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Maurice Ind. ICEBERG موريس الصناعية

22395

72 p. tables graphs

To: ***Mrs. Mounira Latrech***
Contracts Officer
General Services
Financial Performance Control Branch
Field Operation and Administration Division
UINDO, Vienna, Austria
Fax: 00 431 2692 669

Date: 15 July 2000

Subject: ***Final Report***

Reference: ***Contract Number 2000/015P, Project Number MP/JOR/99/165***

Dear Mrs. Latrech ,

Please find attached herewith our final report. One original and four copies.

Please also find enclosed our invoice number 31758 dated 15 July 2000.

Your prompt action in reviewing the final report & proceed the payment of our invoice is highly appreciated.

With regards,

Maryo Al-Deek
Managing Director

مؤسسة موريس الديك
للمقاولات والمشروعات الهندسية

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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General

This Report has been prepared. Based on the UNIDO TOR and relevant contrat between UNIDO and Maurice Al-Deek Co. to convert eight prototype models into R134a refrigerant circuit system.
Considering all elements and technical services in the UNIDO,s TOR.
And fulfill the entire project requirement in Marka and Al-Arghawi Co to phase out CFC-12.
The project will phase out the use of CFC-12 for the production of commercial refrigerator at Marka and Al-Arghawi companies The implementation of this project will enable Marka and Al-Arghawi companies to convert R12 commercial refrigerator system of its products into Ozone friendly R134a refrigerant System.
Based on Montreal and Jordan agreement, R134a refrigerant was selected as suitable Ozone friendly Refrigerant replacement and an alternative for R12 refrigerant and also R141b Blowing as a substitute for R11.
This change to the cooling system requires significant modification and improvement of cooling system. Due to the enhanced physical and chemical properties of the new refrigerant the main components of the cooling circuits must be replaced or adjusted as a consequence of substitution of R12 into R134a.
This report contents, calculation of prototypes for determination of cooling capacity of each prototypes and also selecting compatible compressor for substituting R12 compressor with R134a compressor, because this is the first step for making prototype. It is indeed a difficult job to find precise compressor capacity to much the installed R12 compressor in the Jordanian market.
The technical data will help us to calculate required refrigeration load that should be produced by the compressor and evaporators. For making prototypes our policy is to keep the existing size of condenser and evaporator and perform minor changes as required in cooling circuit, we think that minor adjustment will be required in refrigerant weight charge and probably in length of capillary tube.
In this report we will give some detailed technical data in different tables for each prototype model and then we calculate the refrigeration load calculation for each prototype.

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Companies Background

Al-Arghawi Company

Al-Arghawi was established in 1989. The company is 100% private. The company employs 51 employees and 6 servicemen. The company manufactures 16 models of commercial refrigerator and cold stores units for local use. The density of the foam is about 40 Kg/Cu mt. The company produced total of 3330 units of different products in 1998

Marka Commercial Manufacturer

Marka Industries was established in 1991 is 100% state owned company. The employing 44 people including servicemen. The company manufactures 12 models of commercial refrigerators. The company also produces cool boxes for commercial and military use. The density of foam is 40 Kg/Cu. Mt. The company produced 7620 units of cool boxes and different commercial refrigerator in 1998. And total consumption of ODS was about 13.8 Tons.

Aim of the Project

The aim of the immediate project is to;

1- Design, calculate and drafting for model redefinition for 8 models.
2- Testing 8 prototypes for functionality and performance criteria.
3- 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

1- A study will be made for 8 models of commercial refrigerators made by four companies to specify;

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

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

Supply of Services

We have visited the counterpart premises in order to;

a) prior to start of contract execution in order to:
   - become familiar with counterpart's premises, local conditions and the counterpart's requirements and expectations;
   - to prepare the scope of counterpart's obligations and responsibilities to allow enough time for the counterpart to meet their obligations.

b) to study on 8 models made by the counterparts, to achieve and specify following:

   (1) Dimensional specification
   (2) Type and insulation thickness
   (3) Refrigeration unit component details
   (4) Working performance
   (5) Energy consumption
   (6) Optimisation of 134a charging
   (7) Selection of HFC 134a compatible components
   (8) Redesigning of the complete refrigeration circuit
   (9) Specifying necessary changes in the capillary, evaporator and condenser, etc. as required.
   (10) Preparation of one prototype per model
   (11) Train the counterpart staff in order to familiarise, how to develop ant test prototypes.

c) Third visit will be

   (1) Testing prototypes for functionality and performance.
   (2) Evaluation of the test result.

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(3) Performing necessary changes and modification if required to the prototypes for trial production.

Following components and material have been used to make prototypes.

i- R134a Compressors
ii- R134a Refrigerant
iii- Refrigerant Accumulators
iv- Specially designed filter drier
v- Specially designed evaporator and condenser
vi- Modification of the side panels as required with the new design criteria
vii- Consumable material as required

Activities

Following activities were achieved to implement the project

1- Paying several visits to the factories for collecting data and advising counterpart to prepare facilities to make prototypes as foreseen in the contract.
2- Advising counterpart to do necessary changes to the design of models in order to improve prototypes, for using R134a ozone friendly Refrigerant.
3- Contacting several training sessions to make the technical staffs familiar with methods of making prototypes as described in our previous report.
4- Calculation of 8 model for redesign of prototypes.
5- Redesign of prototypes to fulfill with R134a refrigeration system change requirement.
6- Performing on the job training for proper use of equipment, refrigerant and material.
7- Performing performance tests on 8 prototypes to evaluate the changes to refrigeration system.
8- Performing pull down test, continuous run, and cyclic run test.
9- Evaluation of test result for modifying the refrigeration system.

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Refrigeration Load Calculation
Upright Refrigerator Arghawi Model JAKC-150

Transmission load calculation

Refrigerator Compartment	Dimension Cm.	Area (sq.mt.)	Insulation Thickness	Temp. Difference
Side Walls	2 x (80x200)	3.2	50mm	27 c
Back Panel	150x200	3.0	50mm	27 c
Bottom	80x200	1.6	50mm	27 C
Top	80x200	1.6	50mm	37 c
Doors	160x200	3.0	50mm	27 c

Insulation Type: Pu Foam with R141b blowing agent.
Thermal Conductivity for R141b PUFoam = 0.0180 W/ mt. ° C
Temperature Difference Refrigerator Compartment:
ΔT = 32 - (+5) = 27 ° C
Ambient Temperature = 32 °C
Refrigerator Air Temperature = +5 °C

Calculation :
Heat Leak For Refrigerator Compartment.

$$Q_{TL} = Q_{SW} + Q_{Back\ Panel} + Q_{door} + Q_{Bottom} + Q_{top}$$

$$Q = U\,A\,(T_a - T_r)$$

$$U = \frac{1}{X_1 / K_1}$$

Where :

U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity

Due to the short thickness of cabinet out side panel (0.6 mm) and inner liner (0.6 mm) heat resistance of these materials have been considered negligible.

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Therefore:

$Q_{SideWalls} = [U A (T_a - T_r)]$
T_a = Ambient Temperature 32
T_r = refrigerator air Temperature 5
U = 1 / (0.050/ 0.0180) = 0.36 W/ sq.m °C
A = 3.0 Sq. Mt.,
T_a = 32 °C and T_f = + 5 °C

therefore

$Q_{SideWalls}$ = 0.36 x 3.2 x 27 = 31 Watts

$$Q_{SideWalls} = 31 \text{ Watts}$$

$Q_{doors} = [U A (T_a - T_r)]$
U = 1 / [(0.050/ 0.018)] = 0.36 W/ sq.m °C
$T_a - T_r$ = 27
A = 3.2

$$Q_{doors} = 0.36 \times 3.0 \times 27 = 29 \text{ Watts}$$

$$Q_{doors} = 29 \text{ Watts}$$

$Q_{top} = [U A (T_a - T_r)]$
U = 0.36 w/sq. Mt. °C,
$T_a - T_r$ = 37 and A = 1.6

$$Q_{top} = 0.36 \times 1.6 \times 37 = 21 \text{ Watts}$$

4 -$Q_{back\ panel} = [U A (T_a - T_r)]$
U = 0.36 w/sq. Mt. °C,
$T_a - T_r$ = 27 and A = 3.0

$$Q_{back\ panel} = 0.36x\ 3.0 \times 27 = 29 \text{ Watts}$$

5 -$Q_{Bottom} = [U A (T_a - T_r)]$
U = 0.36 w/sq. Mt. °C,
$T_a - T_r$ = 27 and A = 1.6

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$$Q_{\text{Bottom Surface}} = 0.36 \times 1.6 \times 27 = 16 \text{ Watt}$$

Total Refrigerator Heat Leak =31 +29 + 21 + 29 + 16= 126 W

Product Load

A product placed in a refrigerator at a temperature higher than the storage temperature will lose heat until it reaches the storage temperature. The quantity of heat to be removed may be calculated from knowledge of the product, including its state upon entering the refrigerator, its final state, its weight, specific heat above and below freezing point, its freezing temperature and latent heat. When a definite weight of product is cooled from one state and temperature to another state and temperature, some or all of the following calculations must be made:

Heat removal from initial temperature to some lower temperature above freezing.

$$Q = mc(T_1 - T_2)$$

Heat removal from initial temperature to freezing point of product.

$$Q = mc(T_i - T_f)$$

Heat removal to freeze product.

$$Q = mh_{if}$$

Heat removal from freezing point to final temperature below freezing.

$$Q = mc(T_f - T_3)$$

Where

Q = heat removed, Kj
M = weight of product, kg
C = specific heat of product above freezing point, Kj/Kg. K
T_1 = initial temp. C
T_2 = lower temperature above freezing, C
T_f = freezing temperature of product, C
H_{if} = latent heat of fusion, kj per kg

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Since this product is mainly used for storing fresh Lamb meet and beef above freezing point at +5 C, we consider 600 Kg of meet to be stored in this refrigerator therefore we calculate as follow,

$$Q = mc(T_1-T_2)$$

M = 600 kg
C = 0.67 Btu/(lb)F deg = 0.67 x 4.184 = 2.8 j/g K
T_1 = 25 C and T_2 = 5 C

Q = 600000x2.8x (25-5) =33600000 jul/86400 = 389 Watt

Internal Load

N/A, appliance is a defrost type upright refrigerator

Door Opening

Refrigerator Internal Volume 1200 lit.
Number of air change as per ASHREA standard = 70 per day
Heat removed per cubic meter of air 75000 j

Air Change load = 1.2x70x75000/86400 = 72.9 Watt

$Q_{Total} = Q_{heat\ leak} + Q_{product\ load} + Q_{internal\ load} + Q_{air\ change}$

Q_{Total} = **126 + 389 + 73 = 588**

Considering 20 % of Q total for safety factor

$Q_{Grand\ Total}$ = ***641 + 20%(128) = 706 watts***

With respect to the above calculation we have to select a compressor of R134a with cooling capacity of approximately 706 watt at –15 degree centigrade evaporating temperature. We should select a compressor to be compatible with Electrolux compressor model S26TY.

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Chest Freezer Model Arghawi Jack-100F

Transmission Load Calculation

Dimension

Descricption	Dimension Cm.	Area (sq. mt.)	Insulation Thickness mm
Side Walls	2 x (70x90)	1.26	80
Front & Back Panel	2 x (100x90)	1.80	80
Chest Door	100 x 70	0.70	80
Bottom Floor	100 x 70	0.70	80

Insulation Type: Pu Foam R141b expanded blowing PU foam
R141b Foam Thermal Conductivity: 0.018 W /mt.C
Temperature Difference: $(\Delta T) = 32 - (-25) = 57$ C
Ambient Temperature = 32 C
Freezer Air Temperature = - 25 C

Calculation:

$$Q_{TL} = Q_{side\ Walls} + Q_{Bottom} + Q_{Top}$$

$$Q = U A (T_a - T_f)$$

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + \ldots\ldots}$$

Where :

U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity
X_1 = Foam Thickness

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Note : Due to the short thickness of cabinet out side panel (0.6 mm) and inner liner (0.6 mm) heat resistance of these materials have been considered negligible.

Therefore:

$Q_{SideWalls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.08/0.018) = 0.22 W/ sq.m C
A = 1.26 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{SideWalls} = 0.22 \times 1.26 \times 57 = 15.5 \text{ Watts}$$

$Q_{Front\ and\ back\ Walls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.080/0.018) = 0.22 W/ sq.m C
A = 1.8 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Front\ and\ back\ Walls} = 0.22 \times 1.8 \times 57 = 22.6 \text{ Watts}$$

$Q_{Top\ door} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.080/0.018) = 0.22 W/ sq.m C
A = 0.7 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Top} = 0.22 \times 0.7 \times 57 = 8.8 \text{ Watts}$$

$Q_{Bottom} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1/(0.080/ 0.018) = 0.22 W/ sq.m C

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A = 0.7 Sq. Mt.
T_a = 42 C and T_f = - 25 C

$$Q_{Bottom} = 0.22 \times 0.7 \times 67 = 10.3 \text{ Watts}$$

Total Heat Leaks;

Q_{TL} = 15.5 + 22.6 + 8.8 + 10.3= 57 watts

$$Q_{\text{Total Heat Leaks}} = 57 \text{ Watts}$$

Ice Making Capacity = 5 $_{Kg}$ x 1 x (24 - 0) x1.163= 139 Watts

c) Heat gain through infiltration;

We consider 10% safety factor for door opening and infiltration
Heat gain by infiltration = 0.1 x (total heat leaks)
Heat gain by infiltration = 0.1 x (196) = 20Watts
Total Cooling Capacity Required is calculated as follows;

$$Q_{Grand\ Total} = Q_{Heat\ Leaks} + Q_{Ice\ Making} + Q_{Infiltration}$$

$$Q_{Grand\ Total} = 57 + 139 + 20 = 216 \text{ Watts}$$

$$Q_{Grand\ Total} = 216 \text{ Watts}$$

The suitable R134a compressor should be compatible with cooling capacity of 216 watt. Considering C.O.P of compressor.

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Chest Freezer Model Arghawi Jack-150F

Transmission Load Calculation

Dimension

Descricption	Dimension Cm.	Area (sq. mt.)	Insulation Thickness mm
Side Walls	2 x (70x90)	1.26	80
Front & Back Panel	2 x (150x90)	2.70	80
Chest Door	150 x 70	1.05	80
Bottom Floor	150 x 70	1.05	80

Insulation Type: Pu Foam R141b expanded blowing PU foam
R141b Foam Thermal Conductivity: 0.018 W /mt.C
Temperature Difference: $(\Delta T) = 32 - (-25) = 57$ C
Ambient Temperature = 32 C
Freezer Air Temperature = - 25 C

Calculation:

$$Q_{TL} = Q_{\text{side Walls}} + Q_{\text{Bottom}} + Q_{\text{Top}}$$

$$Q = U A (T_a - T_f)$$

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + \ldots\ldots}$$

Where :

U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity
X_1 = Foam Thickness

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Note : Due to the short thickness of cabinet out side panel (0.6 mm) and inner liner (0.6 mm) heat resistance of these materials have been considered negligible.

Therefore:

$Q_{SideWalls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.08/0.018) = 0.22 W/ sq.m C
A = 1.26 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{SideWalls} = 0.22 \times 1.26 \times 57 = 15.5 \text{ Watts}$$

$Q_{Front\ and\ back\ Walls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.080/0.018) = 0.22 W/ sq.m C
A = 2.7 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Front\ and\ back\ Walls} = 0.22 \times 2.7 \times 57 = 33.8 \text{ Watts}$$

$Q_{Top\ door} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.080/0.018) = 0.22 W/ sq.m C
A = 1.05 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Top} = 0.22 \times 10.5 \times 57 = 13.2 \text{ Watts}$$

$Q_{Bottom} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1/(0.080/ 0.018) = 0.22 W/ sq.m C
A = 1.05 Sq. Mt.

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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T_a = 42 C and T_f = - 25 C

$$Q_{Bottom} = 0.22 \times 1.05 \times 67 = 15.5 \text{ Watts}$$

Total Heat Leaks;

Q_{TL} = 15.5 + 33.8 + 13.2 + 15.5= 78 watts

$$Q_{\text{Total Heat Leaks}} = 78 \text{ Watts}$$

Ice Making Capacity = 5 Kg x 1 x (24 - 0) x1.163= 139 Watts

c) Heat gain through infiltration;

We consider 10% safety factor for door opening and infiltration
Heat gain by infiltration = 0.1 x (total heat leaks)
Heat gain by infiltration = 0.1 x (217) = 22Watts
Total Cooling Capacity Required is calculated as follows;

$$Q_{Grand\ Total} = Q_{Heat\ Leaks} + Q_{Ice\ Making} + Q_{Infiltration}$$

$$Q_{Grand\ Total} = 78 + 139 + 22 = 239 \text{ Watts}$$

$$Q_{Grand\ Total} = 239 \text{ Watts}$$

The suitable R134a compressor should be compatible with cooling capacity of 239 watt. Considering C.O.P of compressor.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Load Calculation Water Cooler
Model Arghawi JAWC-60

$Q_1 = m\ C\ \Delta T$, *Where:*

Q_1 Total heat removed from total drinking water tank volume capacity (lit.) during specific period, related to compressor cooling capacity power in Watts, at initial compressor start up, and early in the morning. When the water temperature is 24 C.

m total weight of original water in the water cooler storage tank in Kg. Considering that one litter of water at 24 C is equal to approximately one Kg.

M = 60 liter = 60 Kg.

C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature difference (Ti–Tc), where, Ti is inlet water temperature, and Tc is final cooled water.

Ti = 24 °C and Tc = 10 °C

Ti – Tc = 24-10 = 14 °C

Q_1 = m C ΔT = 60 x 1 x 14 = 840 Kcal = 840 x 1.163 = 977 Watts/24 hrs

Q_1 = 977 /24 water cooler operating time per day = 41 Watts

Q_1 = 41 Watts

$Q_2 = \dot{M}\ C\ \Delta T$

Q_2 Total heat removed from total drinking water flow (lit.) during specific period, 16 hours. In Kcal.

$\dot{M}$ total weight of water flow during 16 hours. in Kg. = H x N x M where:

H = Total Water Cooler Usage Time (Hours) = 16
N = Number of Glass of Drinking Water per Hour = 60
M = Kg weight of water in one Glass of Water = 0.2 Kg

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$\dot{M}$ = 16 x 60 x 0.2 = 96 lit. +20% Waste Water = 230

C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature d($T_i - T_c$), where, Ti is inlet water temperature, and T_c is final cooled water temperature.

Ti = 24 °C and T= 10° C and Ti – Tc = 24-10 = 14° C

$Q_2 = m\ C\ \Delta T$ = 230 x 1 x 14 = 3226 Kcal = 3226 x 1.163 = 3751 Watts/16 hrs

Q_2 = 3751/16 compressor operating time per day = 234 Watts

Q_2 = 234 Watts

$Q_3 = UA\ \Delta T$, Where:

Q_3 Total Leak, gained through side wall of drinking water storage tank by conduction in Kcal..

U Heat Resistance Coefficient Factor in Kcal/Sq. Mt. C

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + ...}$$

U= 0.180/0.080 = 0.22 Watt/Sq. Mt. C

Water Storage Tank Dimension WidthxLengthxHight = 60x70x30 Cm.

$A = A_{\text{side walls}} + A_{\text{Top and Bottom}}$ = {(30 x 260) + (2x60x70)} =0.78+ 0.84 Sq. Mt.

Total Surrounding Area = 1.62 Sq.Mt.

ΔT Temperature difference (Ta – Tc), where, T is ambient temperature, and T_c is final cooled water temperature.

Ta = 30 °C and Tc = 10° C

Ta – Tc = 30-10 = 20 °C

$Q_3 = UA\ \Delta T$ = 0.22 x 1.62 x 20 = 7.2 Watts

Q_3 = 7.2 Watts

$Q_t = Q_1 + Q_2 + Q_3$ = 41 + 234 + 7.2 = 282 Watts

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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Q_{total} = 282 watts

Suitable compressor to be selected should have at least 282 watt cooling capacity and must be compatible with compressor model Electrolux L76AV.

Chest Freezer Model Marka CF-290 lit.

Transmission Load Calculation

Dimension

Descricption	Dimension Cm.	Area (sq. mt.)	Insulation Thickness mm
Side Walls	2 x (60x80)	0.96	70
Front & Back Panel	2 x (120x80)	1.92	70
Chest Door	120 x 60	0.72	70
Bottom Floor	120 x 60	0.72	70

Insulation Type: Pu Foam R141b expanded blowing PU foam
R141b Foam Thermal Conductivity: 0.018 W /mt.C
Temperature Difference: (ΔT) = 32 - (-25) = 57 C
Ambient Temperature = 32 C
Freezer Air Temperature = - 25 C

Calculation:

$Q_{TL} = Q_{side\ Walls} + Q_{Bottom} + Q_{Top}$

$Q = U A (T_a - T_f)$

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + ...}$$

U = 0.0180/0.70 = 0.26

Where :

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity
X_1 = Foam Thickness

Note : Due to the short thickness of cabinet out side panel (0.6 mm) and inner liner (0.6 mm) heat resistance of these materials have been considered negligible.

