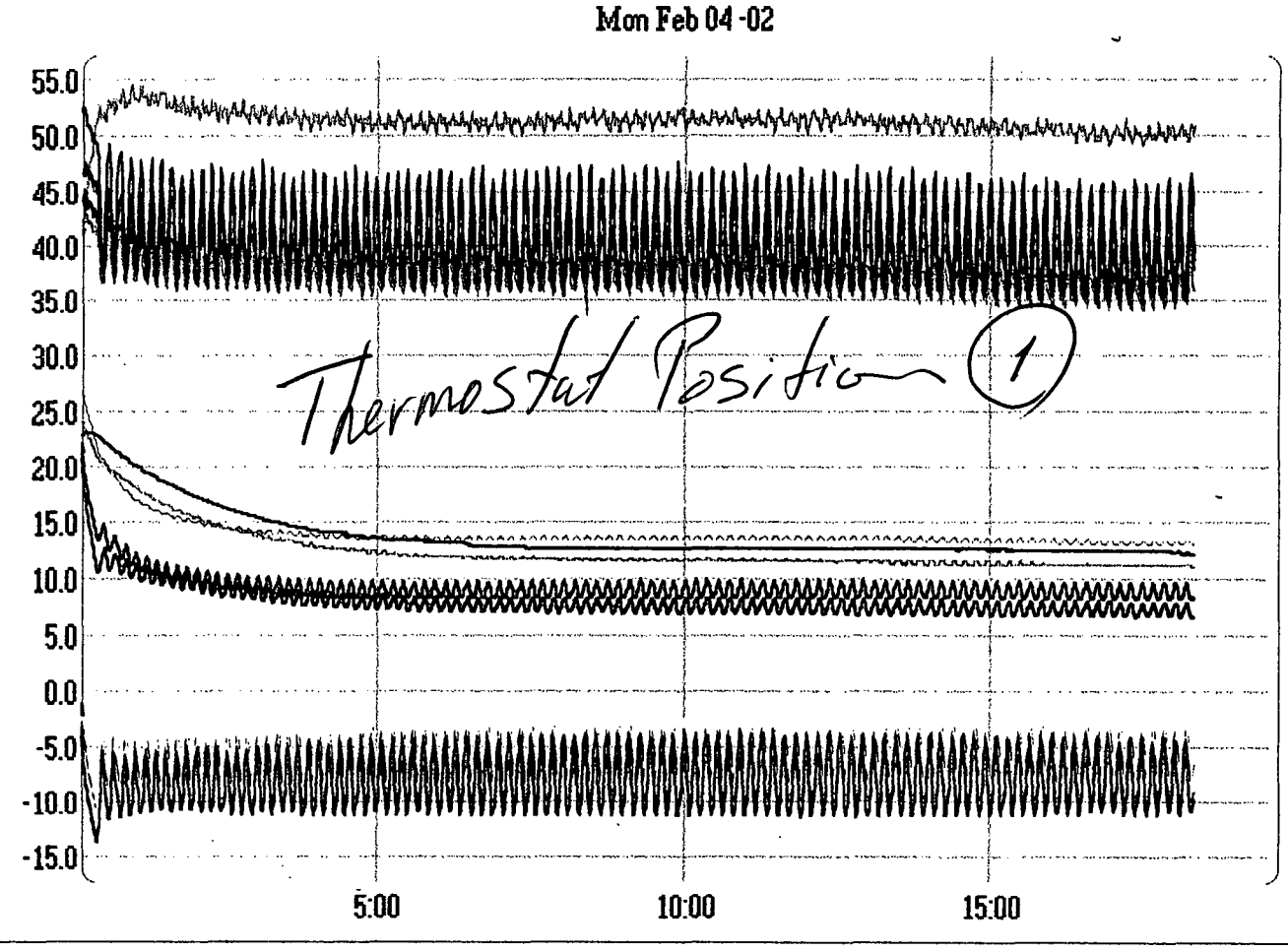
Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	18:31
Working Time(h:m)	06:32
Working Percentage	35.3%
Energy Cons.(KWh)	2.356
Av. En. Cons.(KWh/Day)	3.054
No. of Thermostat	103
No. of Over Load	0





Tehran Shirak [redacted]