Therefore:

$Q_{SideWalls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.07/0.018) = 0.26 W/ sq.m C
A = 0.96 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{SideWalls} = 0.26 \times 0.96 \times 57 = 14.2 \text{ Watts}$$

$Q_{Front\ and\ back\ Walls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.070/0.018) = 0.26 W/ sq.m C
A = 1.92 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Front\ and\ back\ Walls} = 0.26 \times 1.92 \times 57 = 28.5 \text{ Watts}$$

$Q_{Top\ door} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.070/0.018) = 0.26 W/ sq.m C
A = 0.72 Sq. Mt.
T_a = 32 C and T_f = - 25 C

$$Q_{Top} = 0.26 \times 0.72 \times 57 = 10.7 \text{ Watts}$$

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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$Q_{Bottom} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1/(0.070/ 0.018) = 0.26 W/ sq.m C
A = 0.72 Sq. Mt.
T_a = 42 C and T_f = - 25 C

Q_{Bottom} = 0.26 x 0.72 x 67 = 12.5 Watts

Total Heat Leaks;

Q_{TL} = 14.2 + 28.5 + 10.7 + 12.5 = 65.9 watts

$$Q_{Total\ Heat\ Leaks} = 65.9 \text{ Watts}$$

Ice Making Capacity = 5 $_{Kg}$ x 1 x (24 - 0) x1.163= 139 Watts

c) Heat gain through infiltration;

We consider 10% safety factor for door opening and infiltration
Heat gain by infiltration = 0.1 x (total heat leaks)
Heat gain by infiltration = 0.1 x (217) = 22Watts
Total Cooling Capacity Required is calculated as follows;

$$Q_{Grand\ Total} = Q_{Heat\ Leaks} + Q_{Ice\ Making} + Q_{Infiltration}$$

$$Q_{Grand\ Total} = 65.9 + 139 + 22 = 226.9 \text{ Watts}$$

$$Q_{Grand\ Total} = 227 \text{ Watts}$$

The suitable R134a compressor should be compatible with cooling capacity of 227 watt. Considering C.O.P of compressor.

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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Chest Freezer Model Marka CF-290-30C.

Transmission Load Calculation

Dimension

Descricption	Dimension Cm.	Area (sq. mt.)	Insulation Thickness mm
Side Walls	2 x (60x80)	0.96	70
Front & Back Panel	2 x (120x80)	1.92	70
Chest Door	120 x 60	0.72	70
Bottom Floor	120 x 60	0.72	70

Insulation Type: Pu Foam R141b expanded blowing PU foam
R141b Foam Thermal Conductivity: 0.018 W /mt.C
Temperature Difference: $(\Delta T) = 32 - (-30) = 57$ C
Ambient Temperature = 32 C
Freezer Air Temperature = - 30 C

Calculation:

$Q_{TL} = Q_{side\ Walls} + Q_{Bottom} + Q_{Top}$

$Q = U A (T_a - T_f)$

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + \ldots\ldots}$$

U = 0.0180/0.70 = 0.26

Where :

U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity
X_1 = Foam Thickness

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Note : Due to the short thickness of cabinet out side panel (0.6 mm) and inner liner (0.6 mm) heat resistance of these materials have been considered negligible.

Therefore:

$Q_{SideWalls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.07/0.018) = 0.26 W/ sq.m C
A = 0.96 Sq. Mt.
T_a = 32 C and T_f = - 30 C

$$Q_{SideWalls} = 0.26 \times 0.96 \times 62 = 15.5 \text{ Watts}$$

$Q_{Front\ and\ back\ Walls} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.070/0.018) = 0.26 W/ sq.m C
A = 1.92 Sq. Mt.
T_a = 32 C and T_f = - 30 C

$$Q_{Front\ and\ back\ Walls} = 0.26 \times 1.92 \times 32 = 31 \text{ Watts}$$

$Q_{Top\ door} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1 / (0.070/0.018) = 0.26 W/ sq.m C
A = 0.72 Sq. Mt.
T_a = 32 C and T_f = - 30 C

$$Q_{Top} = 0.26 \times 0.72 \times 62 = 11.6 \text{ Watts}$$

$Q_{Bottom} = [U A (T_a - T_f)]$
T_a = Ambient Temperature
T_f = Freezer air Temperature
U = 1/(0.070/ 0.018) = 0.26 W/ sq.m C

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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A = 0.72 Sq. Mt.
T_a = 42 C and T_f = - 30 C

$$Q_{Bottom} = 0.26 \times 0.72 \times 72 = 13.5 \text{ Watts}$$

Total Heat Leaks;

Q_{TL} = 15.5 + 31 + 11.6 + 13.5 = watts

$$Q_{\text{Total Heat Leaks}} = 71.6 \text{ Watts}$$

Ice Making Capacity = 5 Kg x 1 x (24 - 0) x1.163= 139 Watts

c) Heat gain through infiltration;

We consider 10% safety factor for door opening and infiltration
Heat gain by infiltration = 0.1 x (total heat leaks)
Heat gain by infiltration = 0.1 x (217) = 22Watts
Total Cooling Capacity Required is calculated as follows;

$$Q_{Grand\ Total} = Q_{Heat\ Leaks} + Q_{Ice\ Making} + Q_{Infiltration}$$

$$Q_{Grand\ Total} = 71.6 + 139 + 22 = 232.6 \text{ Watts}$$

$$Q_{Grand\ Total} = 233 \text{ Watts}$$

The suitable R134a compressor should be compatible with cooling capacity of 233 watt. Considering C.O.P of compressor.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Load Calculation Water Cooler Model Marka MWC-50lit.

$Q_1 = m\ C\ \Delta T$, *Where:*

Q_1 Total heat removed from total drinking water tank volume capacity (lit.) during specific period, related to compressor cooling capacity power in Watts, at initial compressor start up, and early in the morning. When the water temperature is 24 C.

m total weight of original water in the water cooler storage tank in Kg. Considering that one litter of water at 24 C is equal to approximately one Kg.

M = 50 liter = 50 Kg.

C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature difference (Ti–Tc), where, Ti is inlet water temperature, and Tc is final cooled water.

Ti = 24 °C and Tc = 10° C

Ti – Tc = 24-10 = 14 °C

Q_1 = m C ΔT = 50 x 1 x 14 = 700 Kcal = 700 x 1.163 = 814 Watts/24 hrs

Q_1 = 814 /24 water cooler operating time per day = 34 Watts

Q_1 = 34 Watts

$$Q_2 = \dot{M}\ C\ \Delta T$$

Q_2 Total heat removed from total drinking water flow (lit.) during specific period, 16 hours. In Kcal.

$\dot{M}$ total weight of water flow during 16 hours. in Kg. = H x N x M where:

H = Total Water Cooler Usage Time (Hours) = 16
N = Number of Glass of Drinking Water per Hour = 50
M = Kg weight of water in one Glass of Water = 0.2 Kg

$\dot{M}$ = 16 x 50 x 0.2 = lit. +20% Waste Water = 192

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ ٦ ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ ٦ ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature d($T_i - T_c$), where, Ti is inlet water temperature, and T_c is final cooled water temperature.

Ti = 24 °C and T= 10° C and $T_i - T_c$ = 24-10 = 14° C

$Q_2 = m\ C\ \Delta T = 192 \times 1 \times 14 = 2688$ Kcal = 2688x 1.163 = 3126 Watts/16 hrs

Q_2 = 3126/16 compressor operating time per day = 195 Watts

Q_2 = 195 Watts

$Q_3 = UA\ \Delta T$, Where:

Q_3 Total Leak, gained through side wall of drinking water storage tank by conduction in Kcal..

U Heat Resistance Coefficient Factor in Kcal/Sq. Mt. C

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + \ldots\ldots}$$

U= 0.180/0.050 = 0.36 Watt/Sq. Mt. C

Water Storage Tank Dimension WidthxLengthxHight = 60x40x30 Cm.

$A = A_{\text{side walls}} + A_{\text{Top and Bottom}}$ = {(30 x 200) + (2x40x60)} =0.6+ 0.48 Sq. Mt.

Total Surrounding Area = 1.08 Sq.Mt.

ΔT Temperature difference (Ta – Tc), where, T is ambient temperature, and T_c is final cooled water temperature.

Ta = 30 °C and Tc = 10 °C

Ta – Tc = 30-10 = 20 °C

$Q_3 = UA\ \Delta T = 0.36 \times 1.08 \times 20 = 7.2$ Watts

Q_3 = 7.8 Watts

$Q_t = Q_1 + Q_2 + Q_3 = 34 + 195 + 7.8 = 237$ Watts

Q_{total} = 237 watts

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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Suitable compressor to be selected should have at least 237 watt cooling capacity.

Load Calculation Water Cooler Model Marka MWC-32lit.

$Q_1 = m\ C\ \Delta T$, *Where:*

Q_1 Total heat removed from total drinking water tank volume capacity (lit.) during specific period, related to compressor cooling capacity power in Watts, at initial compressor start up, and early in the morning. When the water temperature is 24 C.

m total weight of original water in the water cooler storage tank in Kg. Considering that one litter of water at 24 C is equal to approximately one Kg.

M = 32 liter = 32 Kg.

C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature difference (Ti–Tc), where, Ti is inlet water temperature, and T_c is final cooled water.

T_i = 24 °C and T_c = 10° C

$T_i - T_c$ = 24-10 = 14 °C

Q_1 = m C ΔT = 32 x 1 x 14 = 448 Kcal = 448 x 1.163 = 521 Watts/24 hrs

Q_1 = 521 /24 water cooler operating time per day = 21.7 Watts

Q_1 = 21.7 Watts

$Q_2 = \dot{M}\ C\ \Delta T$

Q_2 Total heat removed from total drinking water flow (lit.) during specific period, 16 hours. In Kcal.

$\dot{M}$ total weight of water flow during 16 hours. in Kg. = H x N x M where:

H = Total Water Cooler Usage Time (Hours) = 16
N = Number of Glass of Drinking Water per Hour = 40
M = Kg weight of water in one Glass of Water = 0.2 Kg

$\dot{M}$ = 16 x 40 x 0.2 = lit. + 20% Waste Water = 154

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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C Specific heat factor of water in Kcal/Kg °C = 1

ΔT Temperature d($T_i - T_c$), where, Ti is inlet water temperature, and T_c is final cooled water temperature.

Ti = 24 °C and T= 10° C and Ti – Tc = 24-10 = 14° C

$Q_2 = m\ C\ \Delta T = 154 \times 1 \times 14 = 2156$ Kcal = 2156x 1.163 = 2507 Watts/16 hrs

Q_2 = 2507/16 compressor operating time per day = 156 Watts

Q_2 = 156 Watts

$Q_3 = UA\ \Delta T$, Where:

Q_3 Total Leak, gained through side wall of drinking water storage tank by conduction in Kcal..

U Heat Resistance Coefficient Factor in Kcal/Sq. Mt. C

$$U = \frac{1}{X_1 / K_1 + X_2 / K_2 + \ldots\ldots}$$

U= 0.180/0.050 = 0.36 Watt/Sq. Mt. C

Water Storage Tank Dimension WidthxLengthxHight = 50x40x30 Cm.

$A = A_{\text{side walls}} + A_{\text{Top and Bottom}}$ = {(30 x 180) + (2x40x50)} =0.54+ 0.4 Sq. Mt.

Total Surrounding Area = 0.94 Sq.Mt.

ΔT Temperature difference (Ta – Tc), where, T is ambient temperature, and T_c is final cooled water temperature.

Ta = 30 °C and Tc = 10 °C

Ta – Tc = 30-10 = 20 °C

$Q_3 = UA\ \Delta T = 0.36 \times 0.94 \times 20 = 6.8$ Watts

Q_3 = 6.8 Watts

$Q_t = Q_1 + Q_2 + Q_3 = 21.7 + 156 + 6.8 = 236$ Watts

Q_{total} = 184 watts

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Suitable compressor to be selected should have at least 184 watt cooling capacity.

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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Maurice Ind. ICEBERG موريس الصناعية

Amman 12 April 2000

To: ***United Nation Industrial Development Organization***
Attn: ***Mrs. Mounira Latrech***

Dear Mrs. Latrech

Please find below our detailed training program.

Training duration five working days.

Subjects to be taught are as follows:

UNIDO training course
Development of prototypes
Conversion of R12 refrigeration system into ozone friendly R134a refrigerant

Making Prototype
a) Model selection
b) Refrigeration system type
   - Defrost
   - No frost
c) Refrigeration system components definition
   - Condenser
     1) Wire and tube
     2) Tube on plate
     3) Tube inserted plate
     4) Tube inserted fin
     5) Tube inserted body

   - Capillary tube function
     1) Permanently open

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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2) Flow drop depend on pressure drop across its length and condition of liquid entering it
3) Capacity depends on flow
4) Stabilize pressure
5) Reduce pressure
6) Increase velocity

- Capillary tube definition
  1) Tube length
  2) Tube inner diameter
  3) Tube material

- Thermostatic expansion valve function

Regulate flow in response to amount of liquid required to satisfy load condition

- Thermostatic expansion valve type
  1) Internal equalizer
  2) External equalizer

- Filter dryer
  1) Weight
  2) Material
  3) Size & type

- Evaporator
  1) Wire and tube
  2) Tube on plate
  3) Roll bond
  4) Tube inserted fin
  5) Tube inserted body

- Compressor cooling system
  1) Static
  2) Oil
  3) Fan

- Compressor pressure system
  1) LBP

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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2) HBP
3) MBP

- Compressor type
  1) Hermetic
  2) Semi-hermetic
  3) Open

- Compressor refrigerant type
  1) R12
  2) R134a
  3) Isobutene
  4) Blend

- Compressor electrical system and accessories
  1) Capacitor type
  2) Relay type
  3) Voltage ampere
  4) Wiring system

- Compressor mounting pad
  1) Refrigerant flow direction
  2) Top mounting pad
  3) Bottom mounting pad

- Compressor capacity
  1) Watt
  2) Kcal
  3) BTU

- Compressor test condition
  CECOMAF standards
- Evaporating temperature –25 c
- Condensing temperature 55 c
- Ambient temperature 32 c
- Suction gas temperature 32 c
- Liquid temperature 55 c
- Voltage / hertz 220/50 hz

Heat output = Capacity + watt consumption

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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ASHRAE Standard
- Evaporating temp. –23.3 c
- Condensing temp. 55 c
- Ambient temp. 32 c
- Liquid temp. 32 c
- Voltage / hertz 220 / 50 hz

Heat output = capacity + watt consumption

Conversion of capacity from CECOMAF to ASHRAE standard
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 = 1.162 watt
1 BTU = .293 watt

Compressor capacity relation to different evaporating temperature

Thermostat

Thermostat adjustment

Cut in time –5 to –15 c

Thermostat setting
1) Minimum
2) Middle
3) Maximum

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Cut out time –15 to –25 c

Thermostat setting
1) Minimum
2) Middle
3) Maximum

Thermostat working temperature range –5 to –25

New refrigerant operating behavior

R12
R134a
R600 Isobutene
Blend, Butane & Propane

Refrigerant charging method

Cylinder (bottle)
Portable charger
Mass production evacuation and charging machine

Charging amount

Experimental, trial and error
Calculation basis
Comparison with other refrigerant

Testing prototypes

Step one
Testing previously optimized R12 model

Step two
Hot chamber preparation

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Step three
Loading test package, "M" package
Meat. Water, etc.

Step four
Mounting sensors

Step five
Ambient temperature condition

- Tropical 43 c
- Sub-tropical 38 c
- Normal 32 c
- Sub-normal 28 c
- Cold condition 18 c

Relative humidity 60 % to 70 %

Prototype test procedure

1- Performing R12 refrigeration system optimization test
2- Hot chamber test criteria
3- Ambient test condition
4- Different type of test methods
    A) Operational test
    B) Performance test
    C) Energy consumption
    D) Ice making test
    E) Humidity test
5- Test process
    A) Pull down
    B) Continuous run
    C) Cyclic run
    D) Period of each test phase

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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6- Test results data collection
7- Test results analysis

Trial production
1- Batch production
2- Customer data system feed back
3- Prototype improvement
4- Problem solving

Mass production

OZONE

Depletion, its causes and results

An overview to ozone

Atmosphere surrounding earth

Troposphere
(Ground - 11 KM)

Stratosphere
(11 – 48 KM)

Ionosphere
(48 – 480 KM)

Ozone is form of oxygen with three atoms instead of the normal two atoms. Ozone scattered so thinly through the 35 KM deep stratosphere that if it were collected together it would form a layer around the earth not thicker than 3 mm.

From every 300,000 molecule, only one molecule of ozone exists.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Through natural atmospheric process ozone molecule are crated and destroyed continuously.
Ultraviolet radiation from the sun breaks up oxygen into atoms, which then combine with other oxygen molecules to form ozone.

Ozone is not a stable gas and is particularly defenseless to destruction by natural compounds containing hydrogen, nitrogen and chlorine.

Ozone depletion

Chlorine freed by radiation from chlorine containing molecules can take an atom from ozone molecules, producing CLO (chlorine oxide), and normal oxygen.

Every southern spring a "hole" occurs as big as united states in the ozone layer over Antarctica (south pole).

Inactive chlorine collected on the surface of polar stratospheric cloud during winter and is converted into forms that can deplete the ozone layer by chemical reaction in the presence of sunlight.

In 1992 – 1993 the biggest hole so far ozone had depleted by more than 60% from previous observation.

Effects on the environment

- Decrease in crop production, such as wheat, beans, melons, mustard, and cabbage.
- Reducing quality of tomato, potato, sugar beet, and Soya beans.
- Damage to forests.
- Damage to ocean organic organization, such as planktons.
- Decrease in marine food products.
- Rapid wear of materials used in building, such as paints, packaging and countless other substances.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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Effects on human health

- Skin cancer.
- Eye damage.
- Cataracts.
- Deformation of eye lenses.
- Old sight ness.
- Reducing immune system.

Other impacts

Depletion of stratospheric ozone would worsen the photochemical pollution in the troposphere resulting in an increase of ozone at the surface of earth where it is not wanted, therefore, have an enormous risk in preserving the fragile ozone layer shield.

Ozone depleting potential (ODP)

To rank how effectively a single molecule will break down ozone.
CFC-11 is assigned a value of exactly one. All other chemicals are assigned ODP relative to CFC-11. The figure below shows the ODP and atmospheric lifetime of some typical compounds.

Global warming potential (GWP)

Refrigerants may contribute to global warming by way of phenomenon called Greenhouse effect.

Some gases in the atmosphere such as water vapor, carbon dioxide (CO2), methane refrigerants and other gasses will absorb the radiation and re-emit it. These are called Greenhouse Gases.

The effect is

- Warming earth surface

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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- Rising mean level of seas
- Climatic changes, rain, sunshine, etc.
- Harvest, crops could not adapt to the changes in each zone.
- Eco-system, some plants and animals may disappear.

Montreal protocol

- In 1974, Sherwood Rowland and Mario Molina of university of California claimed that man-made chemicals known as chlorofluorocarbon (CFCs) were damaging the stratospheric ozone layer.
- UNEP has been involved in about protecting of the ozone layer since 1972.
- In 1985, the convention for protecting of the ozone layer was signed in Vienna.
- In 1987 more than 24 countries agreed to specific measures to be taken and the Montreal protocol on substances that deplete the ozone layer was signed.
- In 1990 in London the Montreal schedules were adjusted so that five CFCs, (CFC11, 12, 113, 114,and 115) and three halons would be phased out in 2005.
- In 1992 the parties agreed to phase out CFCs in 1996 in developed countries.
- The developing countries, (those that consume less than 0.3 kg. Of CFCs per capita) are exempted and have ten-year grace period.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٤١٦٠٧٨٦ -٦- ٩٦٢ - فاكس : ٤٦١٣٣٤٠ -٦- ٩٦٢ - ص.ب : ٩٢١٩٤٠ عمان - الاردن
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- HCFCs to be phase out until 2030.
- Article 5 countries.
- Multilateral fund.
- Executive committee.
- UN implementing agencies.
  1- UNEP
  2- UNDP
  3- UNIDO
  4- WORD BANK
- Country program & business plan
- Refrigeration management plan.
- Formulation of projects.
- Ozone office.
- Counterparts.
- Subcontractors.

Ozone depletion substances

Blends
Azeotropes: combination of chemicals that act as single refrigerant. Such as R-502.

Zeotropes: combination of chemicals that maintain some of their original characteristics, such as R-404A.

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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Famous ozone friendly alternatives

HFCs (R134a) HCs (Cyclopentaane, pentane, isobutene).

Thermo physical and environmental properties of some common refrigerants.

An introduction to R134a refrigerant.

Refrigeration concepts.

Review of basic refrigeration principles.

- Refrigeration cycle.
- Pressure entholpy diagram.
- Saturated liquid.
- Saturated vapor.
- Density.
- Specific volume.
- Temperature.

هاتف المعرض : ٤٦٥٣٢٦٢ ـ المصنع : ٤١٦١٣٧٢ ـ فاكس : ٤١٦٠٧٨٦ ـ٦ـ ٩٦٢ ـ فاكس : ٤٦١٣٣٤٠ ـ٦ـ ٩٦٢ ـ ص.ب : ٩٢١٩٤٠ عمان ـ الاردن
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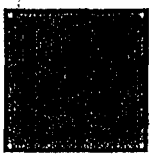

TestDate: 00/06/13 09:39
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/19 11:40

Total Result :

1 - Total Test Time	*50*	*Hours*
2 - Working Percent	*99*	*%On*
3 - Energy	*5.267*	*kwh*
4 - Zoom Time	*49:46*	*Hour*
5 - Compr Current	*3.01*	*Amp*
6 - Evaprator Mean Temp	*4.3*	*C*
7 - Cabin Mean Temp	*4.7*	*C*
8 - Crisp Temp	*5.2*	*C*
9 - Compr Temp	*52*	*C*
10- Condensor In Temp	*62.8*	*C*
11- Condensor Out Temp	*-1.1*	*C*
12- Condition	*38 C*	*32 %H*
13- Volt	*Max=247 Mean=235 Min=216*	
14-		
15-		
16-		
17-		

Product Spec :

1 - File Name		*00061309.k39*
2 - Test Kind	G	*Perform.*
3 - Product Serial		
4 - Product Name		*Show Case*
5 - Product Model		~~*JAWC-60*~~ Ja S c-12r
6 - Product Capacity		*1000 Lit.*
7 - Compressor Name		*Electr.*
8 - Compressor Model		*GL99AA*
9 - Compressor Power		*1/4 Hp*
10- Compressor Amper		*3 Amp*
11- Thermostat No.		*3*
12- Thermostat Type		*Ranco*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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للثلاجات والمصنوعات المعدنية

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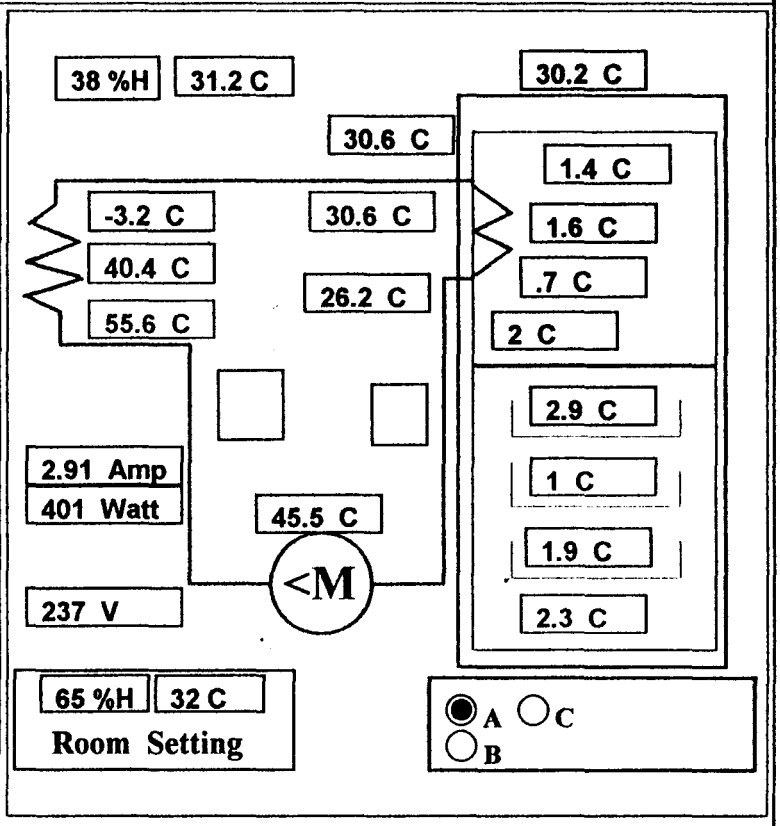
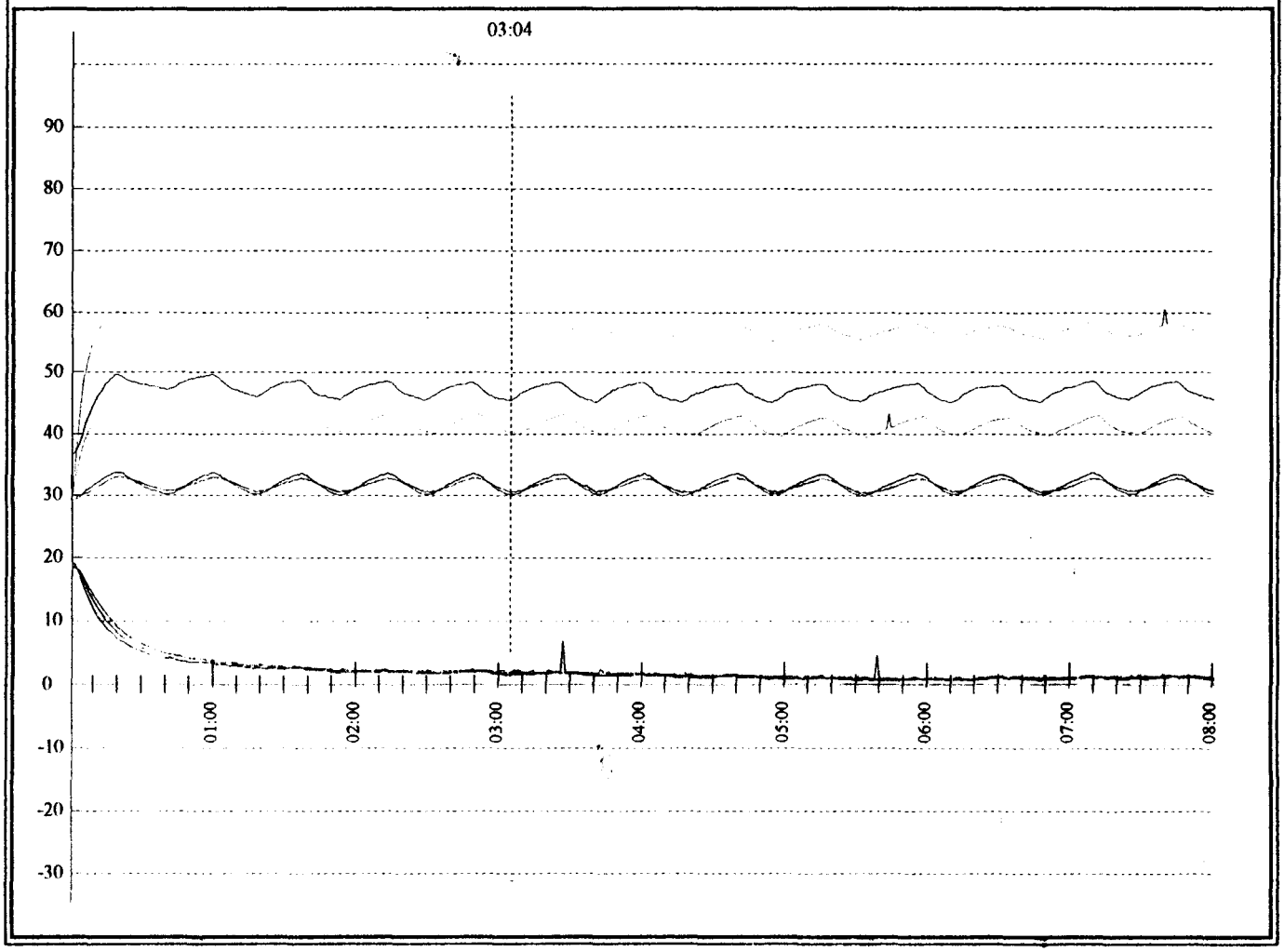
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 11:44

Page Result :

1 - Page Test Time	*8 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*2.402 kwh*
4 - Zoom Time	*3:05 Hour*
5 - Compr Current	*2.91 Amp*
6 - Evaprator Mean Temp	*1.4 C*
7 - Cabin Mean Temp	*1.9 C*
8 - Crisp Temp	*2.3 C*
9 - Compr Temp	*45.5 C*
10- Condensor In Temp	*55.6 C*
11- Condensor Out Temp	*-3.2 C*
12- Condition	*31.2 C 38 %H*
13- Volt	*Max=242 Mean=233 Min=222*
14-	
15-	
16-	
17-	





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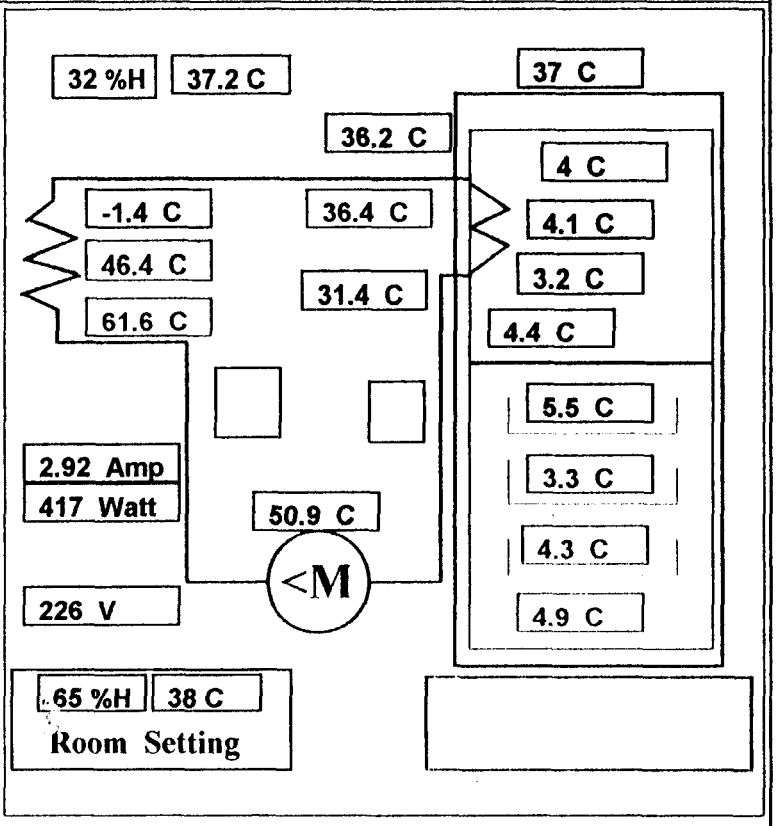
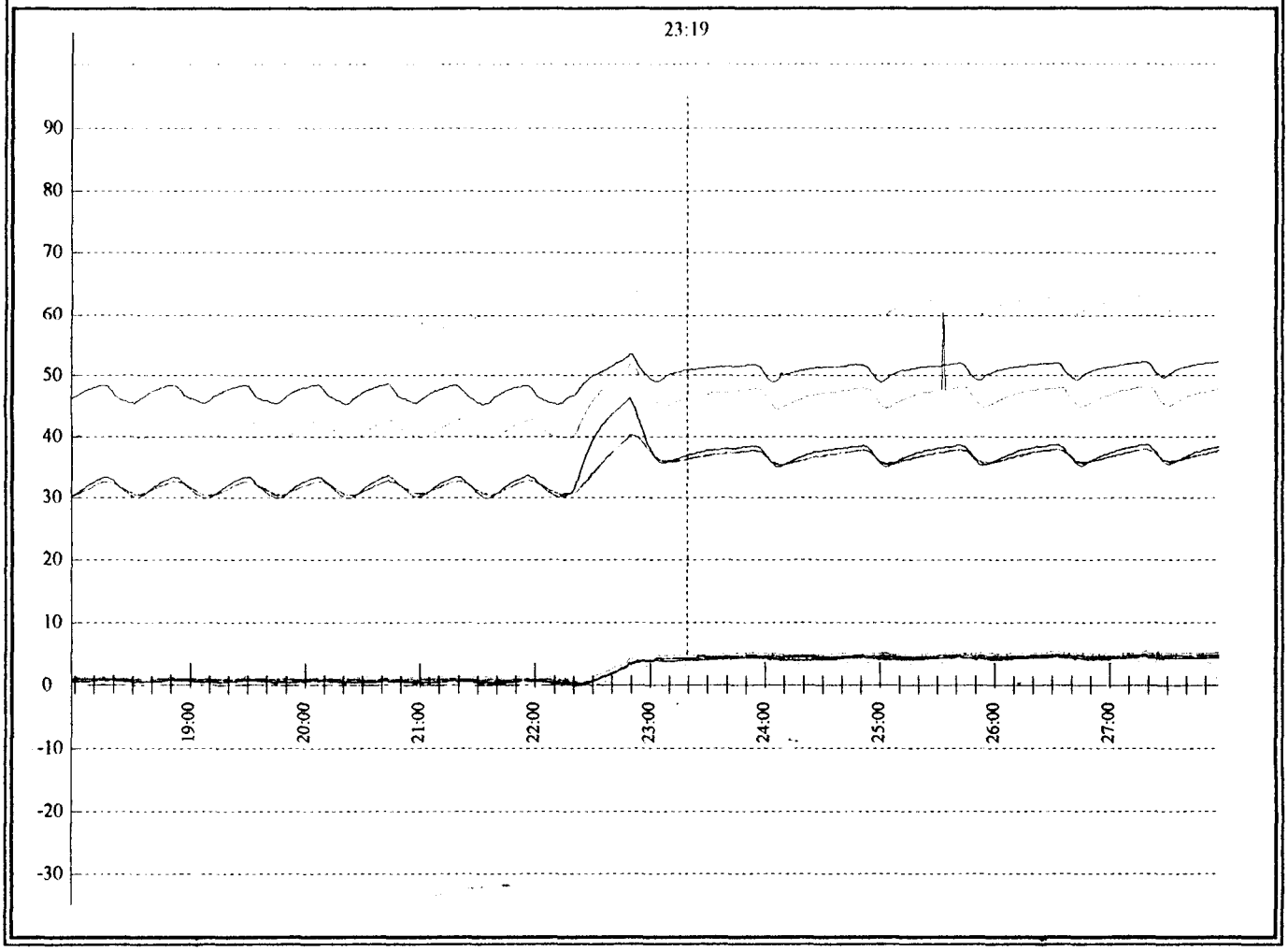
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 11:51

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*1.505 kwh*
4 - Zoom Time	*23:19 Hour*
5 - Compr Current	*2.92 Amp*
6 - Evaprator Mean Temp	*3.9 C*
7 - Cabin Mean Temp	*4.3 C*
8 - Crisp Temp	*4.9 C*
9 - Compr Temp	*50.9 C*
10- Condensor In Temp	*61.6 C*
11- Condensor Out Temp	*-1.4 C*
12- Condition	*37.2 C 32 %H*
13- Volt	*Max=245 Mean=233 Min=216*
14-	
15-	
16-	
17-	





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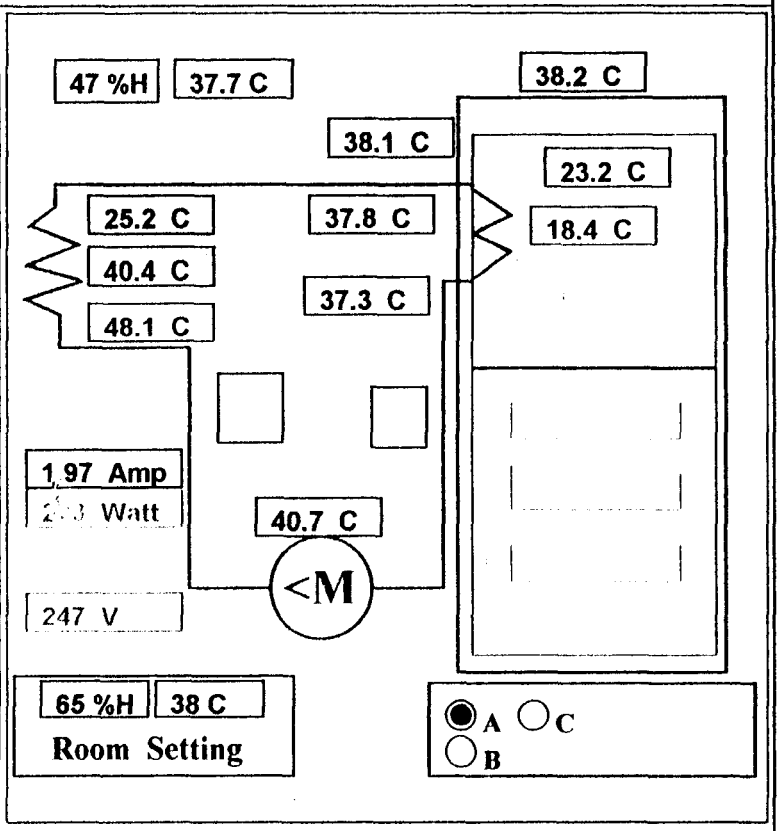
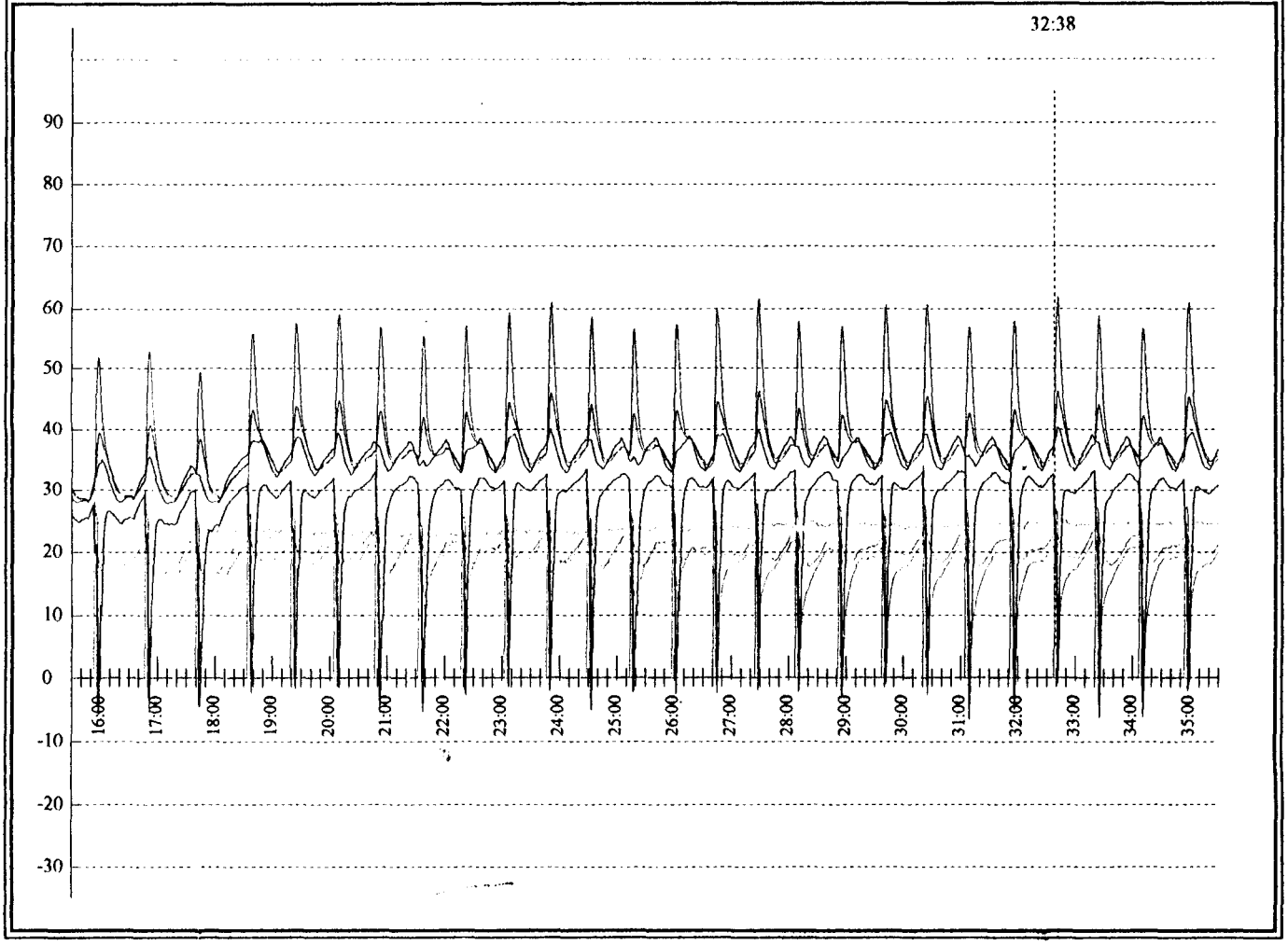
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:24

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*8 %On*
3 - Energy (Accord to page)	*0.223 kwh*
4 - Zoom Time	*32:39 Hour*
5 - Compr Current	*1.97 Amp*
6 - Evaprator Mean Temp	*27.6 C*
7 - Cabin Mean Temp	*34.1 C*
8 - Crisp Temp	*34.6 C*
9 - Compr Temp	*40.7 C*
10- Condensor In Temp	*48.1 C*
11- Condensor Out Temp	*25.2 C*
12- Condition	*37.7 C 47 %H*
13- Volt	*Max=252 Mean=239 Min=223*
14-	
15-	
16-	
17-	





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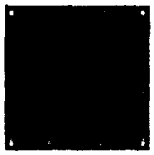

TestDate: 00/06/13 09:39
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/19 12:03

Total Result :

1 - Total Test Time	*50 Hours*
2 - Working Percent	*74 %On*
3 - Energy	*2.145 kwh*
4 - Zoom Time	*49:14 Hour*
5 - Compr Current	*1.25 Amp*
6 - Evaprator Mean Temp	*-26.1 C*
7 - Cabin Mean Temp	*-23.8 C*
8 - Crisp Temp	*-21.8 C*
9 - Compr Temp	*80.9 C*
10- Condensor In Temp	*59.5 C*
11- Condensor Out Temp	*35.9 C*
12- Condition	*38 C 32 %H*
13- Volt	*Max=247 Mean=235 Min=216*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	*00061309.k39*
2 - Test Kind G	*Performan*
3 - Product Serial	
4 - Product Name	*Ch.Freezer*
5 - Product Model	*JACK-100*
6 - Product Capacity	*200 Litres*
7 - Compressor Name	*L.G*
8 - Compressor Model	*V75LAEG*
9 - Compressor Power	*1/4*
10- Compressor Amper	*3*
11- Thermostat No.	*3*
12- Thermostat Type	*Ranco*
13-	
14-	

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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Printing In Labaratory Of
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Maurice Ind. [Jordan]