Setting

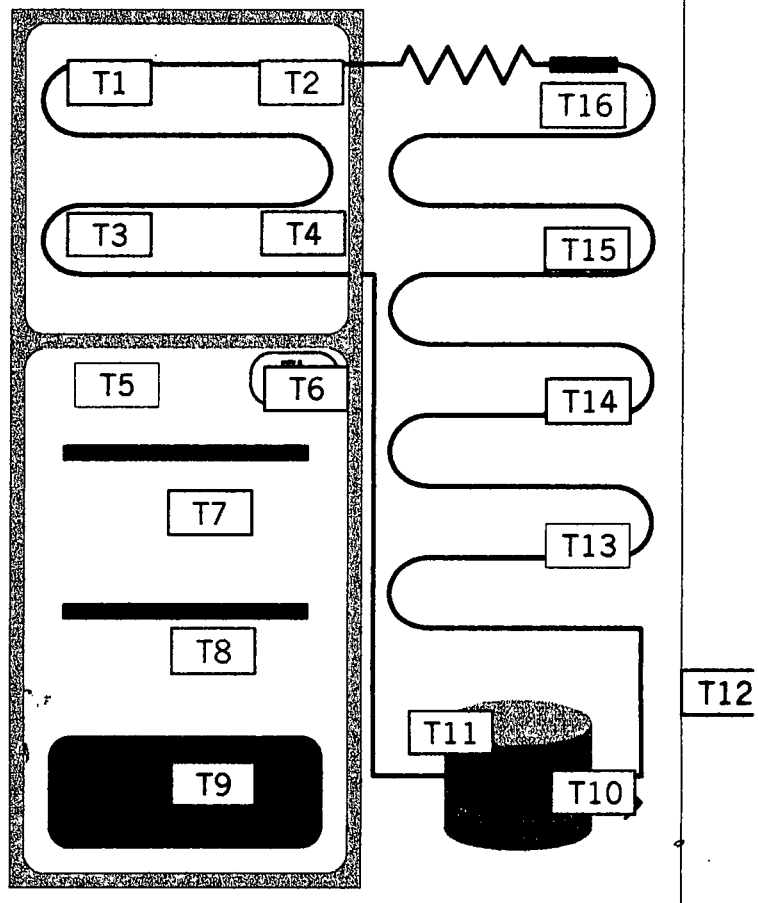
Test Date	Tue Feb 05-02
Test Type	-
Hot Room Temp.	32
Hot Room Hum.	50
File Name	test2