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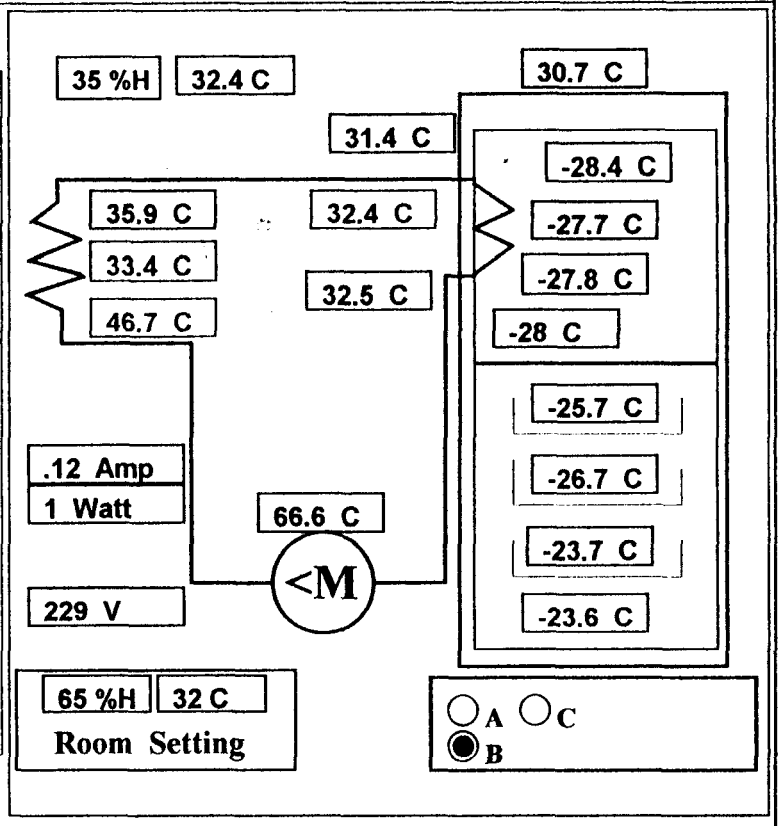
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 12:06

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*56 %On*
3 - Energy (Accord to page)	*1.564 kwh*
4 - Zoom Time	*6:03 Hour*
5 - Compr Current	*0.12 Amp*
6 - Evaprator Mean Temp	*-27.9 C*
7 - Cabin Mean Temp	*-25.3 C*
8 - Crisp Temp	*-23.6 C*
9 - Compr Temp	*66.6 C*
10- Condensor In Temp	*46.7 C*
11- Condensor Out Temp	*35.9 C*
12- Condition	*32.4 C 35 %H*
13- Volt	*Max=245 Mean=234 Min=222*
14-	
15-	
16-	
17-	



Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
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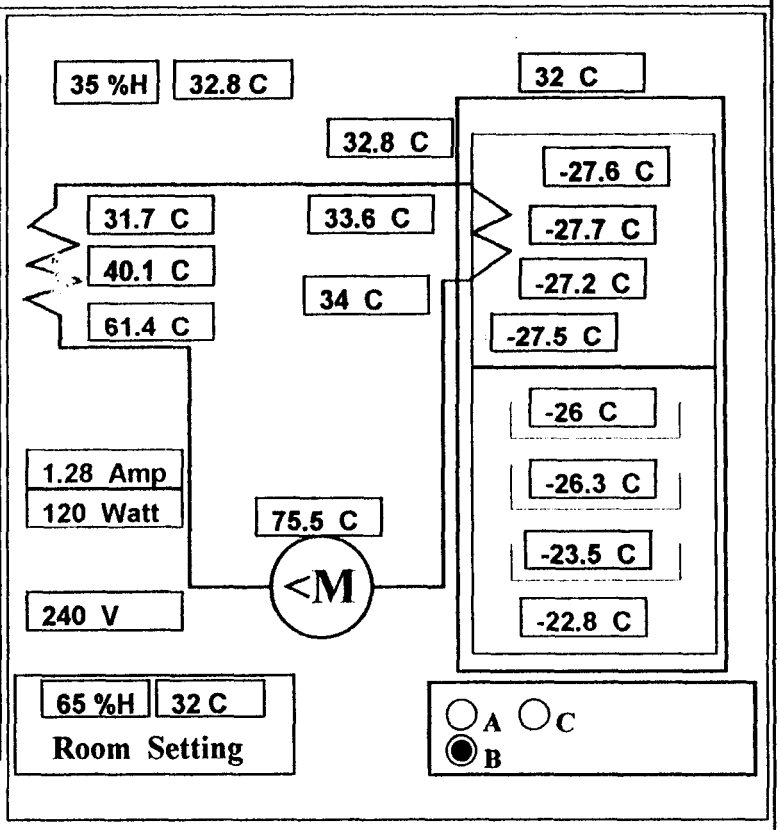
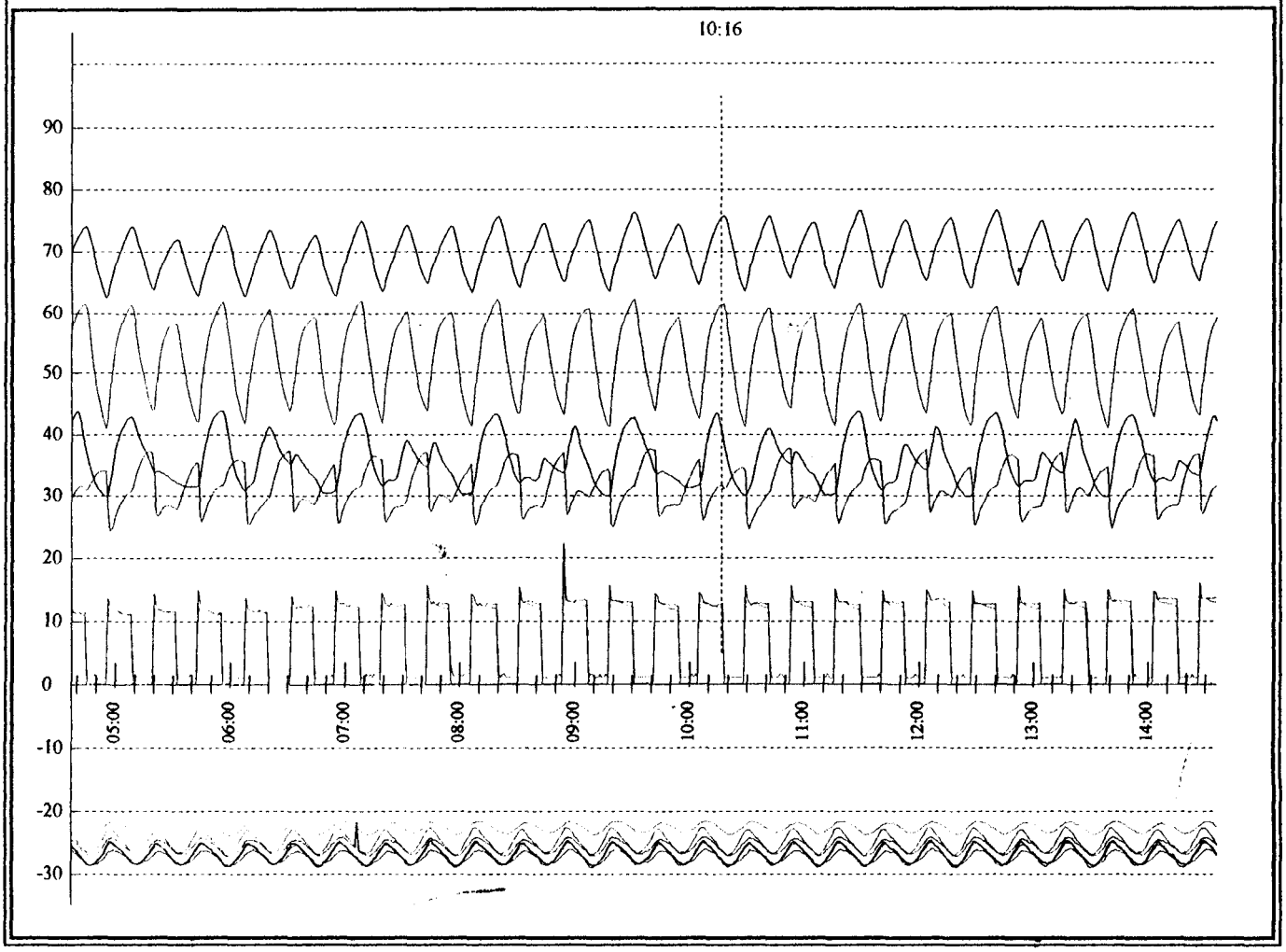
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 12:09

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*54 %On*
3 - Energy (Accord to page)	*1.51 kwh*
4 - Zoom Time	*10:17 Hour*
5 - Compr Current	*1.28 Amp*
6 - Evaprator Mean Temp	*-27.5 C*
7 - Cabin Mean Temp	*-25.2 C*
8 - Crisp Temp	*-22.8 C*
9 - Compr Temp	*75.5 C*
10- Condensor In Temp	*61.4 C*
11- Condensor Out Temp	*31.7 C*
12- Condition	*32.8 C 35 %H*
13- Volt	*Max=246 Mean=238 Min=223*
14-	
15-	
16-	
17-	





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Printing In Labaratory Of
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Maurice Ind. [Jordan]

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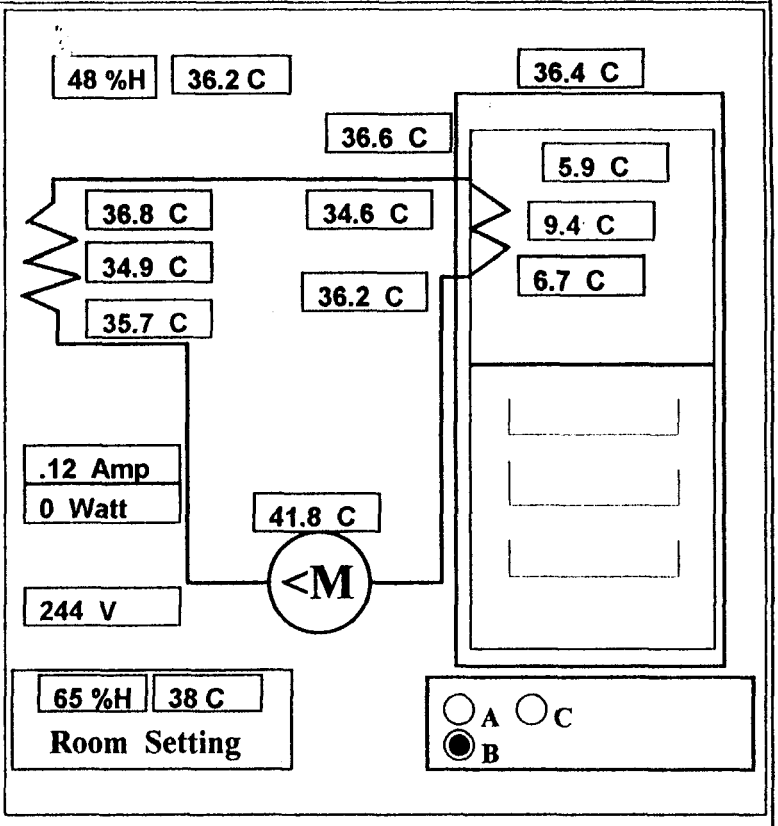
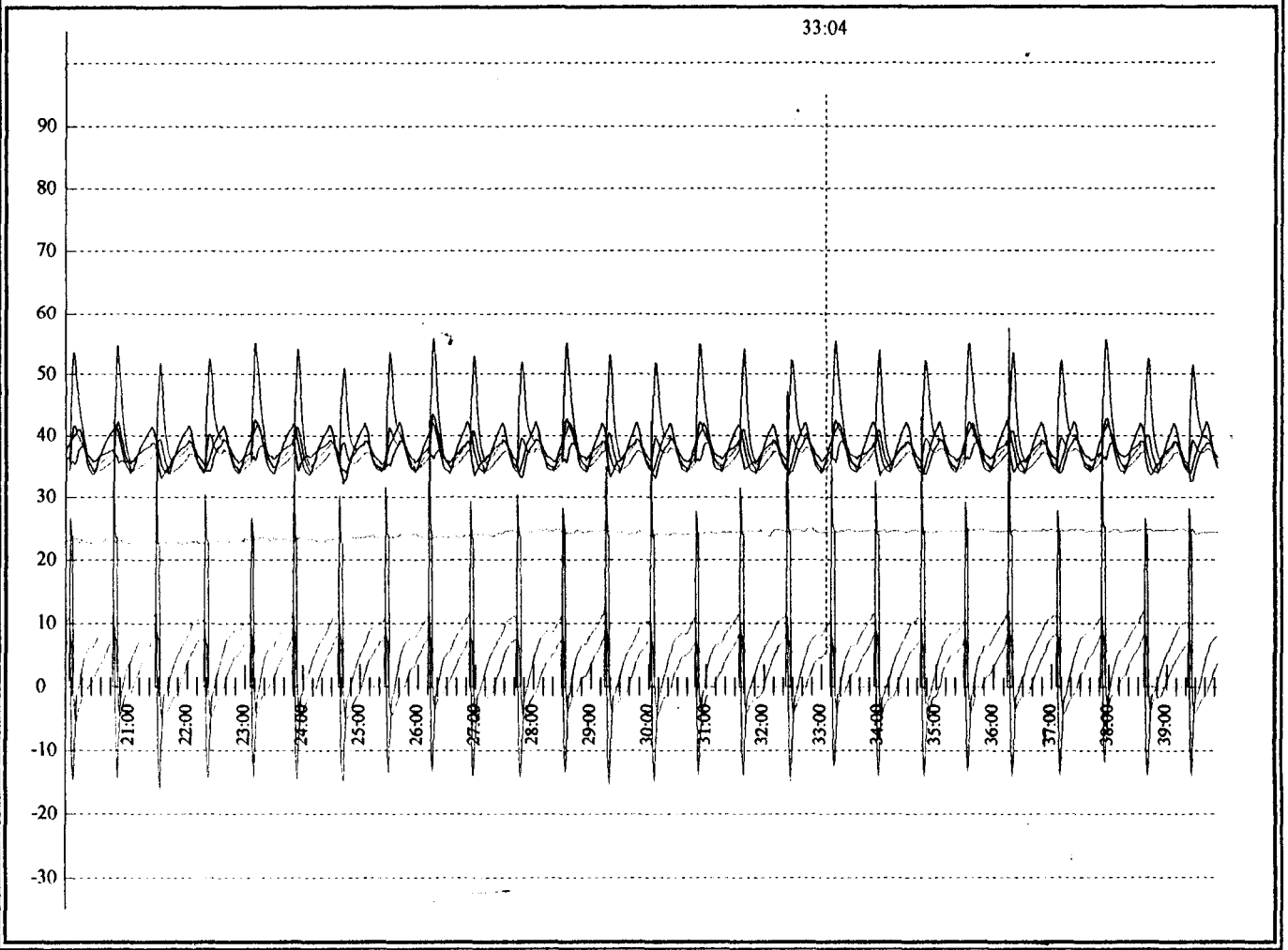
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:26

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*8 %On*
3 - Energy (Accord to page)	*0.178 kwh*
4 - Zoom Time	*33:05 Hour*
5 - Compr Current	*0.12 Amp*
6 - Evaprator Mean Temp	*13.8 C*
7 - Cabin Mean Temp	*33.4 C*
8 - Crisp Temp	*35.2 C*
9 - Compr Temp	*41.8 C*
10- Condensor In Temp	*35.7 C*
11- Condensor Out Temp	*36.8 C*
12- Condition	*36.2 C 48 %H*
13- Volt	*Max=252 Mean=241 Min=223*
14-	
15-	
16-	
17-	





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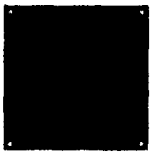

TestDate: 00/06/13 09:39
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/19 12:16

Total Result :

1 - Total Test Time	*50 Hours*
2 - Working Percent	*94 %On*
3 - Energy	*3.293 kwh*
4 - Zoom Time	*49:14 Hour*
5 - Compr Current	*1.5 Amp*
6 - Evaprator Mean Temp	*-28.3 C*
7 - Cabin Mean Temp	*-28.2 C*
8 - Crisp Temp	*-24.6 C*
9 - Compr Temp	*57.9 C*
10- Condensor In Temp	*54.8 C*
11- Condensor Out Temp	*30.9 C*
12- Condition	*38 C 32 %H*
13- Volt	*Max=247 Mean=235 Min=216*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	*00061309.k39*
2 - Test Kind G	*Perform.*
3 - Product Serial	
4 - Product Name	*Ch.Freezer*
5 - Product Model	*JACK-130*
6 - Product Capacity	*300 litres*
7 - Compressor Name	*LG*
8 - Compressor Model	*V75LAEG*
9 - Compressor Power	*1/4 Hp*
10- Compressor Amper	*3*
11- Thermostat No.	*3*
12- Thermostat Type	*Ranco*
13-	
14-	

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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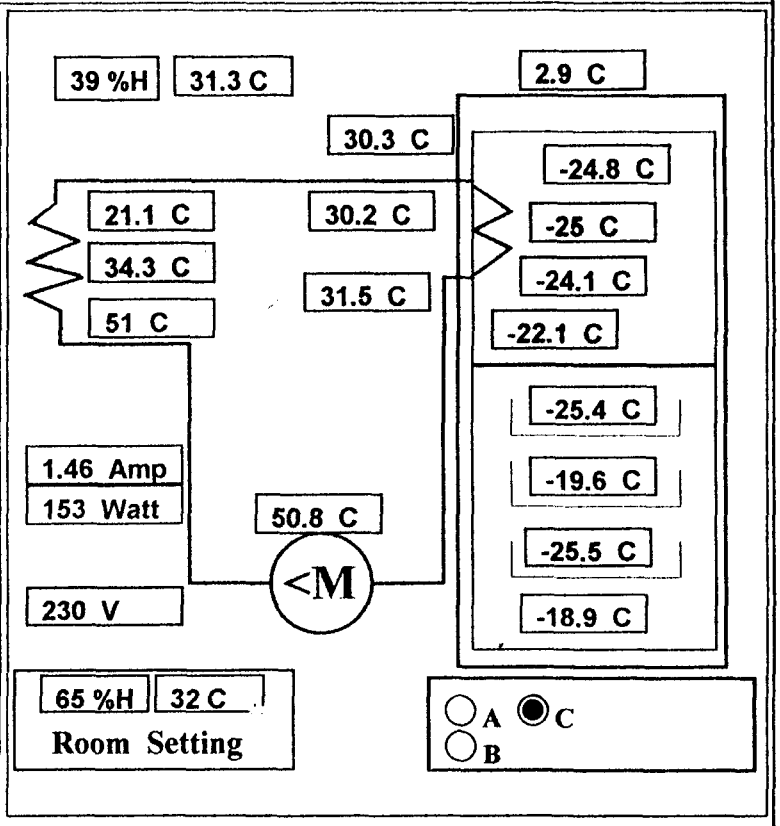
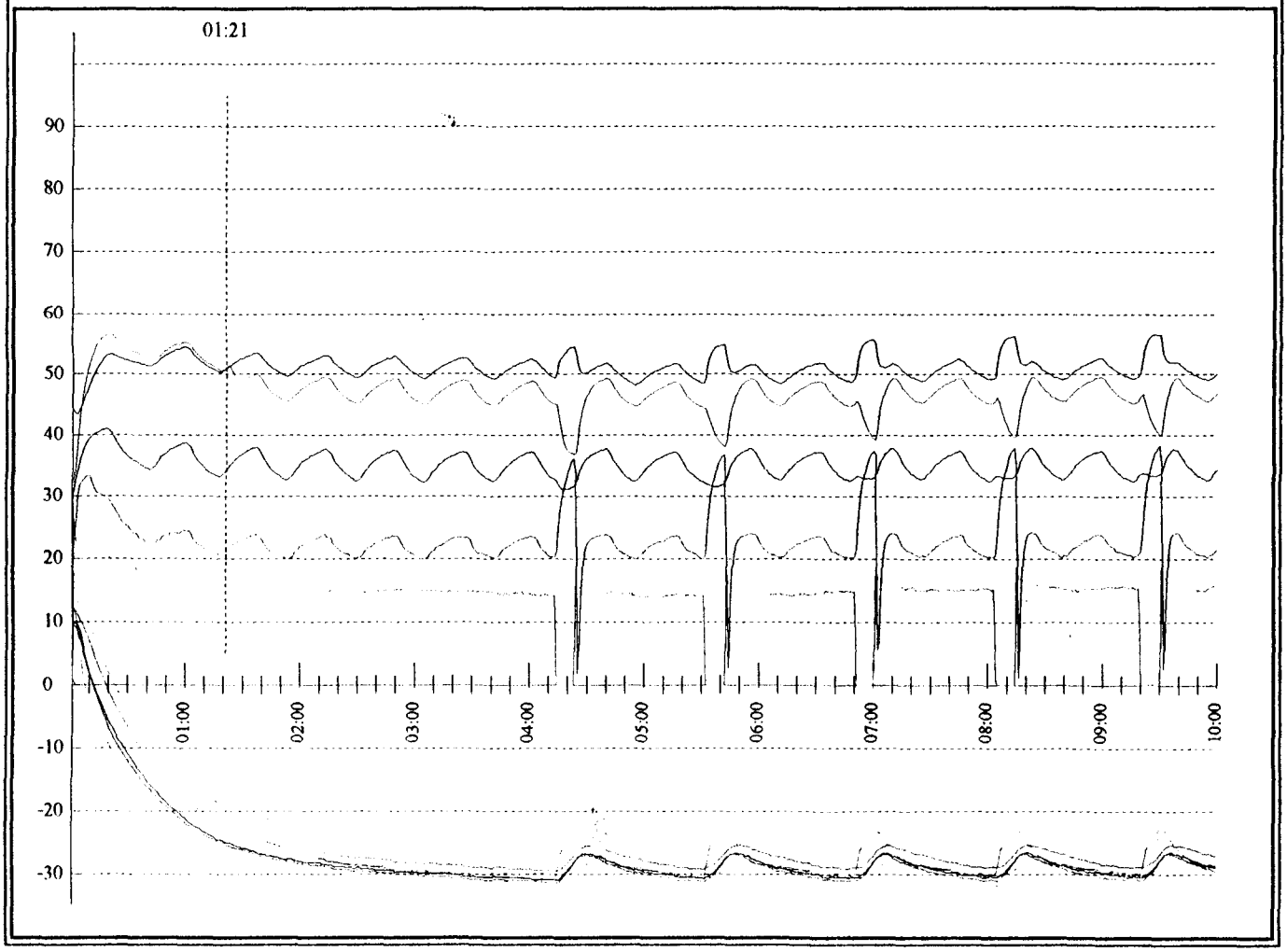
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 12:18

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*91 %On*
3 - Energy (Accord to page)	*2.977 kwh*
4 - Zoom Time	*1:21 Hour*
5 - Compr Current	*1.46 Amp*
6 - Evaprator Mean Temp	*-24 C*
7 - Cabin Mean Temp	*-23.5 C*
8 - Crisp Temp	*-18.9 C*
9 - Compr Temp	*50.8 C*
10- Condensor In Temp	*51 C*
11- Condensor Out Temp	*21.1 C*
12- Condition	*31.3 C 39 %H*
13- Volt	*Max=245 Mean=234 Min=222*
14-	
15-	
16-	
17-	





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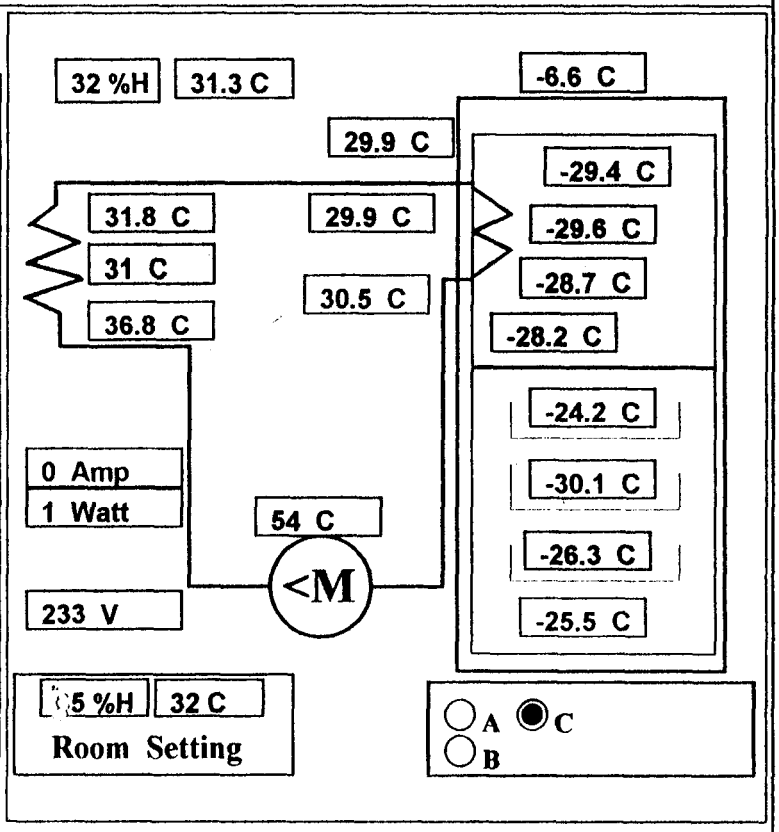
TestDate: 00/06/13 09:39 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/19 12:28

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*89 %On*
3 - Energy (Accord to page)	*2.991 kwh*
4 - Zoom Time	*21:35 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*-28.9 C*
7 - Cabin Mean Temp	*-26.8 C*
8 - Crisp Temp	*-25.5 C*
9 - Compr Temp	*54 C*
10- Condensor In Temp	*36.8 C*
11- Condensor Out Temp	*31.8 C*
12- Condition	*31.3 C 32 %H*
13- Volt	*Max=245 Mean=234 Min=222*
14-	
15-	
16-	
17-	



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Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

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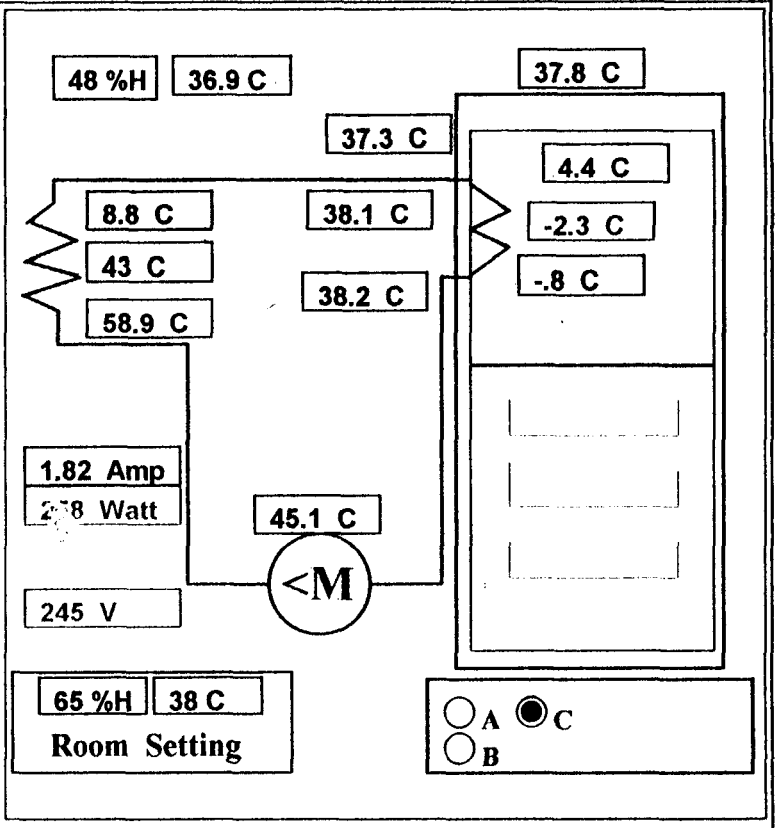
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:28

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*12 %On*
3 - Energy (Accord to page)	*0.272 kwh*
4 - Zoom Time	*29:04 Hour*
5 - Compr Current	*1.82 Amp*
6 - Evaprator Mean Temp	*8.9 C*
7 - Cabin Mean Temp	*34.1 C*
8 - Crisp Temp	*34.3 C*
9 - Compr Temp	*45.1 C*
10- Condensor In Temp	*58.9 C*
11- Condensor Out Temp	*8.8 C*
12- Condition	*36.9 C 48 %H*
13- Volt	*Max=252 Mean=240 Min=223*
14-	
15-	
16-	
17-	



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TestDate: 00/06/25 13:51
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/27 10:16

Total Result :

1 - Total Test Time	*44 Hours*
2 - Working Percent	*7 %On*
3 - Energy	*0.164 kwh*
4 - Zoom Time	*44:03 Hour*
5 - Compr Current	*0.12 Amp*
6 - Evaprator Mean Temp	*12.7 C*
7 - Cabin Mean Temp	*30.9 C*
8 - Crisp Temp	*31.9 C*
9 - Compr Temp	*38 C*
10- Condensor In Temp	*30.5 C*
11- Condensor Out Temp	*32.3 C*
12- Condition	*32 C 44 %H*
13- Volt	*Max=252 Mean=241 Min=223*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	*00062513.k51*
2 - Test Kind G	*Performan*
3 - Product Serial	
4 - Product Name	*Water Cool*
5 - Product Model	*JAWC-60*
6 - Product Capacity	*100 lit/h*
7 - Compressor Name	*Electrlox*
8 - Compressor Model	*GL99AA*
9 - Compressor Power	*1/4*
10- Compressor Amper	*3*
11- Thermostat No.	*3*
12- Thermostat Type	*Ranco*
13-	
14-	

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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Printing In Labaratory Of
Maurice Ind. [Jordan]

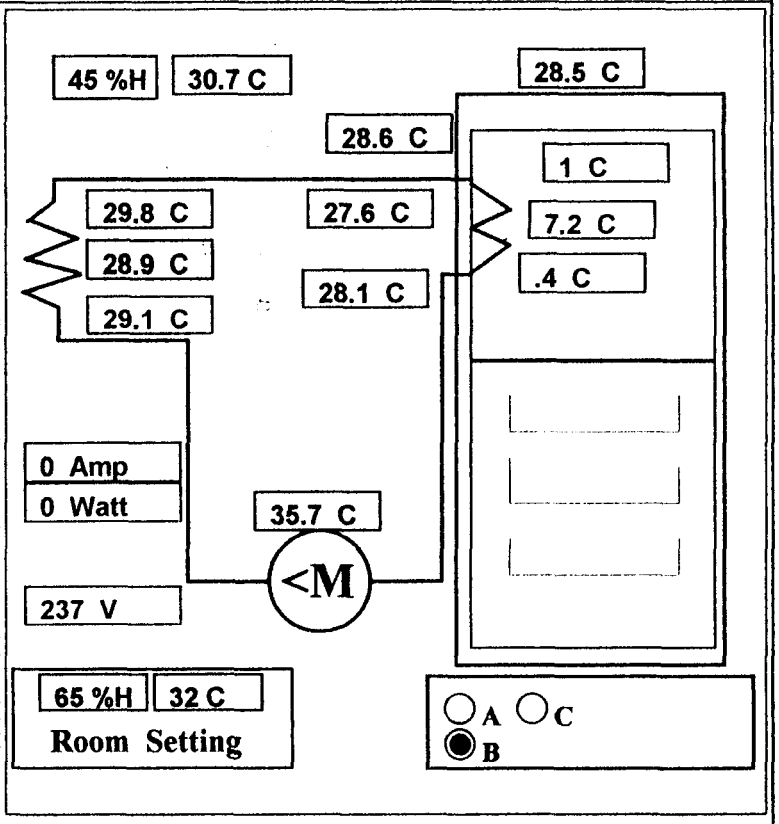
Maurice Ind. [Jordan]

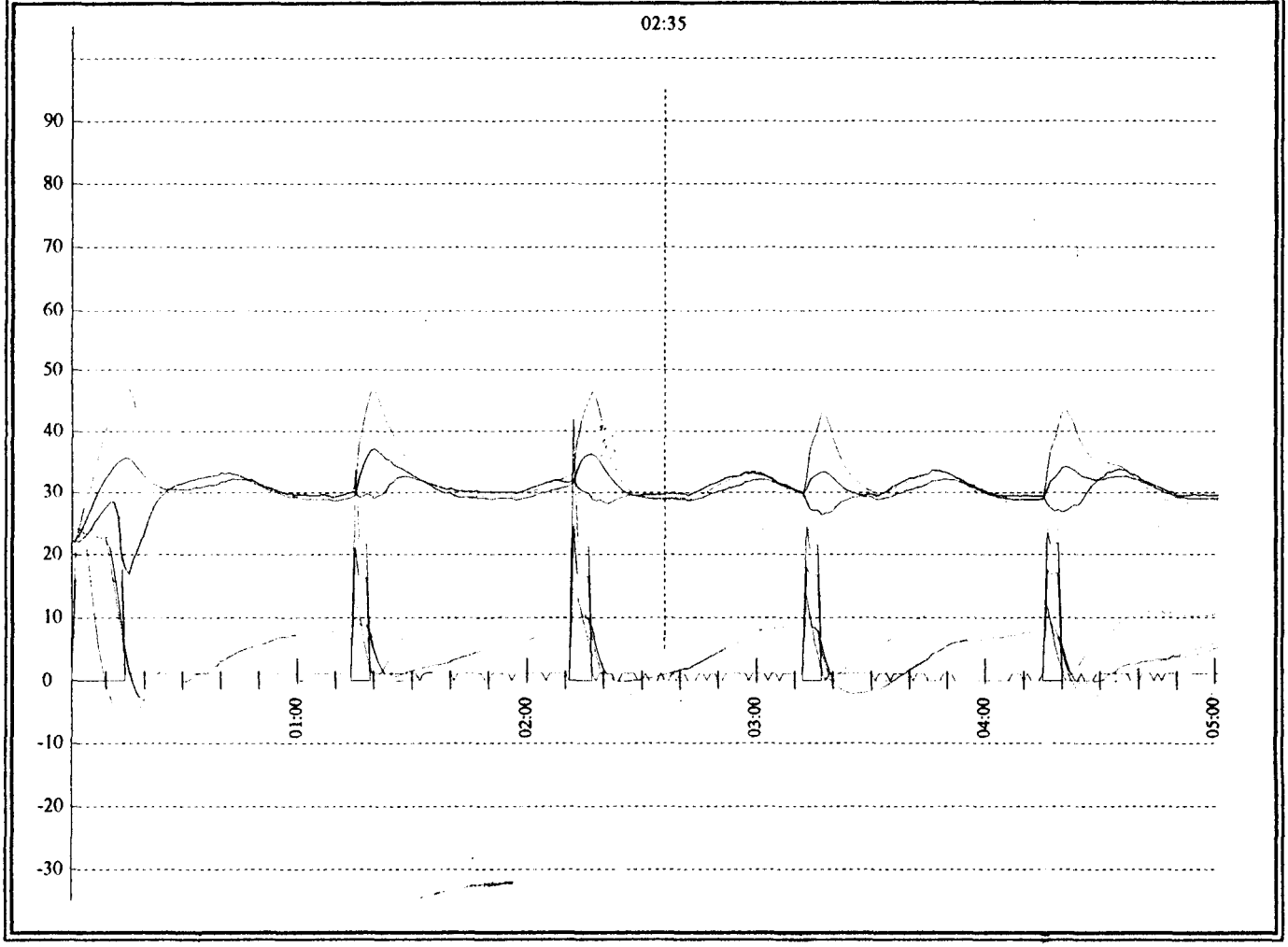
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:18

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*10 %On*
3 - Energy (Accord to page)	*0.216 kwh*
4 - Zoom Time	*2:36 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*8.7 C*
7 - Cabin Mean Temp	*27.3 C*
8 - Crisp Temp	*27.9 C*
9 - Compr Temp	*35.7 C*
10- Condensor In Temp	*29.1 C*
11- Condensor Out Temp	*29.8 C*
12- Condition	*30.7 C 45 %H*
13- Volt	*Max=246 Mean=235 Min=223*
14-	
15-	
16-	
17-	





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Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

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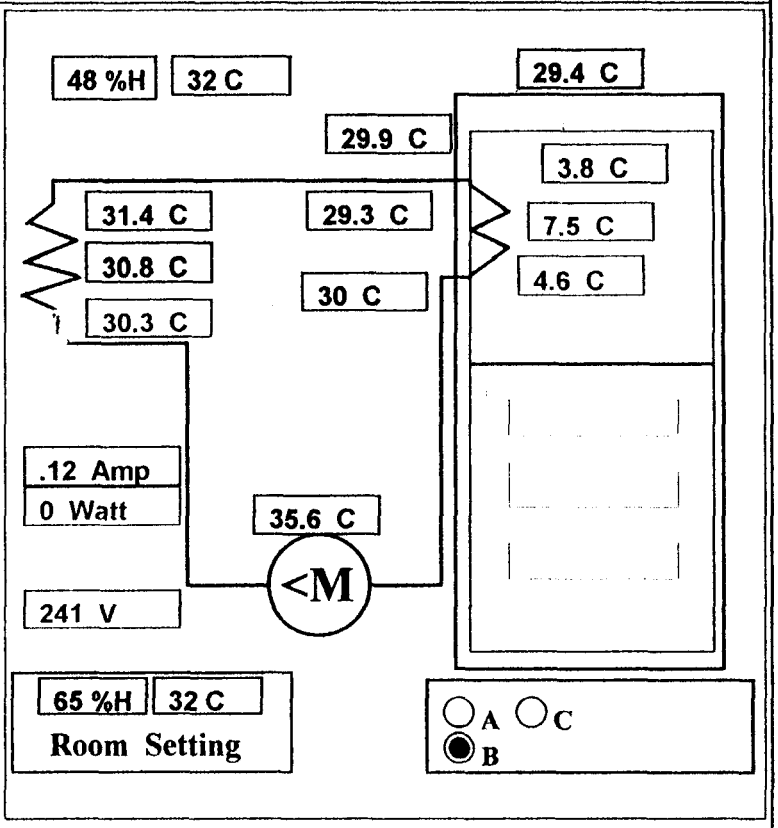
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:20

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*7 %On*
3 - Energy (Accord to page)	*0.128 kwh*
4 - Zoom Time	*17:01 Hour*
5 - Compr Current	*0.12 Amp*
6 - Evaprator Mean Temp	*11 C*
7 - Cabin Mean Temp	*28.9 C*
8 - Crisp Temp	*29.8 C*
9 - Compr Temp	*35.6 C*
10- Condensor In Temp	*30.3 C*
11- Condensor Out Temp	*31.4 C*
12- Condition	*32 C 48 %H*
13- Volt	*Max=250 Mean=243 Min=226*
14-	
15-	
16-	
17-	



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Printing In Labaratory Of
Maurice Ind. [Jordan]

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TestDate: 00/06/25 13:51
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/27 10:32

Total Result :

1 - Total Test Time	*44 Hours*
2 - Working Percent	*11 %On*
3 - Energy	*0.226 kwh*
4 - Zoom Time	*44:03 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*5.6 C*
7 - Cabin Mean Temp	*30.9 C*
8 - Crisp Temp	*30 C*
9 - Compr Temp	*41.1 C*
10- Condensor In Temp	*35.1 C*
11- Condensor Out Temp	*18 C*
12- Condition	*32 C 44 %H*
13- Volt	*Max=252 Mean=241 Min=223*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name		*00062513.k51*
2 - Test Kind	G	*Perform.*
3 - Product Serial		
4 - Product Name		*Water Cool*
5 - Product Model		*MWC-50 Lit*
6 - Product Capacity		*100 Lit/h*
7 - Compressor Name		*Korean Mad*
8 - Compressor Model		*HSL27YE-5*
9 - Compressor Power		*1/4 Hp*
10- Compressor Amper		*3*
11- Thermostat No.		*3*
12- Thermostat Type		*Ranco*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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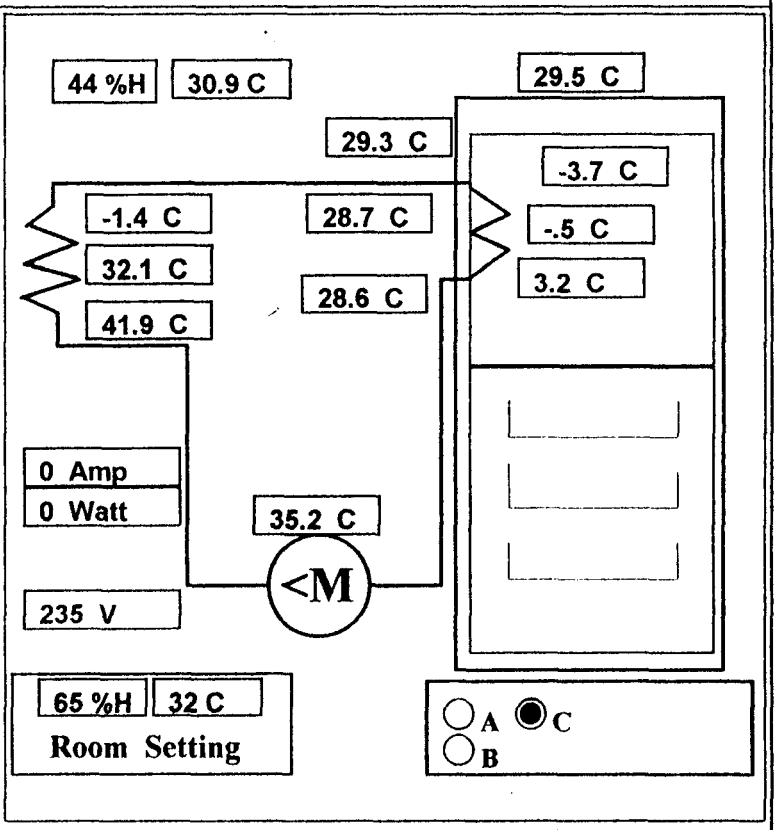
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:30

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*13 %On*
3 - Energy (Accord to page)	*0.229 kwh*
4 - Zoom Time	*2:32 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*6.6 C*
7 - Cabin Mean Temp	*27.6 C*
8 - Crisp Temp	*27.1 C*
9 - Compr Temp	*35.2 C*
10- Condensor In Temp	*41.9 C*
11- Condensor Out Temp	*-1.4 C*
12- Condition	*30.9 C 44 %H*
13- Volt	*Max=246 Mean=235 Min=223*
14-	
15-	
16-	
17-	



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Maurice Ind. [Jordan]

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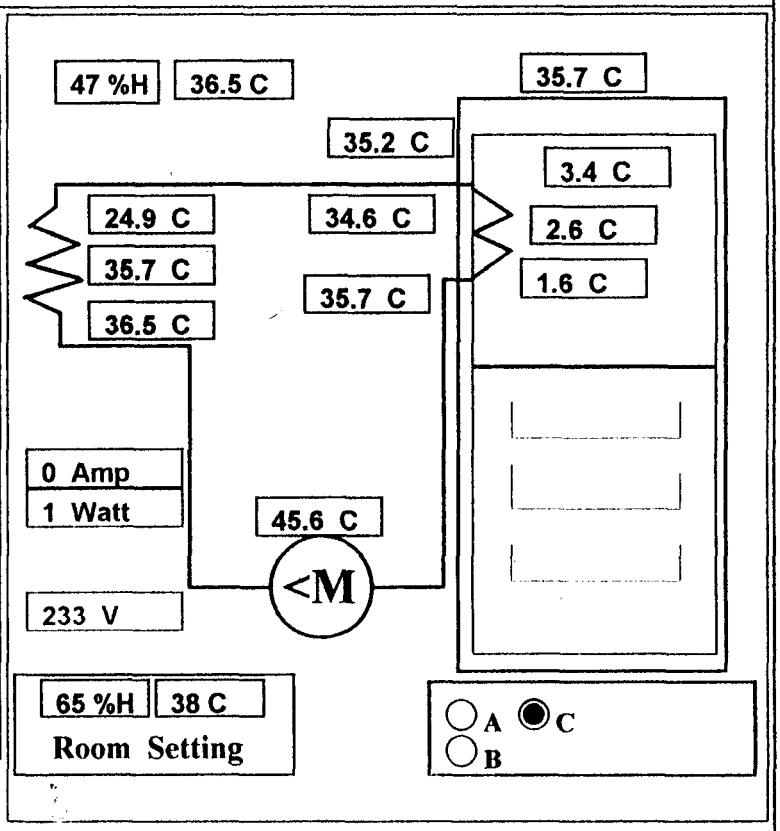
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:34