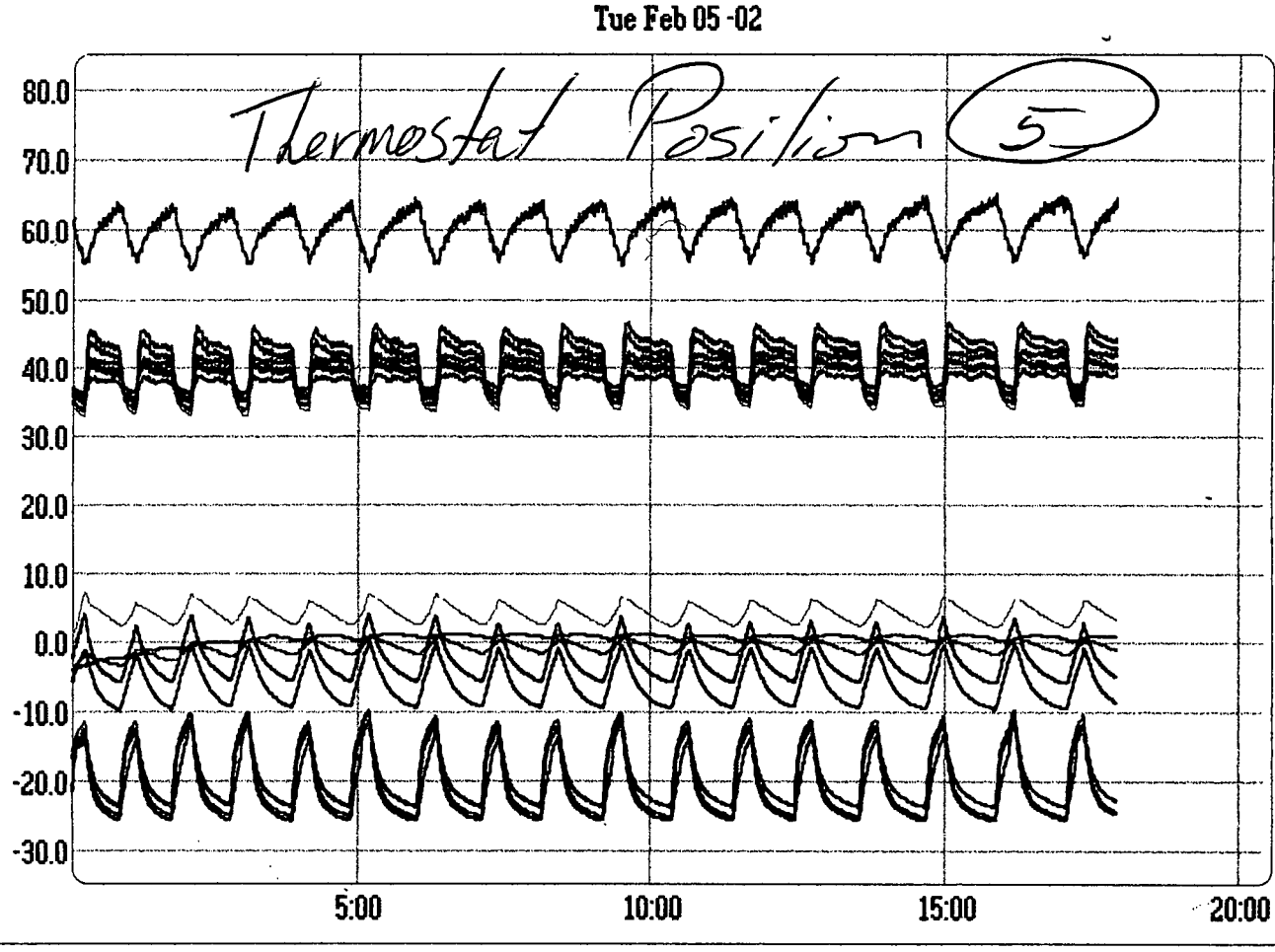
Product Specification

Product Type	-
Compressor Type	-
Refrigerant	-
Cappil. Length	-
Evap. Volume	-
Condensor Length	-
Thermostat Type	-

Test Result

Total Test Time(h:m)	17:56
Working Time(h:m)	12:42
Working Percentage	70.9%
Energy Cons.(KWh)	2.645
Av. En. Cons.(KWh/Day)	3.540
No. of Thermostat	16
No. of Over Load	0

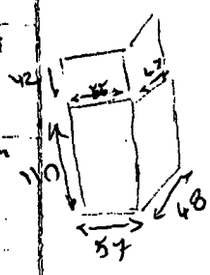




262468

Product Technical Specification GE 160

Description	Specification
Company Name	TEHRAN SHIRAK Co
Product Name	Freezer and refrigerator
Product Model	GE 160
Product Application	Domestic refrigerator
Operating Temperature Climatic Condition	} model
Product Overall Dimension WxLxH mm	650 x 615 x 1810 mm
Freezer Compartment Overall Dimension and Wall Thickness	H 42cm W 55cm L 47cm 5 cm
Refrigerator Compartment Overall Dimension and Wall Thickness	H 110 cm W 57cm L 48cm 4 cm
Product Shape, Double Doors, Upright, Chest, etc	Double Doors
Freezer Internal Net Volume	Wire and Tube
Refrigerator Net Volume	Evaporator
Product Net Volume	
Product Inside Temperature C	-18°c to +1°c
Water Storage Tank Capacity, Water Cooler	
Type of Water Storage Tank Cylinder, Cubic, etc.	
Water Fellow per hour for water cooler	
Water Storage Tank Dimension	
Water Outlet Temperature	
Water Inlet Temperature	
Freezer Inside Temperature	-18°c
Refrigerator Inside Temperature	+1 °c
Evaporating Temperature	S T B
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	40 to 65mm 60mm 40mm 40mm 70mm
Type of PU Foam	ICI and IPC
Foam Density, Kg/Cu. Mt.	32 kg m³
Foam Mixture, Percentage Pol% + R11% + Isocyanate%	ICI P:100 R11:35 ISO 137 IPC " 100 " 32 " 132
Total amount of Foam Injection, Kg	8.5 kg
Refrigerant Type	R12
Refrigerant Charge Weight Gr.	260 gr



Von EMPFANGEN !!