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*12 %On*
3 - Energy (Accord to page)	*0.257 kwh*
4 - Zoom Time	*24:05 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*10.2 C*
7 - Cabin Mean Temp	*32.9 C*
8 - Crisp Temp	*32.4 C*
9 - Compr Temp	*45.6 C*
10- Condensor In Temp	*36.5 C*
11- Condensor Out Temp	*24.9 C*
12- Condition	*36.5 C 47 %H*
13- Volt	*Max=249 Mean=235 Min=223*
14-	
15-	
16-	
17-	



Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

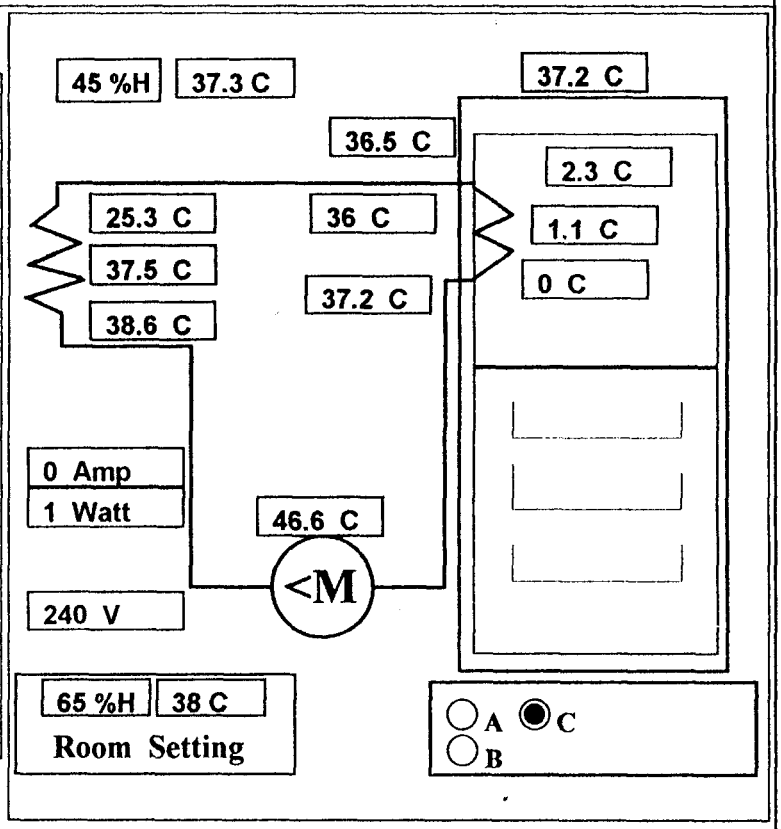
[redacted]

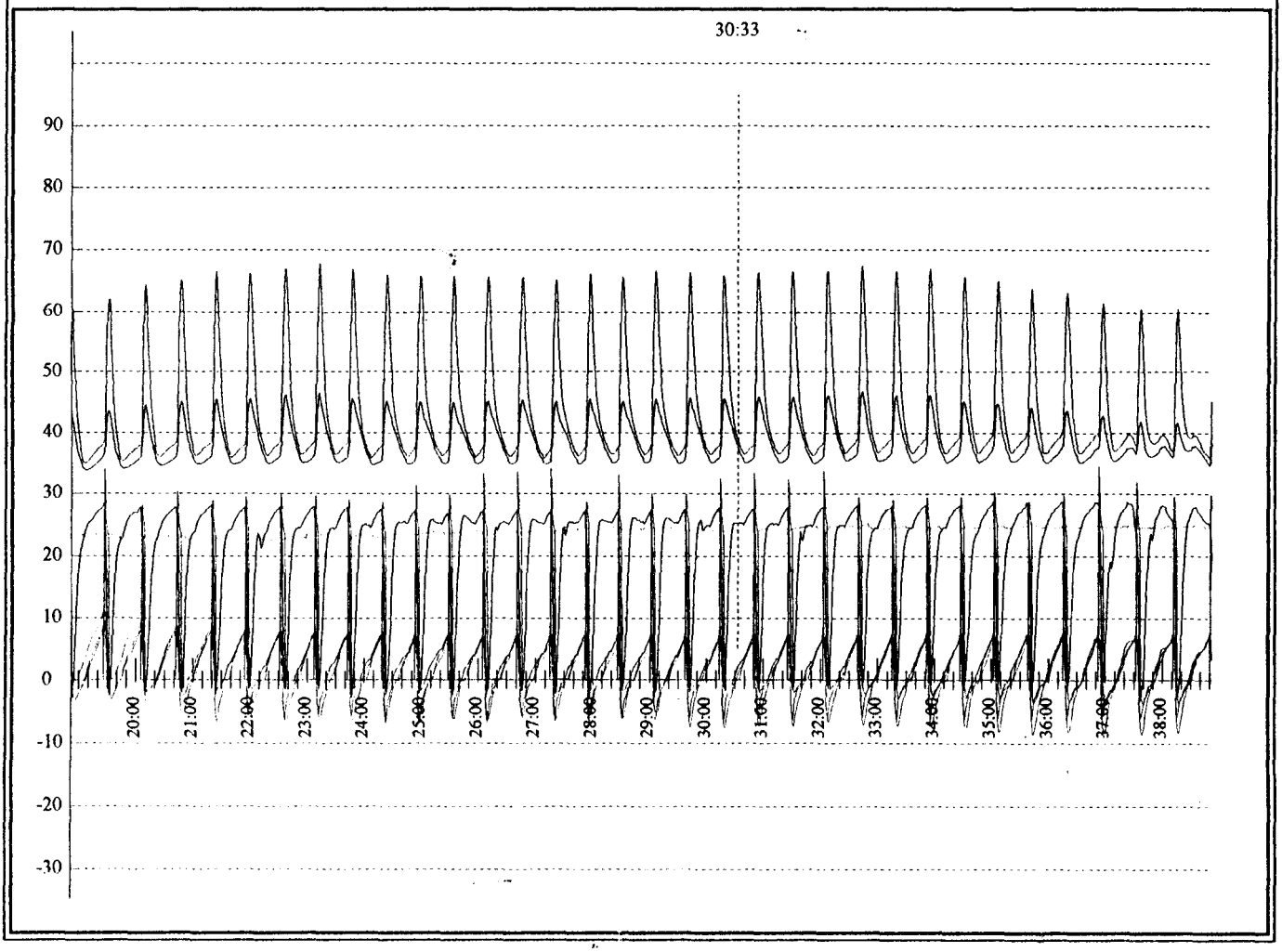
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:36

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*11 %On*
3 - Energy (Accord to page)	*0.272 kwh*
4 - Zoom Time	*30:33 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*9.3 C*
7 - Cabin Mean Temp	*33.7 C*
8 - Crisp Temp	*33.2 C*
9 - Compr Temp	*46.6 C*
10- Condensor In Temp	*38.6 C*
11- Condensor Out Temp	*25.3 C*
12- Condition	*37.3 C 45 %H*
13- Volt	*Max=252 Mean=240 Min=223*
14-	
15-	
16-	
17-	





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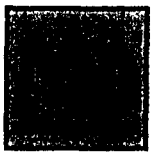
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]



TestDate: 00/06/25 13:51
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/27 10:00

Total Result :

1 - Total Test Time	*44 Hours*
2 - Working Percent	*8 %On*
3 - Energy	*0.207 kwh*
4 - Zoom Time	*44:03 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*24.9 C*
7 - Cabin Mean Temp	*30.4 C*
8 - Crisp Temp	*30.2 C*
9 - Compr Temp	*37 C*
10- Condensor In Temp	*31 C*
11- Condensor Out Temp	*26.9 C*
12- Condition	*32 C 44 %H*
13- Volt	*Max=252 Mean=241 Min=223*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	M	*00062513.k51*
2 - Test Kind	P	*Perform.*
3 - Product Serial		
4 - Product Name	W	*Water Cool*
5 - Product Model	M	*MWC-32 lit*
6 - Product Capacity	1	*75 Lit/h*
7 - Compressor Name	K	*Electr.*
8 - Compressor Model	H	*GL99AA*
9 - Compressor Power	1	*1/4 Hp*
10- Compressor Amper	3	*3 Amp*
11- Thermostat No.	3	*3*
12- Thermostat Type	R	*Ranco*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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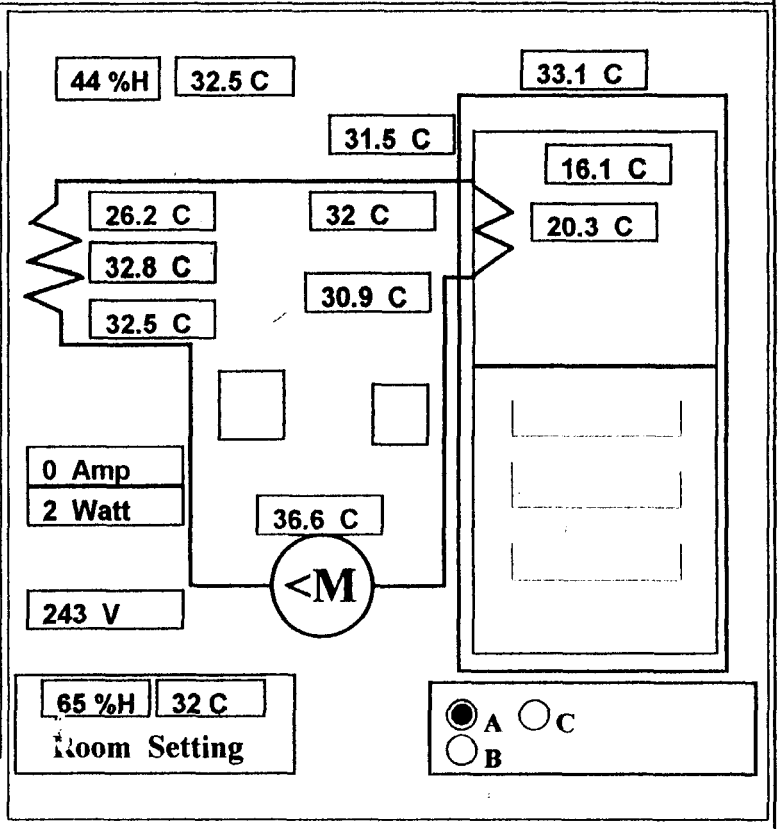
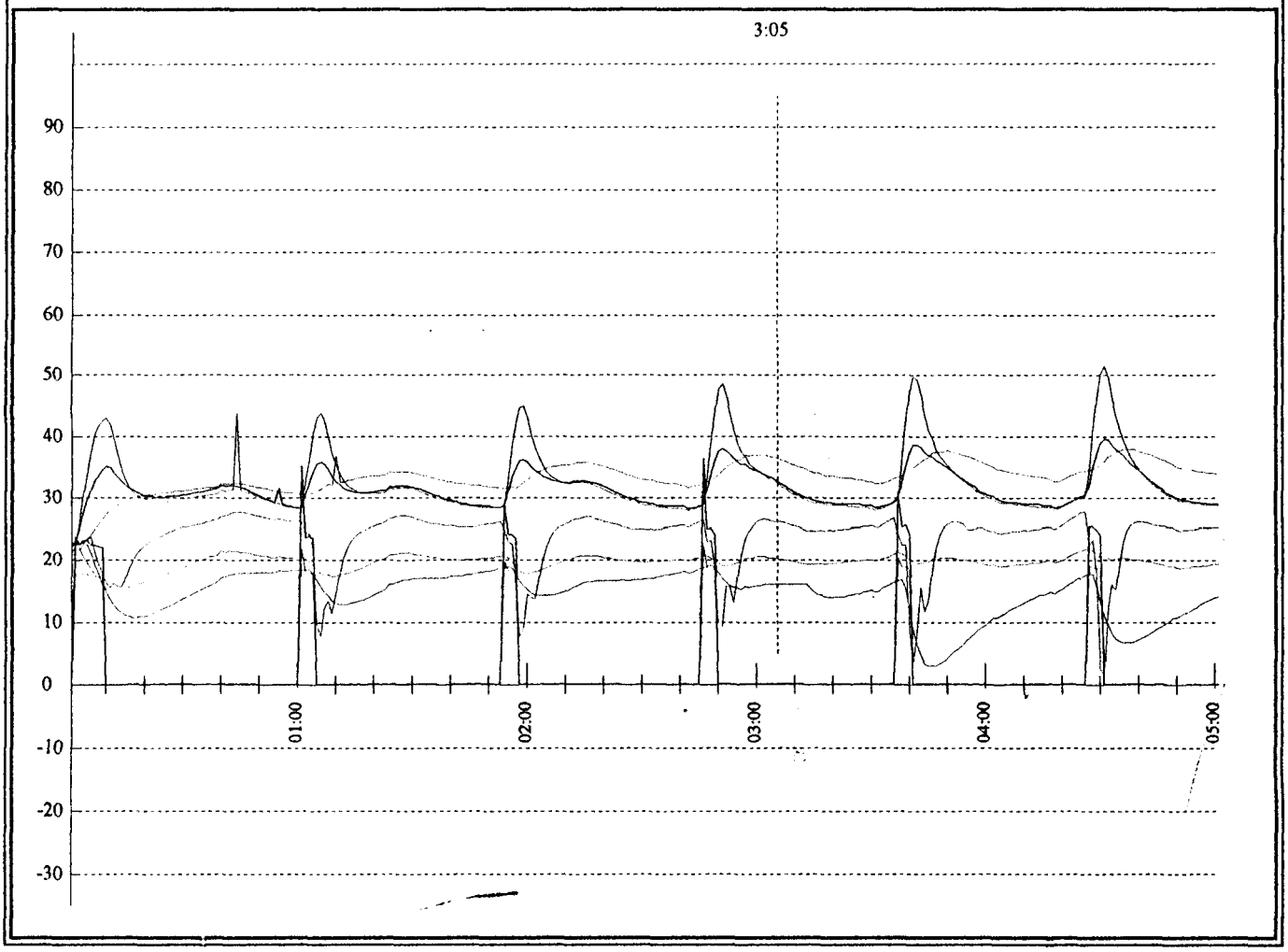
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:03

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*9 %On*
3 - Energy (Accord to page)	*0.188 kwh*
4 - Zoom Time	*3:05 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*23.8 C*
7 - Cabin Mean Temp	*28.4 C*
8 - Crisp Temp	*28.5 C*
9 - Compr Temp	*36.6 C*
10- Condensor In Temp	*32.5 C*
11- Condensor Out Temp	*26.2 C*
12- Condition	*32.5 C 44 %H*
13- Volt	*Max=246 Mean=235 Min=223*
14-	
15-	
16-	
17-	





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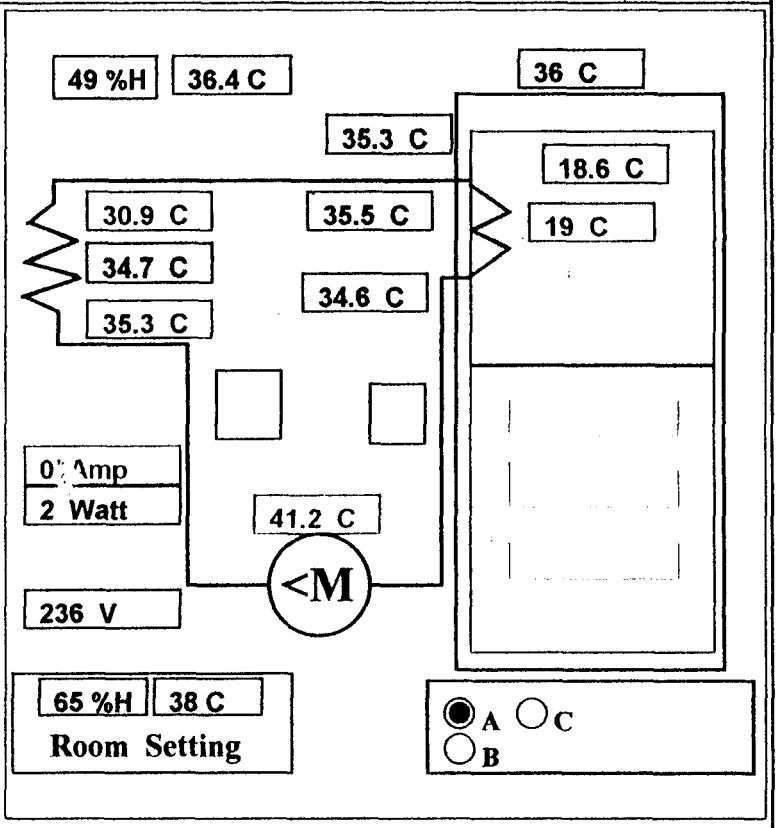
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:06

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*9 %On*
3 - Energy (Accord to page)	*0.23 kwh*
4 - Zoom Time	*24:52 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*26.1 C*
7 - Cabin Mean Temp	*32.7 C*
8 - Crisp Temp	*33 C*
9 - Compr Temp	*41.2 C*
10- Condensor In Temp	*35.3 C*
11- Condensor Out Temp	*30.9 C*
12- Condition	*36.4 C 49 %H*
13- Volt	*Max=247 Mean=234 Min=223*
14-	
15-	
16-	
17-	



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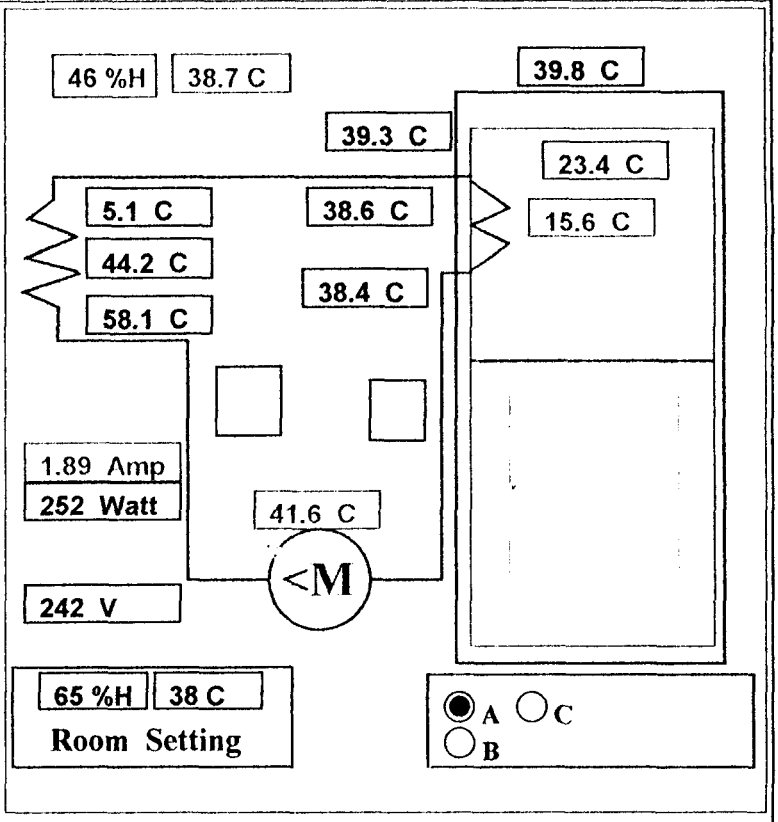
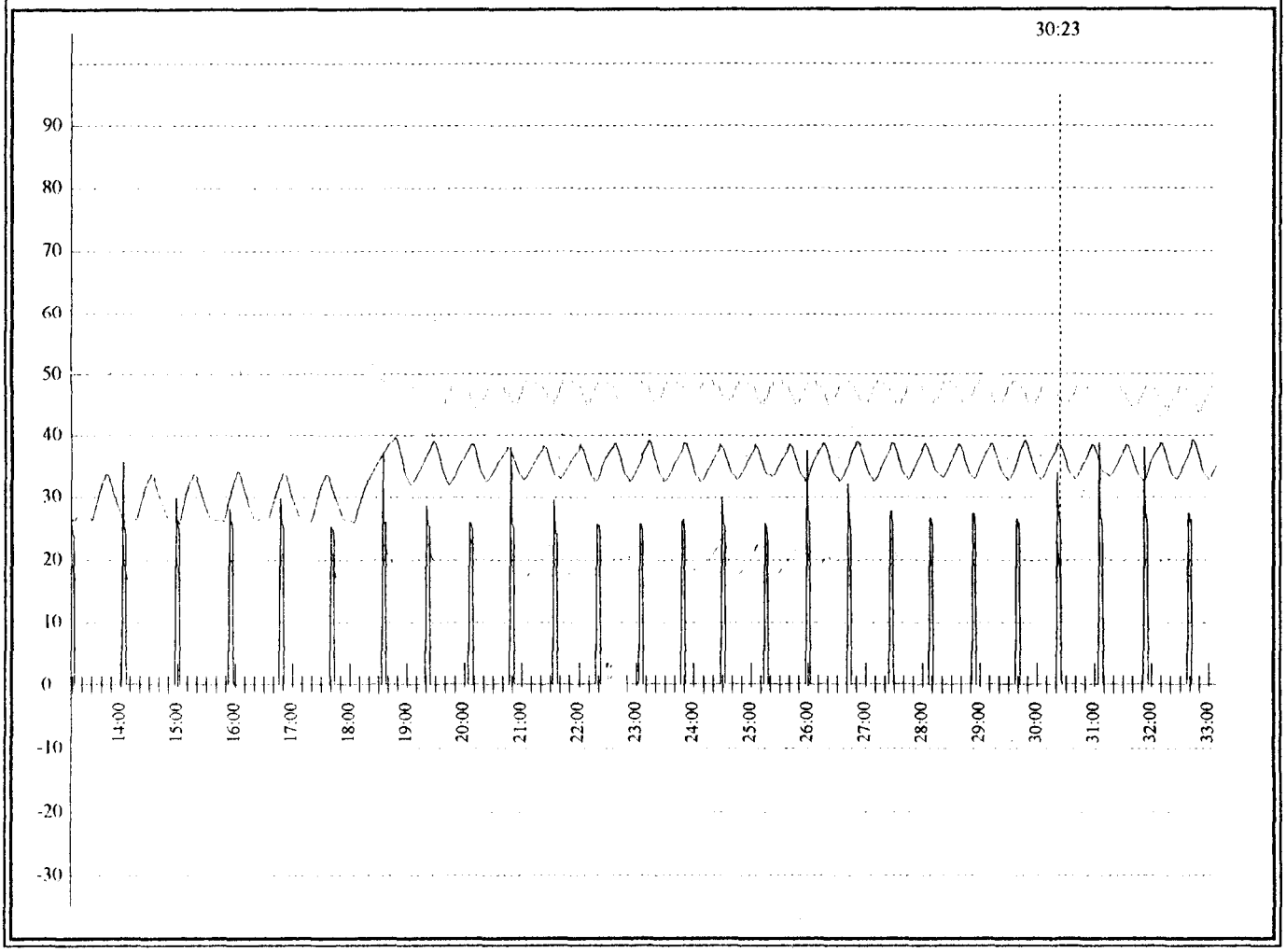
TestDate: 00/06/25 13:51 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/27 10:10

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*8 %On*
3 - Energy (Accord to page)	*0.219 kwh*
4 - Zoom Time	*30:24 Hour*
5 - Compr Current	*1.89 Amp*
6 - Evaprator Mean Temp	*27.2 C*
7 - Cabin Mean Temp	*34.4 C*
8 - Crisp Temp	*34.9 C*
9 - Compr Temp	*41.6 C*
10- Condensor In Temp	*58.1 C*
11- Condensor Out Temp	*5.1 C*
12- Condition	*38.7 C 46 %H*
13- Volt	*Max=252 Mean=239 Min=223*
14-	
15-	
16-	
17-	





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Maurice Ind. [Jordan]

TestDate: 00/06/27 12:22
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/29 14:31

Total Result :

1 - Total Test Time	*50 Hours*
2 - Working Percent	*100 %On*
3 - Energy	*3.746 kwh*
4 - Zoom Time	*49:19 Hour*
5 - Compr Current	*1.36 Amp*
6 - Evaprator Mean Temp	*-19.4 C*
7 - Cabin Mean Temp	*-20.6 C*
8 - Crisp Temp	*-20.6 C*
9 - Compr Temp	*44.9 C*
10- Condensor In Temp	*55 C*
11- Condensor Out Temp	*35.2 C*
12- Condition	*32.1 C 34 %H*
13- Volt	*Max=249 Mean=237 Min=221*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	M	*00062712.k22*
2 - Test Kind	P	*Perform.*
3 - Product Serial		
4 - Product Name	C	*Chest Free*
5 - Product Model	C	*CF-290*
6 - Product Capacity	6	*500 lit.*
7 - Compressor Name	K	*Electr.*
8 - Compressor Model	H	*GL99AA*
9 - Compressor Power	1	*1/4 Hp*
10- Compressor Amper	3	*3 Amp*
11- Thermostat No.	3	*3*
12- Thermostat Type	M	*Ranco*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

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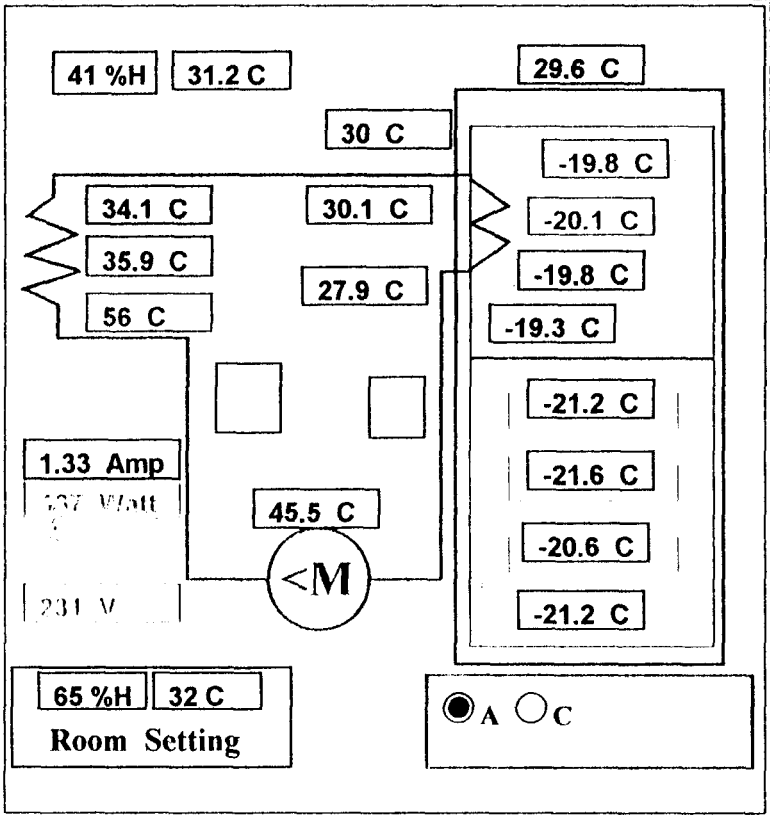
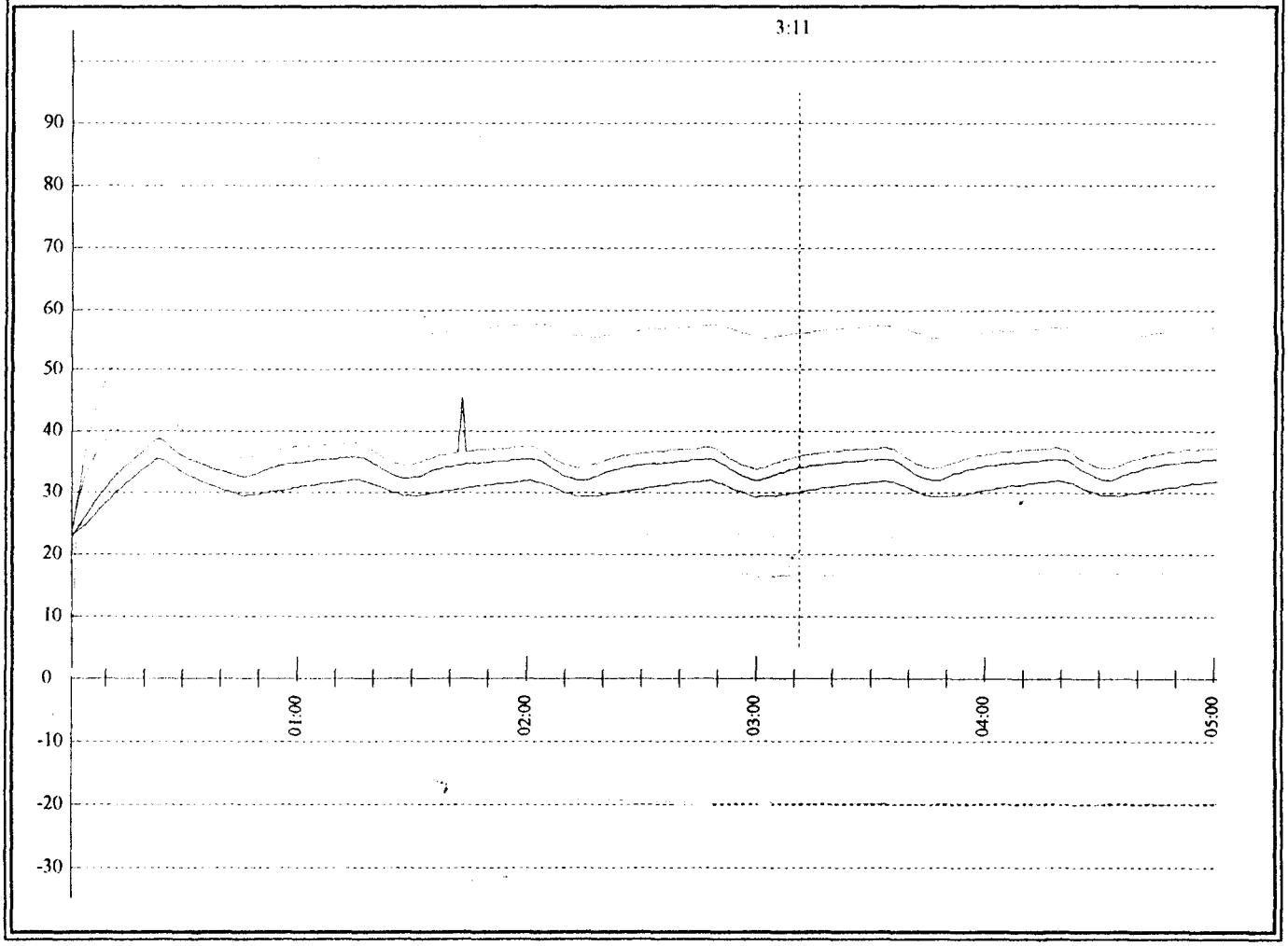
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:32

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.42 kwh*
4 - Zoom Time	*3:11 Hour*
5 - Compr Current	*1.33 Amp*
6 - Evaprator Mean Temp	*-19.7 C*
7 - Cabin Mean Temp	*-21.1 C*
8 - Crisp Temp	*-21.2 C*
9 - Compr Temp	*45.5 C*
10- Condensor In Temp	*56 C*
11- Condensor Out Temp	*34.1 C*
12- Condition	*31.2 C 41 %H*
13- Volt	*Max=239 Mean=232 Min=223*
14-	
15-	
16-	
17-	





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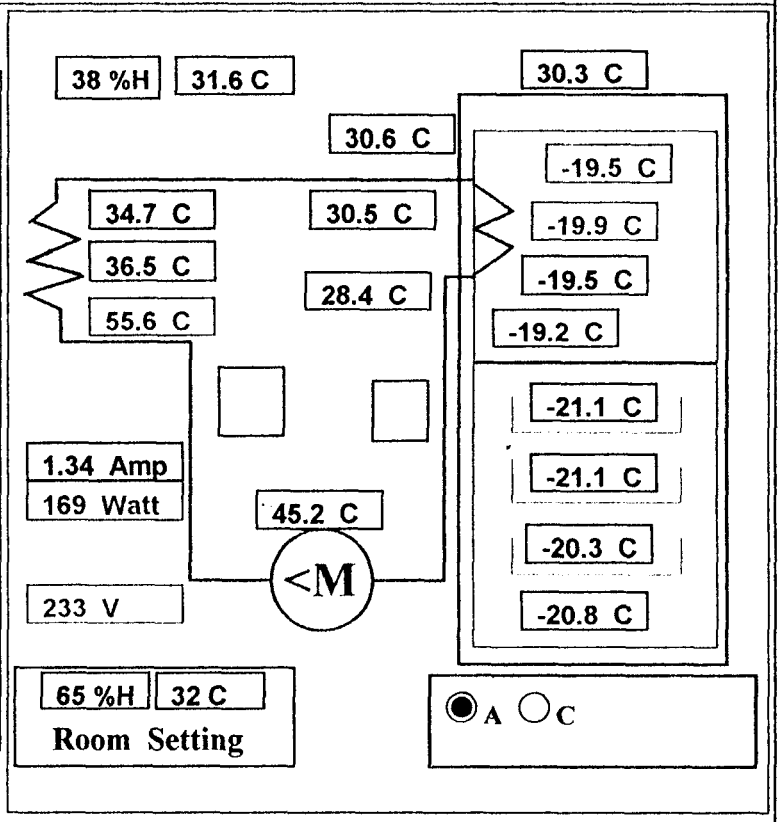
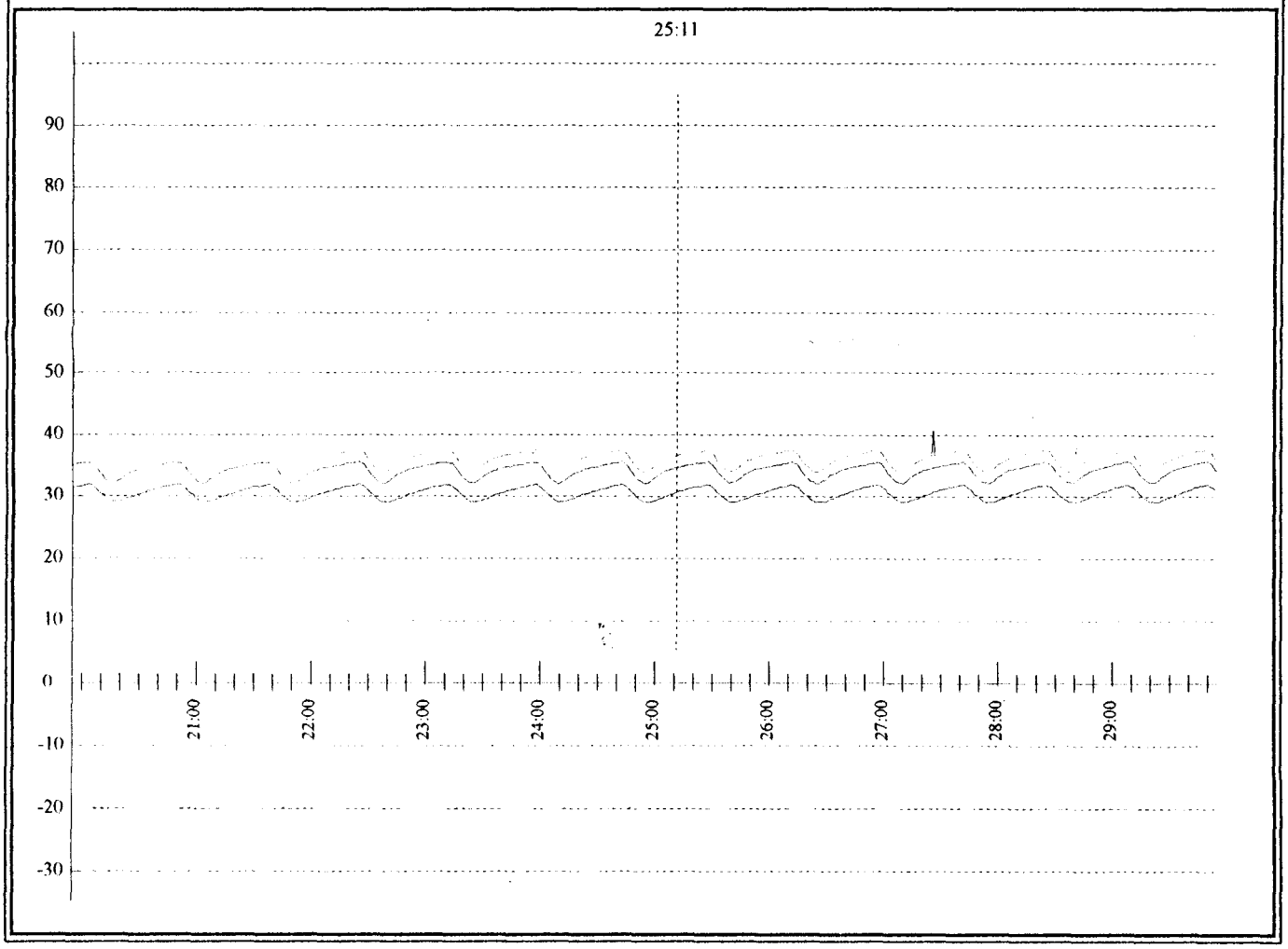
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:35

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.725 kwh*
4 - Zoom Time	*25:11 Hour*
5 - Compr Current	*1.34 Amp*
6 - Evaprator Mean Temp	*-19.5 C*
7 - Cabin Mean Temp	*-20.8 C*
8 - Crisp Temp	*-20.8 C*
9 - Compr Temp	*45.2 C*
10- Condensor In Temp	*55.6 C*
11- Condensor Out Temp	*34.7 C*
12- Condition	*31.6 C 38 %H*
13- Volt	*Max=247 Mean=233 Min=224*
14-	
15-	
16-	
17-	





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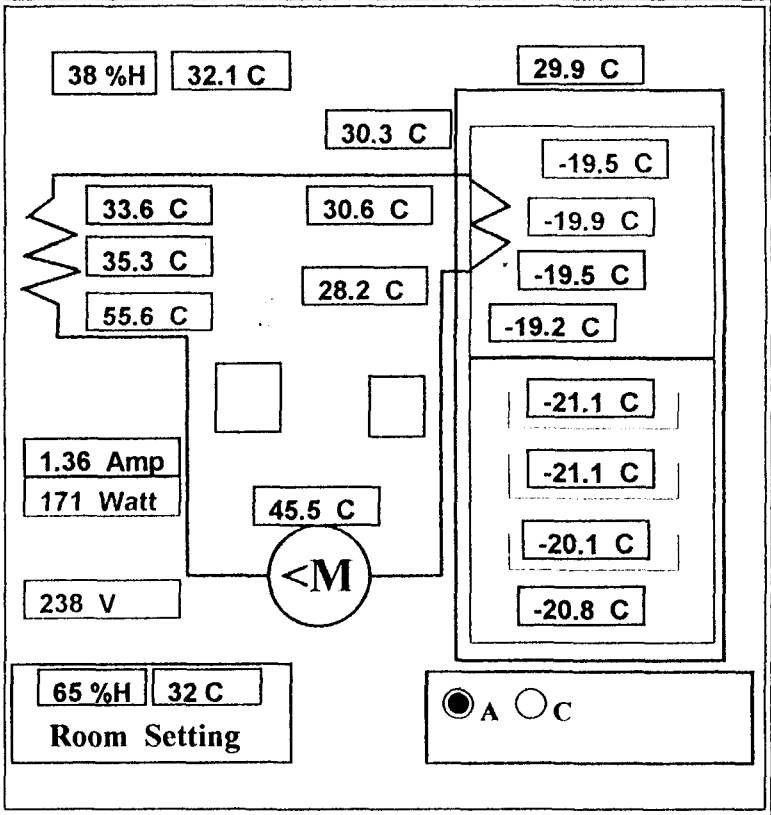
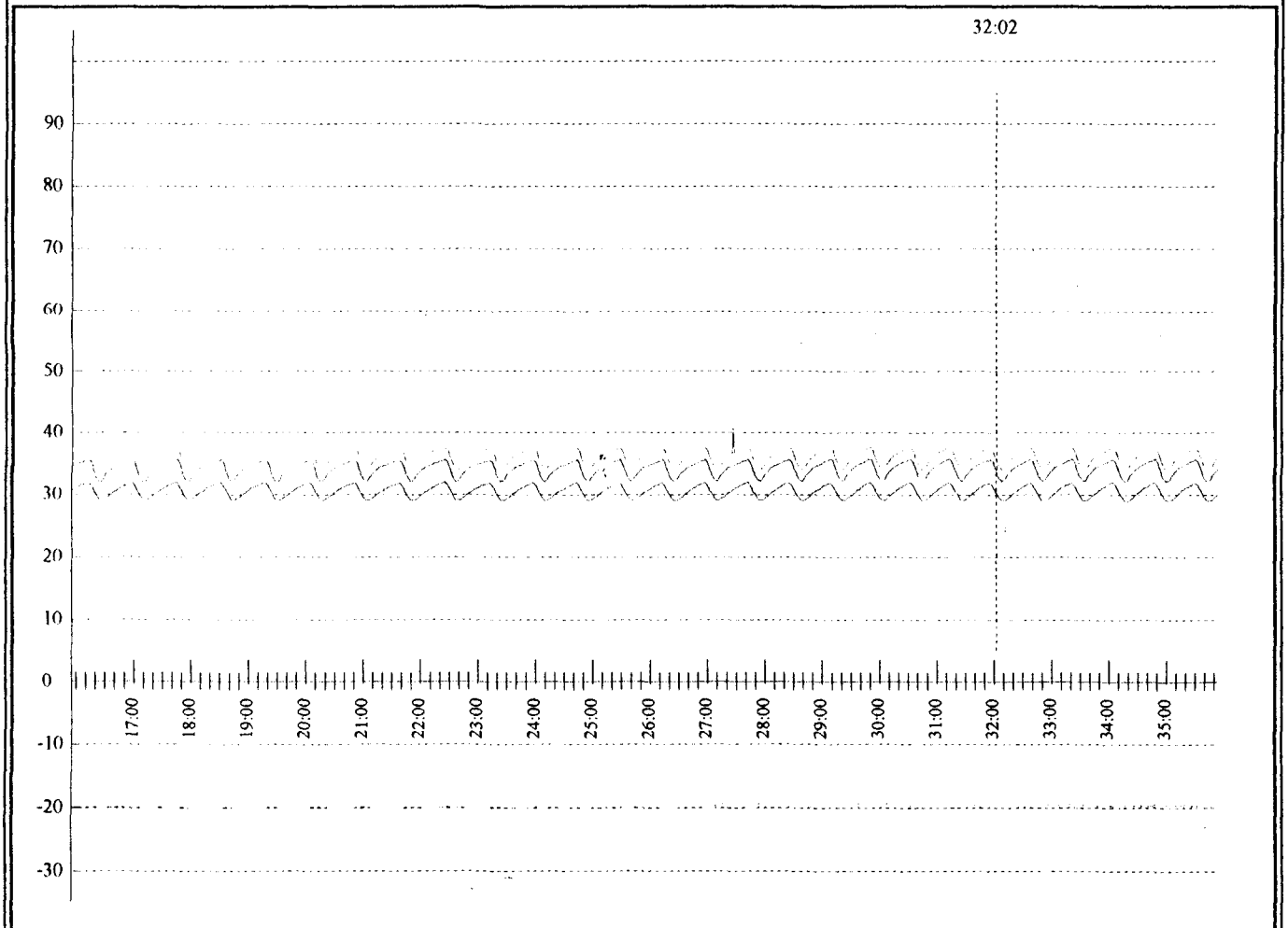
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:37