Ksp Inc. 262468

FROM :

PHONE NO. :

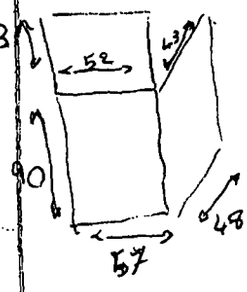
Nov. 15 2001 11:27AM P3

GE 100

Type of Compressor, Hermetic, Semi Hermetic, Open	Hermatic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Static
Compressor Cooling Capacity Watt	1/4 HP
Compressor input Power, Watt	175 w
Compressor Model Number	17
Compressor Manufacturer	National
Compressor Mounting Place Top, Bottom, Front, Back	Bottom Back
Condenser Type, Static, Fan Cooled	Static
Condenser Dimension, Length, Inside Tube Diameter,	φ6 mm
Condenser Material Aluminum, Copper, Copper Coated, etc.	Copper Coated
Condenser mounting Place, Back Wall, Top, Bottom	Back wall
Evaporator Type, Fin and Tube, Roll Bond, Wire and Tube, etc.	Roll Bond wire and Tube
Evaporator Dimension, Length, Surface Area, Inside Tube Diameter	φ8 mm
Evaporator Material, Aluminum, Copper, Copper Coated, etc.	Copper coated and Aluminum
Dryer Type, Dryer Material, Weight and Size	15 gr copper
Capillary Tube Diameter and Length	0.136 340 cm

Product Technical Specification GE 200

Description	Specification
Company Name	TEHRAN SHIRAK Co
Product Name	Freezer and refrigerator
Product Model	GE 200
Product Application	Domestic refrigerator
Operating Temperature	3 model
Climatic Condition	
Product Overall Dimension WxLxH mm	650x615x1960 mm
Freezer Compartment Overall Dimension and Wall Thickness	H 73cm W 52cm L 43 cm 6.5 cm
Refrigerator Compartment Overall Dimension and Wall Thickness	H 90cm W 57cm L 48cm 4cm
Product Shape, Double Doors, Upright, Chest, etc	Double Doors
Freezer Internal Net Volume	wire and Tube
Refrigerator Net Volume	evaporator
Product Net Volume	
Product Inside Temperature C	-18c to +1c
Water Storage Tank Capacity, Water Cooler	
Type of Water Storage Tank Cylinder, Cubic, etc.	
Water Fellow per hour for water cooler	
Water Storage Tank Dimension	
Water Outlet Temperature	
Water Inlet Temperature	
Freezer Inside Temperature	-18°C
Refrigerator Inside Temperature	+1°C
Evaporating Temperature	
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	40 to 65 mm 40mm 40mm 40mm - 60mm
Type of PU Foam	ICI and IPC
Foam Density, Kg/Cu Mt	32 kg m³
Foam Mixture, Percentage Pol% + R11% + Isocyanate%	ICI P:100 R11:35 IS 0/133 IPC P:100 ~ 34 ~ 134
Total amount of Foam Injection, Kg	8.5 kg
Refrigerant Type	R12
Refrigerant Charge Weight Gr	280 gr



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Von EMPFANGEN !!

GE Q00

Type of Compressor, Hermetic, Semi Hermetic, Open	Hermatic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Static
Compressor Cooling Capacity Watt	1/3 HP
Compressor input Power, Watt	Q00 w.
Compressor Model Number	- Q0
Compressor Manufacturer	National
Compressor Mounting Place Top, Bottom, Front, Back	Bottom Back
Condenser Type, Static, Fan Cooled	Static
Condenser Dimension, Length, Inside Tube Diameter,	98mm
Condenser Material, Aluminum, Copper, Copper Coated, etc.	copper caated
Condenser mounting Place, Back Wall, Top, Bottom	Back wall
Evaporator Type, Fin and Tube, Roll Bond, Wire and Tube, etc.	Roll Bond wire and Tube
Evaporator Dimension. Length, Surface Area, Inside Tube Diameter	98mm
Evaporator Material Aluminum, Copper, Copper Coated, etc.	Copper coated and Aluminum
Dryer Type,	
Dryer Material, Weight and Size	15 gr Copper
Capillary Tube Diameter and Length	0136 390cm