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.783 kwh*
4 - Zoom Time	*32:02 Hour*
5 - Compr Current	*1.36 Amp*
6 - Evaprator Mean Temp	*-19.5 C*
7 - Cabin Mean Temp	*-20.7 C*
8 - Crisp Temp	*-20.8 C*
9 - Compr Temp	*45.5 C*
10- Condensor In Temp	*55.6 C*
11- Condensor Out Temp	*33.6 C*
12- Condition	*32.1 C 38 %H*
13- Volt	*Max=247 Mean=237 Min=224*
14-	
15-	
16-	
17-	





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TestDate: 00/06/27 12:22
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2000/06/29 14:39

Total Result :

1 - Total Test Time	*50 Hours*
2 - Working Percent	*100 %On*
3 - Energy	*3.612 kwh*
4 - Zoom Time	*49:19 Hour*
5 - Compr Current	*1.43 Amp*
6 - Evaprator Mean Temp	*-23.8 C*
7 - Cabin Mean Temp	*-24.7 C*
8 - Crisp Temp	*-24.5 C*
9 - Compr Temp	*40.2 C*
10- Condensor In Temp	*49.2 C*
11- Condensor Out Temp	*18.5 C*
12- Condition	*32.1 C 34 %H*
13- Volt	*Max=249 Mean=237 Min=221*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	M	*00062712.k22*
2 - Test Kind	P	*Perform.*
3 - Product Serial		
4 - Product Name	C	*Chest Free*
5 - Product Model	C	*CF-290-30*
6 - Product Capacity	6	*600 Lit.*
7 - Compressor Name	K	*Korean Mad*
8 - Compressor Model	H	*HSL27YE-5*
9 - Compressor Power	1	*1/4 Hp*
10- Compressor Amper	3	*3*
11- Thermostat No.	3	*3*
12- Thermostat Type	M	*Marka Work*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

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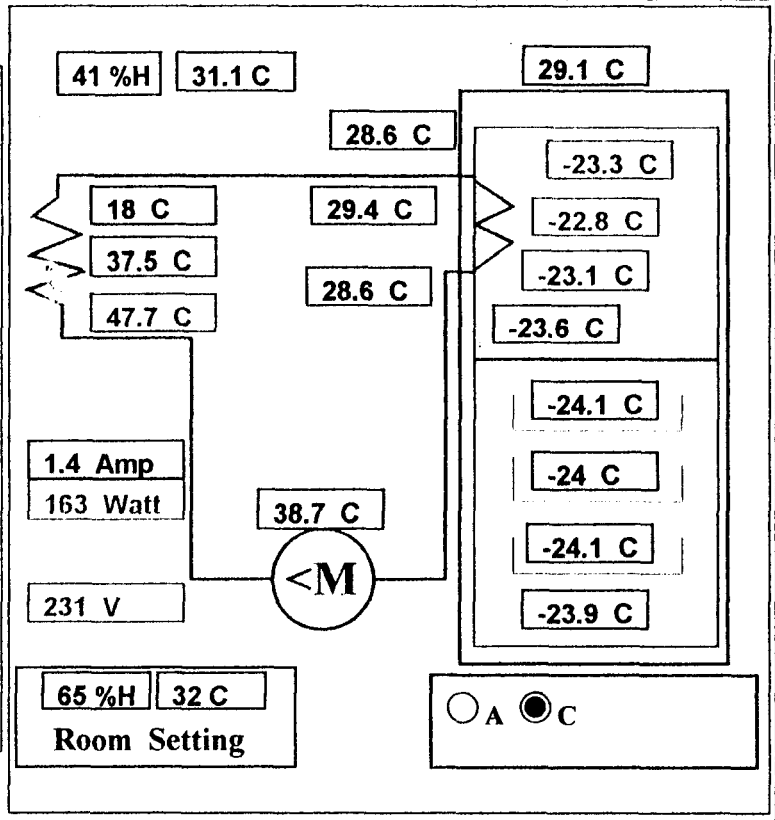
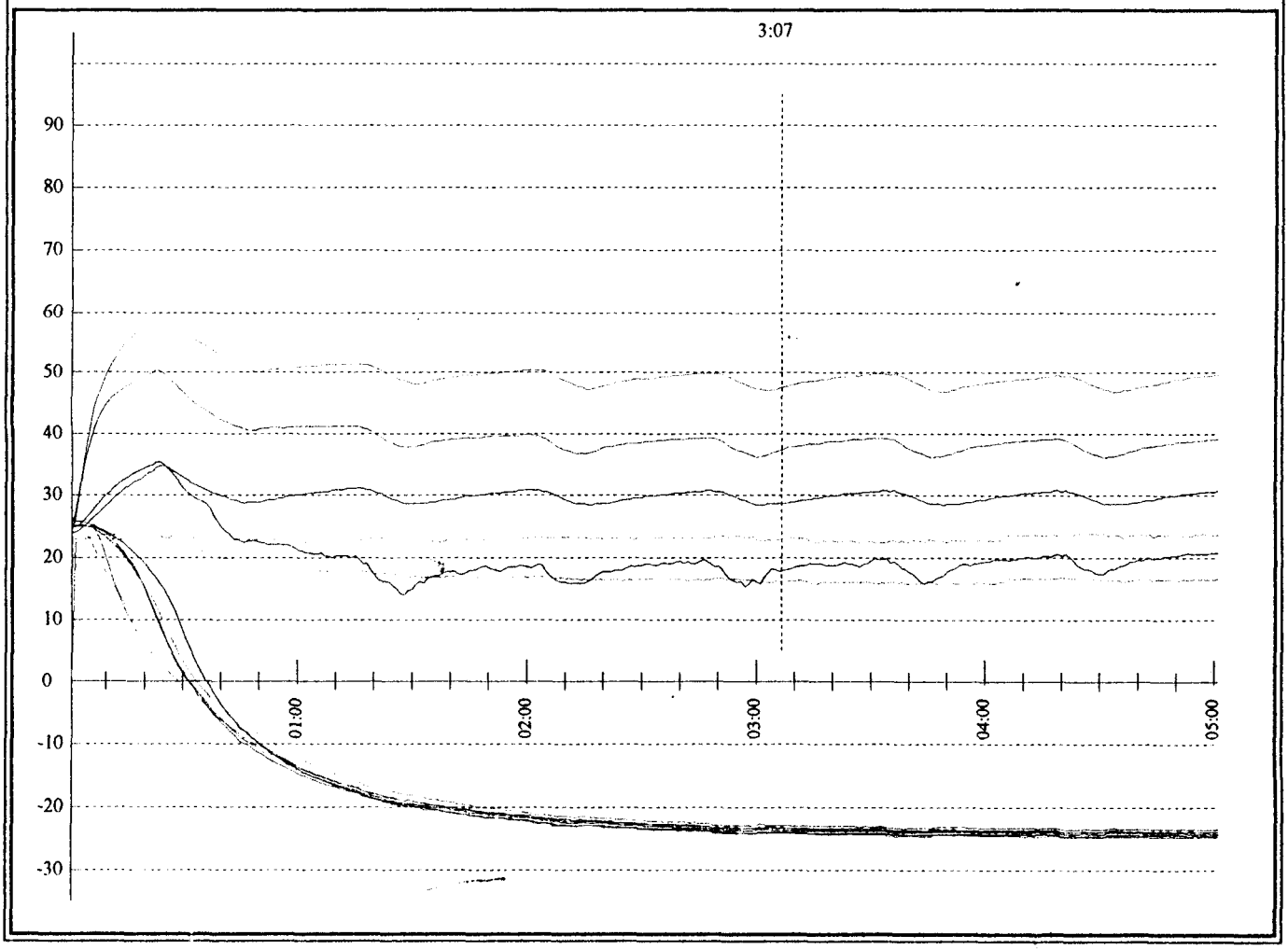
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:40

Page Result :

1 - Page Test Time	*5 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.317 kwh*
4 - Zoom Time	*3:07 Hour*
5 - Compr Current	*1.4 Amp*
6 - Evaprator Mean Temp	*-23.2 C*
7 - Cabin Mean Temp	*-24 C*
8 - Crisp Temp	*-23.9 C*
9 - Compr Temp	*38.7 C*
10- Condensor In Temp	*47.7 C*
11- Condensor Out Temp	*18 C*
12- Condition	*31.1 C 41 %H*
13- Volt	*Max=239 Mean=232 Min=223*
14-	
15-	
16-	
17-	





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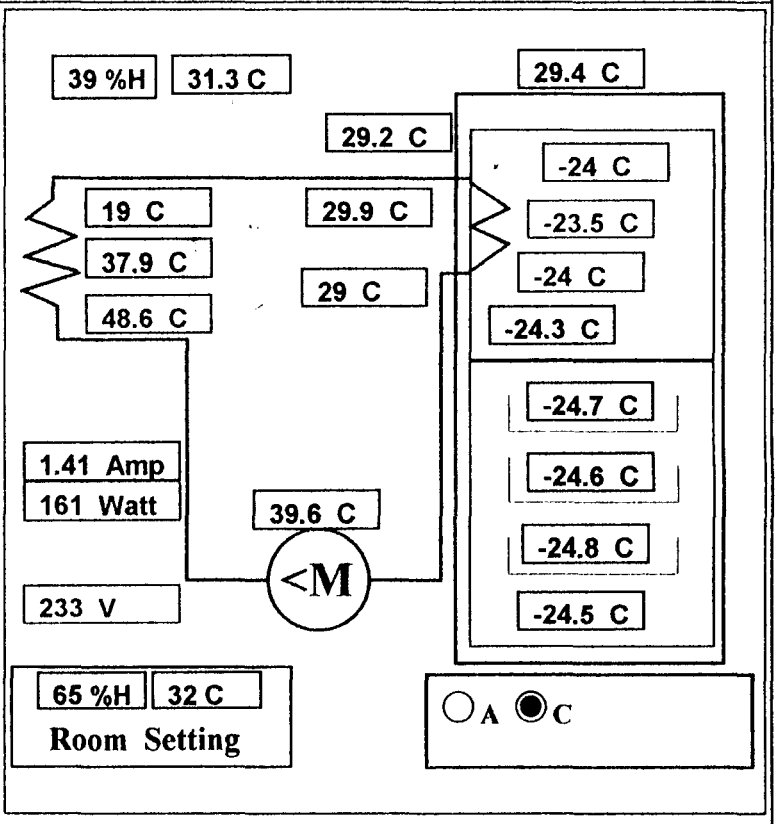
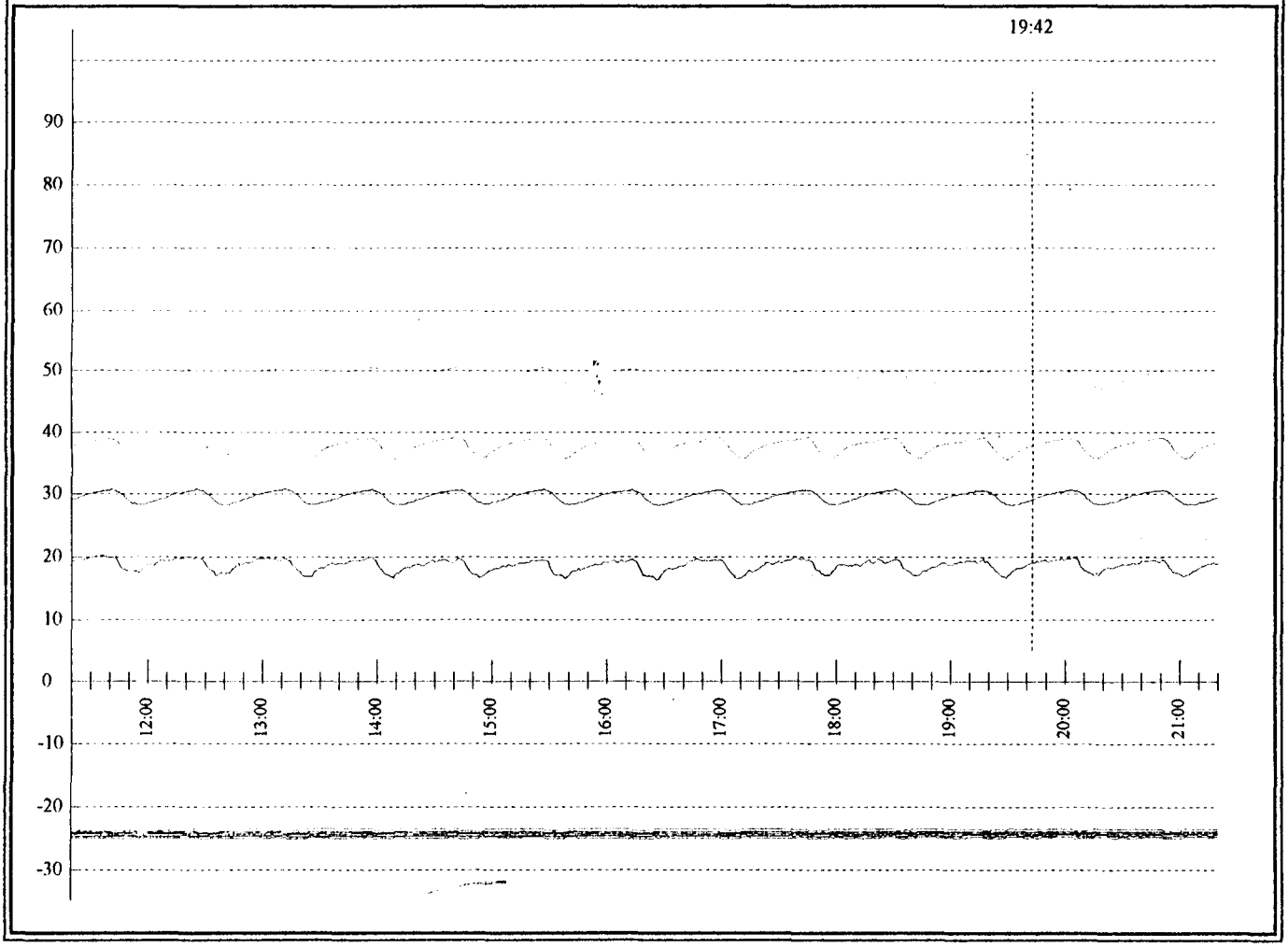
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:41

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.689 kwh*
4 - Zoom Time	*19:43 Hour*
5 - Compr Current	*1.41 Amp*
6 - Evaprator Mean Temp	*-23.9 C*
7 - Cabin Mean Temp	*-24.7 C*
8 - Crisp Temp	*-24.5 C*
9 - Compr Temp	*39.6 C*
10- Condensor In Temp	*48.6 C*
11- Condensor Out Temp	*19 C*
12- Condition	*31.3 C 39 %H*
13- Volt	*Max=247 Mean=240 Min=225*
14-	
15-	
16-	
17-	





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Maurice Ind. [Jordan]

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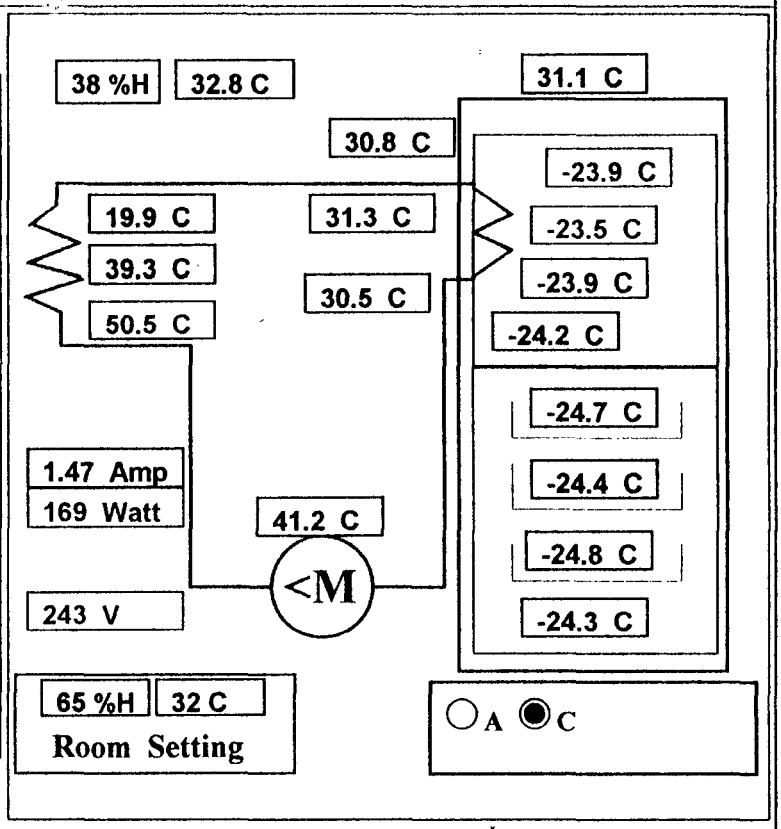
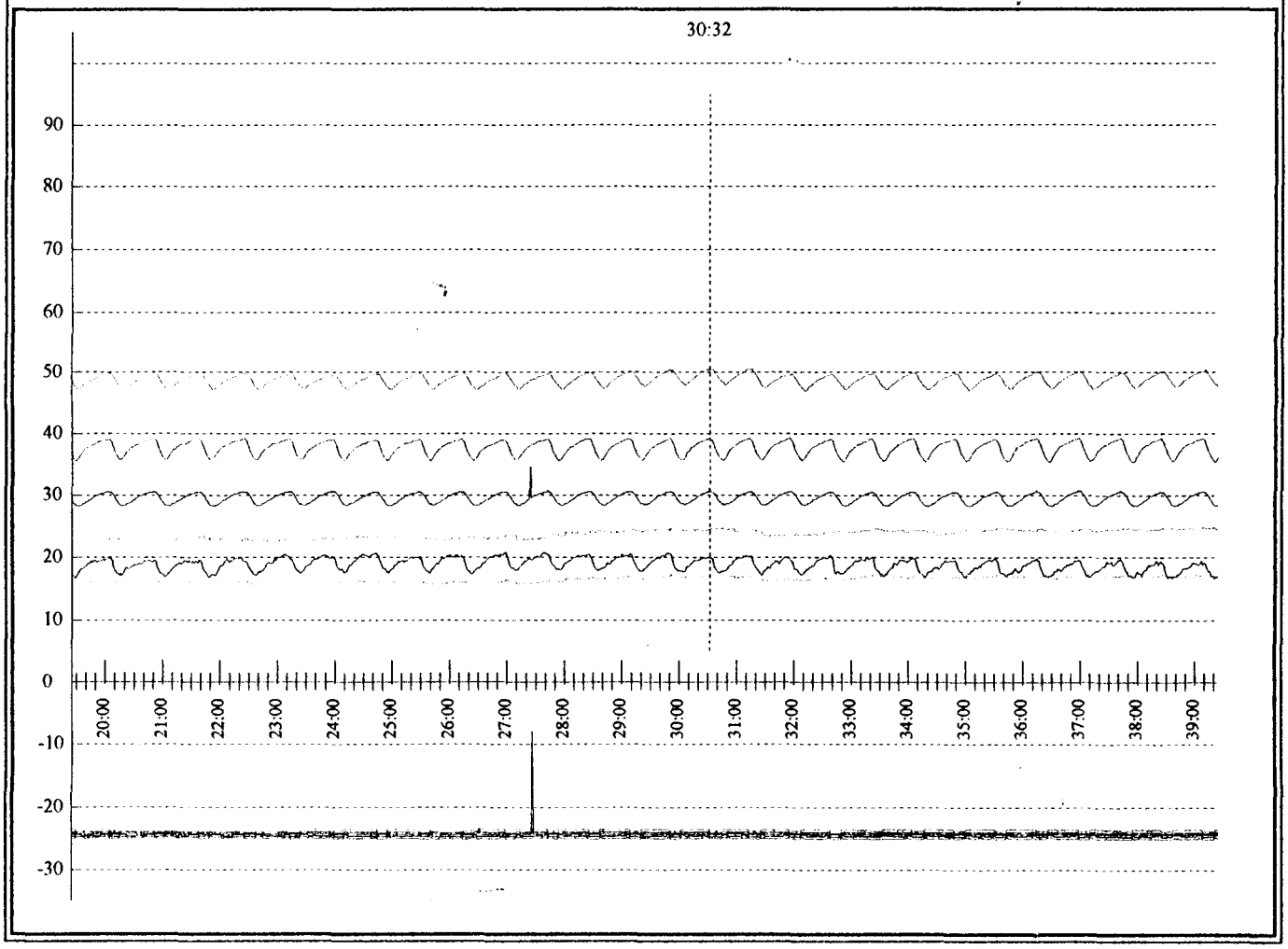
TestDate: 00/06/27 12:22 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2000/06/29 14:45

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*100 %On*
3 - Energy (Accord to page)	*3.641 kwh*
4 - Zoom Time	*30:32 Hour*
5 - Compr Current	*1.47 Amp*
6 - Evaprator Mean Temp	*-23.8 C*
7 - Cabin Mean Temp	*-24.6 C*
8 - Crisp Temp	*-24.3 C*
9 - Compr Temp	*41.2 C*
10- Condensor In Temp	*50.5 C*
11- Condensor Out Temp	*19.9 C*
12- Condition	*32.8 C 38 %H*
13- Volt	*Max=248 Mean=237 Min=224*
14-	
15-	
16-	
17-	





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